DECstation 300 SERIES

PERSONAL COMPUTER
SERVICE GUIDE

EP-PC42A-SV-001
1 OF 1 FEB 1989

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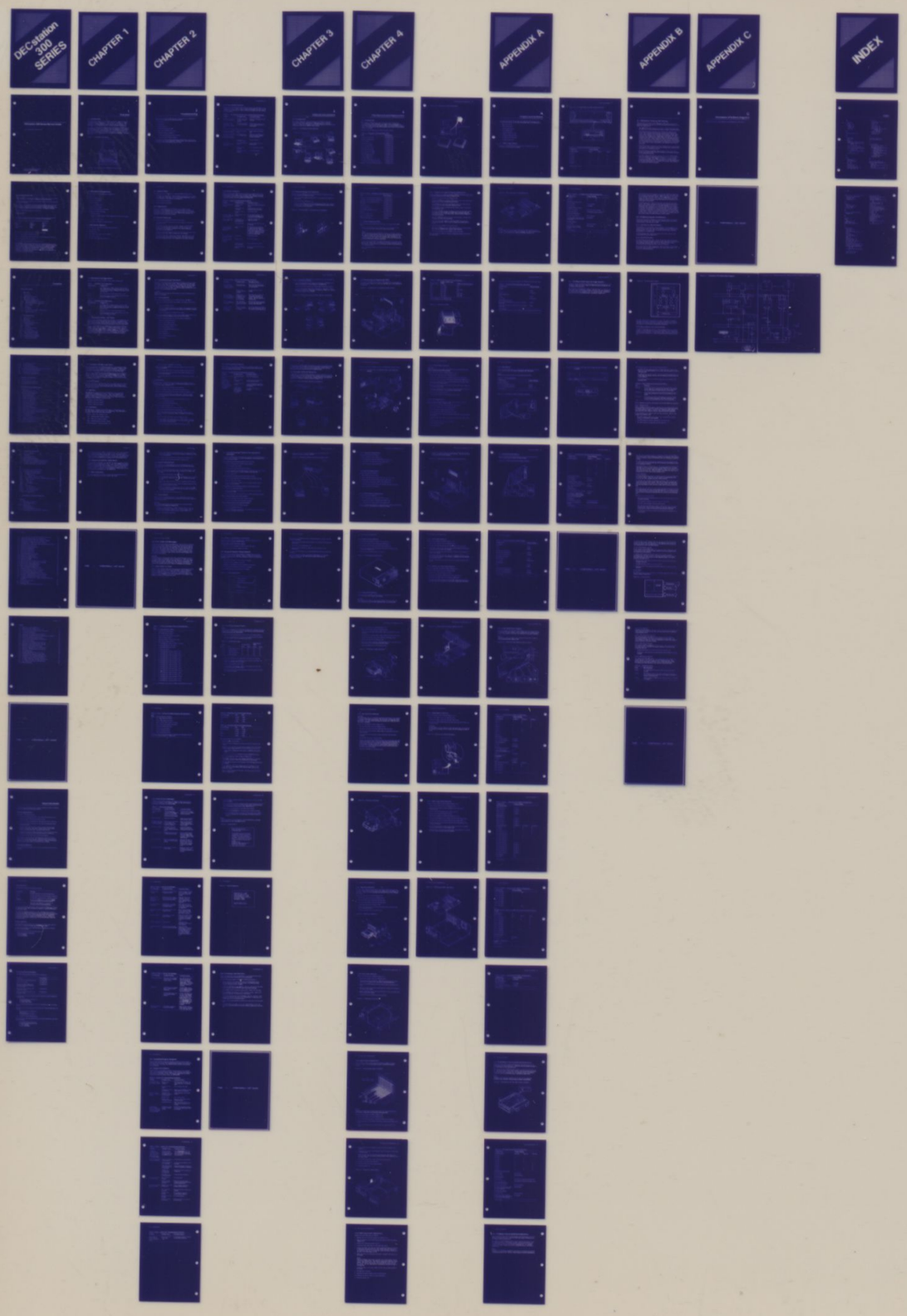


DECstation
3000
SERIES

DECstation 300 Series Service Guide

Order Number EK PC42A SV 001

digital equipment corporation
maynard massachusetts

First Edition, December 1988

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Contents

About this Guide ix

1 Overview

1 1 Introduction 1
1 2 DECstation Components 2
1 3 DECstation Options 2
1 4 DECstation Configurations 3
1 4 1 DECstation 316 Main Logic Board 3
1 4 2 DECstation 320 Main Logic Board 4
1 4 3 Power Supply 4
1 4 4 Monitors 4
1 4 5 VGA Board 4
1 4 6 Keyboard and DIGITAL VSXXX Mouse 5
1 4 7 Math Coprocessor 5

2 Troubleshooting

2 1 Special Tools 8
2 2 Diagnostics 8
2 3 Normal Power Up 8
2 4 Troubleshooting Procedures 9
2 4 1 Getting Started 9
2 4 2 No Power 10
2 4 3 System Does Not Boot 11
2 4 4 System Boots 11
2 5 Error Codes and Messages 12
2 5 1 Beep Code Error Codes 12
2 5 2 Power Up Error Messages 15
2 6 Troubleshooting by Symptom 18
2 6 1 System Unit Problems 18

2 6 2 Disk Related Problems 21
2 6 3 Monitor Problems 22
2 6 4 Pointing Device Problems 24
2 7 Troubleshooting Problems During System Operation 25
2 8 Using the System Utility Diskette 26
2 8 1 Running the Setup Program 27
2 8 2 Formatting a Hard Disk Drive 31

3 Ethernet Connections

3 1 Introduction 33
3 2 Disconnecting From Ethernet 34
3 3 Standard Ethernet Networks 36

4 FRU Removal and Replacement

4 1 Introduction 39
4 1 1 Before Replacing FRUs 40
4 2 Removing and Replacing FRUs 41
4 2 1 Keyboard Replacement 43
4 2 2 Monitor Replacement 43
4 2 3 VSXXX Mouse Replacement 43
4 2 4 System Cover Removal 44
4 2 5 Floppy Drive Removal 44
4 2 6 Hard Disk Drive Removal 46
4 2 7 Tape Drive Removal 48
4 2 8 Drive Tower Removal 49
4 2 9 Option Board Replacement 50
4 2 10 Math Coprocessor Removal and Replacement 52
4 2 11 Single-In Line Memory Module Replacement 54
4 2 12 Power Supply Removal 56
4 2 13 Fan Replacement 56
4 2 14 Card Guide Removal 58
4 2 15 Speaker and LED Cable Removal 58
4 2 16 CMOS Battery Removal 60
4 2 17 Main Logic Board Removal 61

A Jumpers and Switches

A 1 Main Logic Board 63
A 2 VGA Board 66
A 3 Serial/Parallel Board 67
A 4 16 Bit SCSI Host Adapter 69
A 5 40/80 Mbyte Internal SCSI Hard Disk Drive 74
A 6 170 Mbyte Internal SCSI Hard Disk Drive 76
A 7 150 Mbyte SCSI Tape Cartridge System 79

B

B 1 DECstation Powerup Self Testing 83
B 2 PC Microcomputer Architecture 84
B 2 1 The Parts of a Microcomputer 84
B 2 2 The CPU Function 84
B 2 3 Data, Address, and Control Busses 85
B 2 4 Machine Cycles, Interrupts, and Direct Memory Access 86
B 2 4 1 Machine Cycle 86
B 2 4 2 Interrupts 87
B 2 4 3 Direct Memory Access 88
B 2 5 CPU 88
B 2 5 1 CPU Registers 89
B 2 5 2 CPU Arithmetic/Logic Unit 89
B 2 5 3 CPU Control Circuitry 89
B 2 6 Addressing Modes 89

C DECstation CPU Block Diagrams

Figures

1 1 DECstation with Monitor 1
2–1 Utility Diskette Menu 26
2 2 Setup Screen 1 29
2–3 Setup Configuration 30
3–1 Two Sample ThinWire Networks 33
3–2 Disconnecting a T connector from a DECstation 34

3–3	Correct and Incorrect ThinWire Segment Connections	35
3–4	DEPCA/AUI Option Network Configurations	36
3–5	DECstation Network Connection through a DELNI	37
4–1	Exploded View of DECstation System Chasis	41
4–2	Exploded View of DECstation Main Logic Board and Options	42
4–3	Removing the System Cover	44
4–4	Removing a Floppy Disk Drive	45
4–5	Removing a Hard Disk	47
4–6	Removing a Tape Drive	48
4–7	Removing a Drive Tower	49
4–8	Recommended Option Locations	50
4–9	Replacing an Option Board	51
4–10	Replacing the Math Coprocessor	53
4–11	Removing a SIMM	55
4–12	Removing the Power Supply/Removing the Fan	57
4–13	Removing the Card Guide Speaker and LED	59
4–14	Removing the CMOS RAM Battery	60
4–15	Removing the Main Logic Board	62
A–1	Main Logic Board of DECstation 316	64
A–2	VGA Board Jumper and Switch Locations	66
A–3	Serial/Parallel Board Jumper Locations	67
A–4	16 Bit SCSI Host Adapted Jumper Locations	69
A–5	40/80 Mbyte SCSI Hard Disk Jumper Locations	74
A–6	170 Mbyte SCSI Hard Disk Jumper Locations	77
A–7	150 Mbyte SCSI Tape Drive Jumper and Bus Terminator Locations	80
B–1	Microcomputer Diagram	84
B–2	Inside the CPU	87
C–1	DECstation CPU Board Block Diagram	89

Tables

1–1	DECstation 316 Configurations	3
1–2	DECstation 320 Configurations	3
2–1	Powerup Test Beep Codes and Test Description	13
2–2	Powerup Test Messages	15
2–3	System Unit Troubleshooting Procedures	18
2–4	Hard Disk and Diskette Drive Troubleshooting Procedures	21
2–5	Monitor Troubleshooting Procedures	22
2–6	Pointing Device Troubleshooting Procedures	24
2–7	Diskette Drive Types	27
2–8	DECstation 316 CPU/BUS Speed Settings	28
2–9	DECstation 320 CPU/BUS Speed Settings	28
4–1	DECstation Field Replaceable Units	39
4–2	Memory Configurations on the DECstation	55
A–1	DECstation 300 Series Main Logic Board	65
A 2	VGA Configuration	66
A–3	Serial/Parallel Board Jumper Settings	68
A–4	16-Bit SCSI Host Adapter Configurations	70
A–5	40/80 Mbyte Internal SCSI Hard Disk Drive	75
A–6	170 Mbyte Internal SCSI Hard Disk Drive	77
A–7	150 Mbyte SCSI Tape Cartridge Configuration	81
B–1	Data, Address, and Control Bus Function	85
B–2	Addressing Modes	88

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About this Guide

The DECstation 300 Series Service Guide is designed to help you diagnose and repair DECstation 300 series systems

Guide Organization

The guide is organized as follows

- Chapter 1 provides an overview of the DECstation system series
- Chapter 2 details troubleshooting instructions
- Chapter 3 contains procedures for disconnecting from an Ethernet
- Chapter 4 contains procedures for removing and replacing Field Replaceable Units
- Appendix A provides information about jumpers and switches, memory configuration, the Video Graphics Array (VGA), SCSI adapters, and other DIGITAL supported option boards
- Appendix B contains a detailed description of the powerup test plus background information about personal computer architecture
- Appendix C has an illustration of the block diagram

For information about network troubleshooting, refer to the *PCSA Network Troubleshooting Guide* For additional information about PC architecture, and the Digital Ethernet Personal Computer Bus Adapter (DEPCA) option board, refer to the *DEPCA Service Guide*

Intended Audience

The procedures in this guide are for service technicians trained only by DIGITAL

Conventions

This document uses the following conventions

Convention	Meaning
Warning	Provides information to prevent personal injury
Caution	Provides information to prevent damage to equipment
Note	Provides general information you should be aware of
Ctrl/Alt/Del	Press and hold Ctrl while you press both Alt Del. Control key sequences have special functions
`Strike the F1 key`	What the screen displays as a prompt or an instruction is shown in monospaced type

Throughout this guide, *DECstation* refers to both the DECstation 316 and the DECstation 320 When information applies to a specific DECstation, the full title is used

The computer industry recognizes two open architectures as industry standards the IBM-PC/AT bus structure and the Microsoft disk operating system, MS DOS The term industry-standard refers to compatibility with these architectures Support for MS-DOS requires a defined set of ROM BIOS (read-only memory basic I/O system services), which the DECstation offers

Ordering Parts

Customers who maintain their own equipment can order spare parts by either phone or mail, or through any DIGITAL sales office

To order parts by phone, call 1-800-DIGITAL from 8:30 am to 8:00 pm (Eastern Standard Time)

To order parts by mail, send a purchase order to

Digital Equipment Corporation
P O Box CS2008
Nashua NH 03061

Ordering Documentation

The following documents are referred to in this guide

Document	Part Number
PCSA Network Troubleshooting Guide	AA-JU54A-TH
DEPCA Service Guide	EK-DEPCB-SV
DECconnect System Stand-alone ThinWire Networks Planning and Installation Guide	EK-DECSY TG
DECconnect System Planning and Configuration Guide	EK-DECSY-CG
DECconnect System Installation and Verification Guide	EK-DECSY-VG

DIGITAL personnel may order documents with part numbers beginning with EK from

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Northboro, MA 01532

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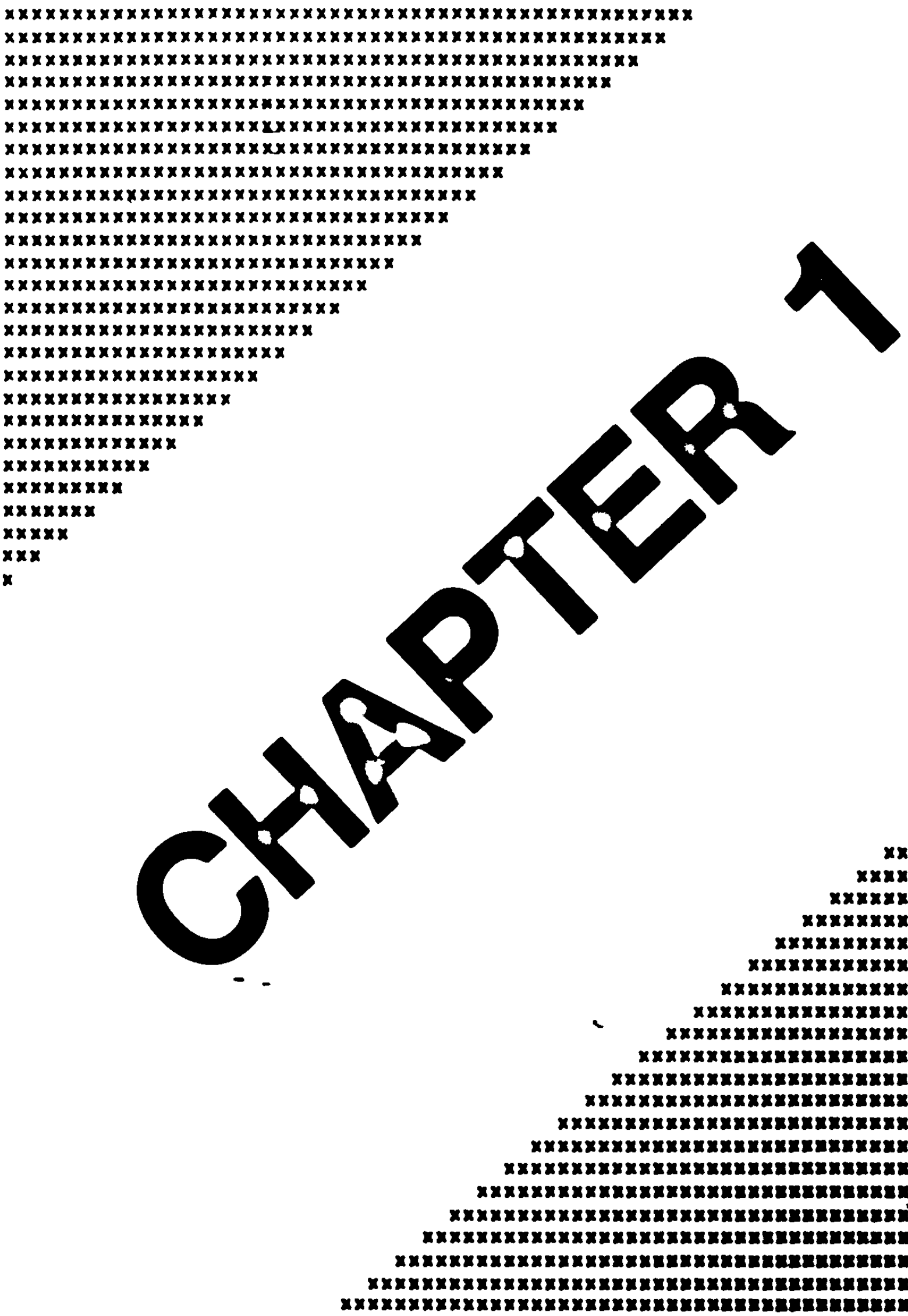
CHAPTER 1



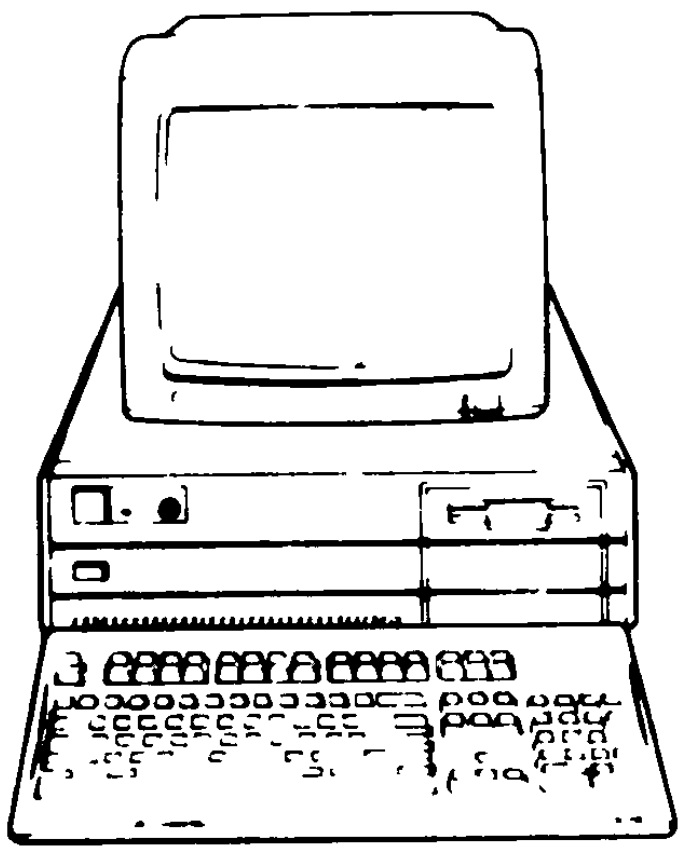
1
Overview

1.1 Introduction

The DECstation (Figure 1–1) is a desktop computer It can be used as a standalone personal computer or as a node on a network to a VAX computer or another DECstation with network server software The DECstation runs DIGITAL and other industry-standard applications

As a node on a Personal Computing System Architecture (PCSA) network, the DECstation is the user's interface with the applications and services that the PCSA family of products provides As part of a network, the DECstation communicates with other computers on the network and shares the various resources and services offered by DIGITAL computers and servers

Figure 1 1 DECstation with Monitor



The DECstation supports only the MS DOS operating system

1.2 DECstation Components

The following is a list of DECstation components

- Monitor
- Enhanced keyboard
- System unit including
  - Serial board
  - 3.5 inch floppy drive
- 192 Watt power supply
- Weitek 1167 Coprocessor (20 MHz)
- Main logic board containing
  - 80386 processor
  - Sockets for LED, speaker, CMOS RAM battery, and power supply cables
  - Socket for coprocessor
- Option slots for industry-standard options

1.3 DECstation Options

The following are options for the DECstation 300 series

- VGA adapter board
- DEPCA board
- Intel 80387 coprocessor (16 or 20 MHz)
- SCSI 16-bit board
- 5.25 inch SCSI streaming tape drive

1.4 DECstation Configurations

Each DECstation 300 is available in three basic configurations

Table 1–1 DECstation 316 Configurations

Model Number	Configuration
PC402	Intel 80386-based 16 MHz, personal computer with 1 Mbyte RAM, including all standard features and 101-key enhanced keyboard and an additional 3-1/2 inch or 5-1/4 inch drive bays
PC420	Base system with the Video Graphics Array board
PC425	Base system with the Video Graphics Array board, SCSI board, and 40 Mbyte hard disk

Table 1–2 DECstation 320 Configurations

Model Number	Configuration
PC403	Intel 80386-based 20 MHz, personal computer with 2 Mbyte RAM including all standard features and 101-key enhanced keyboard and an additional 3-1/2 inch or 5-1/4 inch drive bays
PC430	Base system with the Video Graphics Array board
PC435	Base system with the Video Graphics Array board, SCSI board, and 40 Mbyte hard disk

1.4.1 DECstation 316 Main Logic Board

The main logic board of the DECstation 316 has an Intel 80386 CPU chip with onboard memory management and protection An optional Intel 80387 math coprocessor can be added to enhance the CPU by providing fast processing of math functions on floating point and other data types

The main logic board has four 256K Single-In Line Memory Modules (SIMMs) that provide one Mbyte of dynamic RAM memory You can add four additional 256K SIMMs to expand memory to two Mbytes By replacing the 256K SIMMs with one Mbyte SIMMs you can have as many as eight Mbytes of RAM on board By installing the Zero K Memory Expansion Adapter you can have as many as 16 Mbytes of memory

1.4.2 DECstation 320 Main Logic Board

The main logic board of the DECstation 320 has a 20 megahertz (MHz) Intel 80386 CPU chip An optional 20 MHz Intel 80387 or Weitek 1167 math coprocessor can be added to enhance the CPU by providing fast processing of math functions on floating point and other data types

The main logic board has eight 256K SIMMs that provide two Mbytes of dynamic RAM memory By replacing the 256K SIMMs with one Mbyte SIMMs you can have as many as eight Mbytes of RAM on board By installing the Zero K Memory Expansion Adapter you can have as many as 16 Mbytes of memory

1.4.3 Power Supply

The DECstation has a standard 192 watt power supply that has a North American power cord The power supply provides the necessary power to operate the main logic board, floppy disk drive, and any other options installed in the system

1.4.4 Monitors

The DECstation supports both color (PC4YV BA) and monochrome (PC4YV-AA) 14-inch diagonal monitors They are compatible with industry-standard Video Graphics Array (VGA) The color monitor displays a video image from a palette of 256 colors The color monitor also supports three different scanning modes

- 720 dots x 350 lines (mode 1)
- 720 dots x 400 lines (mode 2)
- 640 dots x 480 lines (mode 3)

1.4.5 VGA Board

The DECstation is shipped with the VGA board This board provides the video display control functions of the DECstation The VGA board is compatible with the following video standards

- MCGA Multi Color Graphics Array
- EGA - IBM Extended Graphics Adapter
- CGA IBM Color Graphics Adapter
- MDA IBM Monochrome Display Adapter
- Hercules graphics Hercules graphic card

The VGA board can run software written for any of the video standards on any supported monitor For example, you can run monochrome or color software on the VGM 200/300 color monitor VGA also supports 132 column text mode Text mode and color or monochrome mapping can be set by using the VGA EXE utility supplied by the VGA adapter board

1.4.6 Keyboard and DIGITAL VSXXX Mouse

The keyboard is compatible with DIGITAL and other industry-standard computers when the appropriate cable is used The VSXXX three-button mouse is a pointing device that provides X Y coordinate output data for moving the cursor on the screen and selecting menu items and icons (pictures) It has a resolution of 0 127 millimeters (0 005 inches) for use in controlling various functions of the DECstation

1.4.7 Math Coprocessor

The math coprocessor is a chip that plugs into the system board and allows the DECstation to process numeric data faster

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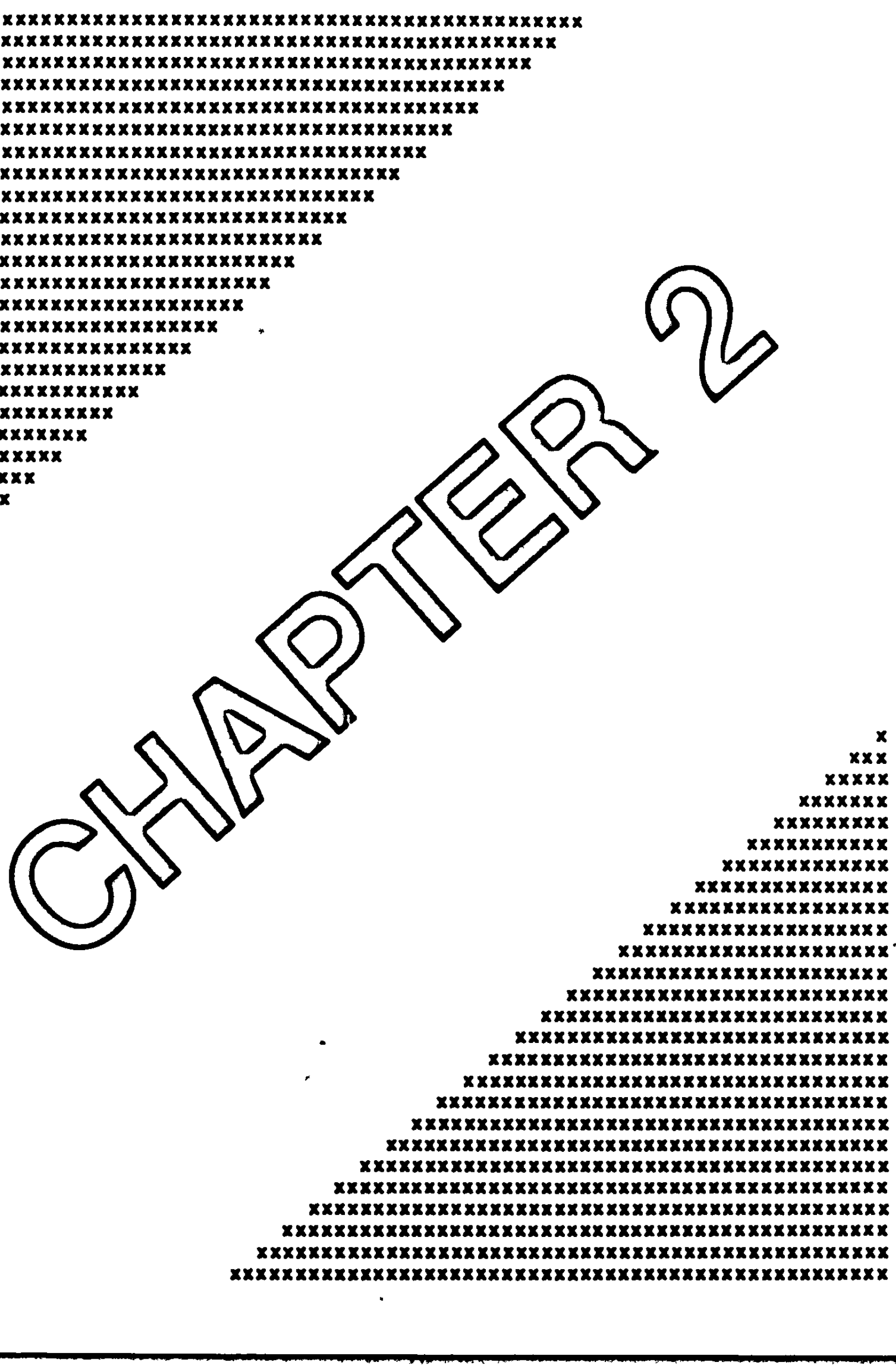
CHAPTER 2

2
Troubleshooting

This chapter provides troubleshooting instructions for the DECstation system. It is divided into the following sections:

- Special tools
- Diagnostics
- Normal power up
- Troubleshooting procedures
- Error codes and how to use them
- Troubleshooting by symptom
- Troubleshooting during system operation
- Using the System Utilities diskette

For information about jumper settings, troubleshooting, and servicing the DEPCA option board, DIGITAL VSXXX mouse, and related network connections refer to the *DEPCA Service Guide*

2.1 Special Tools

The following tools are needed to troubleshoot the DECstation 300

- CTI Diagnose Diagnostics These standalone diagnostics are available separately For information on how to use these diagnostics, refer to the *CTI Diagnose User Manual and Reference*
- Serial loopback connectors
- Parallel loopback connectors

2.2 Diagnostics

As an aid to troubleshooting a DECstation has internal system diagnostics These diagnostics are run at system power up and verify the operation of the machine Error messages are given in two formats beep codes and messages on the monitor These error messages are explained in Section 2 5 of this chapter

2.3 Normal Power Up

In a normal system powerup the following takes place

1 Power to the monitor and system unit are turned on Both power indicators are on

2 The system executes its power up tests, displays the BIOS ROM version, assorted copyright information, and the memory size Depending on the option(s) installed in the system additional information may be displayed

   If there is an error during any of the power-up tests the system either generates a beep error code or displays an error message

3 The system generates a single beep, displays information about the operating system, and gives the date prompt Note that the actual information displayed at this time depends on the system software

2.4 Troubleshooting Procedures

This section describes three troubleshooting procedures that can be used depending on the state of the system These procedures are described as a series of steps The purpose of each procedure is to get the system to a state where it can run the CTI Diagnose diagnostic package To determine the procedure to follow perform the steps in Section 2 4 1 and then go to the recommended procedure

CAUTION
Before troubleshooting the DECstation it must be disconnected from any network.

