DECpc 320P

Service Guide

Order Number ER-PCP11-SV-001

Digital Equipment Corporation

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About This Guide

This service guide is designed to help you diagnose and repair the DECpc 320P notebook computer. This guide contains information on servicing the base system only. Information on installing, replacing, and configuring specific options is provided in the installation guides supplied with those products.

Organization

This guide is organized as follows:

- Chapter 1 provides an overview of the DECpc 320P.
- Chapter 2 details troubleshooting instructions.
- Chapter 3 contains procedures for replacing field replaceable units.

Intended Audience

The procedures in this guide are intended only for service technicians trained by Digital Equipment Corporation.

Conventions

This document uses the following conventions:

Convention	Meaning
WARNING	Information to prevent personal injury.
CAUTION	Information to prevent damage to equipment.
NOTE	General information you should be aware of.
CTRL+ALT+DEL	Key sequence. Press and hold the indicated keys in the order shown. In this example, press and hold down CTRL while you press both ALT and DEL. Key sequences have special functions.
`Strike the F1 key`	A prompt or an instruction displayed on the screen.

Throughout this guide, DECpc refers to the DECpc 320P.

The DECpc 320P is compatible with the industry-standard IBM PC/AT architecture and the Microsoft disk operating system (MS-DOS). Support for MS-DOS requires a defined set of ROM-BIOS (Read-Only Memory, Basic Input/Output System) services, which the DECpc offers.

Ordering Parts

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

To order parts by phone, call 1-800-DIGITAL from 8:30 a.m. to 8:00 p.m. (Eastern Standard Time).

To order parts by mail, send a purchase order to:

Digital Equipment Corporation
P. O. Box CS2008
Nashua, NH 03061

Related Documentation

The following document is available as a supplement to this guide.

Document Title	Part Number
DECpc 320P User's Guide	ER-PCP11-UG

Digital personnel can order documents with part numbers beginning with ER or EK from:

Digital Equipment Corporation
444 Whitney Street
Northboro, MA 01532

Attn: Publishing and Circulation Services (NR03/W3)
Order Processing Section

Digital personnel can order documents with part numbers beginning with AA from:

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Peripherals and Supplies Group
P. O. Box CS2008
Nashua, NH 03061

1

Overview

Introduction

The DECpc 320P (shown below) is an IBM PC/AT-compatible notebook personal computer. The DECpc runs Digital and other industry-standard applications.

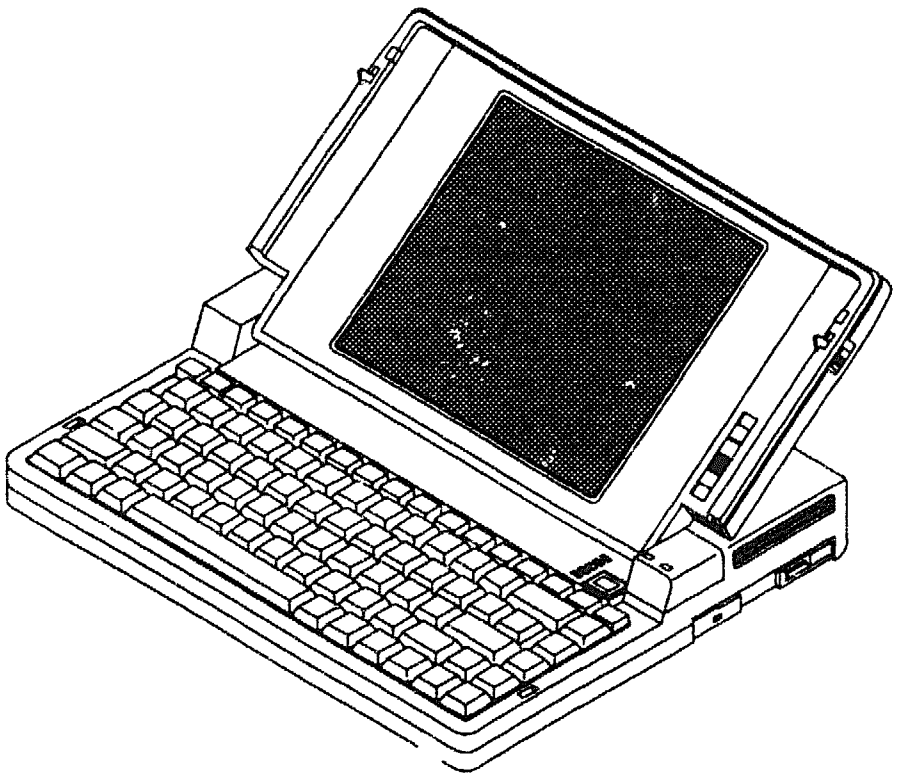


Figure 1-1. DECpc 320P notebook computer

DECpc Base System

The DECpc base system unit consists of the following components:

- lightweight notebook case
- main logic board containing:
  - —20 MHz Intel 386SX microprocessor
  - —socket for optional Intel 387SX math coprocessor
  - —2MB RAM, expandable to 8MB using optional RAM modules
  - —power management circuitry that extends battery life
- serial and parallel ports
- 3½-inch, 1.44MB diskette drive
- 2½-inch, 40MB or 80MB IDE hard disk drive
- LCD display with fluorescent backlight
- Country-specific, 84-key keyboard with full emulation of a 101-key keyboard
- Rechargeable battery
- AC adapter/charger
- PS/2-style AT-compatible external keyboard interface
- external VGA monitor connector

DECpc Options

The following options are available for the DECpc base system:

- 2MB, 4MB, or 6MB internal RAM modules
- 2400-baud internal data modem
- 9600-baud internal data/fax modem
- 20 MHz Intel 387SX math coprocessor
- Carrying case

NOTE

Options listed were available at the time of printing. Additional options may now be available.

Computer Layout

The following two figures show the layout of the computer.

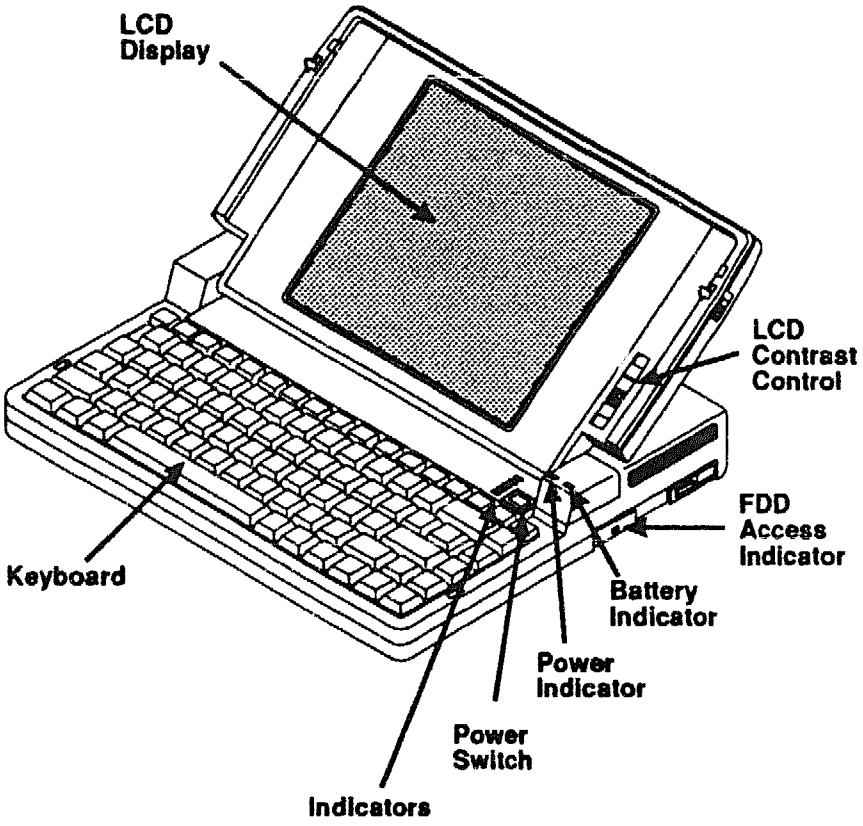


Figure 1-2. Front panel layout

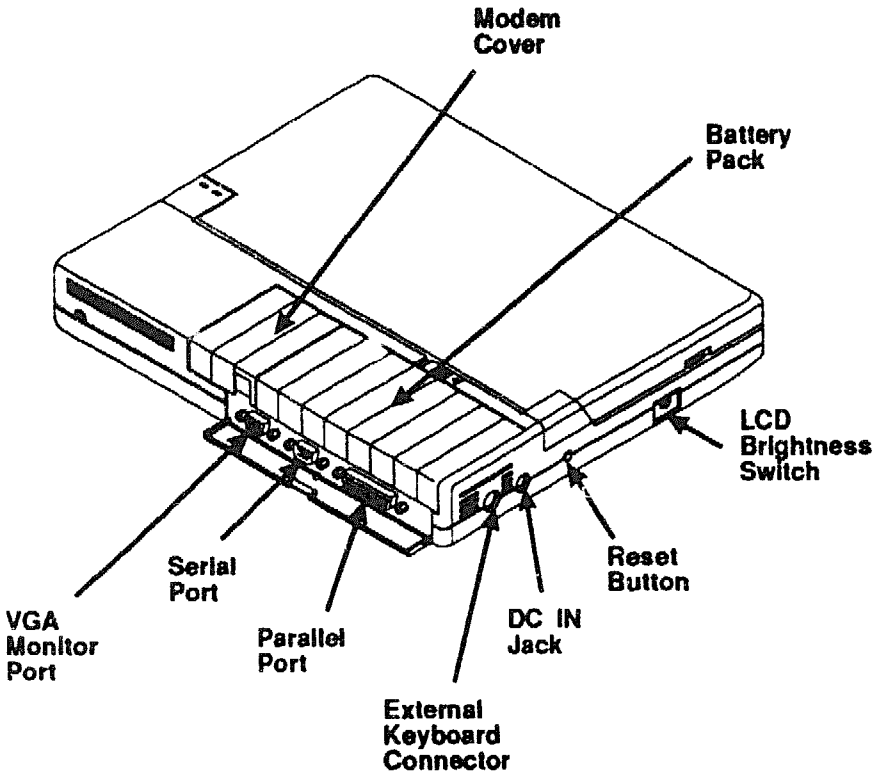


Figure 1-3. Back panel layout

DECpc System Configurations

The DECpc notebook computer is available in various configurations of the base system using 40MB or 80MB hard disk drives and country-specific keyboards. Customers can order systems with various factory-installed options or install the options themselves. Base system configurations are listed in the following table.