2.4.1 Getting Started

The following steps prepare you for troubleshooting a DECstation

1 Ask the customer to describe the problem You might want to find out

   — When the problem started

     If any new hardware options were added to the system around the time the problem started and if the options are DIGITAL certified or third party

   — If any new software was added to the system

2 Have the customer supply you with a *copy* of the Utilities diskette and the MS-DOS Startup diskette that came with the system

3 Have the customer provide you with the system configuration

   Type and amount of memory

   Type of video adapter board

   Type and number of disk drives

   Type of disk adapter board

   Type of serial/parallel adapter board

   Type of monitor

   Type of keyboard

   Type of network adapter board

   Type of mouse

— Any other options installed in the system

4 Observe the problem Based on what you observe refer to one of the following procedures

— If the system does not power up refer to Section 2 4 2, No Power

— If the system powers up but will not boot refer to Section 2 4 3, System Does Not Boot

If the system powers up and boots refer to Section 2 4 4, System Boots

2.4.2 No Power

This procedure is to help determine the cause of the problem when the DEC'station does not power up Before starting this procedure be sure you have done the steps in Section 2 4 1

1 Check the system for loose cables and connections

2 Check the 115/220 V switch on the back of the system unit

3 Plug the system unit and monitor power cord into a working ac outlet

4 Turn on power to the monitor and system unit Check for system power The following are indications that the system and monitor have powered up

Power indicators on the system unit and monitor are on

You can hear the fan running

You can hear the hard disk spinning

5 If the system does not power up

a Turn off power to the system unit and monitor

b Unplug the system and monitor from the ac outlet

c Turn off the power to all the hard disk drives and remove all options except the VGA board Refer to Chapter 4 for removing options

d Plug the monitor and system into a working ac outlet

e Turn the monitor and system power on If the system powers up now either there was a faulty device, too many options installed or another power related problem

f Try booting the system from the MS-DOS startup diskette

g Replace the DIGITAL certified options one at a time to find out if the system powers up each time an option is replaced or a disk drive is reconnected

6 If the system powers up and does not boot refer to Section 2.4.3

7 If the system powers up and boots refer to Section 2.4.4

2.4.3 System Does Not Boot

This procedure is to help determine why the DECstation does not boot. Before starting this procedure be sure you have done the steps in Section 2.4.1.

1 Remove any third party options and try to reboot the system. If the system generates any beep codes refer to Section 2.5.1, Beep Code Error Codes.

2 Try booting from the MS-DOS Startup diskette.

a If the system does not boot verify that all jumpers are set correctly (see Appendix A). Reboot the system after verifying the jumper settings.

b Lack of beep codes and video indicate a possible bad VGA board.

c If the system still does not boot remove all options except the VGA board and try to boot the system.

d Replace the DIGITAL certified options one at a time to find out if the system powers up and boots each time an option is replaced or a disk drive is reconnected.

3 When the system boots refer to Section 2.4.4.

2.4.4 System Boots

This procedure is to help determine why the DECstation boots and a problem exists. Before starting this procedure be sure you have done the steps in Section 2.4.1.

CAUTION

The system must be disconnected from any network before running the CTI Diagnose diagnostics.

1 Determine what the failure is. Refer to Section 2.5 for a list of possible error messages. If there are no error messages refer to Section 2.6 for a list of possible symptoms and possible causes.

2 Run the CTI Diagnose diagnostics.

3 Replace the necessary FRU

2.5 Error Codes and Messages

During the powerup sequence the DECstation executes built in diagnostic and *bootstrap* routines During the first portion of powerup testing, the system generates beep codes on the speaker if the test program detects a fatal error The system uses the beep codes to report test results only until screen initialization and screen retrace verification has occurred After screen initialization and verification the built in diagnostic sends non fatal error messages to video memory and the system displays the messages on the monitor

CAUTION
Do not connect or disconnect the video cable from the monitor or system when the monitor and/or system is on. This can cause damage to the system. Always turn the monitor and system off, then wait 20 seconds and disconnect the power cord before you remove the system unit cover. Observe antistatic precautions.

2.5.1 Beep Code Error Codes

Table 2–1 lists the beep codes and initial power up tests being performed The beep codes indicate a main logic board failure, memory failure or memory configuration error, or a video error If a memory failure is indicated check the configuration jumpers and reseat the single-in-line memory modules (SIMMs) on the main logic board If you suspect a bad SIMM first replace one and then the other

Table 2 1 Powerup Test Beep Codes and Test Description

Beep Codes	Test Description or Failure
1 1 3	CMOS write/read test failure
1 1 4	BIOS ROM checksum failure
1 2 1	Programmable Interval Timer test failure
1 2 2	DMA initialization failure
1 2 3	DMA page register write/read test failure
1 3 1	RAM refresh verification failure
1 3 3	1st 64K RAM chip of data line failure - multi bit [1]
1 3 4	1st 64K RAM odd/even logic failure
1 4 1	1st 64K RAM address line failure
1 4 2	1st 64K parity failure
2 1 1	1st 64K RAM chip or data line failure bit 0
2 1 2	1st 64K RAM chip or data line failure bit 1
2 1 3	1st 64K RAM chip or data line failure bit 2
2 1 4	1st 64K RAM chip or data line failure bit 4
2 2 1	1st 64K RAM chip or data line failure bit 4
2 2 2	1st 64K RAM chip or data line failure bit 5
2 2 3	1st 64K RAM chip or data line failure bit 6
2 2 4	1st 64K RAM chip or data line failure bit 7
2 3 1	1st 64K RAM chip or data line failure bit 8
2 3 2	1st 64K RAM chip or data line failure bit 9
2 3 3	1st 64K RAM chip or data line failure bit A
2 3 4	1st 64K RAM chip or data line failure bit B
2 4 1	1st 64K RAM chip or data line failure bit C
2 4 2	1st 64K RAM chip or data line failure bit D
2 4 3	1st 64K RAM chip or data line failure bit E
2 4 4	1st 64K RAM chip or data line failure bit F

[1] Any of the RAM failures can be caused by a SIMM not properly seated in its socket

Table 2 1 (Cont) Powerup Test Beep Codes and Test Description

Beep Codes	Test Description or Failure
3-1 1	Slave DMA register test failure
3 1 2	Master DMA register test failure
3 1 3	Master interrupt mask register test failure
3-1-4	Slave interrupt mask register test failure
3-2-4	Keyboard controller test failure
3-3-4	Screen memory test failure [2]
3-4-1	Screen initialization failure
3-4-2	Screen retrace tests failure

[2]Test failures from this point on can usually be attributed to the VGA board or the slot connector Try moving the adapter to a different slot

2.5.2 Power Up Error Messages

Table 2–2 lists system messages and suggests steps you can take to correct the problem. If the problem persists, run the CTI Diagnose diagnostics and replace any failing FRUs.

Table 2–2 Powerup Test Messages

Error Message	Possible Problem	Corrective Action
Display adapter failed	VGA board problem, incorrect CMOS RAM setup information, bad CMOS battery, or incorrect main logic board jumper setting	Check all video jumpers, system set up, and CMOS battery connection
Keyboard failure	Keyboard connection	Make sure the keyboard cable is firmly in place
Keyboard stuck key, controller clock line or data line failure	Stuck key, poor connection, or main logic board keyboard buffers, clock or data line failures	Make sure the keyboard is free of obstructions and the keyboard cable is firmly in place
Keyboard is locked	Keyboard locked, lock not working properly, or problem with the main logic board	Unlock the keyboard. Check to see if the lock mechanism has been bent.
Time-of-day not set	Time not entered in setup or CMOS battery failure	Run the utility program and set the time of day. Check the CMOS battery connection, replace a failed CMOS battery
Hard disk failure	Drive not formatted, loose cables, or incorrect jumper settings	Make sure the drive is formatted, all cables are firmly in place, and all jumpers are set correctly on the drive and SCSI board
Diskette drive failure	Loose cables or incorrect switch setting	Make sure all drive cables are firmly in place and that the drive switch is set correctly

Table 2 2 (Cont) Powerup Test Messages

Error Message	Possible Problem	Corrective Action
No boot device available	System can not get a drive to respond correctly	Check the floppy and hard drives, controllers, cables, and jumper and switch settings
Hard disk read failure, or No boot sector on hard disk	Hardware failure in disk drive or drive not initialized with an operating system	Make sure the drive is initialized Check all cable connections and jumper settings Run the diagnostics
Diskette subsystem reset failed	Diskette drive main logic board jumper removed or controller problem	Make sure the switch is set at either the primary or secondary position Run the diagnostics
Diskette drive 0 seek failure	First diskette drive is not seeking correctly	Make sure any diskette drive is selected as DS1 and that the correct drive termination is present.
Tape drive failure	Loose cable or incorrect jumper settings	Make sure the drive cables are firmly in place and all jumpers are set correctly on the drive and SCSI board
Invalid configuration	Incorrect setup	Check the setup information on the system Utility diskette
Configuration record bad	Incorrect setup hard disk may be incorrectly identified	Check the setup information on the system Utility diskette Also see the hard disk drive for any labels identifying the number of heads, cylinders, bad blocks, and so on

Table 2 2 (Cont) Powerup Test Messages

Error Message	Possible Problem	Corrective Action
Clock chip lost power	Momentary loss of CMOS battery power or CMOS battery is dead	Turn off the system unit. Wait 20 seconds and then try starting the system again Check the CMOS battery connection Replace the battery if necessary
DEPCA #6	Conflicting jumper settings, IRQ or memory and I/O addressing	Check all IRQ, memory, and I/O address settings See the *DEPCA Service Guide* for directions
	A diskette generated reset after using the Utility diskette	Options 1 through 5 and 9 on the Utility diskette generate a reset which is not satisfactory to the DEPCA board At the end of the utility session press Ctrl Alt Del at the same time (a soft reset) to properly reset the hardware
Beeps, long, short, long short	VGA adapter missing or incorrectly installed	Make sure the adapter is firmly seated in its socket on the main logic board

2.6 Troubleshooting by Symptom

This section describes causes and corrective actions for minor system problems that you can fix. The troubleshooting procedures are separated into system unit, hard disk and diskette drives, monitor, and pointing device problems.

2.6.1 System Unit Problems

Table 2–3 lists some common problems with the system unit, possible cause, and a suggested corrective action. If the corrective action does not work and if it is possible, run the CTI Diagnose diagnostics to further isolate the problem and then replace the failing FRU.

Table 2–3 System Unit Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
No response when the system is turned on	System is not plugged in	Turn the system off. Plug in the system then turn on the system again
	No power at wall outlet	Use a working wall outlet
	Voltage select switch incorrectly set	Make sure the 115/220 V voltage select switch is set correctly
Power is on, but there is no monitor display	Brightness and contrast controls are not set properly	Adjust brightness and contrast controls
	Monitor is off	Turn on the monitor
	Monitor cable incorrectly installed	Make sure the monitor cable is installed properly
	VGA board failure	Make sure VGA is seated in its socket and its jumpers are set correctly
Coprocessor is present. System comes up in the boot state but hangs after the memory check	Coprocessor jumper installed, oscillator missing	Remove the coprocessor jumper from the main logic board; install the oscillator

Table 2 3 (Cont.) System Unit Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
A DEPCA is installed but the node does not boot when you try to reboot after using the utility diskette	Using a diskette generated reset is not compatible with the DEPCA board	Press Ctrl Alt Del at the same time (a soft reset) to properly reset the hardware, turn system power off and on
System does not boot from the hard disk	There is no software on the partition	Install software on the partition
	System software is not on the disk	Load the system software on the hard disk
	Requested partition does not exist or is not formatted	Check the partitions. Format the partition, repartition if necessary
	Primary and secondary drive set incorrectly	Make sure the drive jumpers are correctly set
	Hard disk is not installed properly	Check hard disk installation
Tape does not work in the tape drive	Tape is worn or damaged	Try another tape
	Tape is not fully inserted into the tape drive	Make sure the tape is fully inserted and the cartridge release handle is locked down.
System does not boot from the diskette drive	Diskette is not in the diskette drive	Insert a diskette containing bootable system software
	Drive switch set incorrectly	Make sure the drive switch is set correctly
	Diskette is not bootable	Use a diskette containing bootable system software.
	Diskette is worn or damaged	Try another diskette
	Hardware conflict (remote boot)	Make sure system is not set up for remote boot

Table 2 3 (Cont.) System Unit Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
System does not reboot when the power is turned off and on	Power was not off long enough	Turn the power off for at least 20 seconds before rebooting.

2.6.2 Disk Related Problems

Table 2–4 lists some common disk related problems, possible cause, and a suggested corrective action If the corrective action does not work, run the CTI Diagnose diagnostics to further isolate the problem and then replace the failing FRU

Table 2–4 Hard Disk and Diskette Drive Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
Hard disk cannot read or write information	Problem exists with the drive or drive adapter	Make sure all jumpers are set correctly
Hard disk works but produces extra characters or garbled text	Hard disk is affected by static electricity	Move system away from any motors, magnetic devices, or photocopiers
Increase the humidity in the room and use antistatic mats around the system		
Intermittent hard disk read/write problems	Possible corrupted files	Restore disk from back-up files
System won't start from the diskette drive or displays the message Abort Retry Ignore	The diskette has been demagnetized	Make sure the diskette drive cable is correctly installed Replace the diskette
	Improperly formatted diskette	Reformat diskette
Diskette drive cannot read or write information	The diskette drive is empty	Insert a diskette into the diskette drive
	Diskette is not formatted	Use a preformatted diskette
	Diskette is worn or damaged	Try another diskette

2.6.3 Monitor Problems

Table 2–5 lists some common monitor problems, possible cause, and a suggested corrective action If the corrective action does not work and it is possible to run the CTI Diagnose diagnostics, use them to further isolate the problem and then replace the failing FRU

Table 2 5 Monitor Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
Monitor green LED is not on	Monitor is not turned on	Turn on the monitor and then the system
	Power cord is not connected	Make sure the power cord is connected to the wall outlet.
	No power at wall outlet	Use another outlet.
There is no light at the F1 key when you start the system	Setup program was not run	Run the Setup program Use your monitor and adapter card manuals and utility diskette(s)
Screen is blank and monitor LED is on	Contrast and brightness controls set to minimum	Adjust the contrast and brightness controls
	VGA board failed	Replace the VGA board and then the monitor
Screen goes blank after successful powerup, monitor LED is off	Power or Monitor failure	Turn the monitor and system off Disconnect the monitor from the system and wall Plug the monitor into an active wall outlet If the monitor LED does not turn on, there is a problem with the monitor or monitor LED
Monitor LED is off, but display is OK	Faulty LED	Replace the monitor
Monitor is on, but no cursor or text displays	System is not on	Turn on the system
	Contrast control is set to minimum	Turn up the contrast control
	Video subsystem is defective	Replace the VGA board and then the monitor

Table 2 5 (Cont) Monitor Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
Screen display distorted, rolling, flickering or wrong or uneven color	Electromagnetic interference exists	Move any electromechanical device away from the monitor or move the monitor
	Monitor cable connector pins bent or broken	Straighten pins or replace monitor
Screen displays distorted images or goes blank when you run your software	Software is not configured for or is incompatible with the VGA board current settings	Reconfigure your software for VGA or set VGA board to a standard supported by your software See your software and VGA manuals
Screen displays partially highlighted characters	Main logic board video and VGA board jumpers incorrectly set	Make sure the jumper setting on the main logic board match the setting on the VGA board
You have a color monitor and the display is monochrome	System was turned on *before* turning on the monitor	Turn off the monitor and system Wait at least 20 seconds Turn on the monitor, then the system unit.

2.6.4 Pointing Device Problems

Table 2–6 lists some common pointing device problems, possible cause, and a suggested corrective action. If the corrective action does not work, refer to the *DEPCA Service Guide*.

Table 2–6 Pointing Device Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
Mouse does not track properly	The tracking ball is dirty	Clean the tracking ball
Pointing device indicator does not display on the monitor screen or the monitor does not respond to the pointing device commands	Cable is installed incorrectly	Unplug and then reconnect the cable to reset the device
	Mouse IRQ settings incorrect	Check the DEPCA mouse IRQ settings for possible conflict with other options
	Software does not operate with a pointing device or is configured incorrectly	Reconfigure the software if necessary

2.7 Troubleshooting Problems During System Operation

Sometimes problems occur during system operation Use the following list to help isolate a problem to a specific subsystem by determining how or when the problem occurs

The problem occurs during diskette drive access.

- Check the diskette drive and the jumper setting
- Look for slightly loose cables
- Check the main logic board jumper settings
- Run the diagnostics The problem may be with the main logic board decoding, resistor pack, or faulty loading on the data bus

  See also Section 2 6

The problem occurs during hard disk drive access.

- Check the hard disk drive, including jumper and switch settings
- Check for loose drive cables
- Check the SCSI board Make sure it is seated properly and its jumpers are set correctly

The problem occurs during parallel or serial board access.

- Check the serial/parallel board
- If two serial devices are present make sure they are not both configured as COM1
- Run the diagnostics The problem may be with the system interface

The problem seems to be video related.

- Check the main logic board video jumper settings
- Check the VGA board and the jumper settings

The problem seems to be keyboard related.

- Keyboard lock may be partially engaged
- Check the keyboard connection
- Run the CTI Diagnose diagnostics The problem may be the keyboard interface on the main logic board

The problem is reproducible or intermittent.

Expansion options may be competing for interrupt request lines, I/O address range, or memory address range

The problem seems to be heat related.

- Make sure there is sufficient air flow around the system
- The system unit may be clogged with dust

2.8 Using the System Utility Diskette

The menu driven system Utility diskette is shipped with the system Ask your customer for the diskette Figure 2–1 lists the options from the Utility diskette menu The Setup program must be run anytime the following occur

- The amount of memory in the system is changed
- Diskette drives are added or removed
- A different video display board is installed in the system
- The battery backed up date and time are changed
- The CMOS battery is disconnected or changed

Figure 2 1 Utility Diskette Menu

```
1 — FORMAT DISKETTE
2 — COPY DISKETTE
3 — PREPARE SYSTEM FOR MOVING
4 — SETUP
5 — FORMAT HARD DISK

9 — END UTILITIES
```

2.8 1 Running the Setup Program

NOTE
If you have installed a new SCSI hard disk drive, format the drive before you run the Setup program. See Section 2.8.2, Formatting a Hard Disk Drive for directions.

You need the following information when you run the Setup program

- The type of diskette drive for drive A and optional drive B (usually 1 44 M) Table 2–7 lists the diskette drive types

Table 2 7 Diskette Drive Types

Media		Standard Drive		High-Density Drive	
Size	Type	Read	Write	Read	Write
3 1 2 in	1 44 MB (High Density)	No	No	Yes	Yes
3 1 2 in	720 KB (Standard)	Yes	Yes	Yes	Yes
5 1 4 in	1 2 MB High Density)	No	No	Yes	Yes
5 1 4 in	360 KB (Standard)	Yes	Yes	Yes	Yes

- System base memory size (displayed on the screen at powerup)
- Expansion memory size (displayed on the screen at powerup, OK means no expanded memory present)
- Primary video adapter type (VGA)
- CPU and BUS clock speeds Table 2–8 and Table 2–9 show the possible settings for the DECstation

  CPU speed is the CPU processing speed, and BUS speed is the data bus transmission speed

Table 2–8 DECstation 316 CPU BUS Speed Settings

Speed Settings	CPU	BUS
Factory setting	16 MHz	8 MHz
Fast	16 Mhz	8 MHz
Slow	6 MHz	6 MHz

Table 2–9 DECstation 320 CPU BUS Speed Settings

Speed Settings	CPU	BUS
Factory Setting	20 MHz	10 MHz
Fast	20 Mhz	10 MHz
Medium	10 MHz	8 MHz
Slow	8 MHz	8 MHz

The Setup program is run as follows

1 Turn on power to the monitor

2 Insert the Utilities diskette in the drive and turn on power to the system

The power up tests run, then the system displays either the Utility diskette menu or the instruction `Strike the F1 key to continue`

- If the Menu is displayed, select option 4 (SETUP), then press Enter
- If `Strike the F1 key` is displayed, press the F1 function key

The system displays a screen similar to Figure 2–2

3 Press Enter. The next two screen displays describe how to set the system date and time. Follow the instructions on the screens

4 Press Y or N in response to the prompts on the following screens then press Enter.

If you respond Y, the system displays the next selection. If you respond N, the system displays the selection again and you can change the values

When you finish making the selections, the Setup screen should be similar to Figure 2–3

5 Press Y or N in response to the Are these options correct prompt and press [Enter]

If you enter N, the system redisplays all the setup selections and you can correct your entries. If you enter Y the system records the date, time, and hardware information in the CMOS memory.

6 Reboot the system using one of the following methods:

- Press the [Ctrl] [Alt] [Del] keys simultaneously (preferred method)
- Press the Reset button on the front of the system unit. When the system displays the copyright page the setup procedure is complete.

NOTE
If the hard disk is not formatted, a hard disk failure message might display on the copyright screen.

Figure 2-2 Setup Screen 1

```
Phoenix Software Acs Ltd
Configuration Setup Program Ver x x
(c) Copyright 198x

This program is used to store system
configuration information into battery
backed memory in your computer. It is
necessary to run this program when
any memory, disk drives, or monitors are
added to or removed from your system
or to set the battery maintained time
or dates
ERRORS FOUND
INCORRECT CONFIGURATION INFO
MEMORY SIZE MISCOMPARE
Press <enter> to continue
```

Figure 2 3 Setup Configuration

```
Diskette Drive A  is 1 44M
Diskette Drive B  is NONE
System Base Memory is 640K
Expansion Memory is  XXXXK
Prime Video Adapter is EGA VGA
CPU Speed is  XXMHz
BUS Speed is  XXMHz


Are these option correct
(Reply Y or N then <enter>)

?
```

2.8.2 Formatting a Hard Disk Drive

Many hard disk drives come preformatted (A preformatted hard disk contains documentation stating that it is preformatted.)

Use the following procedure to format an SCSI hard disk drive

1. Turn on power to the system and check the BIOS ROM version number displayed on the copyright screen. An SCSI hard disk requires Version 01.03.01 or higher.
2. Install the MS-DOS startup diskette. Ask your customer for this disk, it was shipped with the MS-DOS operating system package.
3. Run FDISK. Follow directions on the screen. Observe all warnings.
4. Run FORMAT. Use Format C:/s for a bootable volume. Observe all warnings and follow the directions on the screen.

   If the hard disk has more than 32 Mbytes, ask your customer if they want you to partition the drive into a D partition. In this case, run FDISK again for an extended partition.
5. Remove the startup diskette and reboot the system from the hard disk drive.
6. Copy MS-DOS to C:\DOS, if it is your responsibility, or have the customer install MS-DOS and then the software applications and data files.