Table 1-1. Base System Configurations

Model Number	Description
PCP11-A2	40MB system with U. S. keyboard
PCP11-ME	40MB system with U. K. keyboard
PCP11-MM	40MB system with Swedish keyboard
PCP11-MG	40MB system with German keyboard
PCP11-MI	40MB system with Italian keyboard
PCP11-ML	40MB system with Swiss keyboard
PCP11-MP	40MB system with French keyboard
PCP11-MS	40MB system with Spanish international keyboard
PCP11-B2	80MB system with U. S. keyboard
PCP11-PE	80MB system with U. K. keyboard
PCP11-PM	80MB system with Swedish keyboard
PCP11-PG	80MB system with German keyboard
PCP11-PI	80MB system with Italian keyboard
PCP11-PL	80MB system with Swiss keyboard
PCP11-PP	80MB system with French keyboard
PCP11-PS	80MB system with Spanish international keyboard

DECpc 320P Main Logic Board

The DECpc 320P main logic board contains a 20 MHz Intel 386SX microprocessor, a socket for an optional Intel 387SX math coprocessor, a diskette drive controller, serial and parallel ports, a PS/2-compatible keyboard port, a hard disk drive connector, a VGA controller (640 x 480), 2MB of system RAM (fixed) and one memory expansion module slot.

Rechargeable Battery

The DECpc is supplied with a 12 VDC rechargeable battery. The battery takes approximately 2 hours to recharge when the computer is not in use or approximately 5 hours when the computer is in use. The battery can be recharged up to 400 times on average. After that, the battery will no longer hold a charge. When this occurs, the battery must be replaced. Replace the battery with only the same type of battery (Digital Order Number PCP1H-BB).

AC Adapter/Charger

The DECpc is supplied with an AC adapter/charger. It accepts 110-240 VAC (50/60 Hz) at the input and provides 16 VDC at its output. The computer can be powered by the adapter/charger while charging the battery or without the rechargeable battery installed.

LCD with Fluorescent Backlight

The DECpc has a liquid crystal display (LCD) with fluorescent backlight. The display circuitry supports the VGA standard (640 x 480 pixels) using 16 levels of gray to simulate color. The display is adjustable for contrast, brightness, and viewing angle.

External Monitors

The DECpc has an external VGA monitor connector that supports both color and monochrome VGA analog monitors. The VGA controller has a maximum resolution of 640 × 480 pixels with 16 colors. Monitors with different input voltage and alignment specifications are available to meet international requirements.

84-Key Keyboard

The DECpc features an 84-key keyboard with full 101-key functionality. The CTRL and CAPS LOCK keys are user reversible. In addition, the keyboard can be used to activate many of the power management modes of the DECpc.

External Keyboards

Several external keyboards are available as options for the DECpc. Keyboards used with the DECpc must be equipped with a 6-pin miniature DIN (PS/2-style) connector.

387SX Math Coprocessor

The 387SX is a processor extension to the 386SX microprocessor. It enhances the 386SX's numeric processing abilities, particularly in floating point precision. The 387SX also extends the 386SX instruction set to include transcendental (trigonometric and logarithmic) functions. The 387SX plugs directly into a socket on the underside of the computer.

NOTE

The DECpc 320P requires a 387SX that will operate at 20 MHz or faster.

2

Troubleshooting

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

- Diagnostics
- Special Tools
- Normal Power-Up
- Troubleshooting Procedures
- Error Codes and Messages
- Troubleshooting by Symptom
- Troubleshooting Problems Occurring During System Operation
- Using the System Utilities Diskette

Diagnostics

The DECpc has internal ROM-based diagnostics to aid in troubleshooting. These diagnostics are run at system power-up to verify the operation of the machine. Error messages are given in two formats: beep codes and error messages displayed on the screen. Both types of error messages are described in "Error Codes and Messages."

Special Tools

The following table lists the special tools needed to troubleshoot the DECpc system.

Table 2-1. Troubleshooting Tools

Tool	Part Number	Definition
DiagSoft QA Plus Diagnostics Software Version 4.60 or greater	22-00908-02	Stand-alone diagnostics, available separately. For information about using these diagnostics, refer to the *QA Plus User's Guide*.
Tri-wrap Loopback Connector	FD-10164-00	Triple connector. Consists of three loopback connectors (male 25-pin parallel, female 25-pin serial, and female 9-pin serial), bundled together and housed in a convenient package.
DECpc 320P Utilities Diskette	AXX-2124	Use to reconfigure the CPU when options are installed.

Normal Power-Up

A normal system power-up routine includes the following sequence of events:

1. The system unit is turned on. The power indicator (LED) illuminates. The color of the power indicator indicates the CPU speed: green for FAST, orange for SLOW.
2. The system executes its power-up tests and displays the BIOS ROM version, the copyright information, and the memory size.

   If an error occurs during any power-up test, the system generates a beep error code or displays an error message.
3. The system generates a single beep and displays information about the operating system. The actual information displayed at this time depends on the system software.

Troubleshooting Procedures

This section describes three troubleshooting procedures that can be used depending on the state of the system. Each procedure will get the system to a state where it can run the QA Plus diagnostic package. Perform the steps in "Getting Started," and then proceed to the recommended procedure.

CAUTION

Do not connect or disconnect the AC adapter or the loopback cable when the system is on. Doing this can damage the system.

Getting Started

The following steps prepare you for troubleshooting a DECpc:

1. Ask the customer to describe the problem. Find out:
   - when the problem started
   - whether any new hardware options were added to the system around the time the problem started and whether the options are Digital-certified or third party
   - whether any new software was added to the system
2. Have the customer supply you with a copy of the operating system diskette(s) that came with the system.
3. Have the customer provide you with the following system configuration information:
   - amount of memory
   - type of trackball or mouse
   - any other options installed in the system
4. Observe the problem. Based on your observations, refer to one of the following procedures:
   - If the system does not power up, see "No Power."
   - If the system powers up but will not boot, see "System Does Not Boot."
   - If the system powers up and boots, see "System Boots."

No Power

This procedure is to help determine the cause of the problem when the DECpc does not power up. Before starting, be sure you have completed the steps in "Getting Started."

1. Check the system for loose cables and connections.
2. Plug the AC adapter into the DECpc and then into a working AC outlet.
3. Turn on the computer by pressing and holding the power button down for about one second. Check for indications of system power:

   —The power indicator (LED) is on.

   —You can hear the hard disk spinning.

   NOTE

   You must hold the power button down for at least one second to turn the computer on or off. The power button was designed this way to prevent accidentally turning the computer on or off.

4. If the computer does not power up:
   a. Turn off the system unit.
   b. Try a different AC outlet.
   c. Check the AC adapter. Replace the AC adapter, and retry Step 1.
   d. Replace the rechargeable battery, and retry Step 1.

If the system powers up and does not boot, refer to "System Does Not Boot."

If the system powers up and boots, refer to "System Boots."

System Does Not Boot

This procedure is to help determine why the DECpc does not boot. Before starting this procedure, be sure you have completed the steps in "Getting Started."

1. Remove any options, and try to reboot the system. If the system generates any beep codes, refer to "Power-Up Beep Codes."
2. Try booting from the operating system startup diskette. Lack of beep codes and video indicate a possible bad main logic board.
3. When the system boots, refer to "System Boots."

System Boots

This procedure is to help determine the cause of a problem that arises after the DECpc powers up and boots normally. Before starting this procedure, be sure you have completed the steps in "Getting Started."

1. Determine what the failure is. Refer to "Error Codes and Messages" for a list of possible error messages. If there are no error messages, refer to "Troubleshooting by Symptom" for a list of symptoms and possible causes.
2. Run the QA Plus diagnostics.
3. Replace the necessary FRU.

Error Codes and Messages

During the power-up sequence, the DECpc executes built-in diagnostic and bootstrap routines. Initially, the system sends beep codes through the speaker if the test program detects a fatal error. After screen initialization and verification, the built-in diagnostic routine sends non-fatal error messages to video memory and the system displays the message(s) on the LCD.

Beep Codes

The following table lists the beep codes and the test in progress or test failure that corresponds to each numeric beep code pattern. When several bursts of beeps are generated, listen carefully and remember the numeric beep code pattern. For example, "2-1-4" (a burst of two beeps, a single beep, and a burst of four beeps) indicates that a failure of bit 3 in the first 64KB of RAM has been detected.

NOTE

When the battery is low, the BATT indicator (LED) will light red, and the computer will beep every 20 seconds (if the speaker is enabled). Do not confuse these low-power beeps with the beep codes in the table.

Table 2-2. Beep Codes

Beep Code	Description of Test or Failure
none	CPU register test in-progress
1-1-3	CMOS write/read test in-progress or failure
1-1-4	BIOS ROM checksum test in-progress or failure
1-2-1	Programmable Interval Timer test in-progress or failure
1-2-2	DMA initialization test in-progress or failure
1-2-3	DMA page register write/read test failure
1-3-1	RAM refresh verification test in-progress or failure
none	1st 64KB RAM test in-progress
1-3-3	1st 64KB RAM chip or data line failure - multiple-bit
1-3-4	1st 64KB RAM odd/even logic failure
1-4-1	1st 64KB RAM address line failure
1-4-2	1st 64KB parity test in-progress or failure
2-1-1	1st 64KB RAM chip or data line failure – bit 0
2-1-2	1st 64KB RAM chip or data line failure – bit 1
2-1-3	1st 64KB RAM chip or data line failure – bit 2
2-1-4	1st 64KB RAM chip or data line failure – bit 3
2-2-1	1st 64KB RAM chip or data line failure – bit 4
2-2-2	1st 64KB RAM chip or data line failure – bit 5
2-2-3	1st 64KB RAM chip or data line failure – bit 6
2-2-4	1st 64KB RAM chip or data line failure – bit 7
2-3-1	1st 64KB RAM chip or data line failure – bit 8
2-3-2	1st 64KB RAM chip or data line failure – bit 9
2-3-3	1st 64KB RAM chip or data line failure – bit A
2-3-4	1st 64KB RAM chip or data line failure – bit B
2-4-1	1st 64KB RAM chip or data line failure – bit C
2-4-2	1st 64KB RAM chip or data line failure – bit D
2-4-3	1st 64KB RAM chip or data line failure – bit E
2-4-4	1st 64KB RAM chip or data line failure – bit F

Table 2-2. Beep Codes (continued)

Beep Code	Description of Test or Failure
3-1-1	Slave DMA register test in-progress or failure
3-1-2	Master DMA register test in-progress or failure
3-1-3	Master interrupt mask register test in-progress or failure
3-1-4	Slave interrupt mask register test in-progress or failure
none	Interrupt vector loading in-progress
3-2-4	Keyboard controller test in-progress or failure
none	CMOS power failure and checksum calculation in-progress
none	CMOS configuration information validation in-progress
3-3-4	Screen memory test in-progress or failure
3-4-1	Screen initialization test in-progress or failure
3-4-2	Screen retrace test in-progress or failure
none	Search for video ROM in-progress
none	Screen believed operable
none	Screen believed running with video ROM
none	Monochrome LCD believed operable
none	Color LCD (40-column) believed operable
none	Color LCD (80-column) believed operable

Error Messages

After screen initialization and verification, the system displays non-fatal error messages on the monitor. The following table lists the non-fatal error messages and the corresponding BIOS error numbers.

Table 2-3. BIOS Error Messages

Number	Error Message
(01)	Gate A20 failure
(02)	Unexpected interrupt in protected mode
(04)	Memory tests terminated by keystroke
(05)	Memory parity failure at *xxxx*; read *xxxx* expecting *xxxx*
	Memory address line failure at *xxxx*; read *xxxx* expecting *xxxx*
	Memory data line failure at *xxxx*; read *xxxx* expecting *xxxx*
	Memory high address line failure at *xxxx-xxxx*
	Memory odd/even failure at *xxxx*; read *xxxx* expecting *xxxx*
	Memory write/read failure at *xxxx*; read *xxxx* expecting *xxxx*
(06)	Display adapter failed; using alternate
(07)	No timer tick interrupt
(08)	Shutdown failure
(09)	Timer chip counter 2 failed
(10)	Keyboard clock line failure
	Keyboard data line failure
	Keyboard controller failure
	Keyboard stuck key failure
(11)	Diskette subsystem reset failed
(12)	Diskette drive 0 seek failure
(13)	Diskette drive 1 seek failure
(14)	Hard disk configuration error
(15)	Hard disk controller failure
(16)	Hard disk failure
(17)	Time-of-day clock stopped
(18)	Invalid configuration information - Please run SETUP program
(19)	Time-of-day not set - Please run SETUP program

Table 2-3. BIOS Error Messages (continued)

Number	Error Message
(20)	Keyboard is locked - please unlock
(21)	Optional ROM bad checksum = *xx*
(22)	Strike the F1 key to continue, F2 to run the setup utility
(23)	Diskette read failure
(24)	Not a boot diskette
(25)	No boot device available
(26)	Hard disk read failure
(27)	No boot sector on hard disk
(29)	I/O card parity interrupt at *xxxx:xxxx* Type (S)hut off NMI, (R)eboot, other keys to continue
(30)	Memory parity interrupt at *xxxx:xxxx* Type (S)hut off NMI, (R)eboot, other keys to continue
(31)	Unexpected type 02 interrupt at *xxxx*. Type (S)hut off NMI, (R)eboot, other keys to continue
(32)	Strike F1 key to retry boot
(33)	Resume failure
(34)	Resume memory backup failure
(35)	Resume not supported in protected mode

Troubleshooting by Symptom

This section describes causes and corrective actions for minor problems.

CAUTION

Do not connect or disconnect the AC adapter cable from the computer when it is on. Doing this can damage the computer. Always turn off the computer, and then disconnect the power cord before you disassemble the computer. Observe antistatic precautions.

System Unit Problems

The following table lists some common problems, possible causes, and suggested corrective actions. If a corrective action does not work, run the QA Plus diagnostics to isolate the problem. Then, replace the failing FRU.

Table 2-4. System Unit Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
No response when the system is turned on.	Battery is not charged.	Turn off the system. Use the AC adapter/charger to recharge the battery.
	System is not plugged in.	Plug the system in, and then turn it on again.
	No power at wall outlet.	Use a working AC wall outlet.
Power is on, but there is no LCD display.	Standby or Display timeout (battery operation only).	Press the space bar to activate the display. Use the setup utility to increase Standby and/or Display timeout.
	Contrast control is not set properly.	Adjust contrast control.
	Connector cable between LCD and main logic board incorrectly installed.	Make sure the LCD cable is installed properly.

Table 2-4. System Unit Troubleshooting Procedures (Continued)

Problem	Possible Cause	Corrective Action
Power is on, but there is no LCD display. (continued)	LCD failure.	Replace the LCD.
	LCD/VGA controller failure on main logic board.	Replace the main logic board.
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 hard disk.	Load the system software onto the hard disk.
	Requested partition does not exist or is not formatted.	Check the partition. Format the partition; repartition if necessary.
	Hard disk is not installed properly.	Check hard disk installation.
System does not boot from the diskette drive.	Diskette is not in the diskette drive.	Insert a diskette containing bootable system software.
	Diskette is not bootable.	Insert a diskette containing bootable system software.
	Diskette is worn or damaged.	Try another diskette.

Disk-Related Problems

The following table lists some common disk-related problems, possible causes, and suggested corrective actions. If the corrective action does not work, run the QA Plus diagnostics to isolate the problem, and then replace the failing FRU.

If a disk-related problem occurs, verify the information recorded with the setup utility. Incorrect identification in the setup configuration can lead to unexpected responses from the drive.

Table 2-5. Disk-Related Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
Intermittent hard disk read/write problems.	Files possibly corrupted.	Repartition and reformat disk; restore disk from backup files.
Hard disk works, but files contain extra characters or garbled text.	Hard disk is affected by static electricity.	Move system away from any motors, magnetic devices, and photocopiers.
System won't start from the diskette drive or displays the message `Abort, Retry, Fail.`	The diskette has been demagnetized.	Make sure the disk drive cable is correctly installed. Replace the diskette.
	Improperly formatted diskette.	Reformat the diskette.
Diskette drive cannot read or write information.	The diskette drive is empty.	Insert a diskette into the diskette drive.
	The diskette is write protected.	Disable write protection on the diskette.
	Diskette is not formatted.	Use a formatted diskette.
	Diskette is worn or damaged.	Try another diskette.
	Diskette drive cable not connected properly.	Verify correct cable connection.

LCD Unit Problems

The following table lists some common LCD problems, possible causes, and suggested corrective actions. If the corrective action does not work, run the QA Plus diagnostics to isolate the problem. Then, replace the failing FRU.

Table 2-6. LCD Unit Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
Screen is blank, and power LED is on.	Standby or Display timeout (battery operation only).	Press the space bar to activate the display. Use the setup utility to increase Standby and/or Display timeout.
	Contrast and brightness controls set to minimum.	Adjust the contrast and brightness controls.
	LCD failure.	Replace the LCD.
	LCD/VGA controller failure on main logic board.	Replace the main logic board.
Screen goes blank after successful power-up; power LED is off.	AC adapter/power failure.	Replace the AC adapter/charger.
	Main logic board failure.	Replace the main logic board.
Screen displays distorted images or goes blank.	Connector cable between LCD and main logic board is incorrectly installed.	Make sure the LCD cable is installed properly.
	Electromagnetic or electrostatic interference exists.	Move the computer away from any electromechanical devices.
Screen displays distorted images or goes blank when you run specific applications.	Software is not configured for, or is incompatible with, the VGA controller.	Reconfigure the software for VGA.