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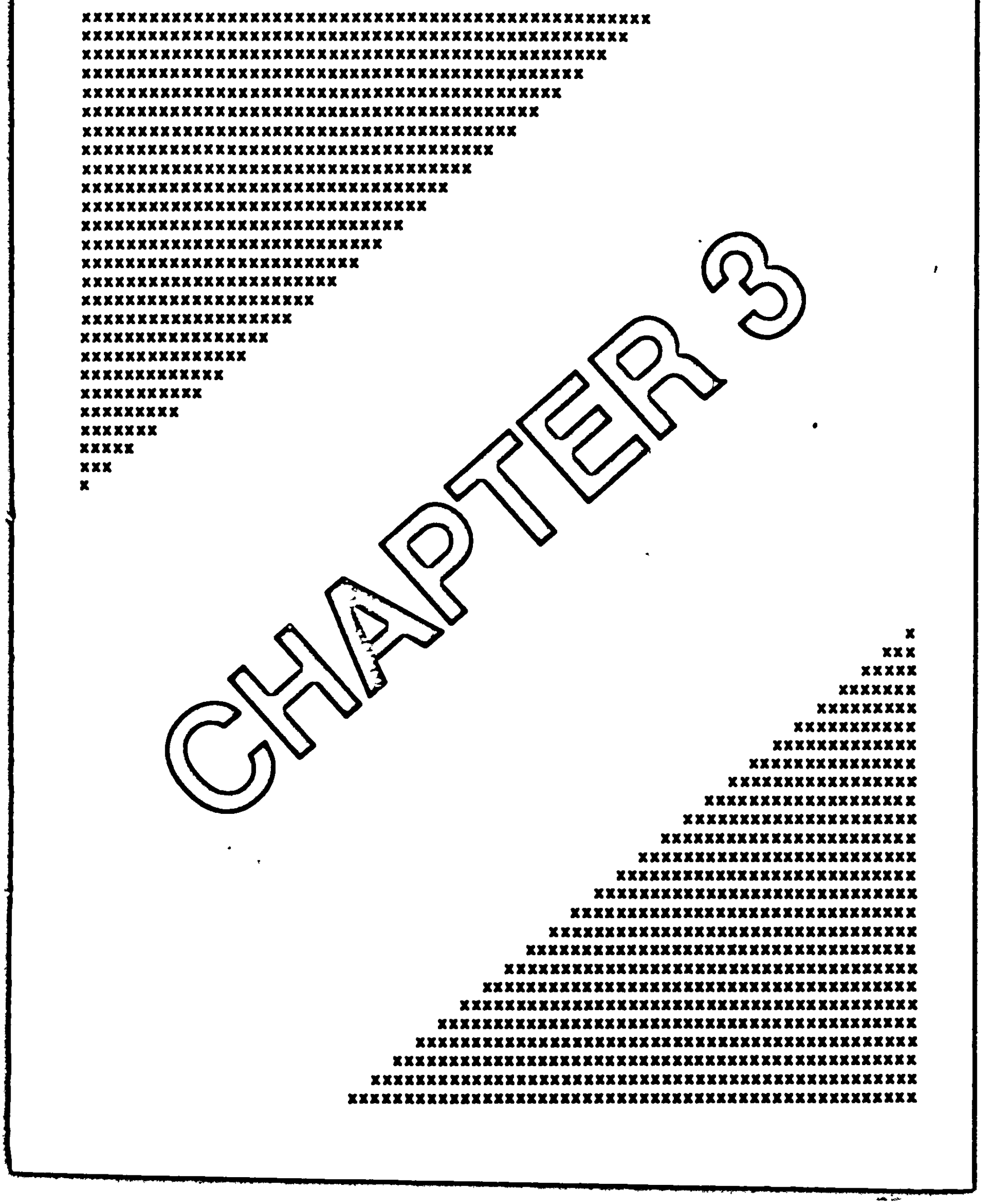

CHAPTER 3

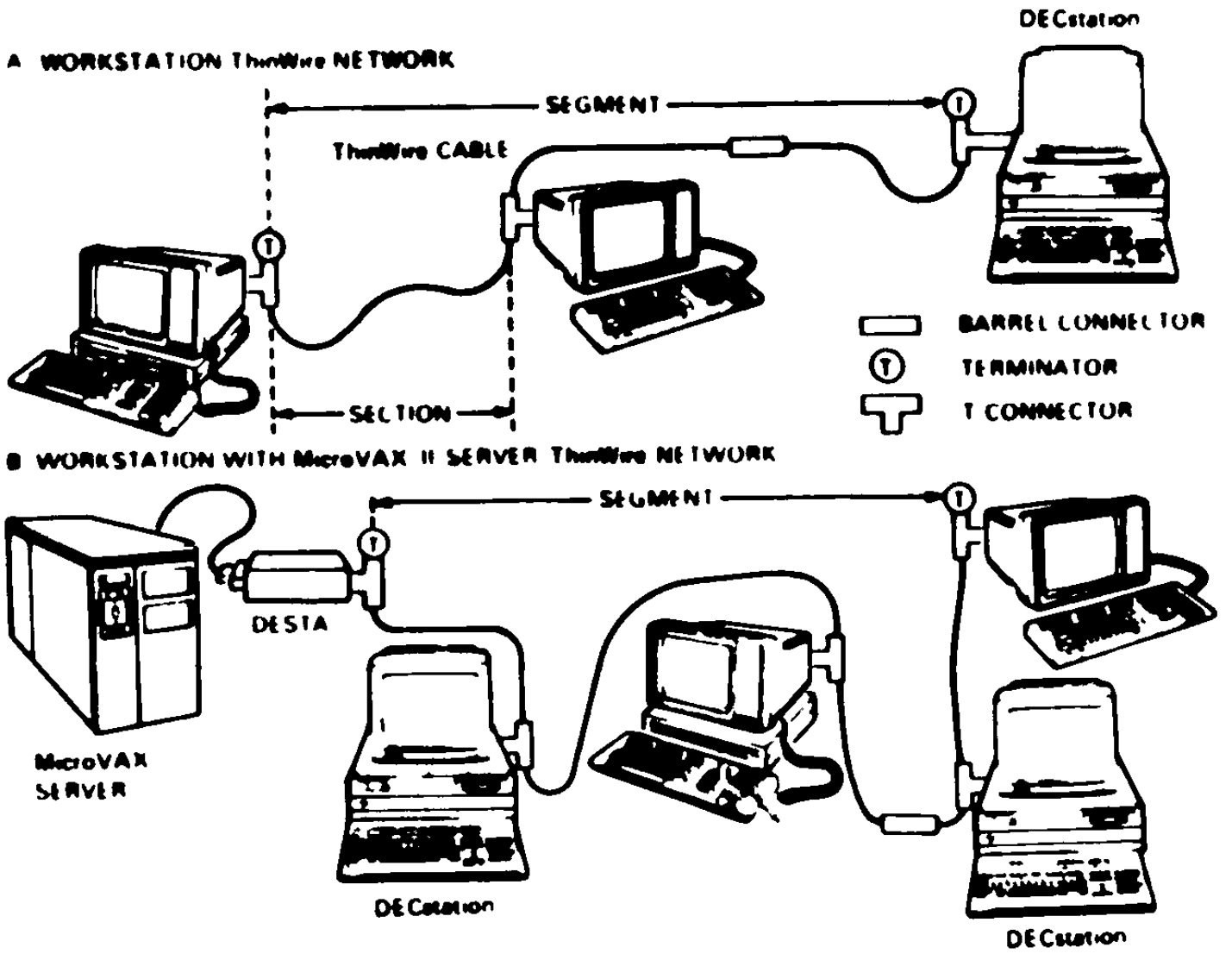
3

Ethernet Connections

3.1 Introduction

This chapter discusses standard Ethernet and ThinWire Ethernet connections and how to disconnect a DECstation from a network Figure 3–1 shows the cabling for two ThinWire Ethernet networks linking DECstations that have a DEPCA option board

Figure 3–1 Two Sample ThinWire Networks



3.2 Disconnecting From Ethernet

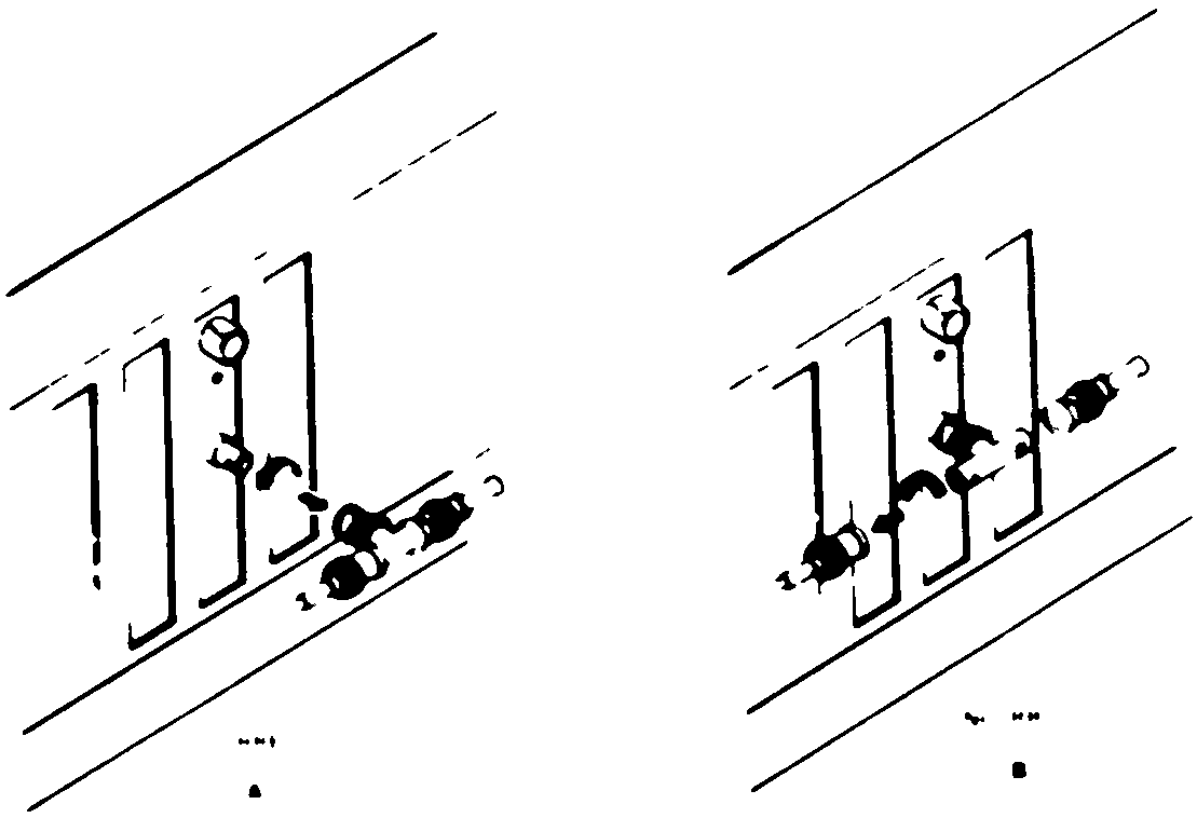
Before servicing a DECstation, disconnect it from the ThinWire network Use the following procedure to do this

1 Inform the system administrator that you are going to disconnect the DECstation

2 Turn power to the DECstation off

3 Disconnect the T connector from the DECstation (Figure 3–2) **Do not** disconnect the T-connector from the ThinWire Ethernet cable or from the terminator, if one is present

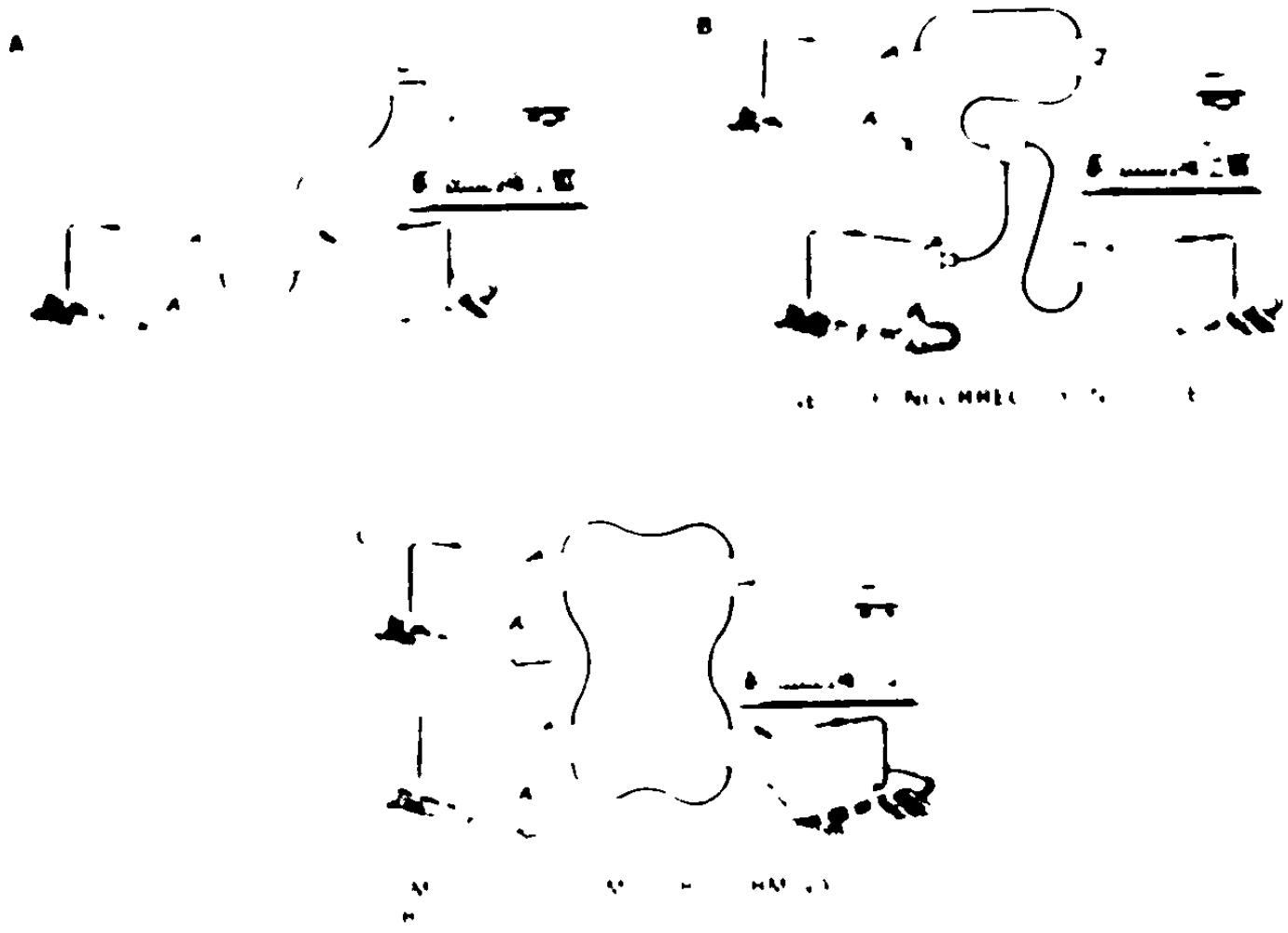
Figure 3 2 Disconnecting a T-connector from a DECstation



When re connecting a DECstation to a ThinWire network, be careful to observe the following guidelines

- Never install a cable at the stem of a T-connector **Example A in Figure 3–3 shows a correct Ethernet installation.**
- Never join two T connectors or a barrel and a T connector together
- Never create a loop configuration (Figure 3–3, example C) There must be a terminator at both ends of a segment (Figure 3–3, example A Only one end can be a DEMPR

Figure 3 3 Correct and Incorrect ThinWire Segment Connections



To learn how to install complex ThinWire networks, see the *DECconnect System Stand-alone ThinWire Networks Planning and Installation Guide*, the *DECconnect System Planning and Configuration Guide*, and the *DECconnect System Installation and Verification Guide*

3.3 Standard Ethernet Networks

A DECstation can also be linked directly to a standard Ethernet network A DEPCA board with the Attachment Unit Interface (AUI) can connect to a standard Ethernet network through a Digital Ethernet Local Network Interconnect (DELNI) or H4000 transceiver (Figure 3–4)

Figure 3–4 DEPCA AUI Option Network Configurations

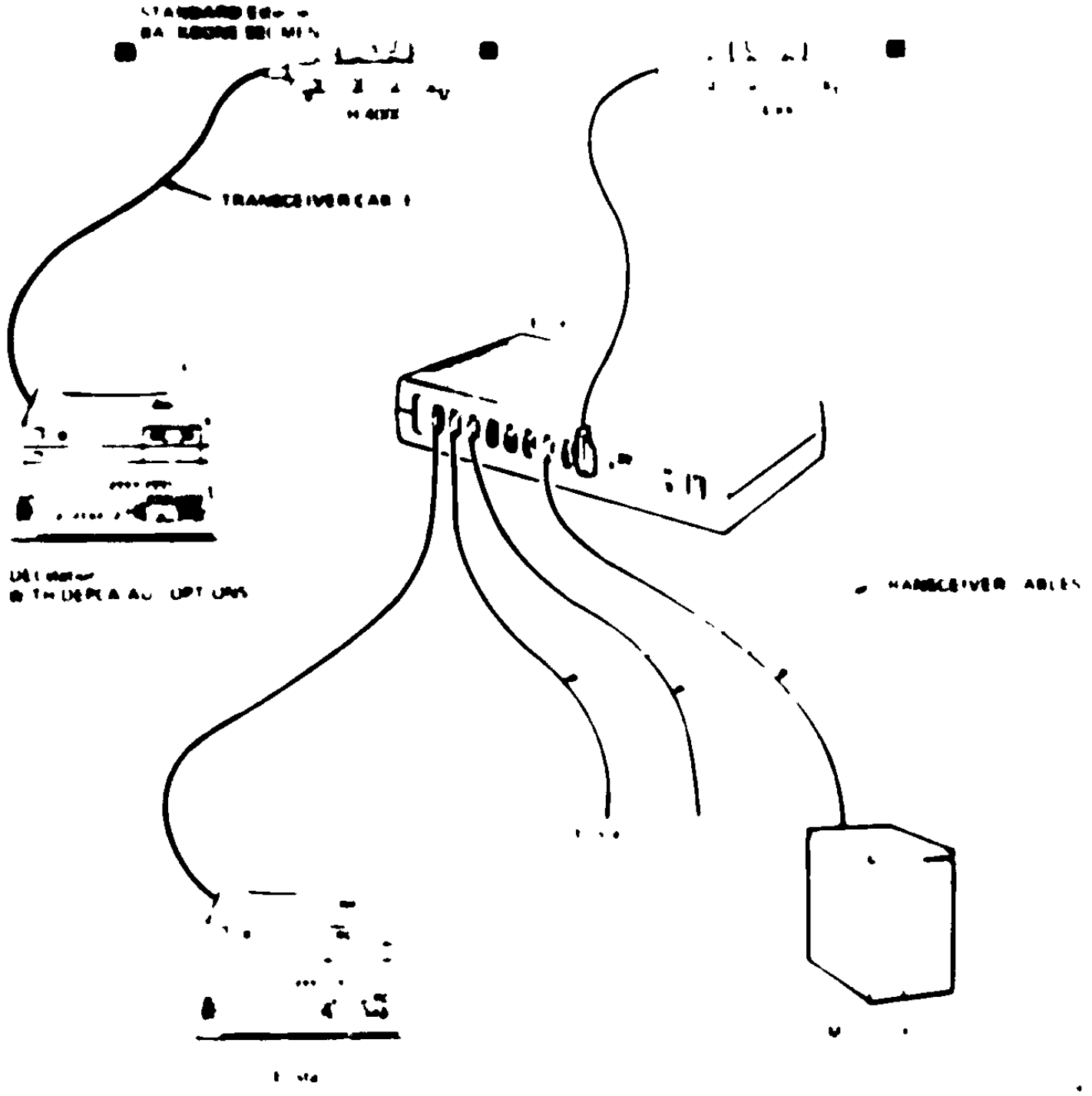
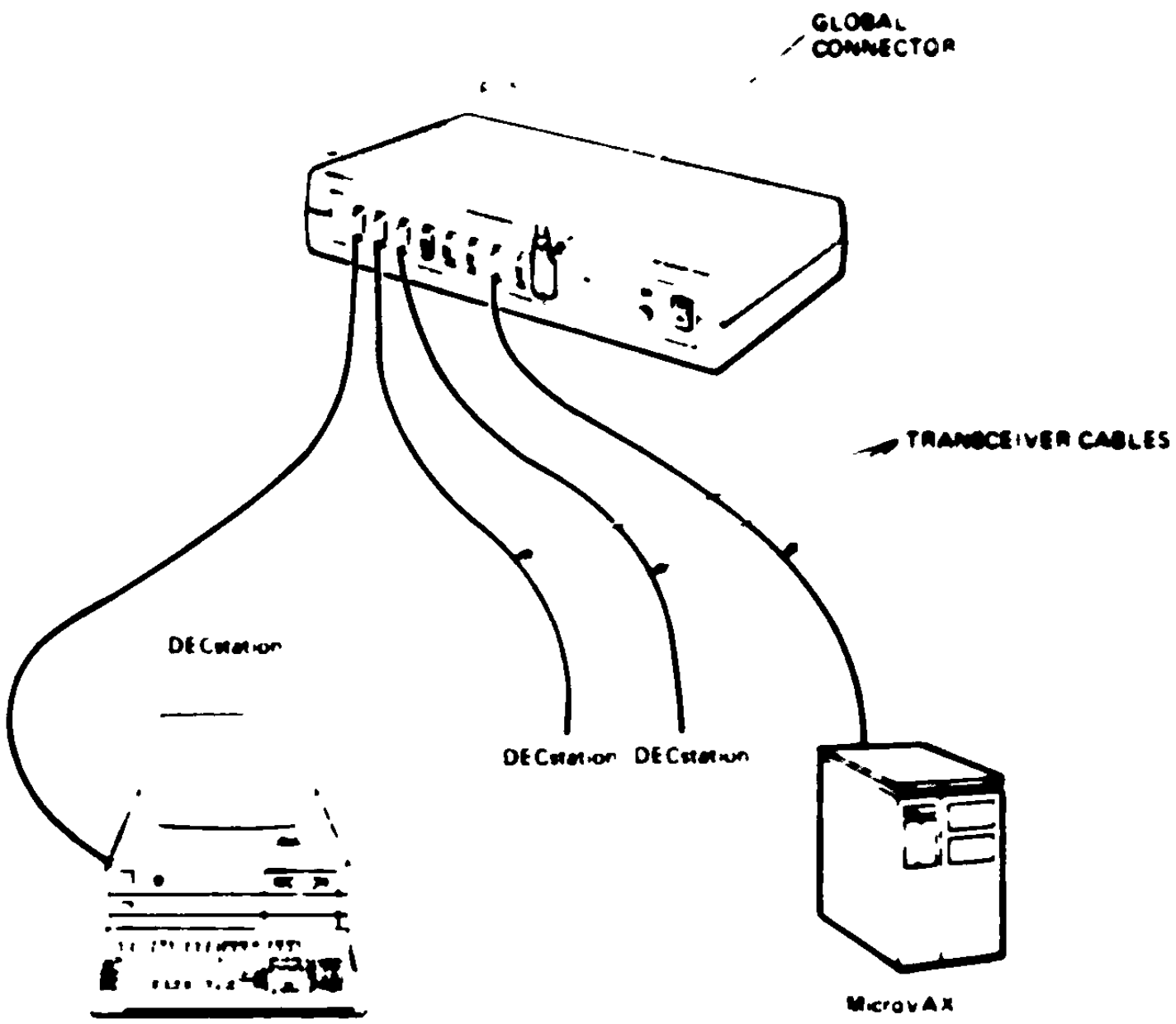


Figure 3–5 shows a network connection for a DECstation with a DEPCA/AUI option through a DELNI

Figure 3 5 DECstation Network Connection through a DELNI



To disconnect a DECstation from a standard Ethernet network, use the following procedure

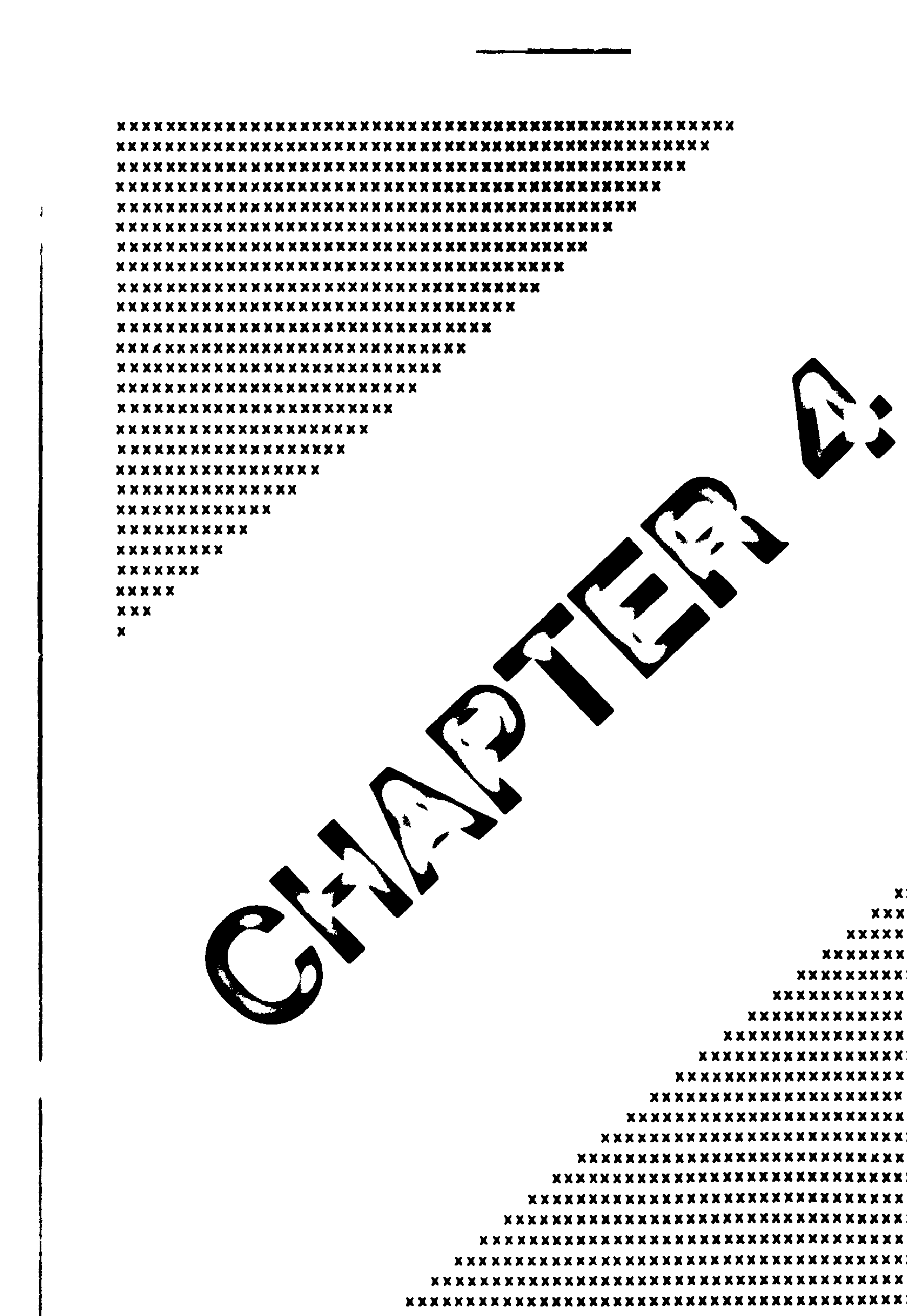
1 Inform the system administrator that you are going to disconnect the DECstation

2 Turn power to the DECstation off

3 Disconnect the transceiver cable from the connector on the DECstation

To connect the DECstation to a standard Ethernet network, reverse this procedure

For more information about connecting a DECstation to a standard Ethernet network, see the *DECconnect System Planning and Configuration Guide*


CHAPTER 4:

4

FRU Removal and Replacement

4.1 Introduction

This chapter contains procedures on how to remove and replace each DECstation field replaceable unit (FRU) Only qualified service technicians should remove and replace FRUs Use only DIGITAL supplied spares To install many of the FRUs, perform the reverse of the procedure when it is so noted

Table 4–1 lists the DECstation FRUs and part numbers

Table 4–1 DECstation Field Replaceable Units

FRU	Part Number
Enhanced 101 Keyboard	29-27442-01.A01
DIGITAL VSXXX Mouse	30-25322-01.A01
Color monitor	30-30901-01.A01
Monochrome monitor	30-30902-01.A01
Power supply (192W)	29 27435-01.A01
Main logic board, 16 Hz	29 27433-01.A01
Main logic board, 20 Hz	29-27434-01.A01
Math coprocessor, 16 MHz	19-30950-01.A01
Math coprocessor, 20 MHz	19 30949-01.A01
1 Mbyte SIMM (100 ns)	19 30957-01.A01
2 Mbyte SIMM (80 ns)	22-00271-01.A01
Zero Kbyte Extended memory board	20-30953-01.A01
1 44 Mbyte 3 5 inch Floppy disk drive	30 30943-01.A01
40 Mbyte 5 25 inch SCSI hard disk drive	30 30903 01 A01

Table 4 1 (Cont.) DECstation Field Replaceable Units

FRU	Part Number
80 Mbyte 5 25 inch SCSI hard disk drive	30 30904 01.A01
170 Mbyte 5 25 inch SCSI hard disk drive	30 30905-01.A01
150 Mbyte 5 25 inch SCSI tape drive	30 30906 01 A01
VGA board	20 30947 01.A01
16-bit SCSI board	20 30945 01 A01
Parallel/Serial board	20 30946 01 A01
Speaker/LED assembly and cable	29 27440 01 A01
Battery	29 27439-01.A01
SCSI drive ribbon cable	29 27441 01.A01
Floppy drive ribbon cable	29 27438 01.A01
DEPCA Adapter board	70 24252

4.1.1 Before Replacing FRUs

The following criteria apply when removing or installing DECstation FRU's

- Always turn off the power to the system unit and monitor and disconnect all external cables before removing any FRU

  NOTE
  Before disconnecting a DECstation from a network, inform the system administrator that you are going to disconnect the ThinWire T-connector from the system unit (Chapter 3). Do not disconnect any cable or terminator from the T-connector. Doing so disrupts network operation.

- Always use a grounded wrist strap and grounded work surface when opening the system unit or handling any external component and its replacement Static electricity can damage printed circuit boards and mass storage devices

- After replacing an FRU verify that it and the system unit function properly

4.2 Removing and Replacing FRUs

This section describes how to remove and replace the various FRUs in the DECstation. Figure 4–1 shows an exploded view of the DECstation system unit.