Troubleshooting Problems Occurring During System Operation

Use the following list to help isolate a problem to a specific subsystem. See also "Troubleshooting by Symptom."

If the problem occurs during diskette drive access:

- Look for loose drive cable.
- Check the main logic board.
- If possible, run the diagnostics. The problem might be with the main logic board, or the diskette drive.

If the problem occurs during hard disk drive access:

- Check for loose drive cables.
- Check the main logic board.
- If possible, run the diagnostics. The problem might be with the main logic board, or the hard disk drive.

If the problem seems to be video related:

- Check the main logic board LCD cable.

If the problem seems to be keyboard related:

- Check the keyboard connection.
- Run the QA Plus diagnostics. The problem might be with the keyboard interface on the main logic board.

If the problem seems to be heat related:

- Make sure that the system is clean and there is sufficient air flow around it.

Using the Utilities Diskette

The menu-driven Utilities Diskette (shipped with the computer and required as a Customer Service tool) must be used when options are added to the computer. A language option menu is displayed when the Utilities Diskette is booted. After a language is selected, the setup utility is displayed. The setup utility must be run each time you want to set the following power up default settings:

- the battery-backed-up date and time
- the video mode and cursor type
- the CPU clock speed
- Shadow RAM
- Power management
- the serial or parallel port configurations
- the suspend, standby, display, and hard drive timeouts

Running the Setup Utility

Execute the setup utility as follows:

1. Insert the Utilities Diskette into the drive and turn on the system. The power-up tests run, and then the monitor displays a language selection menu.
2. Select a language, and then press ENTER.

   The monitor displays the setup utility's menu.
3. Follow the instructions on the bottom of the screen, and select the correct system configuration. Then, press F2 to save the configuration and restart the system.

NOTE

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

3

FRU Replacement

Introduction

This chapter contains procedures for replacing each DECpc field replaceable unit (FRU). When the installation for a FRU is the reverse of the removal procedure, it is so noted. Only qualified service technicians should replace FRUs. Use only Digital-supplied spare parts.

The following tables list standard and optional DECpc FRUs and their part numbers.

Table 3-1. DECpc Standard FRUs

FRU	Part Number
Main logic board with BIOS	29-29572-01
ROM BIOS, Phoenix	8031102P
Upper cabinet assembly	87191281
Lower cabinet assembly	87191226
Cover, BIOS ROM/DRAM	DA0460
Cover, Modem	87191280
Hinge cover, left	8719917
Hinge cover, right	87191298
Power LED assembly	29-29591-01
Status LED board assembly	29-29592-01
LED cable	87091197
LCD display assembly	29-29589-01
LCD backlight lamp	29-29588-01
LCD cable	87091238
LCD cabinet, back	87191296
LCD cabinet, front	87191295

Table 3-1. DECpc Standard FRUs (continued)

FRU	Part Number
Battery terminal base	87191233
Battery pack, Ni-Cad	PCP1H-BB
Battery, Sub, Ni-Cad	8491018
1.44MB 3½-inch diskette drive with shield	29-29574-01
Hard drive cable	8519453
Keyboard, 85-key (U.S. keycaps)	29-29579-01
Keyboard, 84-key (U.K. keycaps)	29-29581-01
Keyboard, 84-key (Swedish keycaps)	29-29582-01
Keyboard, 84-key (German keycaps)	29-29583-01
Keyboard, 84-key (Italian keycaps)	29-29584-01
Keyboard, 84-key (Swiss keycaps)	29-29585-01
Keyboard, 84-key (French keycaps)	29-29586-01
Keyboard, 84-key (Spanish International keycaps)	29-29587-01
Screw kit	HWPCP11AA
Rubber feet	8590334
AC adapter, U.S., with U.S. power cord	PCP1H-EA
AC adapter, international, without power cord	PCP1H-EF
Utilities Diskette	AXX2124

Table 3-2. DECpc Optional FRUs

FRU	Part Number
Modem, 2400-baud data	30-37722-01
Modem, 9600-baud data/fax	30-37722-02
40MB hard disk drive with shield	30-37724-01
80MB hard disk drive with shield	30-37723-01
2MB memory expansion module	PCP1M-BA
4MB memory expansion module	PCP1M-BB
6MB memory expansion module	PCP1M-BC
Cloth carrying case	30-37720-01
20 MHz Intel 387SX math coprocessor	PCXAP-BB
Logitech Trackman Portable	PCPAS-AA

Before Replacing FRUs

Adhere to the following guidelines when removing or installing DECpc FRUs:

- Always turn off the system and the monitor (if present) and disconnect all external cables before removing any FRU.
- After replacing a FRU, verify that it and the system function properly.

CAUTION

Always use a grounded wrist strap and an earth-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.

NOTE

Before disconnecting the DECpc from a network, inform the system administrator that you are going to disconnect the computer. If the network cable has a ThinWire T-connector, do not disconnect any cable or terminator from the T-connector. Doing so disrupts network operation.

Replacing FRUs

This section describes how to replace the various FRUs in the DECpc.

Before disassembling the system:

1. Turn off the computer and disconnect the AC adapter/charger.
2. Remove the diskette, if present, from the diskette drive.
3. Remove the optional modem and RAM expansion module if they are installed.

Modem (Option) Replacement

The procedure described below is the same for the 2400-baud data modem and the 9600-baud data/fax modem.

Remove the optional modem as follows:

1. Disconnect all external cables from the computer.
2. Position the computer so that the back is facing you.
3. Use two fingers to press down on the corners of the modem cover while sliding the cover toward you. Refer to the illustration.

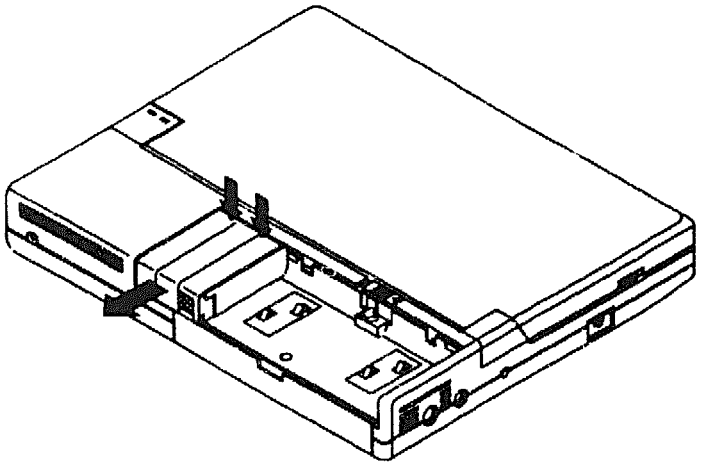


Figure 3-1. Removing the modem cover

4. Lift the modem cover away from the computer.
5. Remove the two screws securing the modem to the case.
6. Lift the modem out of the modem compartment.
7. Disconnect the modem cable from the computer's modem connector.

NOTE

Observe the orientation of the modem cable before disconnecting it from the computer. When replacing or reinstalling the modem, reconnect the modem cable with the same orientation.

Replace the modem by repeating the steps in reverse order.

Memory Expansion Module (Option) Replacement

NOTE

Disable the Resume function before replacing the optional memory expansion module. (Refer to the user's guide for more information on the Resume function.)

Remove the optional memory expansion module as follows:

1. Remove the two screws from the compartment cover on the bottom of the computer and remove the compartment cover.
2. Remove the two screws holding the memory expansion module in place.
3. Slide the memory expansion module sideways—away from the connector. Then lift out the module.

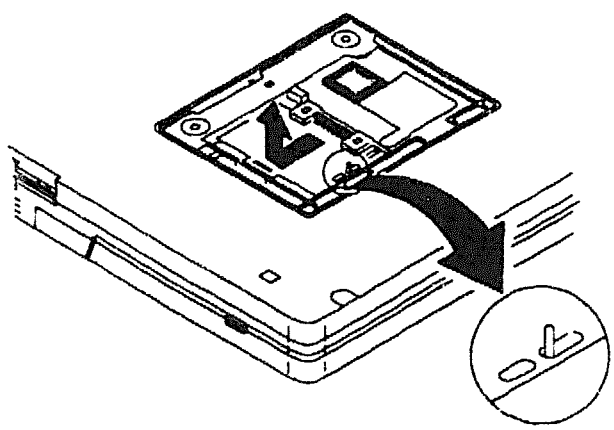


Figure 3-2. Removing a memory expansion module

Replace the memory expansion module by repeating the steps in reverse order.

CAUTION

The memory expansion module is keyed to fit into the slot only one way. Do not force the module into the slot when replacing it.

Removing the Top Case

Remove the top case as follows:

1. Remove the rechargeable battery and modem, if installed.
2. Remove three screws from the battery compartment, two screws from the modem compartment, and one screw from the outside case as illustrated.

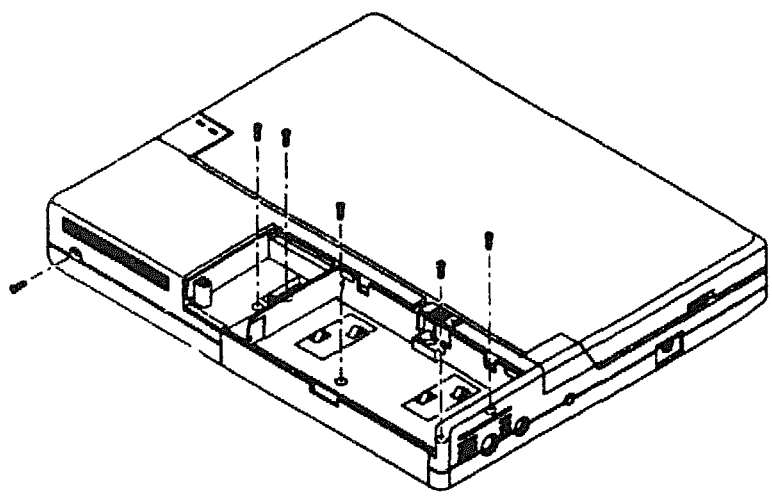


Figure 3-3. Removing the case screws

3. Turn the system over and remove one screw from each of the front corners and one screw from the memory expansion cover at the center of the bottom case.
4. Turn the computer over again so that the front is facing you and open the display panel.
5. Remove the left and right hinge covers by lifting up the rear end of the hinge covers.

6. At the right hinge, pull up the plastic rivet and pull the power/battery LED board away from the computer. Disconnect the power/battery LED board from the power/battery LED cable.

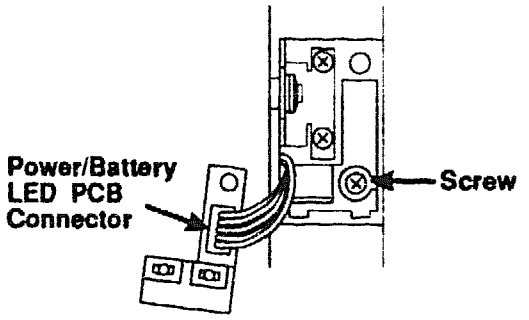


Figure 3-4. Power/battery LED PCB compartment

7. Remove one screw from the power/battery LED compartment.
8. Remove the front screw from the left hinge.
9. Gradually raise the rear end of the top case so that the hooks in front of the keyboard can be unlatched. Disconnect the LCD cable and the battery terminal connector.

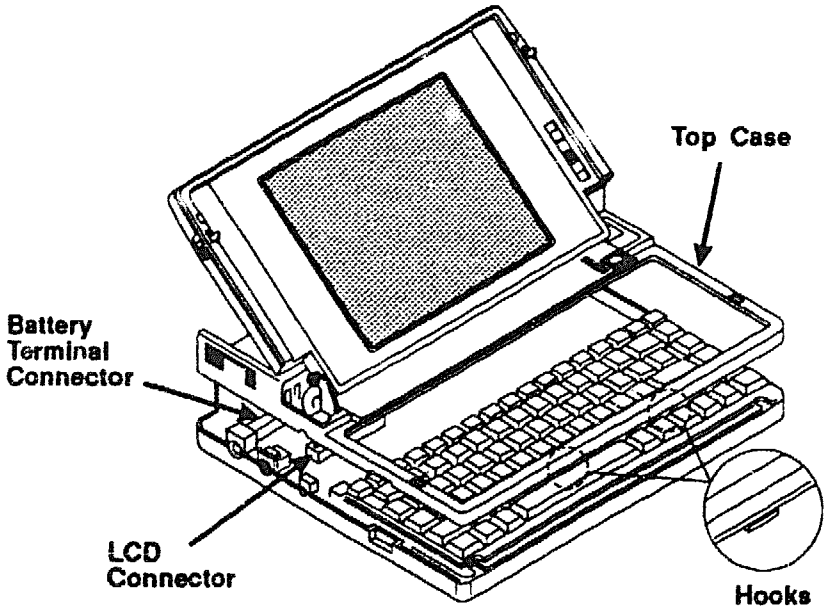


Figure 3-5. Removing the top case

10. Lift the top case away from the bottom case.

Replace the top case by repeating the steps in reverse order.

Keyboard Replacement

Remove the keyboard as follows:

1. Remove the top case.
2. Remove three screws securing the keyboard to the bottom case.
3. Rotate the keyboard forward, and remove the resume battery.

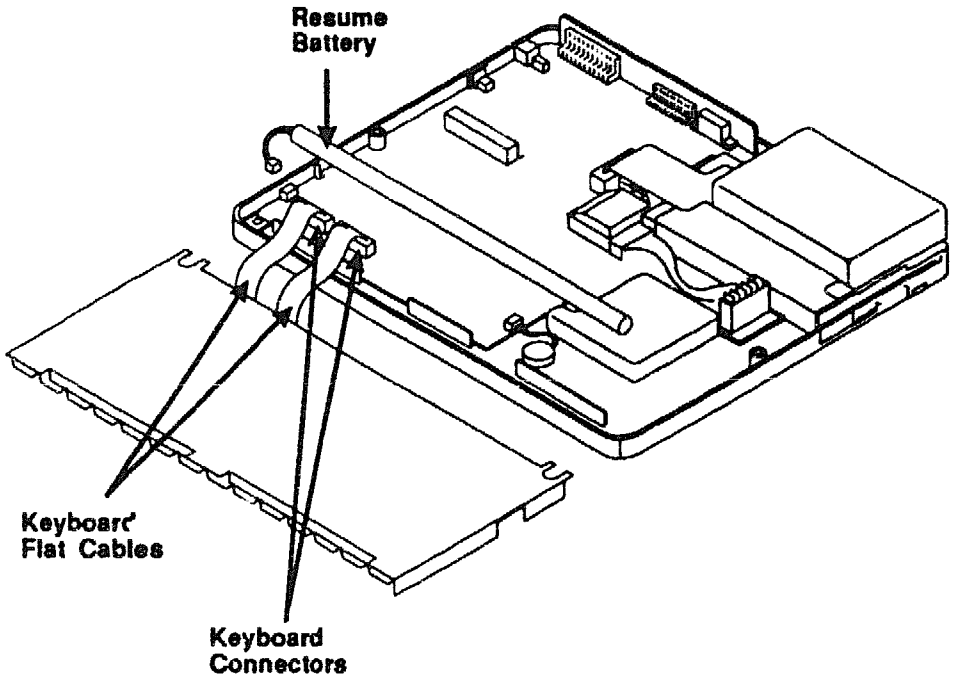


Figure 3-6. Replacing the keyboard

4. Disconnect the keyboard connectors.

Replace the keyboard by repeating the steps in reverse order.

Hard Disk Drive Replacement

Remove the hard disk drive as follows:

1. Remove the top case.
2. Remove the two screws securing the hard disk drive to the diskette drive mounting bracket.

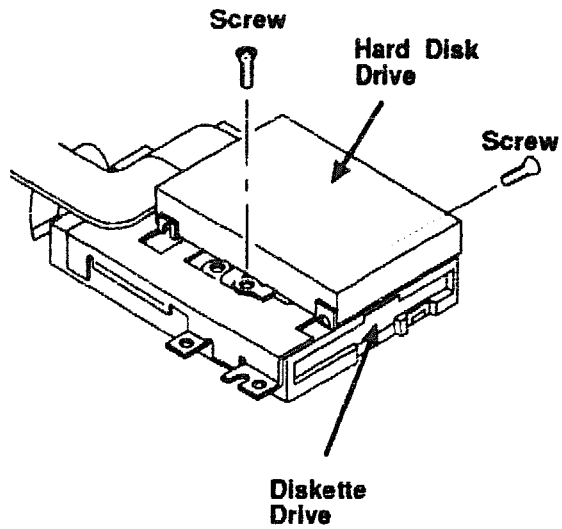


Figure 3-7. Hard drive mounting screws

3. Carefully remove the flat hard disk drive cables from the main logic board.
4. Turn the hard disk drive over, and remove the three screws from the mounting bracket.
5. Remove the hard disk drive from its shield.

6. Carefully remove the flat hard disk drive cables from the hard disk drive by using a small flat head screwdriver to gently pry off the connector. Do not use excessive force.

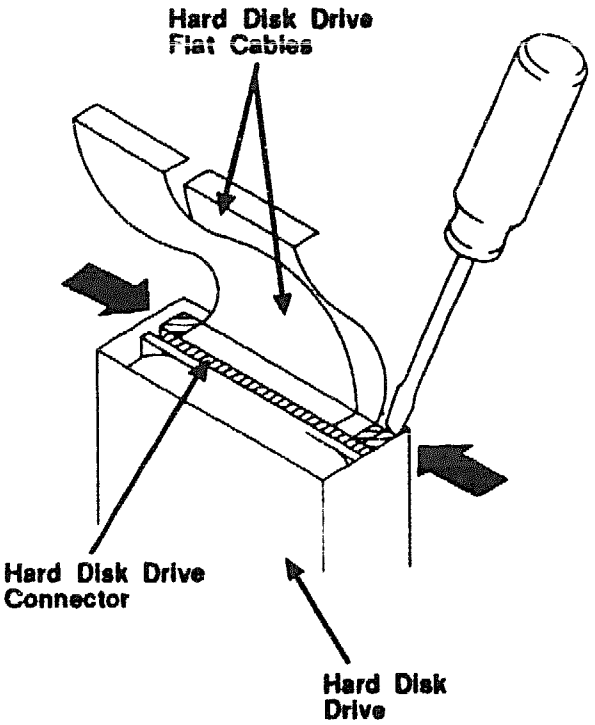


Figure 3-8. Removing the hard disk drive cable

Replace the hard disk drive by repeating the steps in reverse order.