Figure 4–1 Exploded View of DECstation System Chasis

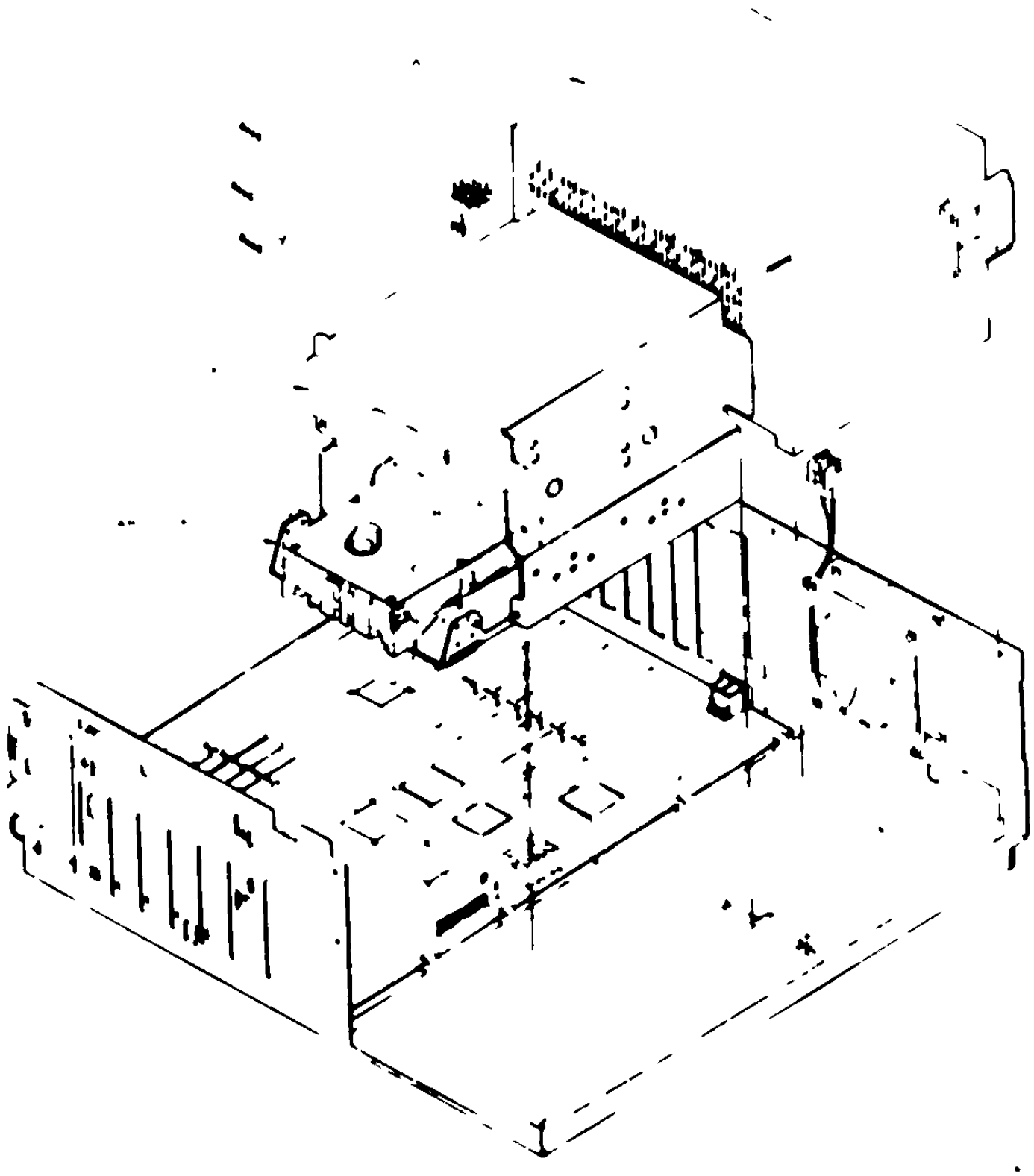
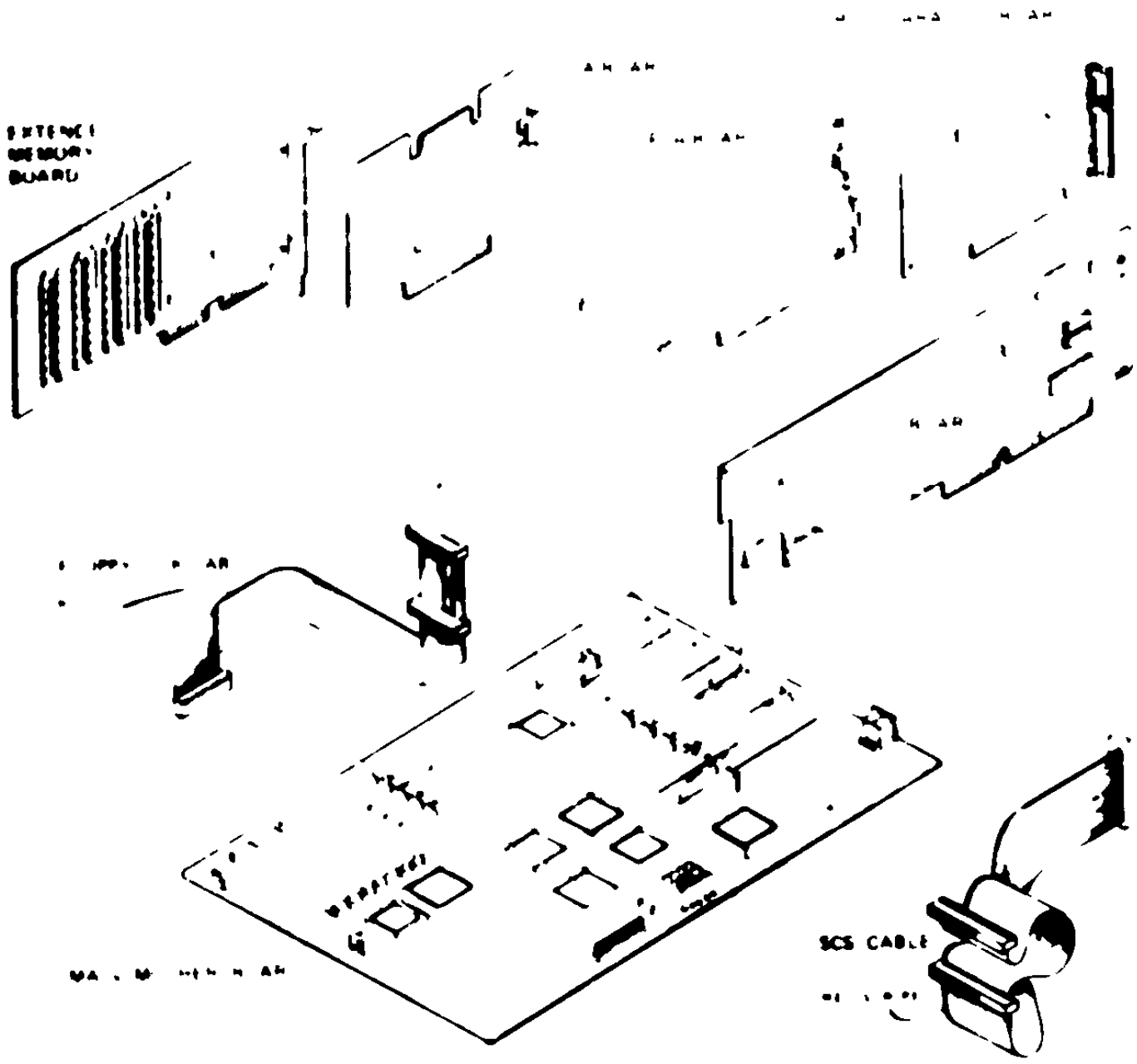


Figure 4–2 shows an exploded view of the DECstation system options

Figure 4 2 Exploded View of DECstation Main Logic Board and Options



4.2.1 Keyboard Replacement

Replace the keyboard as follows

1 Turn off power to the system unit

2 Disconnect the keyboard cable from the system unit

3 Connect the new keyboard to the system unit

4 Turn on power to the system unit

4.2.2 Monitor Replacement

Replace the monitor as follows

1 Turn off power to the monitor

2 Disconnect the monitor power cable from the wall outlet

3 Disconnect the monitor cable from the system unit

4 Connect the new monitor cable to the system unit

5 Plug the power cord from the new monitor into the wall outlet

6 Turn on power to the monitor

4.2.3 VSXXX Mouse Replacement

Replace the mouse as follows

1 Turn off power to the system unit and monitor

2 Disconnect the mouse cable from the system unit

3 Connect the new mouse cable to the system unit

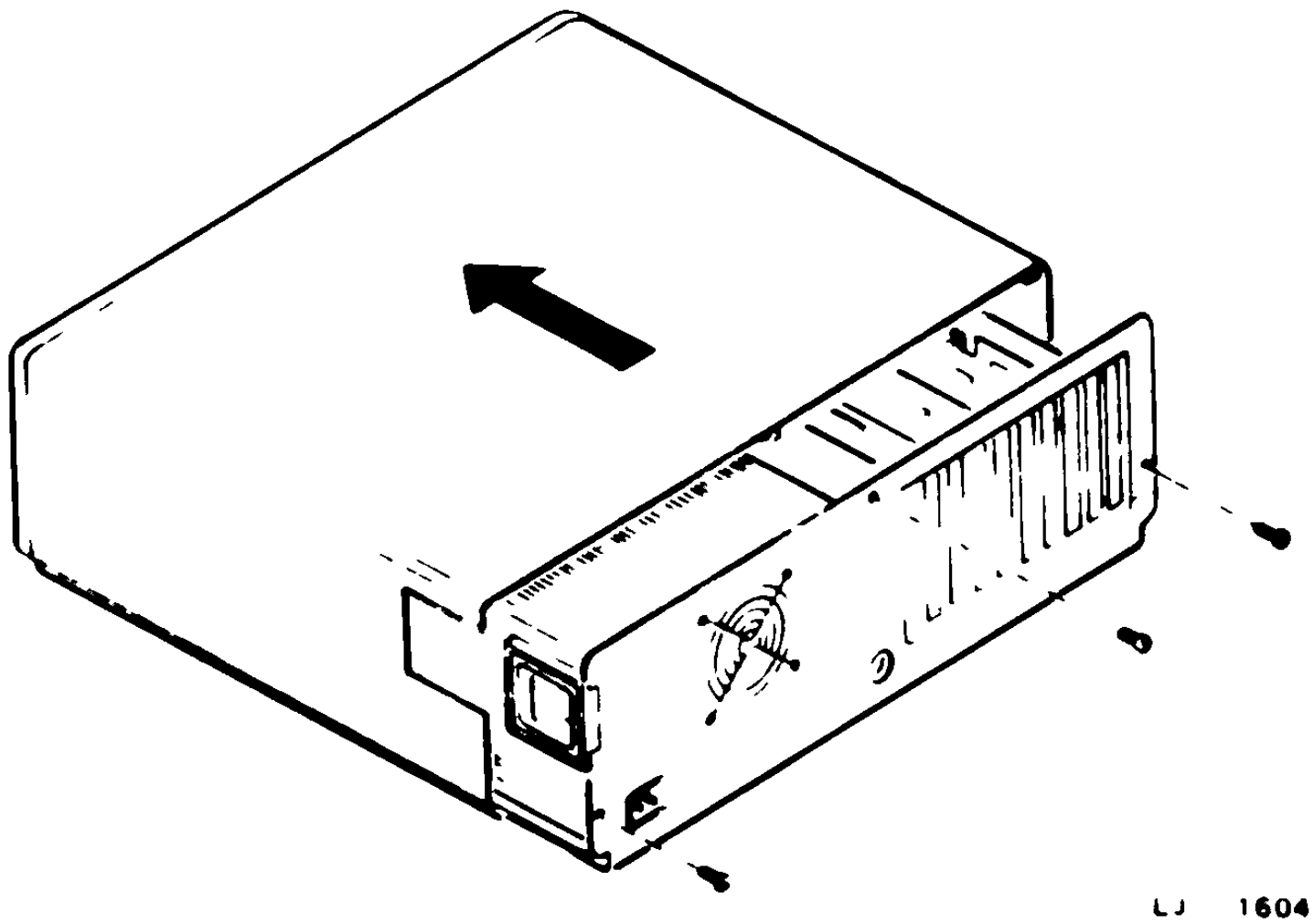
It may sometimes be necessary to clean the mouse Refer to the *DEPCA Service Guide* for information on cleaning the mouse

4.2.4 System Cover Removal

Use the following procedure to remove the system cover

1. Turn off the power to the system unit and monitor
2. Disconnect all cables from the back of the system unit
3. Remove the three screws that secure the cover to the back of the system unit (Figure 4–3)
4. Slide the cover forward until it is removed

Figure 4-3 Removing the System Cover



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4.2.5 Floppy Drive Removal

The floppy drive, hard disk, and tape drive are mounted in the drive tower in the front right of the system unit chassis

CAUTION
The floppy drive cable is not keyed. Before disconnecting the cable, mark it so you can later identify how it is connected.

Remove the floppy drive as follows (Figure 4–4)

1 Remove the system unit cover (Section 4 2 4)

2 Note how the communication ribbon cable is connected to the J3 connector

3 Disconnect the communication ribbon cable from the J3 connector

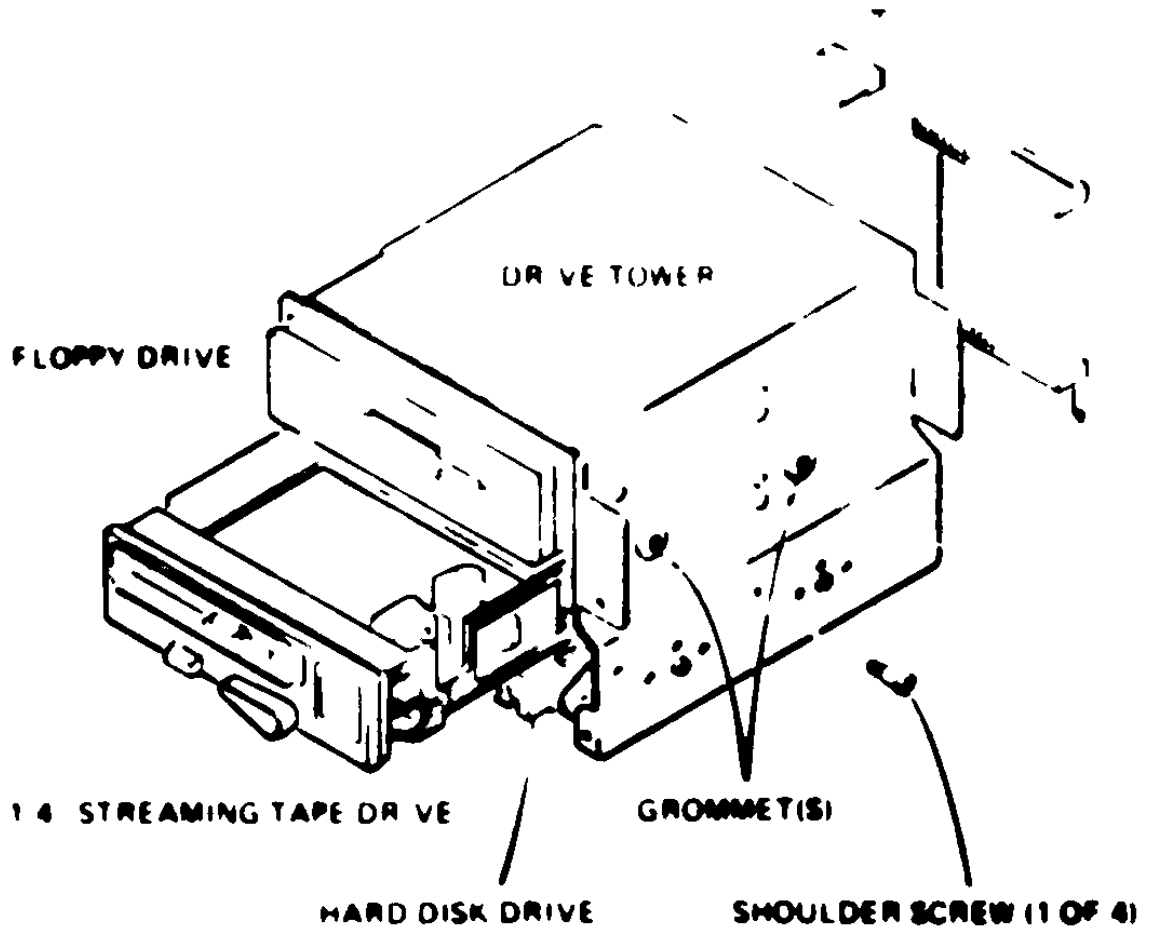
4 Disconnect the four wire power cable from the floppy drive

5 Remove the drive tower (Section 4 2 8)

6 Remove the four screws that hold the floppy drive in the drive tower Two screws are on each side of the drive tower

7 Slide the floppy drive out of the drive tower

Figure 4–4 Removing a Floppy Disk Drive



4.2.6 Hard Disk Drive Removal

CAUTION
The hard disk drive is a delicate precision instrument and subject to damage if handled improperly. Do not drop or bump the hard disk drive. Use care when moving the system unit with the hard disk drive installed.

Remove the hard disk as follows (Figure 4–5)

1 Remove the system unit cover (Section 4 2 4)

2 Disconnect the four wire power cable from the hard disk

3 Note how the communication ribbon cable is connected to the hard disk connector

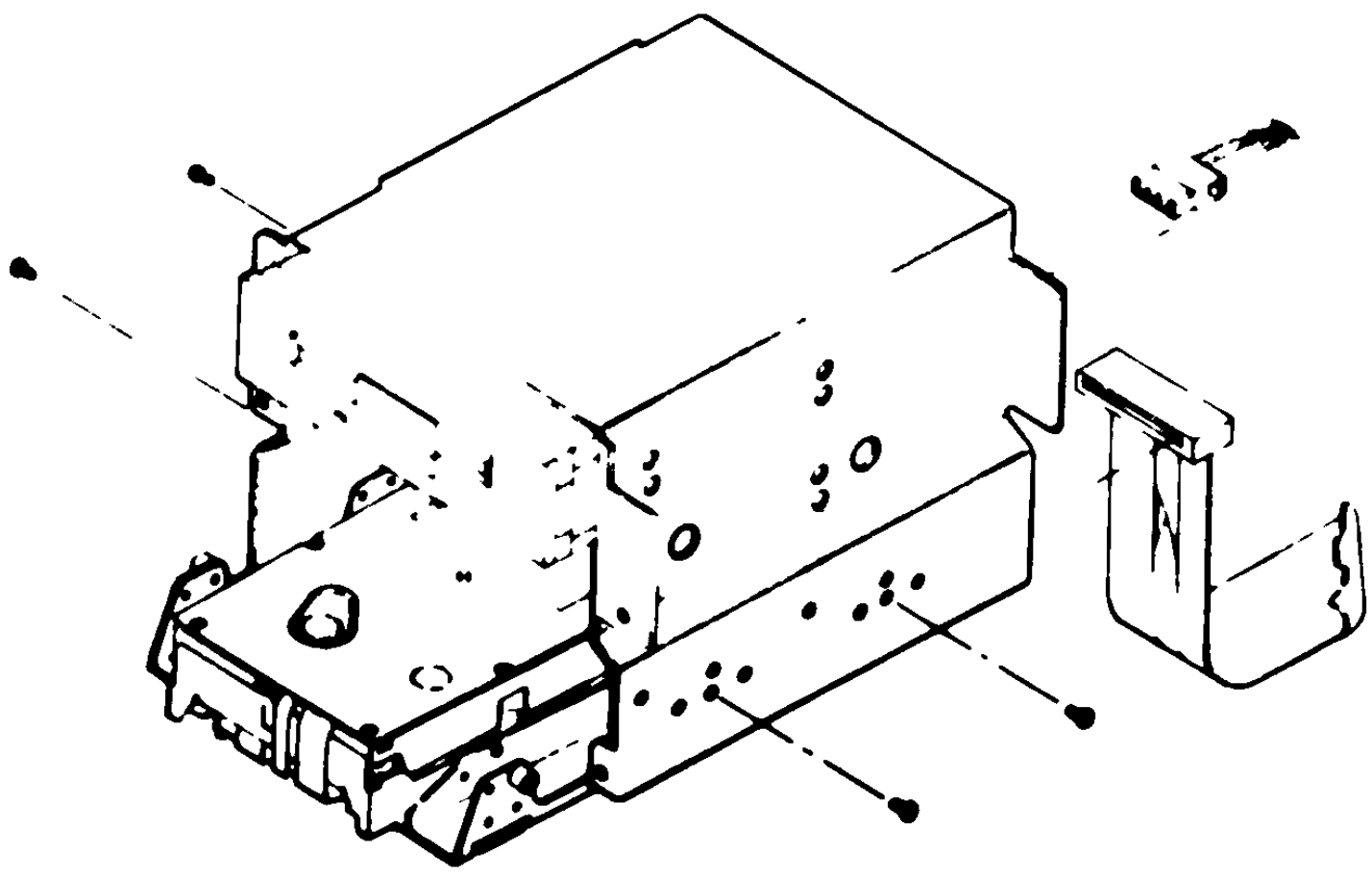
4 Disconnect the communication ribbon cable from the hard disk connector

5 Remove the drive tower (Section 4 2 8)

6 Remove the four screws on the drive tower (two screws each side) that hold the hard disk in place If you are removing a hard disk from the bottom slot, each screw is attached to a shock isolator mounted on the hard disk (A shock isolator is a black plastic attachment 0 5" in diameter It is placed between the drive tower and the hard disk) Save the screws you remove

7 Slide the hard disk out of the drive tower

Figure 4 5 Removing a Hard Disk



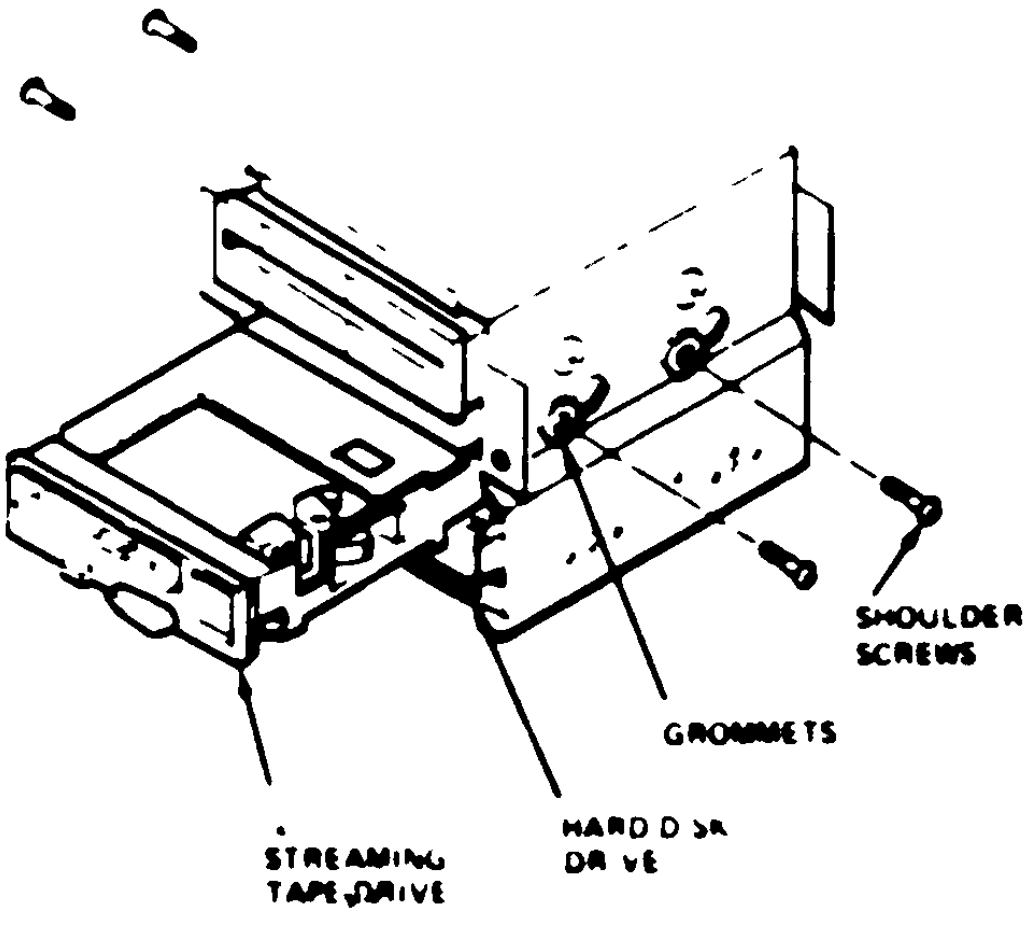
4.2.7 Tape Drive Removal

The drive belt and the circuit board on the bottom of the tape drive are exposed. Contact between these parts and a sharp object can damage the tape drive. Take care when handling the tape drive so you don't damage these parts.

Remove the tape drive as follows (Figure 4–6):

1. Remove the system unit cover (Section 4.2.4).
2. Disconnect the power cable from the tape drive.
3. Disconnect the ribbon cable from the tape drive.
4. Remove the drive tower (Section 4.2.8).
5. Remove the four screws (two screws each side) that attach the tape drive to the drive tower.
6. Slide the tape drive out of the drive tower.

Figure 4–6 Removing a Tape Drive



4.2.8 Drive Tower Removal

Remove the drive tower as follows (Figure 4–7)

1 Remove the system unit cover (Section 4 2 4)

2 Disconnect the four wire power cables and communication ribbon cables from the floppy drive, tape drive, and hard disk drive

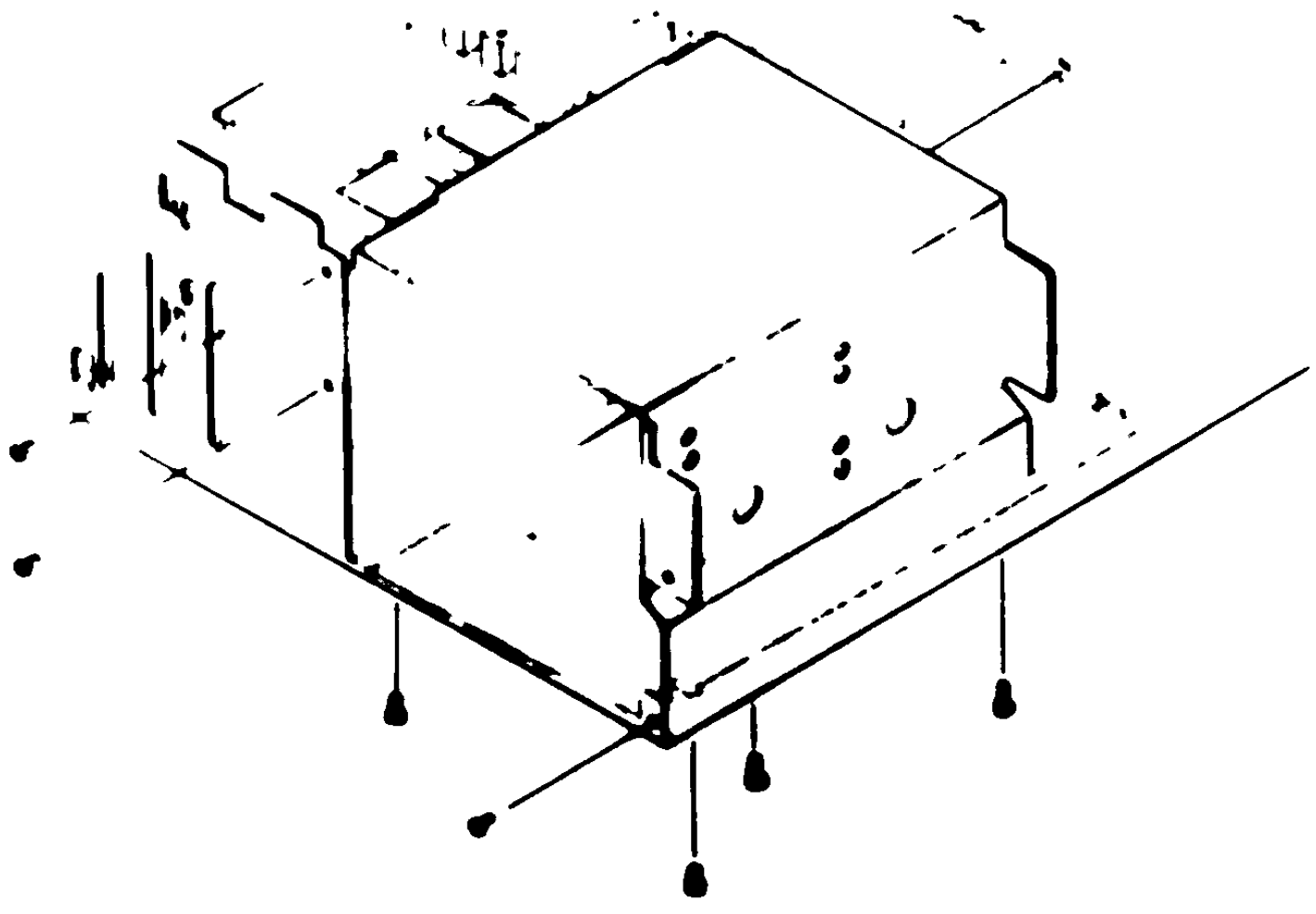
3 Remove the CMOS battery from the velcro strip on the side of the tower

4 Remove the four screws that attach the drive tower to the bottom of the system unit chassis

5 Remove the three screws that attach the drive tower to the the front of the system unit chassis

6 Lift the drive tower off the system unit chassis

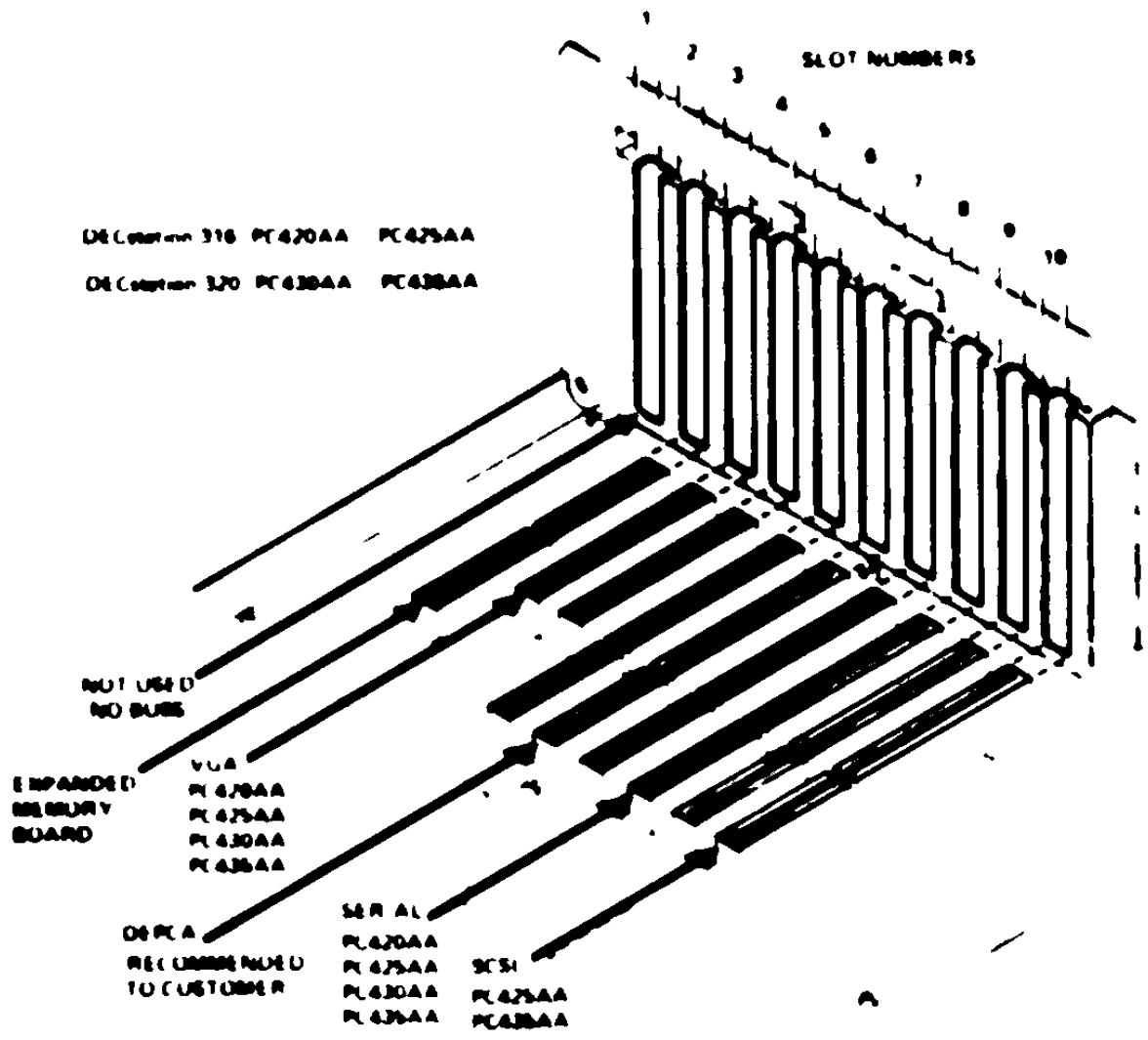
Figure 4 7 Removing a Drive Tower



4.2.9 Option Board Replacement

Different slots on the system unit are available for different options Figure 4–8 shows the recommended location of DIGITAL supplied options

Figure 4–8 Recommended Option Locations



NOTE

Note the slot position of each board that you remove from the DEXstation. Place the new board in the same slot.

Replace an option board as follows (Figure 4–9)

1. Remove the system unit cover (Section 4.2.4)
2. Locate and note the position of the option board to be replaced
3. Note the position of any cables connected to the boards and disconnect them
4. Remove the mounting screw that secures the option board to the chassis

5 Remove the board by pulling it up and out of the expansion slot connector

6 Configure the jumpers and switches on the new board to match those on the old board

7 Install the new board in the slot from which the bad board was removed Make sure the board is firmly seated in the socket(s) on the main logic board

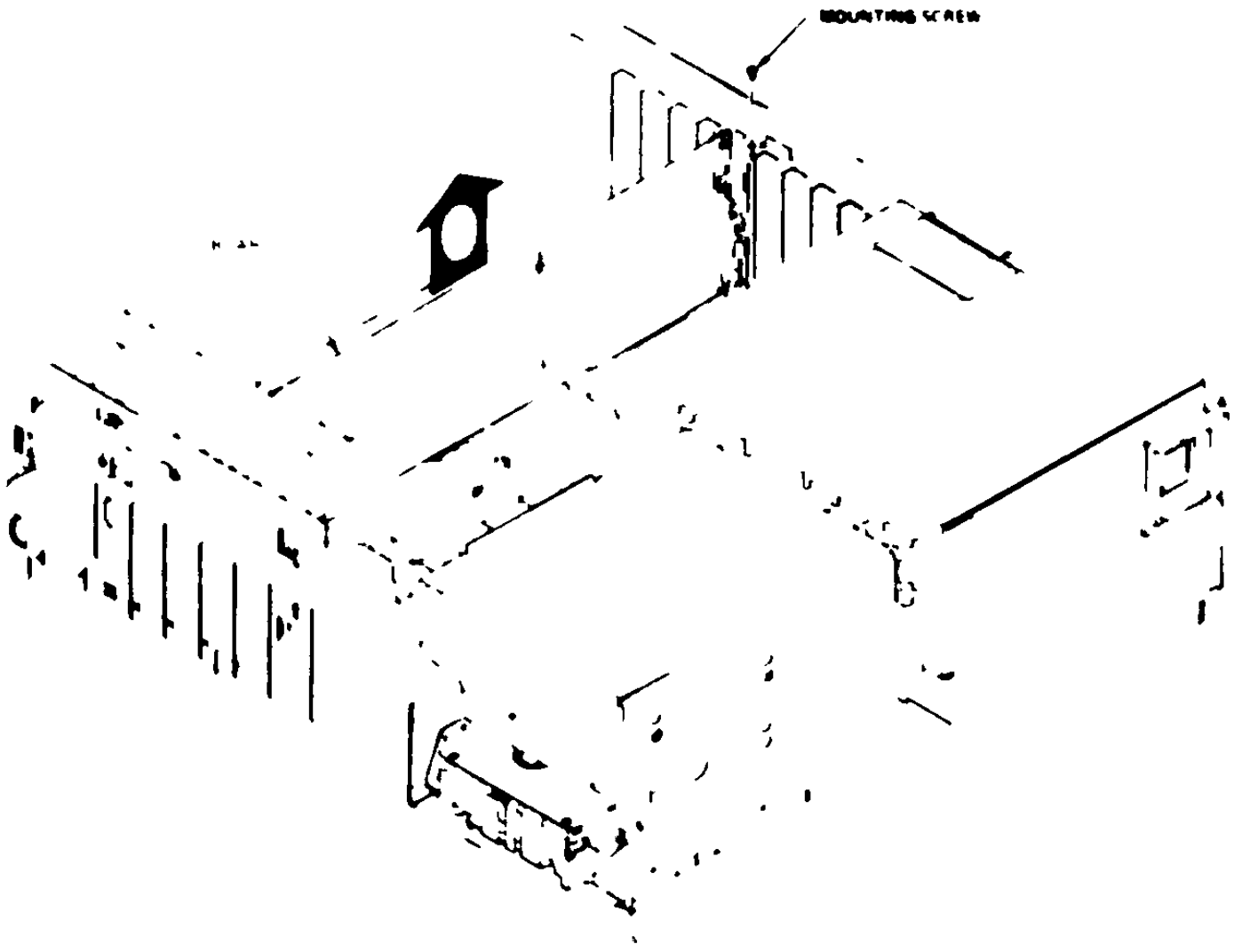
8 Secure the board to the chassis with the mounting screw

9 Reconnect any cables you removed

10 Verify the operation of the replaced board

11 Close the system unit

Figure 4 9 Replacing an Option Board



4.2.10 Math Coprocessor Replacement

Replace the math coprocessor as follows

1 Remove the cover from the system unit (Section 4 2 4)

2 Note the location of each option board and remove it from the system (Figure 4–8)

3 Remove the card guide (Section 4 2 14)

4 Locate the math coprocessor on the main logic board

5 Remove the math coprocessor by using a small, flat-blade screwdriver to alternately lift each end of the chip While lifting the chip out of the socket be careful not to damage the socket and chip or bend any of the pins on the chip (Figure 4–10)

6 Make sure pin one of the math coprocessor is aligned with pin one of the socket

NOTE
Both the Weitek coprocessor and the Intel coprocessor can be used in the DECstation. The Weitek coprocessor fills the entire socket. The Intel coprocessor does not fill the outer rows of the socket. See the appropriate installation manual for more information.

7 Install the chip in the socket Make sure the chip is firmly seated in the socket

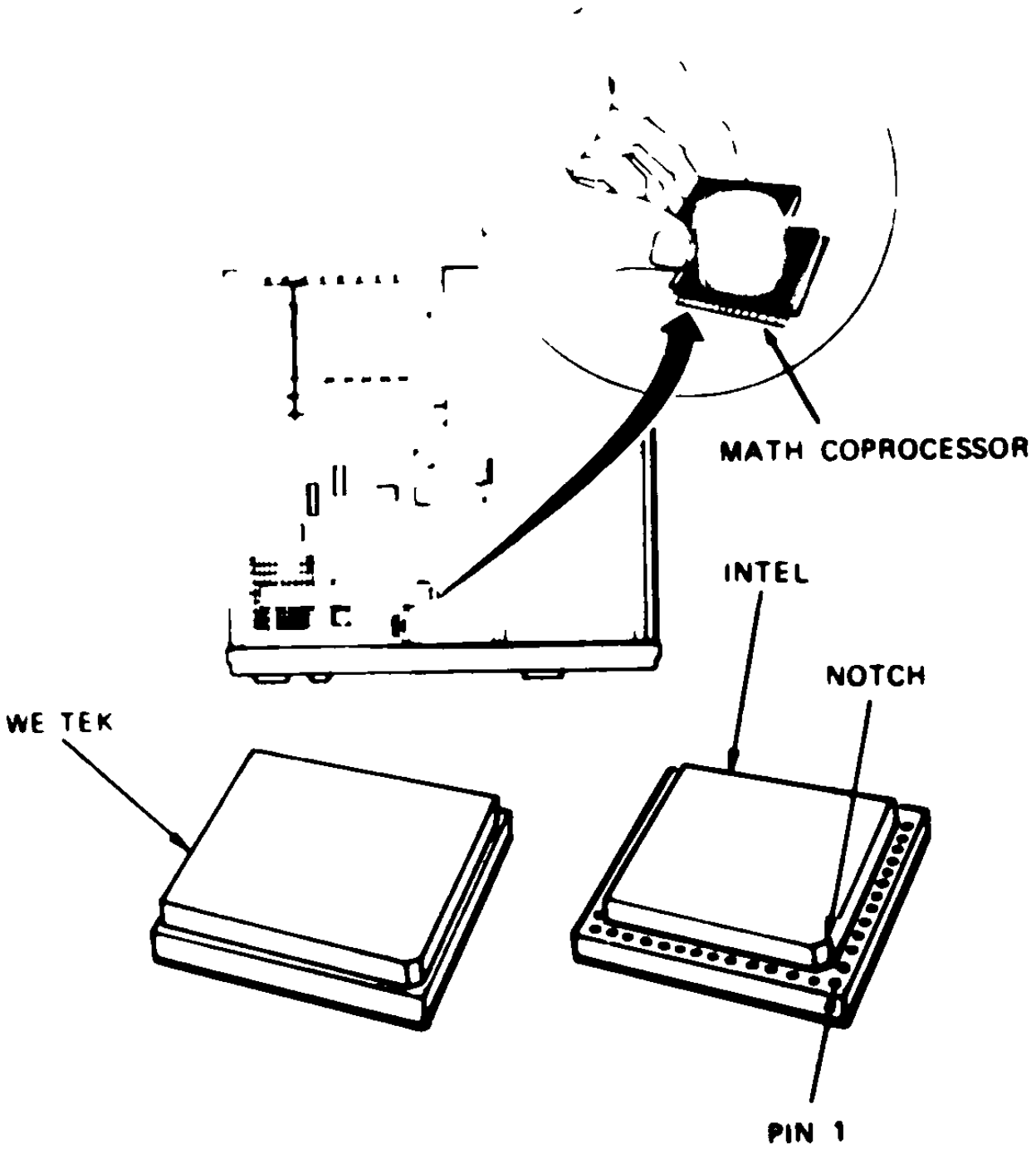
8 Reinstall the card guide

9 Reinstall the option boards in their noted locations

10 Verify the operation of the new math coprocessor

11 Close the system unit

Figure 4 10 Replacing the Math Coprocessor



4.2.11 Single-In-Line Memory Module Replacement

Replace a Single-In Line Memory Module (SIMM) on the main logic board or extended memory board as follows (Figure 4–11)

1 Remove the system unit cover (Section 4 2 4)

2 Locate the SIMM to be replaced This can be on the main logic board (Figure 4–15) or the extended memory board

If the SIMM is on the main logic board, remove the option boards (Section 4 2 9) and the card guide (Section 4 2 14)

If the SIMM is on the extended memory board, remove the memory board (Section 4 2 9)

3 To remove a SIMM, use both thumbs to spread the retaining latches that clamp the front SIMM (the SIMM that is farthest from the keyboard connector) to the chip mount The A arrows in Figure 4–11 show this movement

4 Move the SIMM forward toward the vertical position The B arrows in Figure 4–11 show this movement

5 Then, use your index fingers to pull the SIMM away from the restraining brackets The C arrow in Figure 4–11 shows how to do this

6 Remove the back SIMM in the same manner

7 To install a SIMM, grasp it at both ends and insert it into the socket Make sure the SIMM is fully seated in the connector

8 Press back and down on the SIMM to lock it into place

Table 4–2 shows the different memory configurations that are allowed on the DECstation

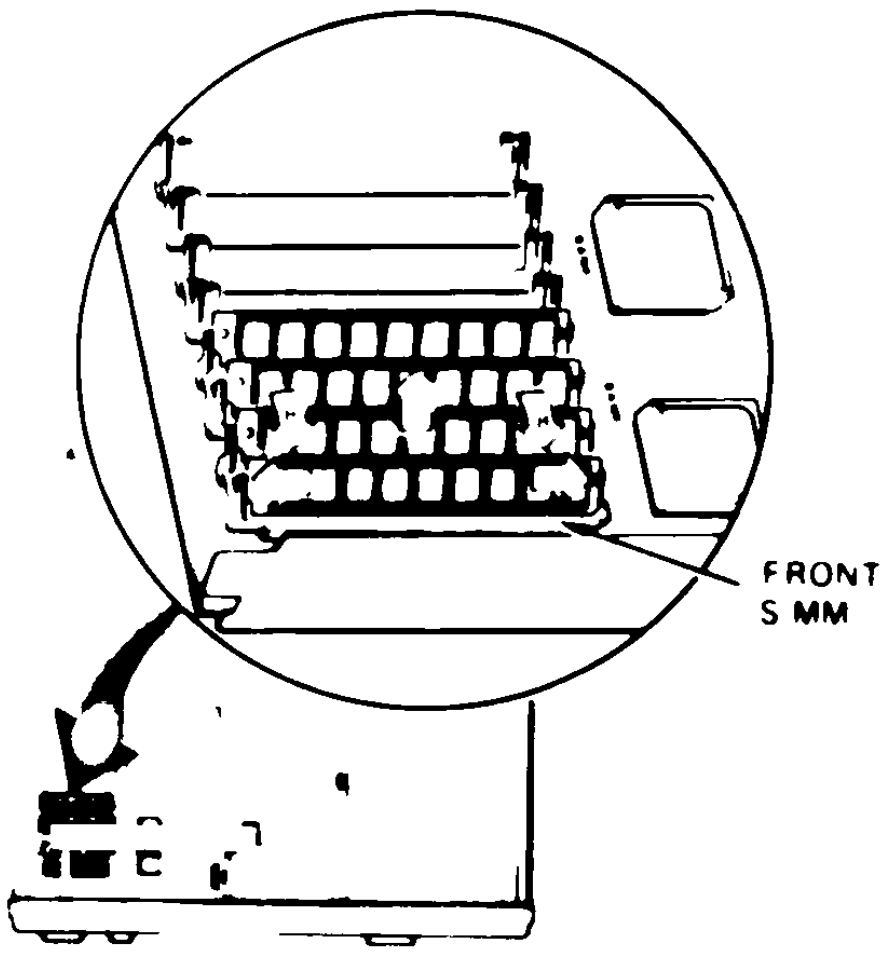
Table 4 2 Memory Configurations on the DECstation

Memory Size	SIMMs on Main Logic Board	SIMMs on Expansion Board
1Mb	Four 256K [1]	none
2Mb	Eight 256K [2]	none
4Mb	Eight 256K	Eight 256K
8Mb	Eight 1Mb	none
10Mb	Eight 1Mb	Eight 256K
16Mb	Eight 1Mb	Eight 1Mb

[1]Default configuration on the DECstation 316

[2]Default configuration on the DECstation 320

Figure 4 11 Removing a SIMM



4.2 12 Power Supply Removal

CAUTION
After you turn power off to the system, do not disconnect the power cord for at least 20 seconds.

Remove the power supply as follows (Figure 4–12)

1 Remove the system unit cover (Section 4 2 4)

2 Unplug the power cable from its socket on the main logic board

3 Unplug the four wire power cable from the back of the diskette drive

4 If present, unplug the four wire power cables from the back of the hard disk drive and tape drive

5 Remove the three screws that attach the back of the power supply to the system unit chassis

6 Check for additional screws that attach the power supply to bottom of the system unit chassis If you find any, remove them

7 Pull the power supply forward 1

8 Lift the power supply out of the system unit chassis

4.2.13 Fan Replacement

The fan removes hot air from the chassis during system operation
Remove the fan as follows (Figure 4–12)

1 Make a note of the direction in which the fan rotates

2 Remove the system unit cover (Section 4 2 4)

3 Remove the power supply (Section 4 2 12)

4 Disconnect the fan cable from the power supply

5 Remove the four sheet metal screws that attach the fan to the system unit chassis

6 Attach the replacement fan to the chassis with the four sheet metal screws

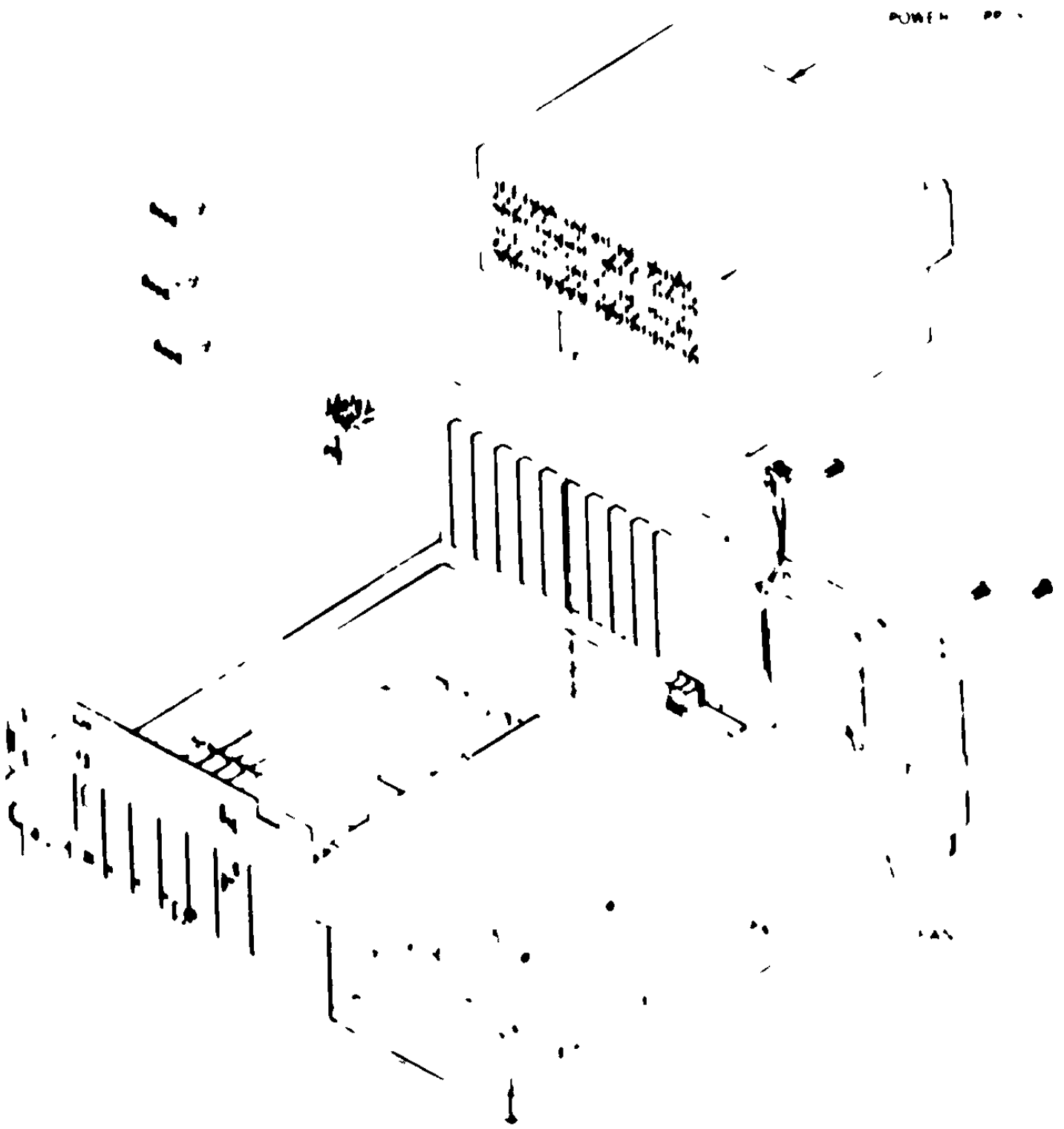
7 Connect the fan cable to the power supply

8 Install the power supply

9 Turn the power on

10 Check the rotation of the fan If the fan is drawing air into the chassis you need to correct the fan's rotation You can do this by reversing the fan cable's polarity

Figure 4 12 Removing the Power Supply/Removing the Fan



4.2 14 Card Guide Removal

Remove the card guide as follows (Figure 4–13)

1 Remove the system unit cover (Section 4 2 4)

2 Remove the option boards that are supported by the card guide

3 Loosen but do not remove the four screws that attach the card guide to the front of the system unit chassis

4 Slide the card guide up so that the screw heads can fit through the holes in the chassis

5 Pull the speaker from the slot where it is wedged and drape it over the outside of the chassis (The speaker is magnetic and can damage the main logic board)

6 Pull the card guide to the back so that it is no longer attached to the chassis

4.2.15 Speaker and LED Cable Removal

Remove the speaker and LED as follows (Figure 4–13)

1 Remove the system unit cover (Section 4 2 4)

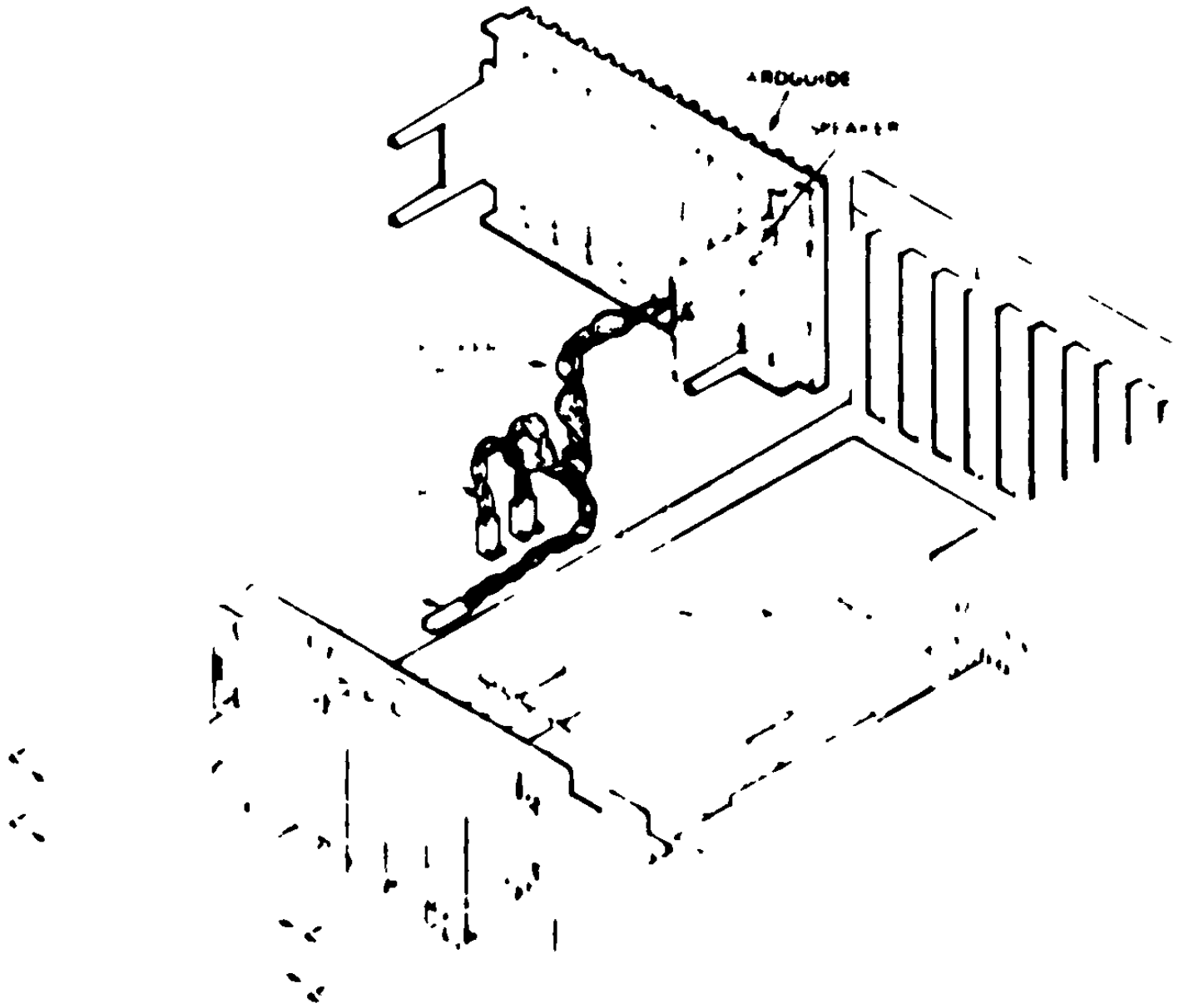
2 Remove the card guide (Section 4 2 14)