Diskette Drive Replacement

Remove the diskette drive as follows:

1. Remove the top case and hard disk drive.
2. Remove the screw fixing the diskette drive bracket to the bottom case.

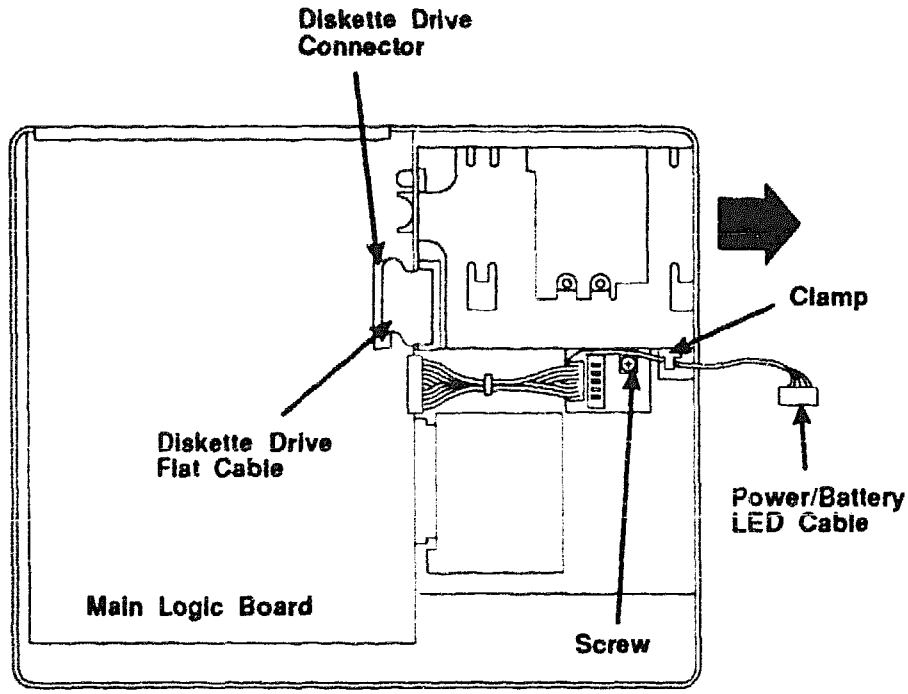


Figure 3-9. Diskette drive replacement

3. Remove the power/battery cable from the cable clamp on the side of the diskette drive bracket.
4. Lift the diskette drive up and away from the computer.
5. Carefully remove the flat diskette drive cable from the main logic board.

CAUTION

Do not disconnect the flat cable from the diskette drive. The cable and drive are one piece.

6. Remove the four screws attaching the diskette drive to its mounting bracket.

Replace the diskette drive by repeating the steps in reverse order.

Main Logic Board Replacement

Remove the main logic board as follows:

1. Remove the RAM expansion module, the math coprocessor, and the modem if they are installed.
2. Remove the top case, keyboard, the hard disk drive, and the diskette drive.
3. Disconnect the LED connector, the beeper connector, and the resume battery connector.
4. Remove the three screws securing the main logic board to the bottom case.

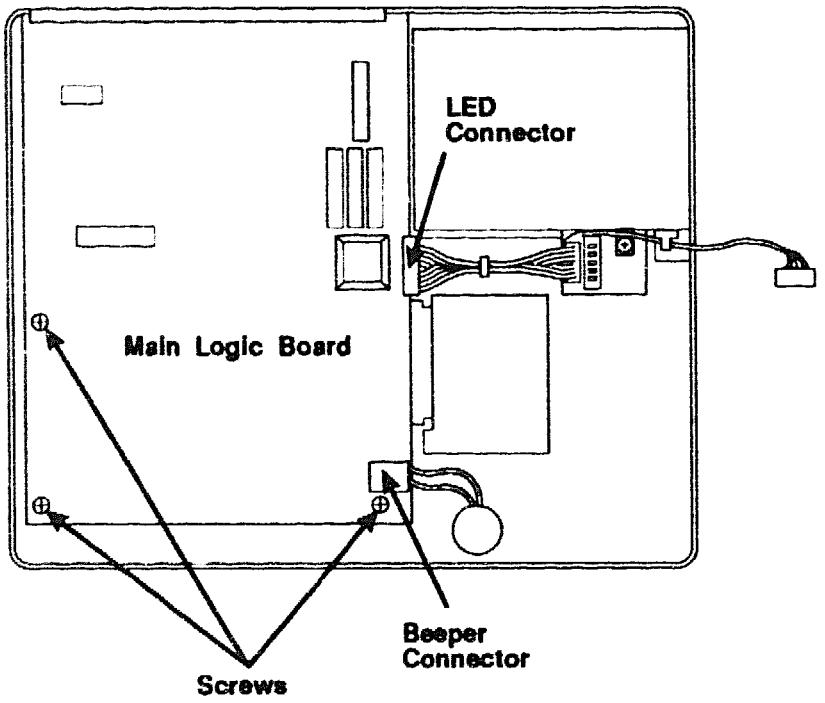


Figure 3-10. Main logic board screws

5. Lift up the front of the main logic board, and then pull the main logic board forward so that the external connectors can clear the back of the bottom case.
6. Remove the external connector frame from the main logic board by removing the six hex retaining screws and lock washers from the external connectors.

CAUTION

The connectors are soldered to the main logic board. Use the proper tools to remove the hex screws, and do not use excessive force.

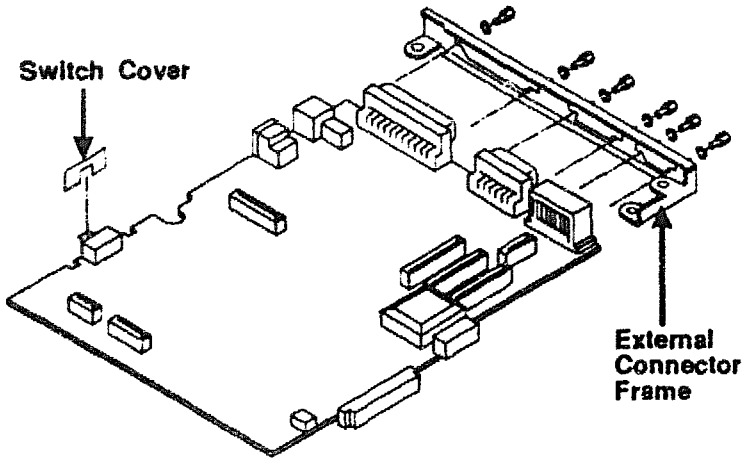


Figure 3-11. Removing the external connector frame

Replace the main logic board by repeating the steps in reverse order.

NOTE

There is a mylar insulator under the main logic board. Make sure it is in position when replacing the main logic board.

LCD Replacement

Remove the LCD unit as follows:

1. Open the display panel.
2. Remove the two rubber screw seals by gently pressing them with a flat-head screwdriver toward the center as illustrated.

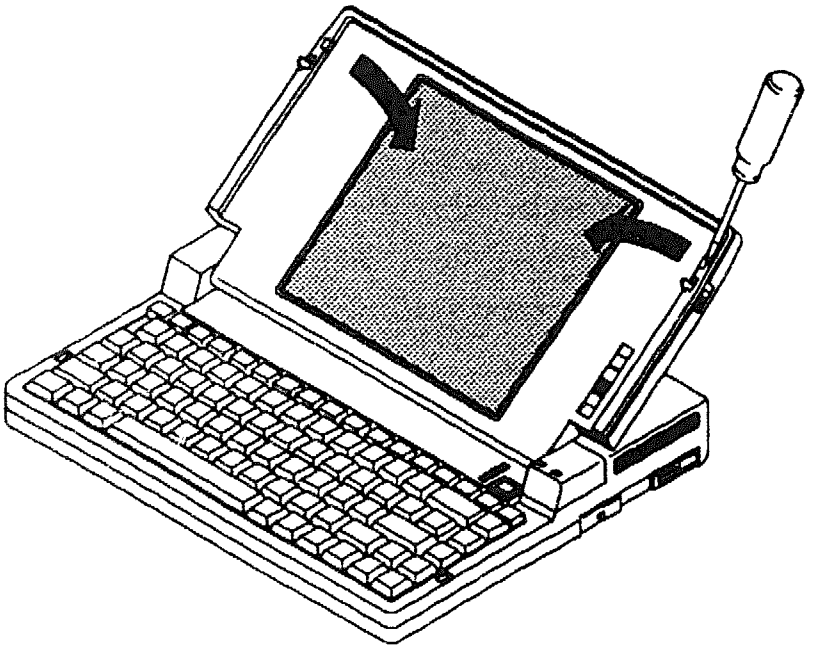


Figure 3-12. Removing the LCD screw seals

3. Remove the two screws hidden by the screw seals.
4. Holding both ends of the contrast slider, gently lift it straight off the display panel.
5. Close the display panel.
6. Gradually pull up on the upper display case, separating it from the lower display case.