3 Disconnect the speaker cable from the main logic board

4 Disconnect the LED cable from the main logic board

5 Disconnect the LED connector from the LED Note the orientation of the LED when you disconnect it (One lead is longer than the other)

Figure 4 13 Removing the Card Guide Speaker and LED



4.2.16 CMOS Battery Removal

Remove the battery pack as follows (Figure 4–14)

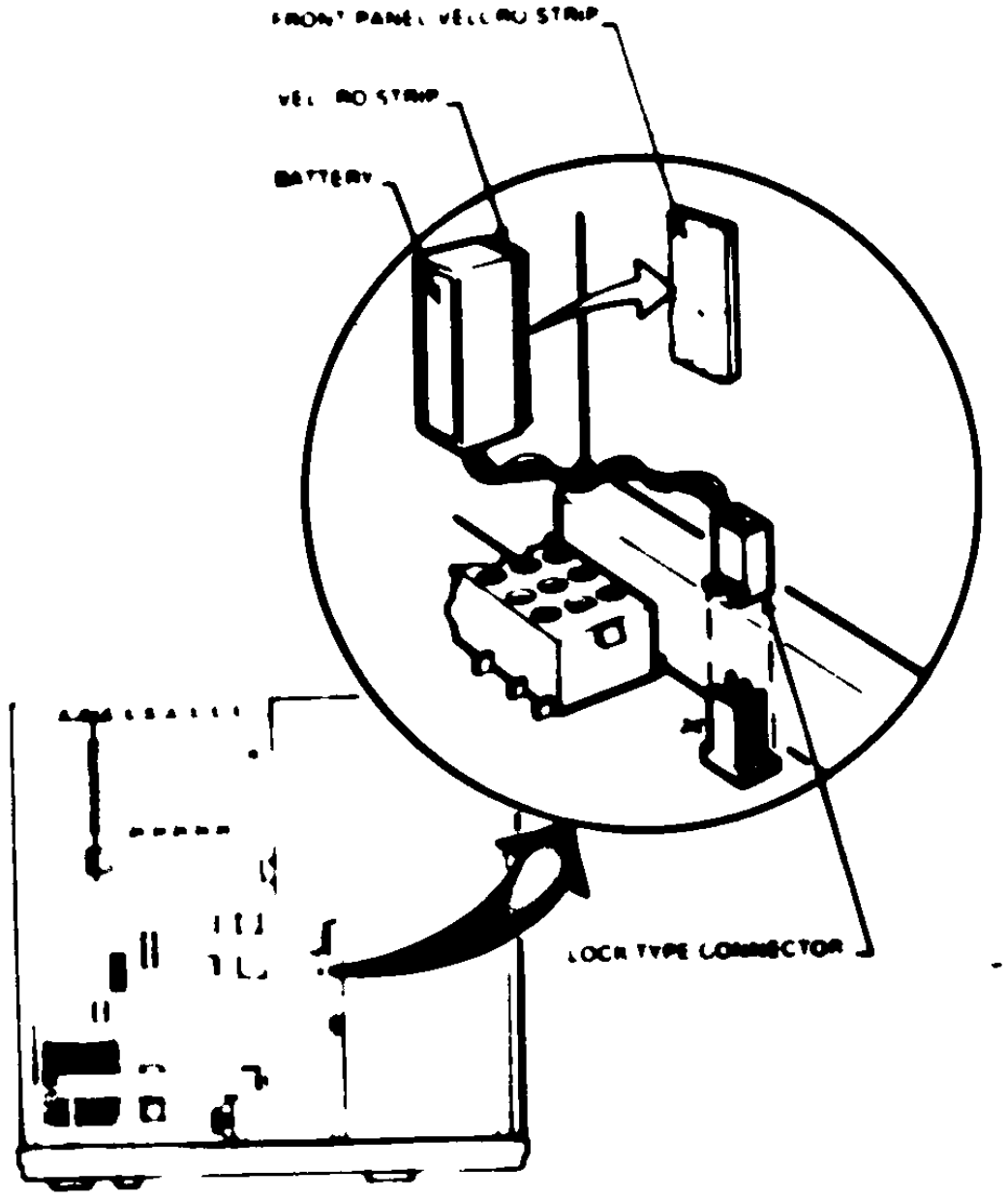
1 Remove the system unit cover (Section 4.2.4)

2 Unplug the battery cable from the main logic board

3 Remove the CMOS RAM battery from the velcro pad that holds it on the drive tower

WARNING
Do not dispose of the battery at the customer site. Do not burn the battery or dispose of it in water. Do not attempt to take it apart.

Figure 4–14 Removing the CMOS RAM Battery



4.2.17 Main Logic Board Removal

Remove the main logic board as follows (Figure 4–15)

1 Remove the system unit cover (Section 4 2 4)

2 Remove all the option boards installed in the system unit (Section 4 2 9)

3 Remove the CMOS RAM battery (Section 4 2 16)

4 Remove the card guide (Section 4 2 14)

5 Remove the speaker and LED cable (Section 4 2 15)

6 Disconnect the floppy drive connector from the main logic board

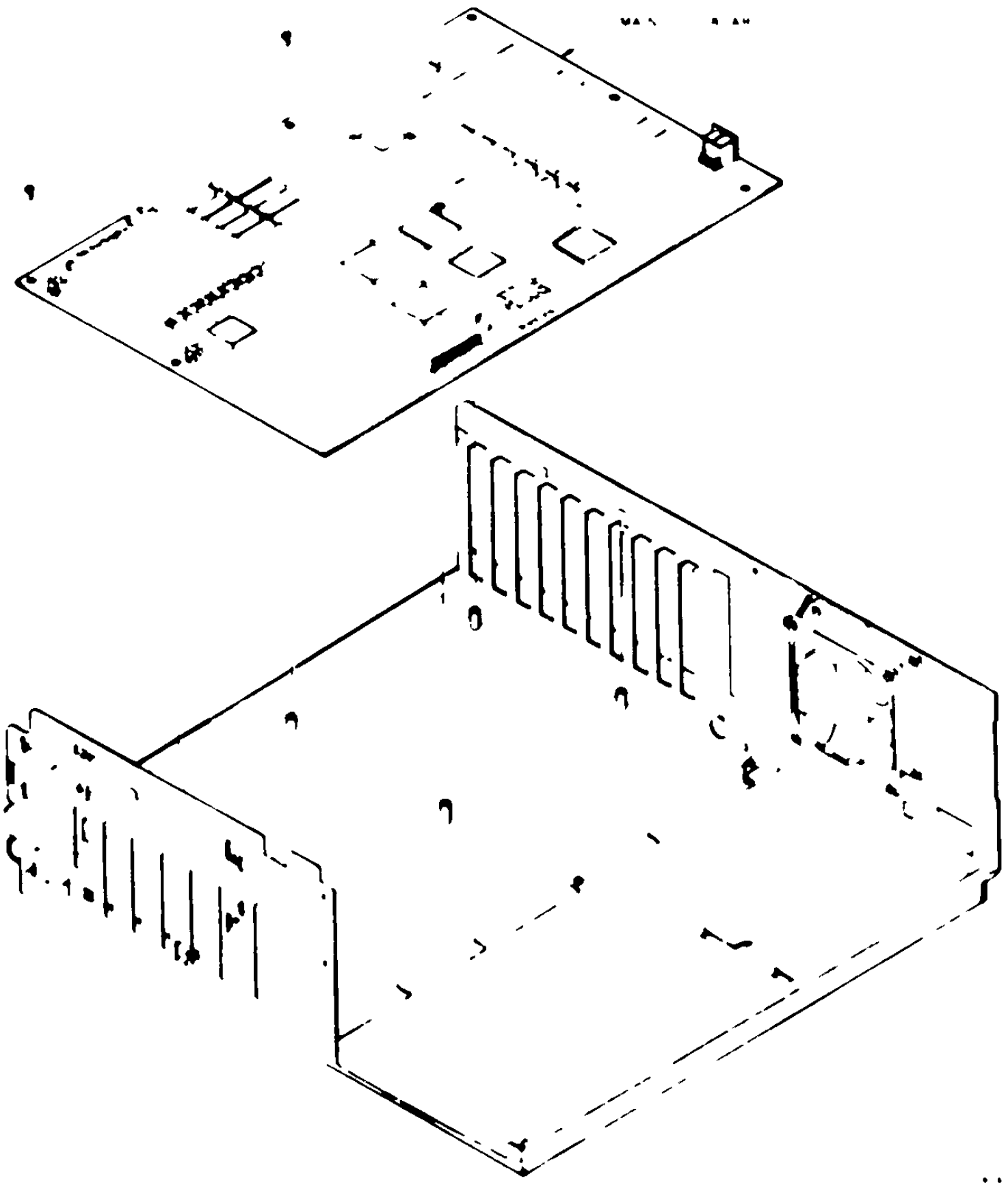
7 Disconnect the power connector from the main logic board

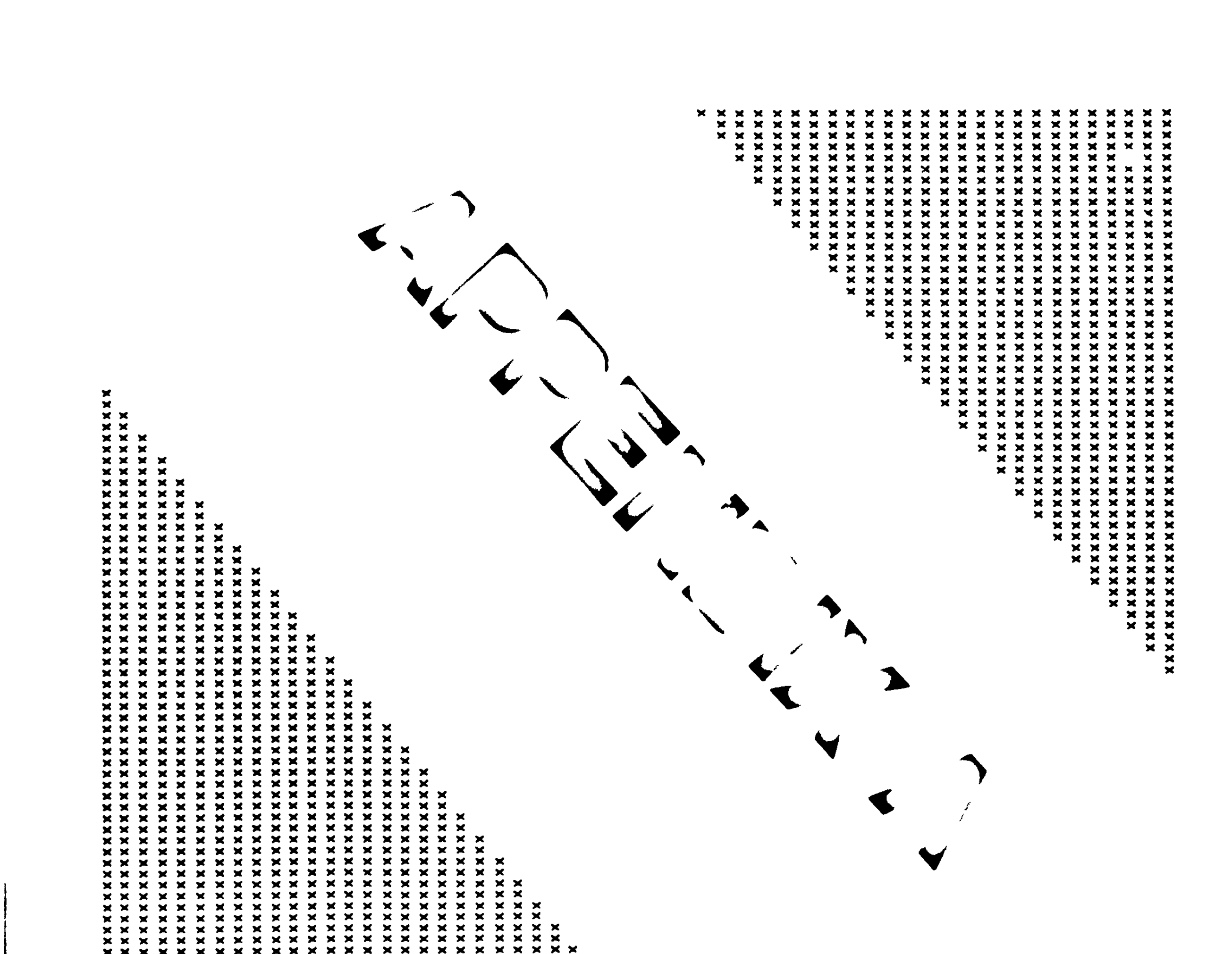
8 Remove the seven screws that attach the main logic board to the system unit chassis

9 Press the keyboard lock against the chassis wall as far as possible You may need to tape it to the chassis wall

10 Slide the main logic board out of the system unit chassis Do not bend the board when you lift it from the chassis

Figure 4 15 Removing the Main Logic Board





A

Jumpers and Switches

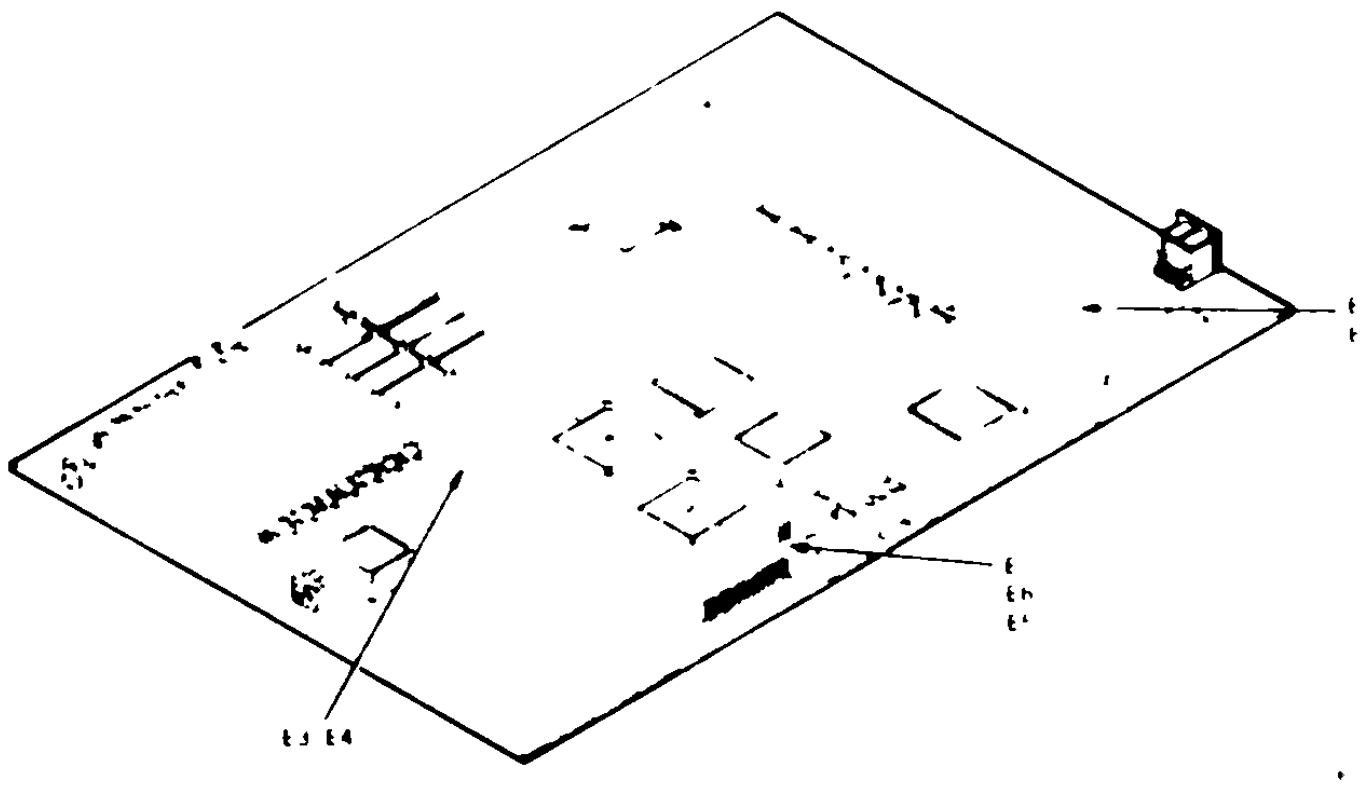
This appendix shows the location and describes the function of the jumpers and switches on the following boards used in the DECstation

- Main logic board
- VGA option board
- Serial/parallel board
- 16-bit SCSI board
- 40 Mbyte SCSI hard disk
- 80 Mbyte SCSI hard disk
- 170 Mbyte SCSI hard disk
- 150 Mbyte tape drive

A.1 Main Logic Board

Figure A-1 shows the main logic board of a DECstation 316. The positions of the jumpers are labeled

Figure A 1 Main Logic Board of DECstation 316



NOTE

The DEC'station 320 main logic board has the same positions for its jumpers The only physical difference between the system boards is that the DEC'station 320 has four additional SIMMs installed on it

Table A 1 lists the jumper settings for the DECstation main logic board

Table A 1 DECstation 300 Series Main Logic Board

Configuration	Jumper Setting
Monitor	
Color	E1-E2*
Monochrome	No Jumper
Math Coprocessor	
Present	E3-E4
Not Present	No Jumper†
Floppy Disk Controller	
Floppy Disk Controller Enabled and Set as Primary Floppy Port	E5 E6*
Floppy Disk Controller Enabled and Set as Secondary Floppy Port	E6-E7

*Default Setting

†If a coprocessor is not present Jumper E3-E4 must be off Otherwise the system will not boot

A.2 VGA Board

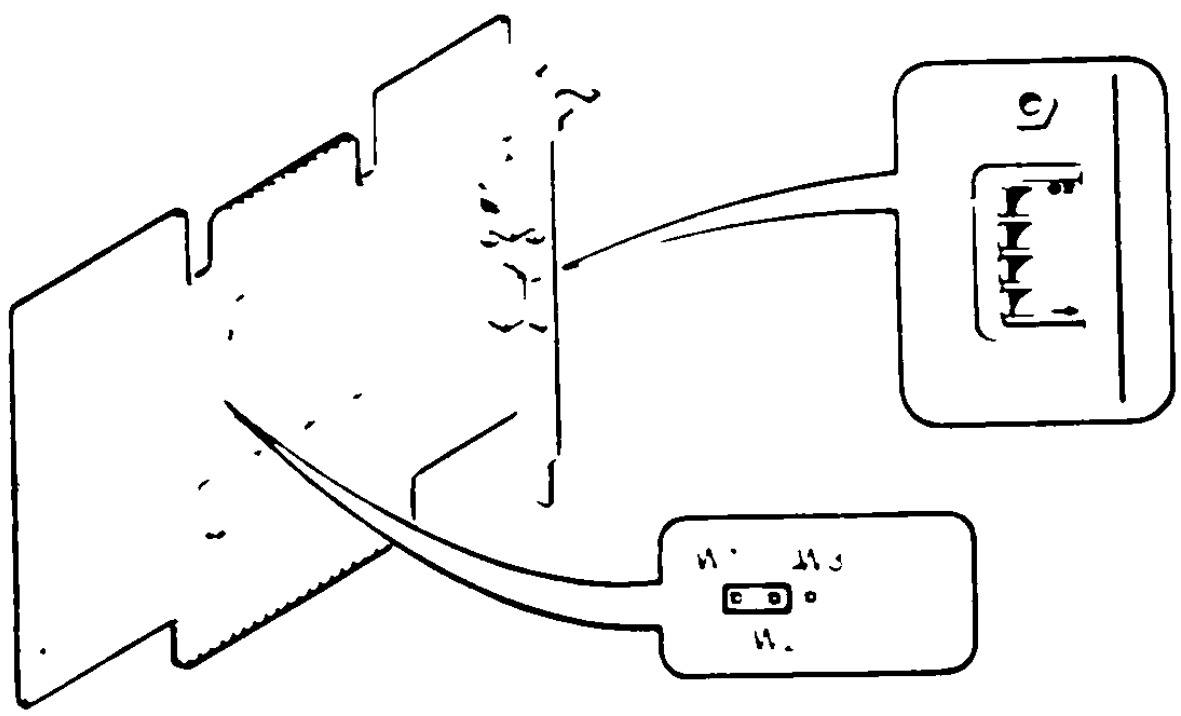
Figure A–2 shows the location of the jumpers and switches on the VGA board. Table A–2 lists the jumper settings for the VGA board.

NOTE
Verify that the dip switches on the VGA are all OFF.

Table A–2 VGA Configuration

Configuration	Jumper Setting
Feature Connector	
132 Column Text Mode Enabled	W1 W2*
132 Column Text Mode Disabled	W2 W3
Default Setting	

Figure A–2 VGA Board Jumper and Switch Locations



A.3 Serial/Parallel Board

Figure A–3 shows the jumper location on the Serial/Parallel board
Table A–3 describes the function of each jumper

Figure A 3 Serial Parallel Board Jumper Locations

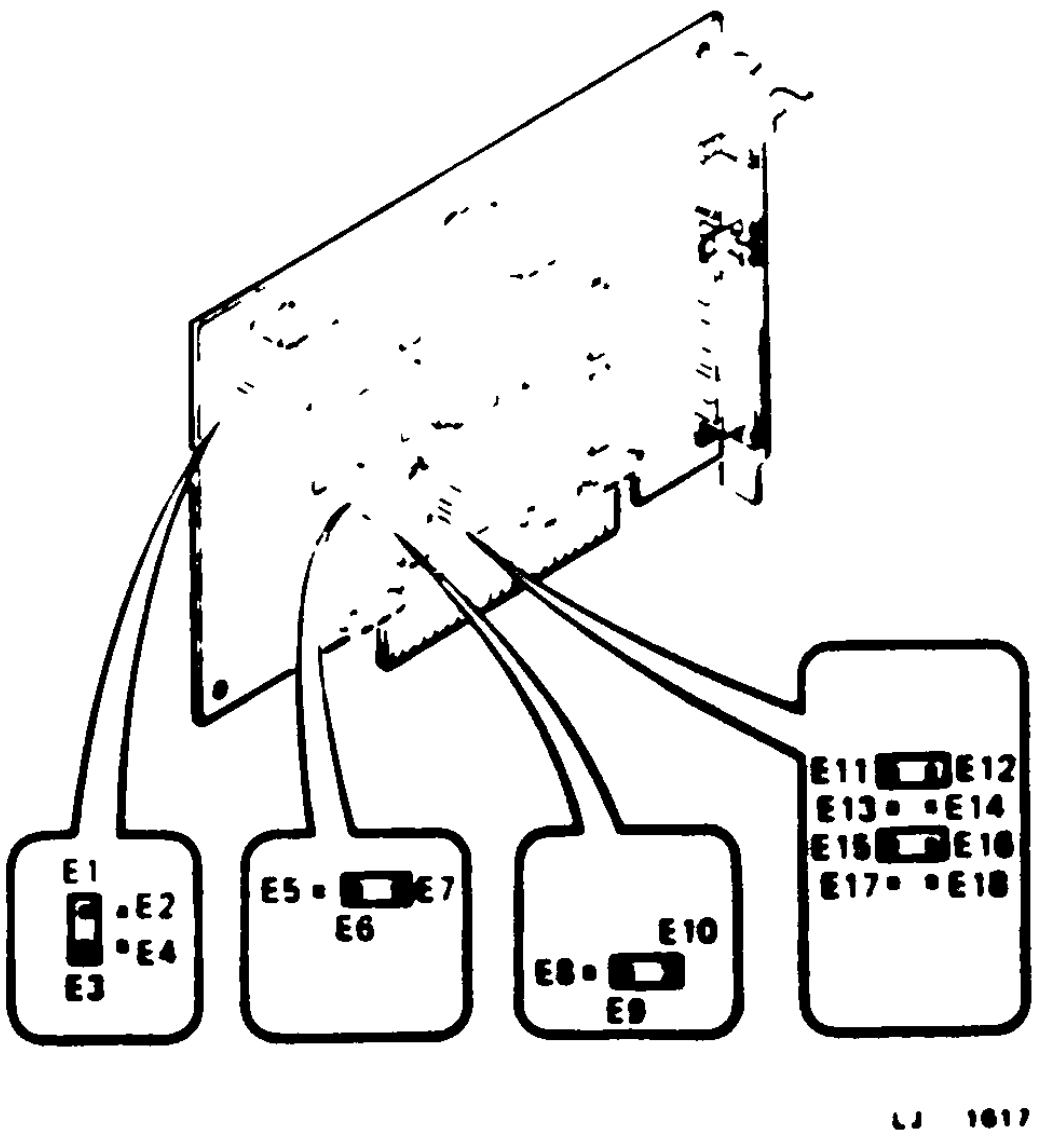


Table A 3 Serial Parallel Board Jumper Settings

Configuration	Jumper Setting
Serial Port	
Port 1	E9 E10*
Port 2	E8-E9
Interrupt for Serial Port	
Interrupt 4 for Serial Port 1	E15 E16*
Interrupt 3 for Serial Port 2	E17 E18
Baud Rate Generator	
USA Standard	E1 E3*
International	E1 E2, E3-E4
Parallel Port	
Port 1	E6-E7*
Port 2	E5-E6
Interrupt for Parallel Port	
Interrupt 7 for Parallel Port 1	E11 E12*
Interrupt 5 for Parallel Port 2	E13 E14

Default Setting

A.4 16-Bit SCSI Host Adapter

Figure A–4 shows the locations of the jumpers and bus terminators on the 16 Bit SCSI Host Adapter. Table A–4describes the function of each jumper. The jumpers in the table are referred to as pin pair numbers.

NOTE
The pins at some locations are numbered from left to right, at other locations from right to left.

Figure A 4 16-Bit SCSI Host Adapted Jumper Locations

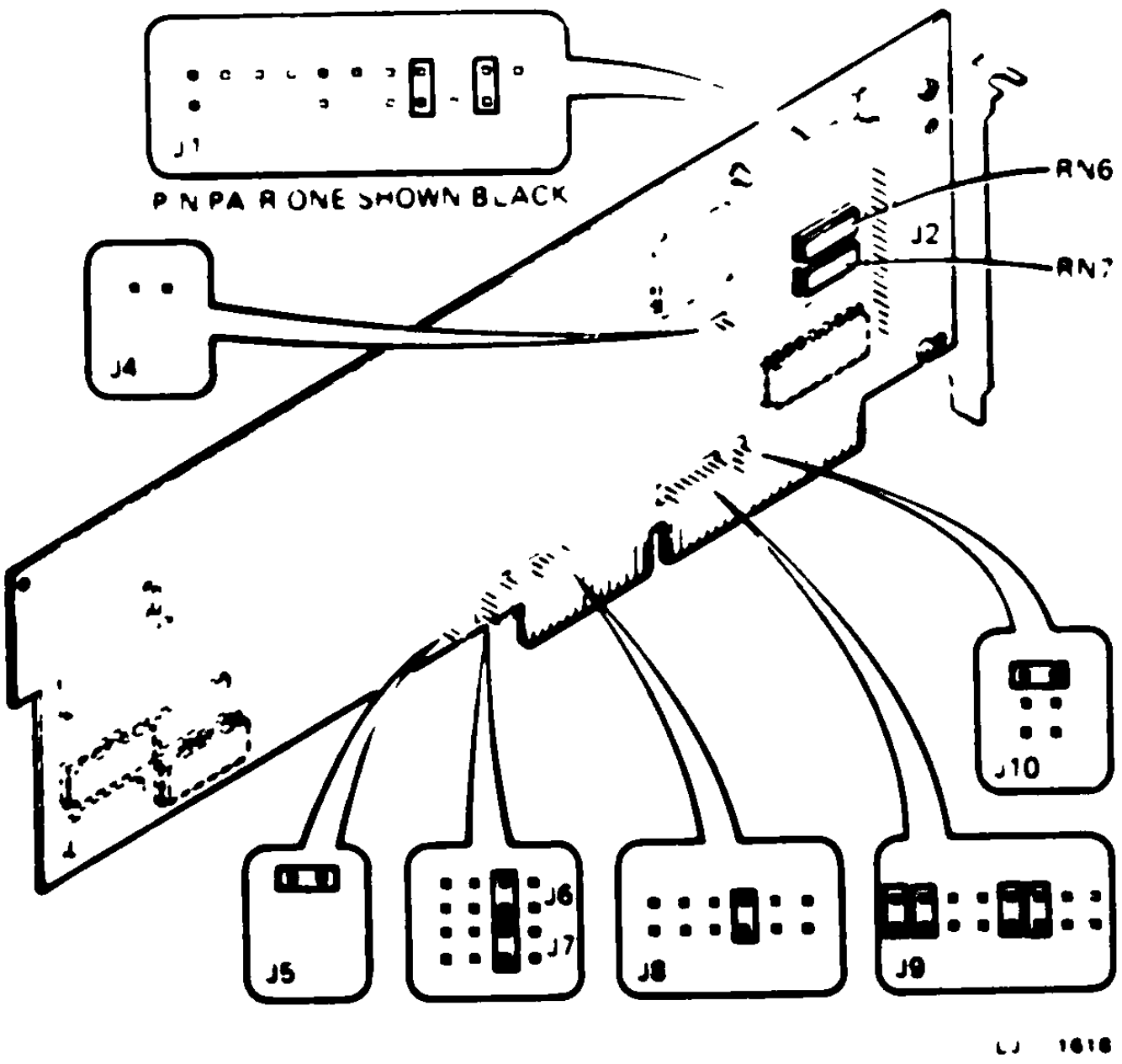


Table A–4 16-Bit SCSI Host Adapter Configurations

Configuration	Jumper Setting		
SCSI Address	**J1,Pair 4**	**J1,Pair 5**	**J1,Pair 6**
Address 0	X	X	X
Address 1		X	X
Address 2	X		X
Address 3			X
Address 4	X	X	
Address 5		X	
Address 6	X		
Address 7			
SCSI Parity			
Parity checking enabled*	No jumper		
Parity checking disabled	J1, Pair 3		
SCSI Terminators			
Installed	RN6 RN7		
Removed	No Jumper		
SCSI Terminator Power			
Installed (Host adapter supplies the terminator power)	F1		
Removed	No Jumper		
SCSI Synchronous Negotiation			
Disabled*	No jumper		
Enabled	J1, Pair 1		
DMA Channel Selection	**J1,Pair 7**	**J1,Pair 8**	
DMA Channel 0	X	X	
DMA Channel 5*		X	
DMA Channel 6	X		
DMA Channel 7			

*Default Setting

Table A–4 (Cont.) 16-Bit SCSI Host Adapter Configurations

Configuration	Jumper Setting		
DMA Acknowledge			
DMA Channel 0	J7, Pair 1		
DMA Channel 5*	J7 Pair 2		
DMA Channel 6	J7, Pair 3		
DMA Channel 7	J7, Pair 4		
DMA Request			
DMA Channel 0	J6, Pair 1		
DMA Channel 5*	J6 Pair 2		
DMA Channel 6	J6, Pair 3		
DMA Channel 7	J6, Pair 4		
Interrupt Channel	**J1,Pair 9**	**J1,Pair 10**	**J1,Pair 11**
Not Defined	X	X	X
Not Defined	X	X	X
Interrupt Channel 15	X		X
Interrupt Channel 14			X
Interrupt Channel 12	X	X	
Interrupt Channel 11*		X	
Interrupt Channel 10	X		
Interrupt Channel 9			
Interrupt Channel 9	J8, Pair 1		
Interrupt Channel 10	J8, Pair 2		
Interrupt Channel 11*	J8, Pair 3		
Interrupt Channel 13	J8 Pair 4		
Interrupt Channel 14	J8, Pair 5		
Interrupt Channel 15	J8 Pair 6		
Port Address	J9		
Address Bit	Pair		

*Default Setting

Table A–4 (Cont.) 16-Bit SCSI Host Adapter Configurations

Configuration	Jumper Setting	
Address Bit 004H	1	LSB
Address Bit 008H	2	
Address Bit 010H	3	
Address Bit 020H	4	
Address Bit 040H	5	
Address Bit 080H	6	
Address Bit 100H	7	
Address Bit 200H	8	MSB

NOTE
The default port address is 0330H. The jumper installed deasserts the bit.

BIOS Address	J10		
BIOS Address	Pair 1	Pair 2	Pair 3
Address 0C0000H	X	X	X
Address 0D0000H		X	X
Address 0C8000H	X		X
Address 0D8000H			X
Address 0C4000H	X	X	
Address 0CC000H	X		X
Address 0D4000H		X	
Address 0C8000H	X		
Address 0DC000H			
BIOS Wait State			
No Wait State	No Jumper		
Wait State	J4		
Computer Configuration Jumper			
DEC station 210	J5		

Default Setting

Table A-4 (Cont.) 16-Bit SCSI Host Adapter Configurations

Configuration	Jumper Setting
DEC station 3XX	No Jumper
Reserved Jumpers	
Normal operation	No Jumper
Normal operation prevented	J1 Pair 2

Default Setting

A.5 40/80 Mbyte Internal SCSI Hard Disk Drive

Figure A 5 shows the location of the jumpers and terminators on the 40/80 Mbyte SCSI hard disk drive Table A–5 lists the jumper settings for the 40/80 Mbyte SCSI hard disk drive

The selection of the SCSI ID number is done with pin pairs A0, A1, and A2 These pins form a 3 bit binary number, with A2 the most significant bit and A0 the least significant bit An installed jumper represents a logical one and an uninstalled jumper represents a logical zero

NOTE
Jumpers are partially installed on A1 and A2 for shipping purposes only. Remove these jumpers before installation.

Figure A 5 40 80 Mbyte SCSI Hard Disk Jumper Locations

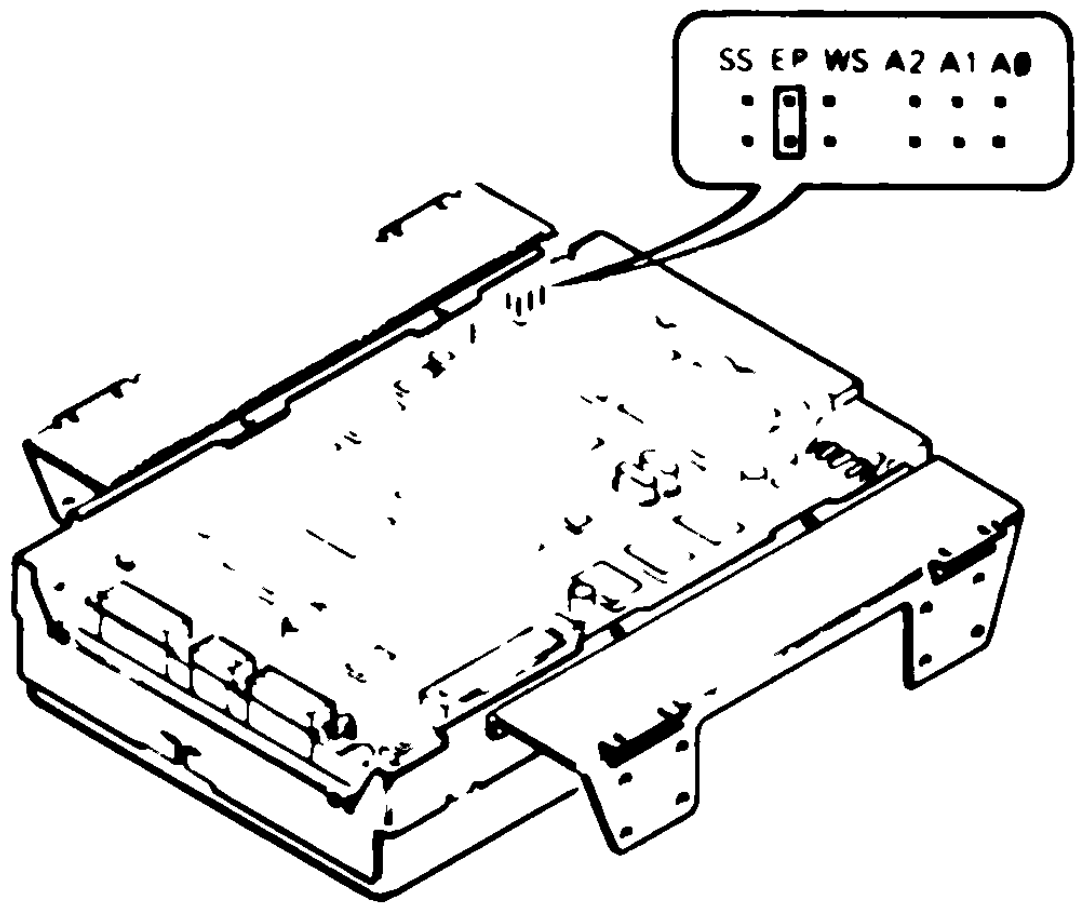


Table A 5 40 80 Mbyte Internal SCSI Hard Disk Drive

Configuration	Jumper Setting		
SCSI ID number	**Pair A0**	**Pair A1**	**Pair A2**
SCSI ID 0			
SCSI ID 1	X		
SCSI ID 2		X	
SCSI ID 3	X	X	
SCSI ID 4			X
SCSI ID 5	X		X
SCSI ID 6		X	X
SCSI ID 7	X	X	X
Enable Parity Option (EP)			
Parity Enabled	EP installed*		
Parity Disabled	EP not installed		
Bus Terminators			
Terminate bus	Terminators installed (if primary drive)		
Do not terminate bus	Terminators removed (if secondary drive)		
Wait Spin (WS) Option			
Motor spin at power up	WS not installed*		
Wait Spin (WS). Motor spins after host sends start/stop command across the SCSI bus	WS installed		
Self Seek (SS) Option			
No Self Seek test	SS Not installed*		
Self Seek test. Drive performs random seek patterns and cuts off communication with SCSI bus	SS installed		

*Default Setting

A.6 170 Mbyte Internal SCSI Hard Disk Drive

Figure A–6 shows the location of the jumpers and terminators on the 170 Mbyte SCSI hard disk drive Table A–6 lists the jumper settings for the 170 Mbyte SCSI hard disk drive

The selection of the SCSI ID number is done with pin pairs A0, A1, and A2 These pins form a 3-bit binary number, with pin pair A2 the most significant bit and pin pair A0 the least significant bit An installed jumper represents a logical one and an uninstalled jumper represents a logical zero

NOTE

Jumpers are partially installed on pin pair A1 and pin pair A2 for shipping purposes only. Remove these jumpers before installation.

Figure A 6 170 Mbyte SCSI Hard Disk Jumper Locations

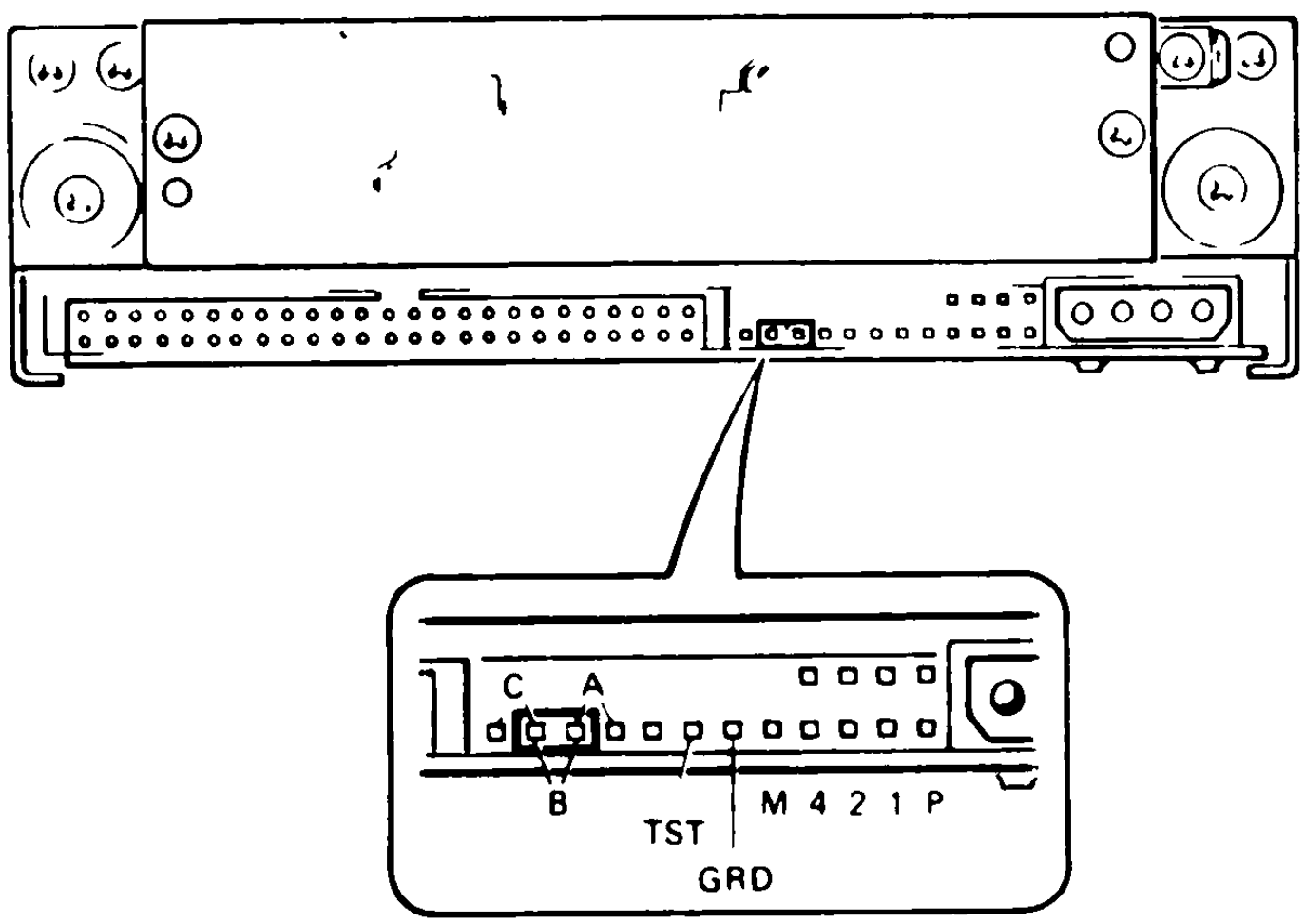


Table A–6 170 Mbyte Internal SCSI Hard Disk Drive

Configuration	Jumper Setting		
SCSI ID number	Pair 4	Pair 2	Pair 1
SCSI ID 0			
SCSI ID 1			X
SCSI ID 2		X	
SCSI ID 3		X	X
SCSI ID 4	X		
SCSI ID 5	X		X

*Default Setting

Table A–6 (Cont.) 170 Mbyte Internal SCSI Hard Disk Drive

Configuration	Jumper Setting		
SCSI ID 6	X	X	–
SCSI ID 7	X	X	X
Enable Parity Option (P)			
Parity Disabled	P not installed*		
Parity Enabled	P installed		
Terminator Power Option			
Jumper in A position	Terminator power supplied		
Jumper in B position	No Terminator power supplied		
Motor Start (M) Option			
Motor spin at power-up	M not installed*		
Wait Spin. Motor spins after host sends start/stop command across the SCSI bus	M installed		
Test Seek Option			
No Test Seek	TST Not installed*		
Test Seek. Drive performs continuous seeks to random cylinders	TST installed		

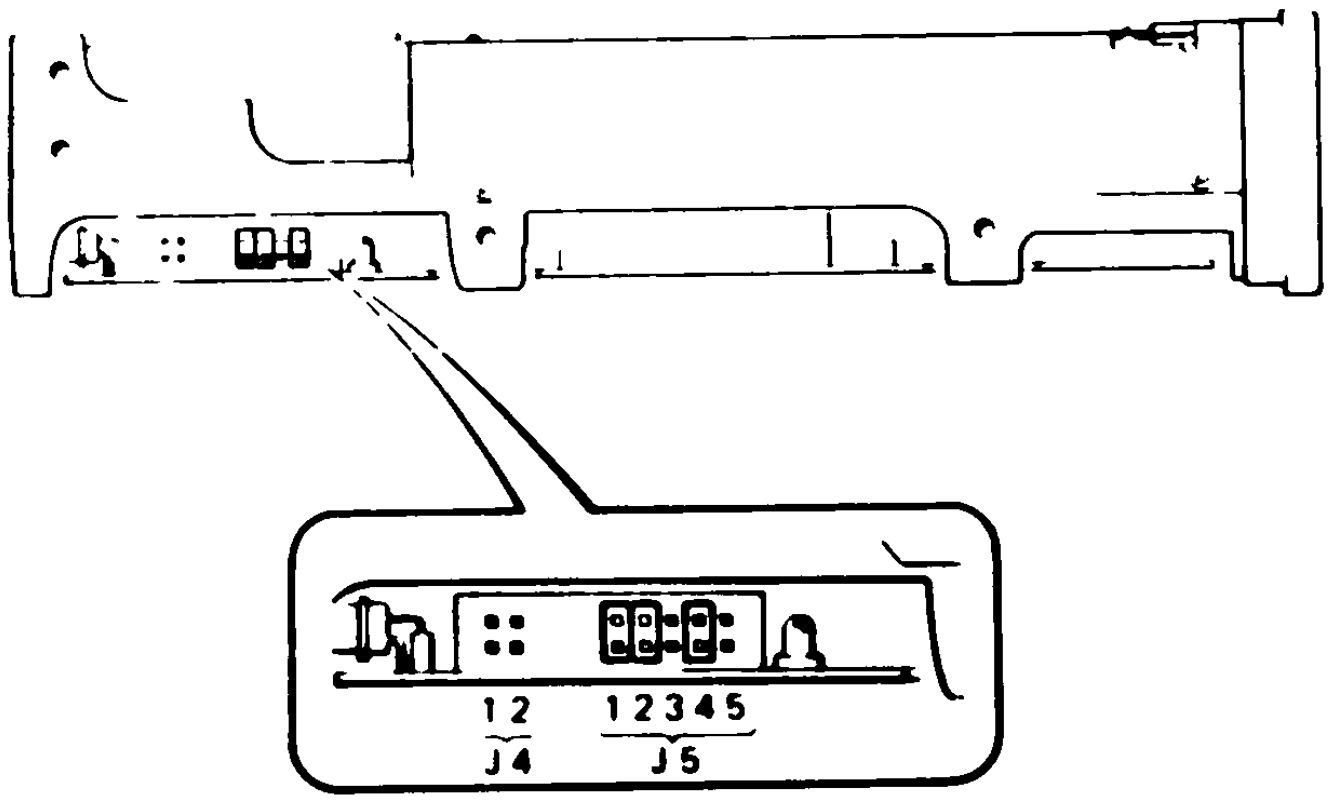
*Default Setting

A.7 150 Mbyte SCSI Tape Cartridge System

Figure A–7 shows the location of the jumpers and bus terminators on the 150 Mbyte SCSI tape drive Table A–7 lists the jumper settings for the 150 Mbyte SCSI tape drive

The selection of the SCSI ID number is done with pins 3, 4, and 5 on J4 These pins form a 3-bit binary number, with Pin 3 the most significant bit and pin 5 the least significant bit An installed jumper represents a logical one and an uninstalled jumper represents a logical zero

Figure A 7 150 Mbyte SCSI Tape Drive Jumper and Bus Terminator Locations



LJ 1600

Table A 7 150 Mbyte SCSI Tape Cartridge Configuration

Configuration	Jumper Setting		
SCSI ID number	**J4,Pin 3**	**J4,Pin 4**	**J4,Pin 5**
0			
1			X
2		X	
3		X	X
4	X		
5	X		X
6	X	X	
7	X	X	X
Enable Parity Option			
Parity Enabled	J4,Pin 2*		
Parity Disabled	No jumper		
Terminator Power Option			
Power supplied to the terminators	J4,Pin 1*		
Power not supplied to the terminators	No jumper		
Autoload Option			
Drive automatically loads cartridge	No jumper*		
Drive does not automatically load cartridge a Load command must be issued before any other commands can be executed	J5,Pin 2		
Terminators			
One SCSI device installed	Terminators installed *		
More than one SCSI device installed	Remove terminators		

*Default Setting

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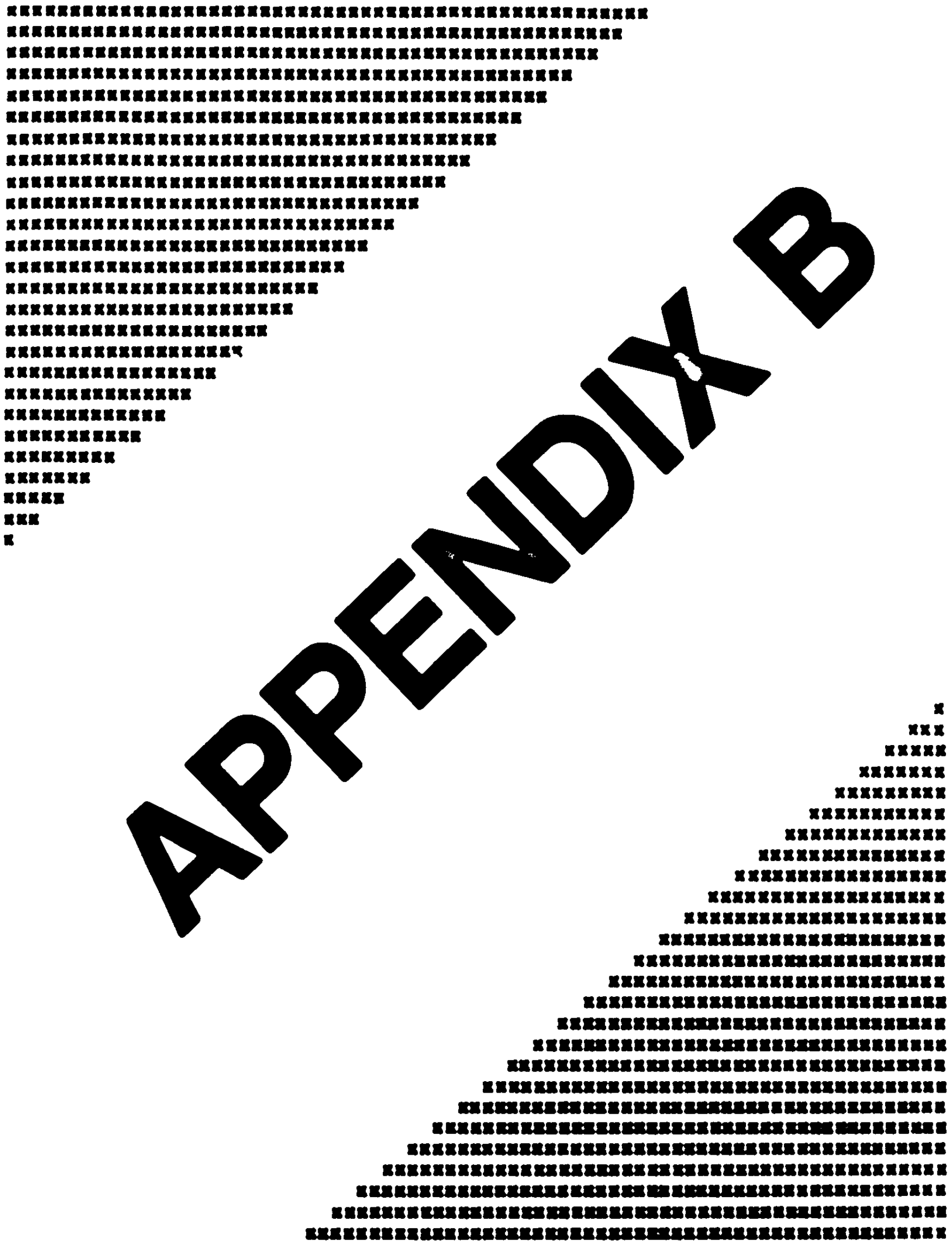
APPENDIX B



B

B.1 DECstation Powerup Self Testing

When you turn on power to the DECstation 300 system, a power up self-test (sometimes referred to as POST) and system initialization occur When you supply power

1 The 80386 CPU starts program execution A jump instruction tells the CPU to go to the powerup test routines located in the BIOS ROM

2 The CPU executes the powerup test routines and initializes the screen The routines test just enough to determine if the screen can be used to display error messages during further testing Basic testing of the following major subsystems is performed the CPU, interrupt timer, RAM circuitry, RAM, DMA, and interrupt controllers, and the video board Video verification tests are the last operations to take place during the first phase of powerup testing The powerup test 'beep codes give you some diagnostic information in case a fatal error occurs *before* screen initialization See Chapter 2 for a list of beep codes

3 The CPU attempts to determine what peripheral devices are available in the system For example, serial ports, parallel ports, diskette and hard drives, and expansion memory

4 The CPU displays the BIOS version message on the screen and further tests system RAM The CPU displays on the screen any RAM error found during testing

5 The CPU compares the devices found to those in the CMOS RAM setup and reports any miscompares with an `Invalid configuration information` message The system can display a variety of other messages during this process The messages are partially determined by the option boards that are installed in the system See Chapter 2 for a partial list of these messages

6 The CPU checks for the presence of expansion ROMs in the system For example, expansion ROMs are found associated with SCSI hard drive controllers and video options Where appropriate, the system turns over test execution to the expansion ROM These expansion ROMs can display messages about the status of the hardware with which they are associated

7 The CPU attempts to start the boot drive and load the operating system The system attempts to boot from the diskette drive first (a floppy disk must be present) If a bootable diskette is not present, the system then attempts to boot from the hard disk drive Failure to boot from the diskette drive can indicate that a system diskette is not present, or that there is a problem with the drive, drive setting, or drive cables Failure to boot from the hard disk can indicate that the drive has not been initialized, or that there is a problem with the drive, drive and/or controller settings, or drive cables

B.2 PC Microcomputer Architecture

The PC microcomputer architecture consists of the CPU, bus structure, instructions, memory, I/O, CPU registers, arithmetic/logic unit (ALU), control circuitry, and addressing modes

B.2.1 The Parts of a Microcomputer

The DECstation is technically a microcomputer A microcomputer is a system of one or more very large scale integrated circuit (VLSI) devices and associated control logic that are used to provide large computer functionality on a smaller scale