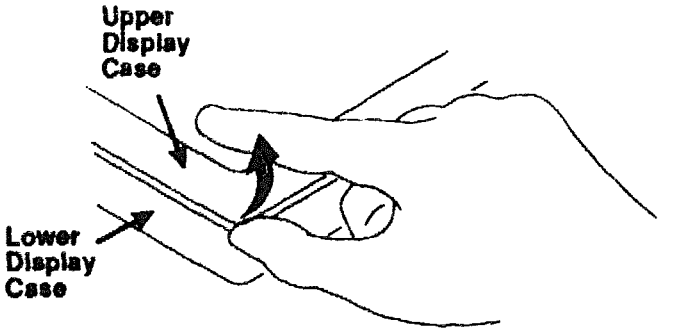


Figure 3-13. Separating the upper and lower display cases

NOTE

When reassembling the display case, carefully latch the five hooks along the hinge first. Then, latch the remaining hooks.

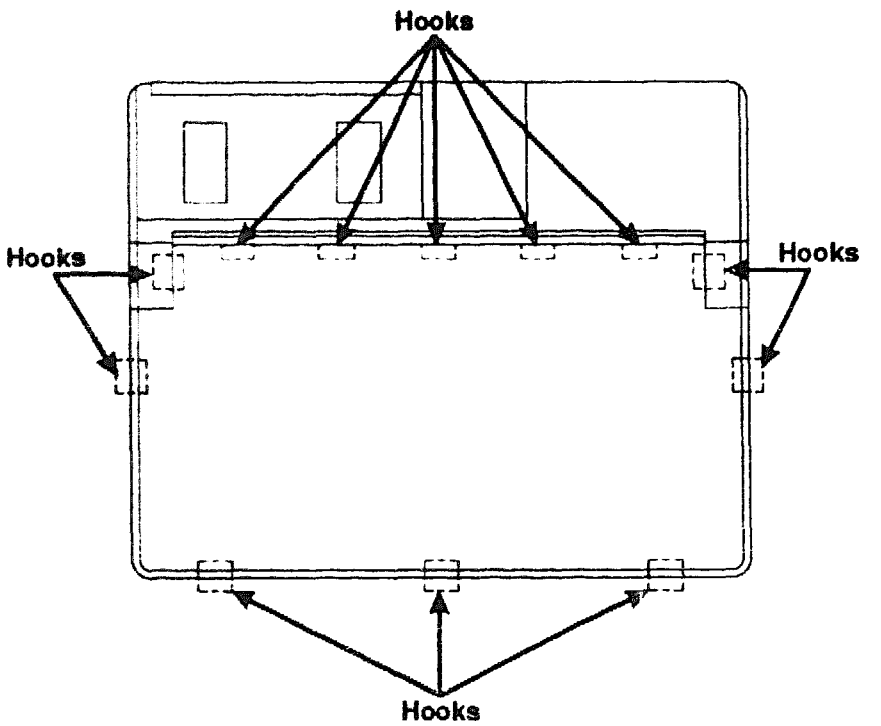


Figure 3-14. Upper display case hooks

7. Peel off the tape holding the LCD cables.
8. Unlatch the hook that holds the fluorescent light inverter PCB, and lift the PCB away from the display case.
9. Disconnect the three connectors on the fluorescent light inverter PCB, and disconnect the main LCD connector.

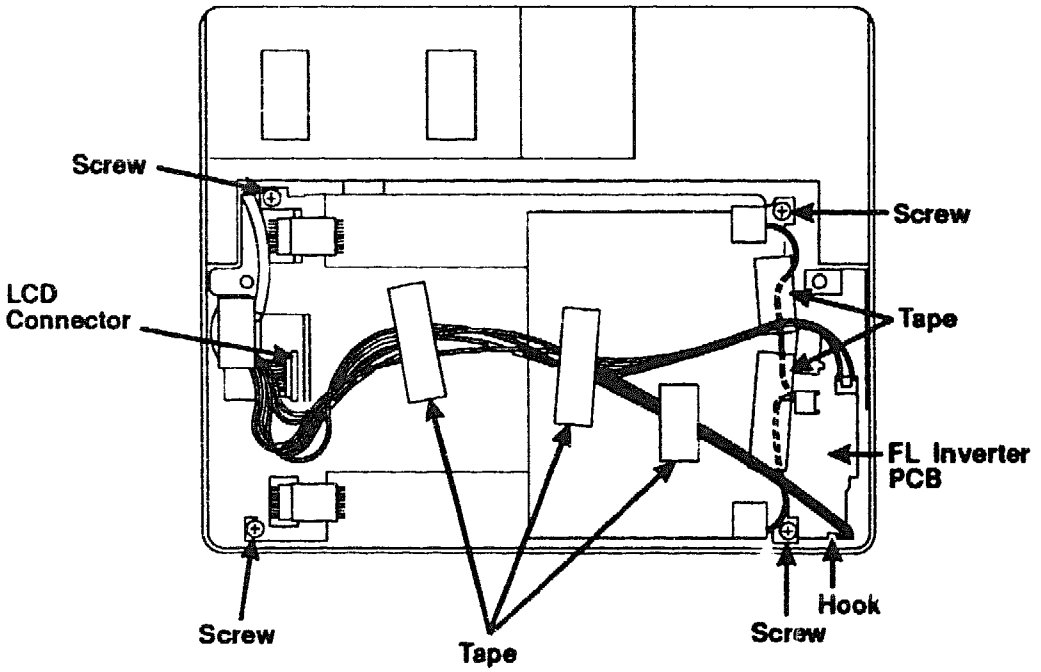


Figure 3-15. LCD cables

10. Remove the three screws that hold the LCD and the radiation plate to the display case.
11. Pull the LCD out of the display case. Remove the radiation plate and the fluorescent light.

Replace the LCD by repeating the steps in reverse order.

Resume Battery Replacement

Remove the resume battery as follows:

1. Remove the top case.
2. Remove three screws securing the keyboard to the bottom case.
3. Rotate the keyboard forward, and disconnect the resume battery.
4. Remove the resume battery.

WARNING

Improper handling of the battery can cause a fire, an explosion, or severe burns. Do not take the battery apart. Never heat the battery above 100 °C (212 °F). Never solder directly to the battery or expose the contents of the battery to water. The replacement battery must be the same type as the old battery.

CAUTION

The replacement battery has a keyed connector that ensures proper polarity. Do not defeat the key or force the connectors together.

Replace the resume battery by repeating the steps in reverse order.

Math Coprocessor (Option) Replacement

CAUTION

Always use a grounded wrist strap and an earth-grounded work surface when handling the math coprocessor and its replacement. Static electricity can damage the math coprocessor and the printed circuit boards inside the computer.

NOTE

Disable the Resume function before replacing the optional math coprocessor. Refer to the user's guide for more information on the Resume function.

Replace the optional math coprocessor as follows:

1. Remove the two screws from the compartment cover on the bottom of the computer, and remove the compartment cover.
2. Locate the math coprocessor. Use a special tool to simultaneously lift each corner of the coprocessor.

CAUTION

While lifting the coprocessor from the socket, be careful not to damage it or the socket or bend any pins.

3. Before installing the new math coprocessor, straighten any pins (if necessary) so that they align with the holes in the socket.
4. Make sure Pin 1 of the math coprocessor (the dot on top of the chip) is aligned with Pin 1 of the socket (the slanted corner).

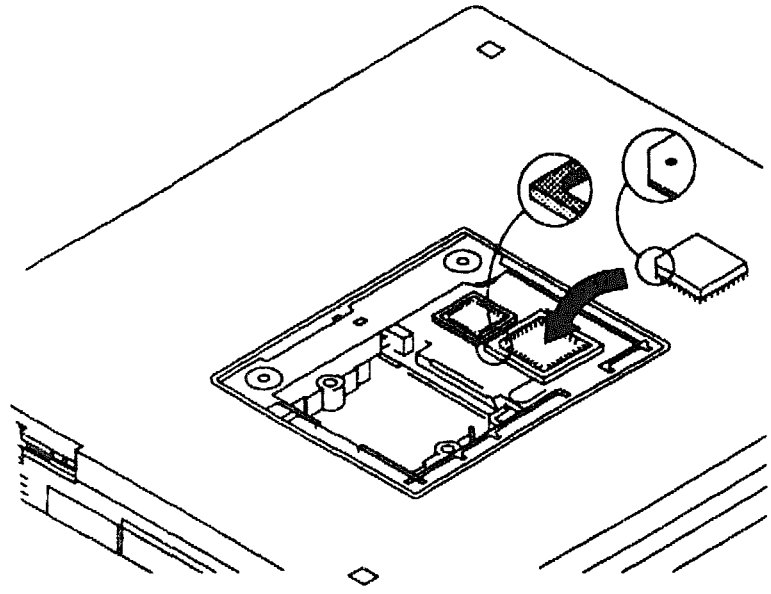


Figure 3-16. Installing a math coprocessor

5. Install the new math coprocessor in the socket by alternately pressing each corner into the socket. Do this until the coprocessor is firmly seated in the socket.
6. Replace the compartment cover, and reinstall the two cover screws.