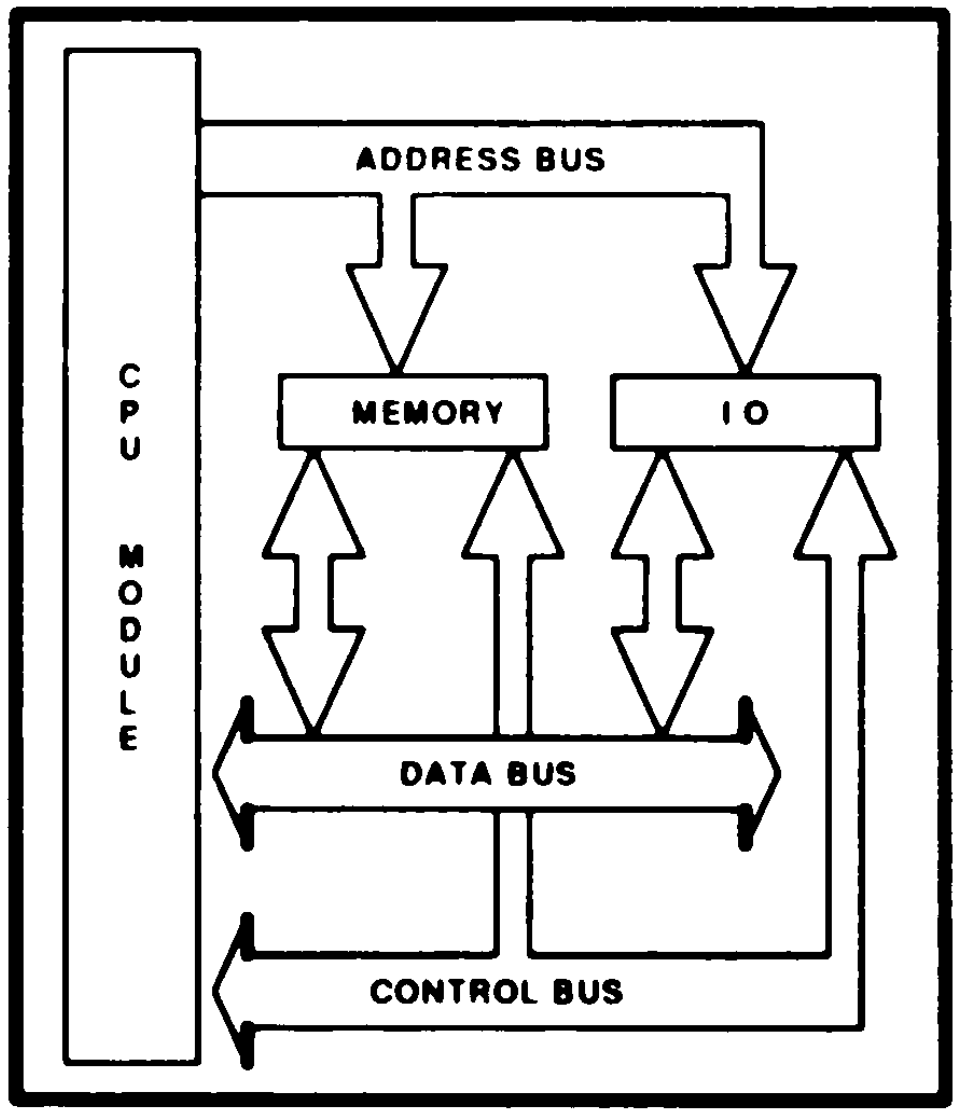
A microcomputer has a central processing unit (CPU), memory, and input/output (I/O) ports (Figure B–1)

B.2.2 The CPU Function

The CPU does the actual work numeric processing, logical operations, and timing *Programs* stored in memory contain sequences of instructions These programs tell the CPU what to do Programs also contain instruction for processing data that is stored in memory

The I/O ports let the CPU communicate with the outside world through I/O devices such as printers, disk drives, terminals, and modems I/O devices are called peripherals

Figure B 1 Microcomputer Diagram



The CPU executes one instruction at a time The speed of execution depends on the type of instruction and speed of memory or I/O device The CPU receives data and control signals through the input ports, it sends data or control signals through the output ports

B.2.3 Data, Address, and Control Busses

The CPU is physically connected to memory and I/O devices by the bus interface A bus interface is a connection of parallel wires (lines) that perform similar functions A microcomputer has a data bus, address bus, and control bus (Figure B–1) Table B–1 describes the function of each bus

The number of lines in each bus varies between CPUs

- An 8-bit CPU has eight data lines A 16-bit CPU has 16 data lines These are sometimes referred to as an 8-bit wide data path or a 16-bit wide data path
- An address bus can have 16, 20, or 24 lines, sometimes referred to as 16-bits wide (64 Kbytes), 20-bits wide (one Mbyte) or 24-bits wide (16 or more Mbytes)
- The number of lines in a control bus depends on the design of the particular CPU

Table B–1 Data, Address, and Control Bus Function

Bus	Function
Data bus	A set of lines used to transfer data between the CPU, memory, and I/O Data can be instructions for the CPU or information that the CPU passes to or from memory or the I/O ports
Address bus	A set o .ines used by the CPU to decode and locate the unique address that corresponds to memory or I/O elements in the system
Control bus	A set of lines that carry control signals to and from the CPU to various system components The signals determine which function is to be performed and when it is to be executed

B.2.4 Machine Cycles, Interrupts, and Direct Memory Access

B.2.4.1 Machine Cycle

When a program is running, data is transferred to and from memory and I/O devices Each time the CPU transfers data between itself and another part of the system is called a *machine cycle* Machine cycles include instructions for such things as memory read/write and I/O read/write

At the completion of a machine cycle, the next one starts Here is what happens in a machine cycle

1 The CPU issues a code to the *address bus* to identify the memory location or I/O device to be accessed

2 The CPU issues an activity command on the *control bus*

3 The CPU receives or sends data over the *data bus*

The CPU has a program counter or instruction pointer register which it uses to keep track of the instruction sequence in a program The program counter or register contains the address of the next instruction located in memory

The CPU executes the instructions in sequence until the program ends or until special instructions tell the CPU to execute instructions in other parts of program memory

Sometimes memory or I/O devices can not respond quickly enough to give valid data to a fast processor during a normal machine cycle In these cases, the system hardware must be designed so that it can impose a *wait state* in the machine cycle When the data is available, the wait state is released and the CPU resumes the machine cycle

B.2.4.2 Interrupts

Interrupts temporarily suspend a program sequence and switch the CPU to a service routine When the service routine is completed the CPU returns to the main program sequence where it left of

For example, the computer is processing a program Part of the program needs to be printed on the printer The CPU is capable of sending the parts to be printed to the printer in one machine cycle But, the printer takes the equivalent of many machine cycles worth of time to print the data

With interrupts, the CPU can temporarily suspend the program and send data to the printer when the printer signals the CPU it is ready to receive data While the data is being printed, the CPU returns to processing the program until it receives an interrupt from the printer for the next data byte

Here is how an interrupt works

- The external device needing service sends an interrupt request to the interrupt controller
- The interrupt controller sends the request to the CPU
- The CPU "acknowledges" the interrupt request
- The interrupt controller then sends a vector to the CPU The vector tells the CPU where to look in memory to find the address of the unique service routine for the device requesting the interrupt
- The CPU gets the service routine and provides the requested service to the device

In systems like the DECstation, many devices may use the interrupt for service In these cases a method exists for establishing which device has priority for service See the appendices in *The DEPCA Service Guide* for more information about interrupt requests

B.2.4.3 Direct Memory Access

Direct memory access (DMA) allows for high speed data transfers between devices such as that required for data transfer to and from diskette and hard disk drives and memory

In ordinary I/O operations, the CPU supervises all data transfer operations from a device to memory But some peripheral devices transfer data faster than the CPU can do it under program control In a DMA operation, the DMA device

1 Takes control of the data and address busses temporarily suspending processor operation

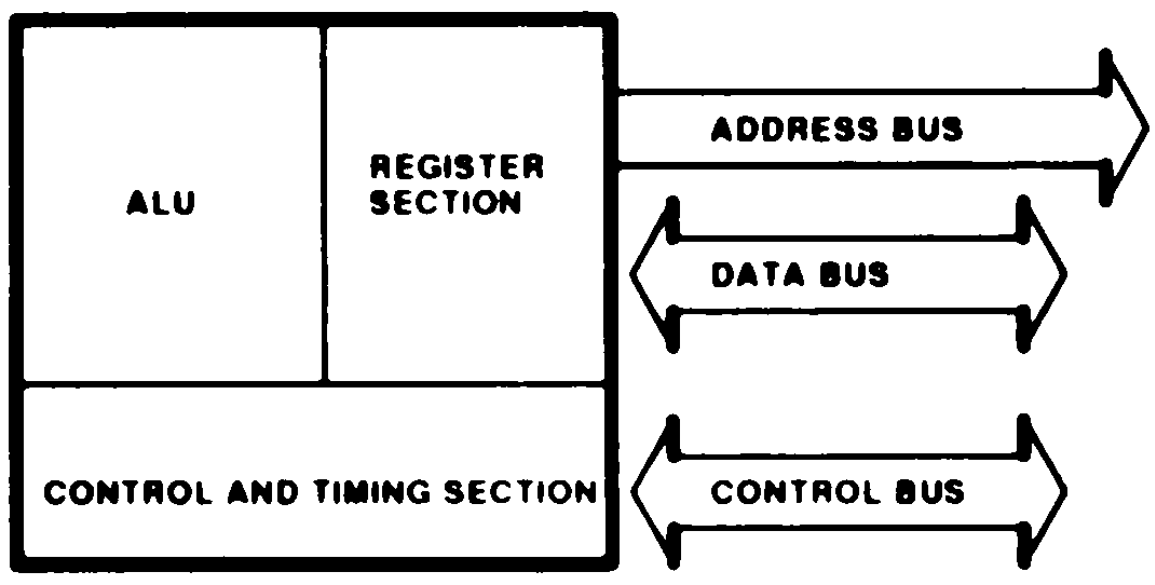
2 Transfers the data without involving the CPU

3 Returns control of the busses to the CPU which then resumes normal operation

B.2.5 CPU

The CPU typically contains registers, the arithmetic/logic unit (ALU), and control circuitry (Figure B–2)

Figure B–2 Inside the CPU



B 2 5 1 CPU Registers

Registers are for temporary storage for data, addresses, status codes, and other information useful to the CPU The size and number of registers varies between CPUs

B.2.5.2 CPU Arithmetic/Logic Unit

The arithmetic/logic unit (ALU) is the hardware in the CPU for performing arithmetic and logical manipulation of binary data The ALU contains an adder for arithmetic operations on data from registers, memory locations, and other sources

B.2 5.3 CPU Control Circuitry

The control circuitry coordinates all CPU activity The control circuitry uses clock inputs to maintain the proper sequence of events for any processing task and

- Issues control signals for CPU internal and external units
- Responds to external control signals such as wait, interrupt, and bus requests

B.2.6 Addressing Modes

The address that the CPU sends on the address bus lines selects one specific memory or I/O device from all the available devices This address can be generated in different ways, called *addressing modes* The addressing mode depends on the operation being performed

Table B–2 Addressing Modes

Mode	Way Generated
Simple	The desired data is contained within the instruction being executed
Complex	The instruction contains the memory address of the desired data or the instruction references a CPU register containing the address of the desired data
Indexed	A logical address is added to a base address located in a specified CPU register

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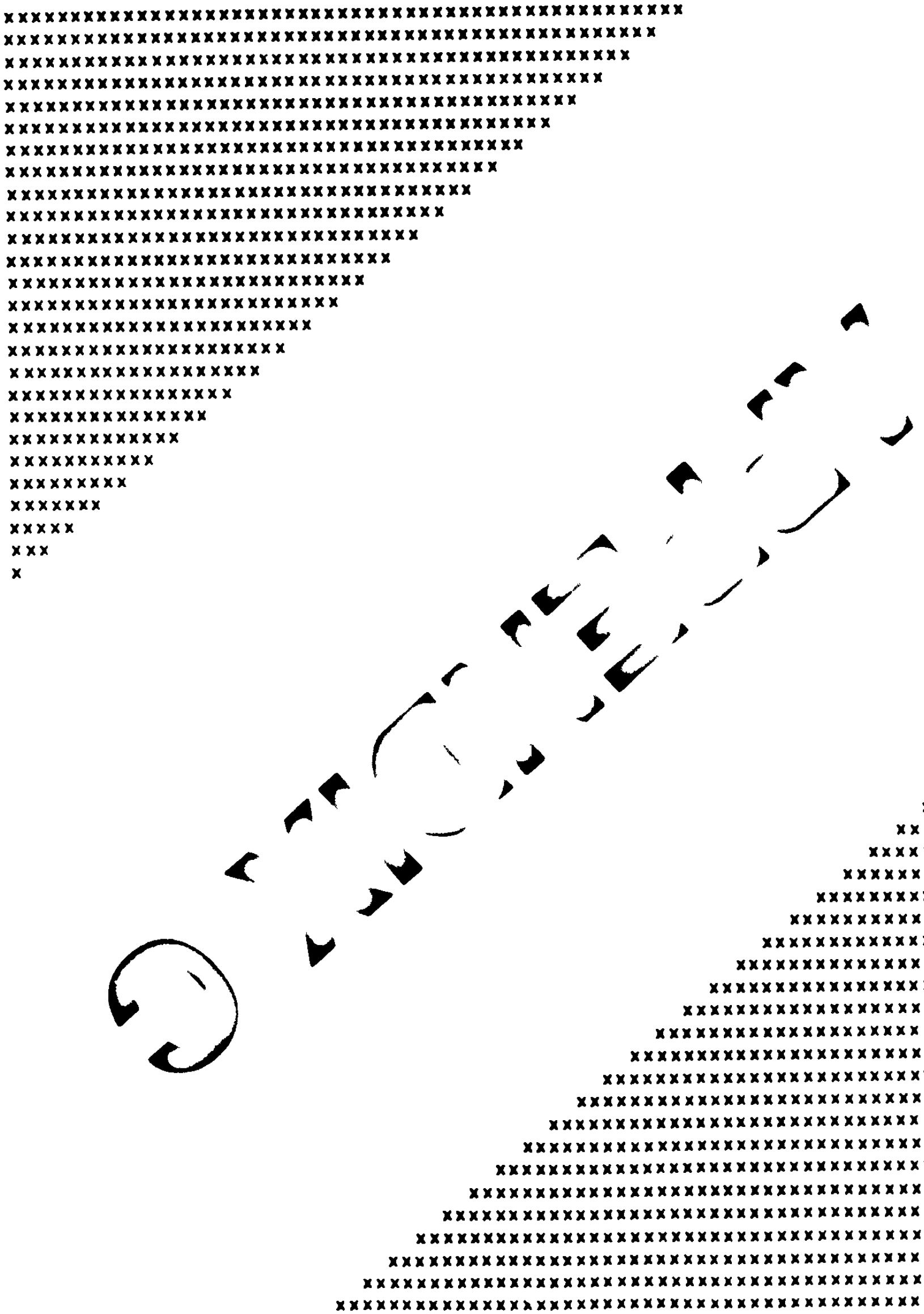

C

DECstation CPU Block Diagrams

Figure C–1 shows a block diagram of the DECstation CPU board

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Figure C 1 DECstation CPU Board Block Diagram

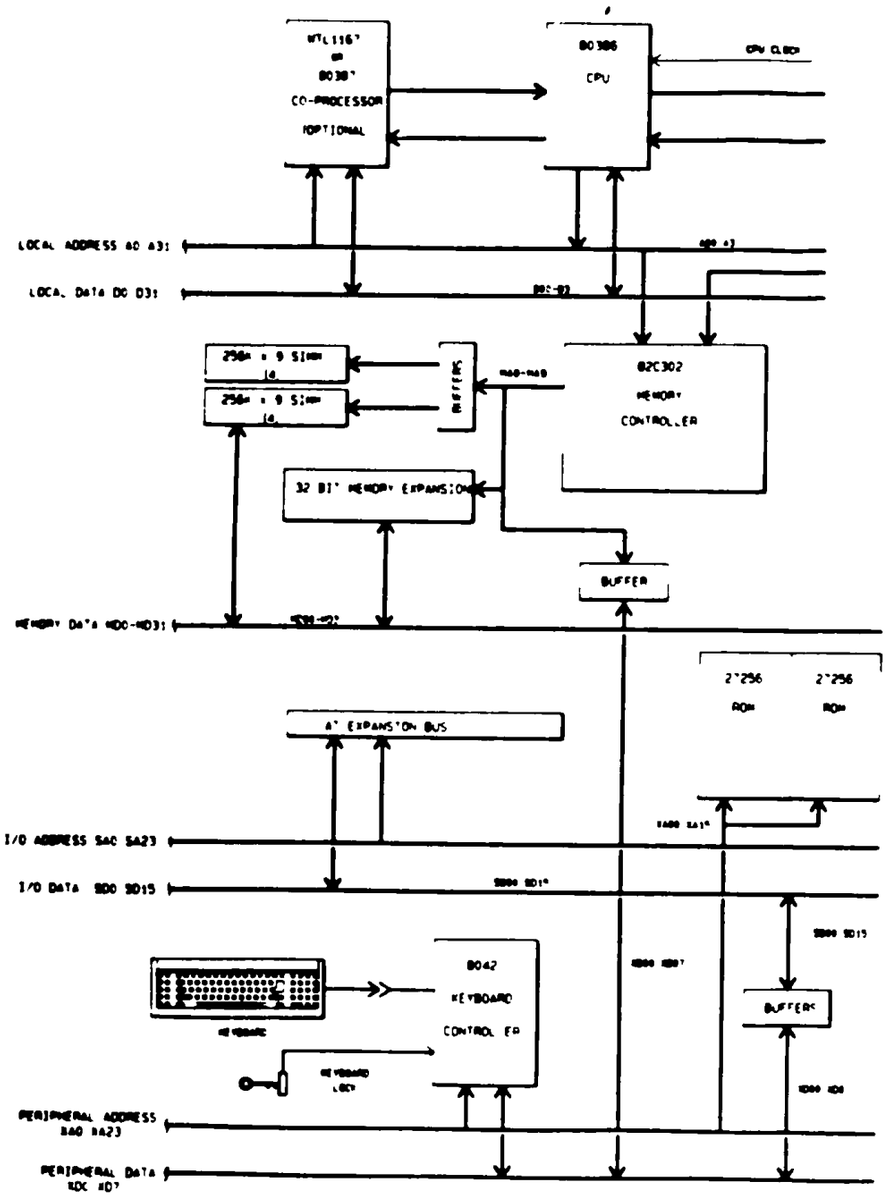

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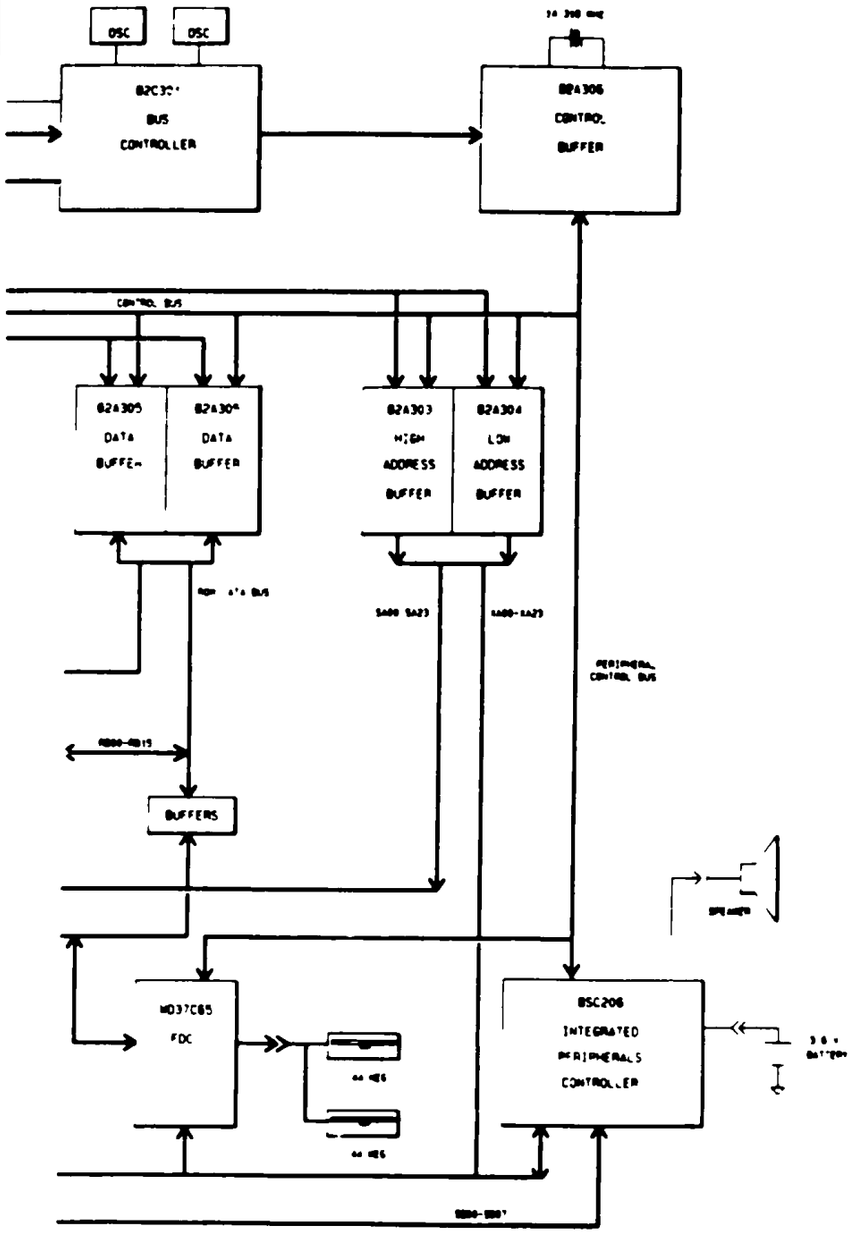
Figure C-1 DECstation CPU Board Block Diagram (cont'd)



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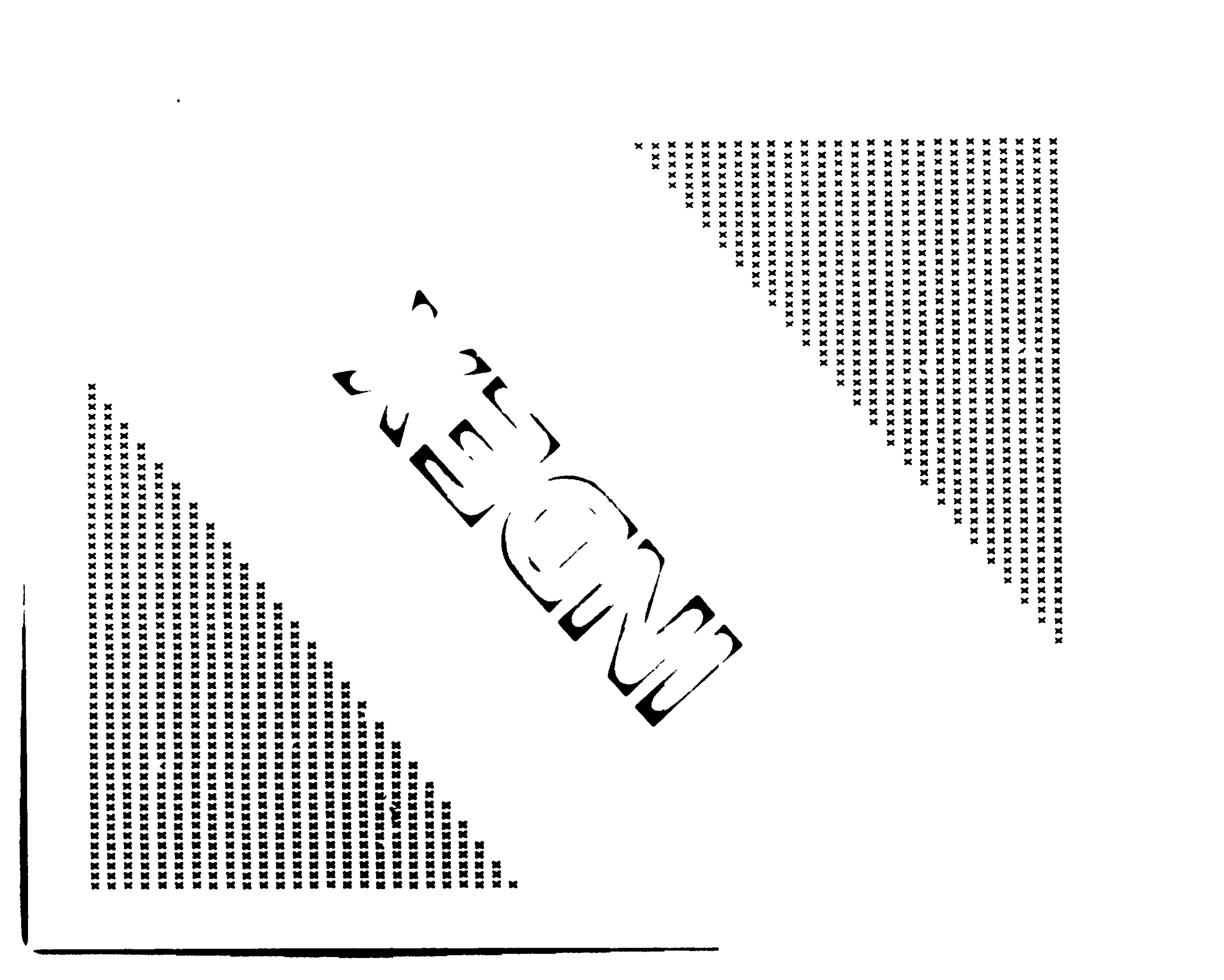

Index

B

beep codes
  table, 13
Bus types, 85
  address, 85
  control, 85
  data, 85

D

DECstation FRUs, 39

E

error messages
  table, 15
Ethernet
  DEPCA/AUI configurations 36
  DEPCA/AUI configuration with DELNI, 37
  how not to connect, 35
  how to connect to ThinWire, 35
  how to disconnect from standard network, 38
  how to disconnect from ThinWire 34
  sample networks, 33

F

FRU
  card guide, 58
  CMOS battery, 60
  drive tower, 49
  fan, 56
  floppy drive, 44
  hard disk drive, 46
  keyboard replacement, 43
  main logic board, 61
FRU (cont'd)
  math coprocessor, 52
  monitor, 43
  mouse, 43
  option board, 50
  power supply, 56
  Single In Line Memory Module (SIMM), 54
  speaker and LED, 58
  system cover 44
  tape drive, 48

H

hard disk formatting, 31
How to run Setup, 27

J

jumper settings
  16-bit SCSI host adapter, 69
  main logic board, 63
  40/80 Mbyte internal SCSI hard disk drive, 74
  170 Mbyte internal SCSI hard disk drive, 76
  150 Mbyte SCSI tape cartridge system, 79
  serial/parallel board, 67
  vga adapter, 66

M

memory configurations, 55
Microcomputer architecture, 83
  busses, 84
  central processor unit (CPU), 87
  CPU, 83
  direct memory access (DMA), 87

Microcomputer architecture (cont'd)
instruction execution 85
interrupts, 86
machine cycle, 85

P

power up
beep error codes, 8
error messages, 8
Power-Up, 82

R

Removing and Replacing FRUs
Criteria, 40

S

Self Test, 82
Setup
when to run, 26
SIMM removal, 54
system utility diskette, 26

T

troubleshooting
beep codes, 8
blank screen, 22
blank screen after power up, 22
boot, 11
CTI Diagnose, 8
diagnostic routines, 12
disks, 21
distorted screen, 23
during operation, 25
error codes and messages, 12
F1 setup error, 22
floppy disk cannot read/write 21
hard disk cannot read/write 21
hard disk produces inaccurate text, 21
intermittent hard disk read/write, 21
internal diagnostics, 8
LED is not on, 22
troubleshooting (cont'd)
LED off with monitor on, 22
monitor messages, 8
monitor on without text or cursor, 22
monochrome display, 23
mouse does not track, 24
no boot, 11
no boot from floppy drive, 19
no boot from hard disk, 19
node not booted with DEPCA, 19
no monitor display, 18
no power, 10
no reboot, 19
no response, 18
no start from floppy disk, 21
pointing device, 24
preparation, 9
procedure, 9
system hang with coprocessor, 19
tape does not work 19