Main Logic Board Diagram

The following figure shows the location of components on the main logic board:

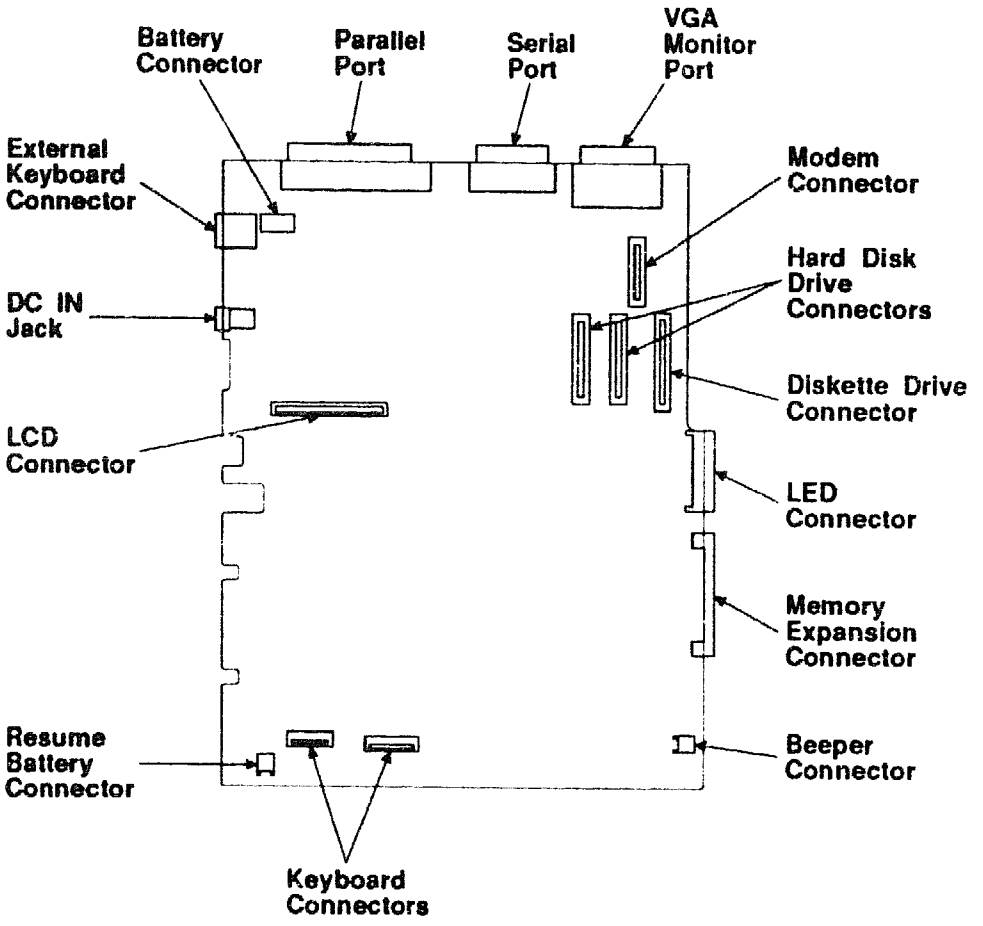


Figure 3-17. Main logic board diagram

A

Specifications

Electrical

System

Input voltage	16 V
Current consumption	1.25 A (maximum)

Rechargeable Battery

Capacity	1.4 AH (5 hour rate) average 12 V average
Operating time	Approximately 3 hours under the following conditions: Fluorescent backlight (middle position) 90% Hard disk drive 10% Diskette drive 1%
Charging time	Approximately 5 hours (power on, under normal operation) Approximately 2 hours (power off)
Duty cycle	400 times average

AC Adapter/Charger

Primary	110 to 240 VAC
Secondary	
Voltage	16 V at 1.25 A
Current capacity	1.25 A (maximum)

Resume Battery

Type	Rechargeable Ni-Cad battery module
Nominal voltage	7.2 V
Nominal capacity	120 mAH (5 hour rate)
Duty cycle	400 times average

Mechanical

Dimensions (W × H × D)	31.0 × 4.4 × 25.4 cm (12.2 × 1.7 × 10 in.)
Weight	2.9 kg (6.5 lbs.)

Environmental

Temperature

Operating	5 °C to 35 °C (41 °F to 95 °F)
Storage	-20 °C to 60 °C (-4 °F to 140 °F)

Humidity

Operating	80% maximum
Storage	80% maximum

B

Connector Pin Assignments

Peripheral Interface Connectors

The following tables and diagrams describe the pin assignments and functions of the external interface connectors on the DECpc 320P.

Table B-1. Serial Port Connector

Pin	Signal
1	DCD
2	RXD
3	TXD
4	DTR–
5	GND
6	DSR
7	RTS–
8	CTS–
9	RI

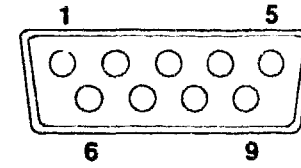


Table B-2. Parallel Port Connector

Pin	Signal
1	STB–
2	PD0
3	PD1
4	PD2
5	PD3
6	PD4
7	PD5
8	PD6
9	PD7
10	ACK–
11	BUSY
12	PE
13	SLCT
14	AFD–
15	ERR–
16	INIT–
17	SLIN–
18	GND
19	N/C
20	N/C
21	N/C
22	N/C
23	N/C
24	GND
25	GND

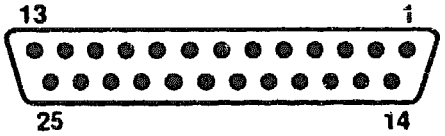


Table B-3. Video Port Connector

Pin	Function
1	Red video
2	Green video
3	Blue video
4	Monitor ID bit 2
5	Ground
6	Ground
7	Ground
8	Ground
9	Not Connected
10	Ground
11	Monitor ID bit 0
12	Monitor ID bit 1
13	Horizontal sync
14	Vertical sync
15	Not used

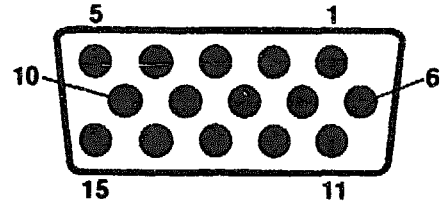


Table B-4. External Keyboard Port Connector

Pin	Signal
1	Data
2	N/C
3	GND
4	+5 VDC
5	Clock
6	N/C

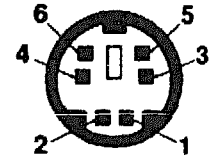


Table B-5. Modem Connector (CN4)

Pin	Signal
1	CTS–
2	GND
3	DSR–
4	+5 VDC
5	RLSD1--
6	DDP6
7	RI
8	SIN
9	MODEMSP–
10	RTS–
11	DTR–
12	SOUT
13	XRESET
14	GND
15	N/C
16	GND
17	N/C
18	GND

Table B-6. RAM Expansion Module Connector (CN17)

Pin	Signal	Pin	Signal
1	Vcc	26	D8
2	EXT RAM	27	SCASL2–
3	MA0	28	D9
4	D0	29	SCASL3–
5	MA1	30	D10
6	D1	31	SCASH2–
7	MA2	32	D11
8	D2	33	SCASH3–
9	MA3	34	D12
10	D3	35	XDWE–
11	MA4	36	D13
12	D4	37	XDWE–
13	MA5	38	D14
14	D5	39	GND
15	MA6	40	D15
16	D6	41	SRAS2–
17	MA7	42	SCASL4–
18	D7	43	SRAS3–
19	MA8	44	SCASH4–
20	GND	45	Vcc
21	MA9	46	SRAS4–
22	GND	47	GND
23	N/C	48	Vcc
24	Vcc	49	GND
25	GND	50	GND

Internal Connectors

The following tables and diagrams describe the pin assignments of the internal connectors on the DECpc 320P.

Table B-7. Diskette Drive Connector (CN3)

Pin	Signal
1	+5 VDC
2	INDEX–
3	+5 VDC
4	DRIVESELECT–
5	+5 VDC
6	DISKCHANGE–
7	+5 VDC
8	N/C
9	N/C
10	MOTORON–
11	MODESELECT
12	DIRECTION
13	GND
14	STEP–
15	GND
16	WRITEDATA–
17	GND
18	WRITEGATE–
19	GND
20	TRACK00–
21	GND
22	WRITEPROTECT–
23	GND
24	READDATA–
25	GND
26	SIDESELECT

Hard Disk Drive Connectors

The following are signal definitions for the two 22-pin hard disk drive port connectors:

Table B-8. Hard Disk Drive Connector A (CN13)

Pin	Signal
1	RESET-
2	GND
3	DATA7
4	DATA8
5	DATA6
6	DATA9
7	DATA5
8	DATA10
9	DATA4
10	DATA11
11	DATA3
12	DATA13
13	DATA2
14	DATA12
15	DATA1
16	DATA14
17	DATA0
18	DATA15
19	GND
20	N/C
21	N/C
22	GND

Table B-9. Hard Disk Drive Connector B (CN12)

Pin	Signal
1	IOW–
2	GND
3	IOR–
4	GND
5	N/C
6	N/C
7	DRQ
8	GND
9	IRQ14
10	IOCS16–
11	A1
12	N/C
13	A0
14	A2
15	HDCCS0–
16	HDCCS1–
17	ACTIVE–
18	GND
19	+5 VDC (logic)
20	+5 VDC (motor)
21	GND
22	AT/XT

Table B-10. Beeper Connector

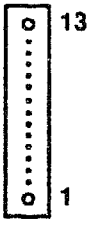
Pin	Signal
1	P1
2	P2

Table B-11. LCD Connector (CN2)

Pin	Signal
1	S
2	CP1
3	CP2
4	+5 VDC (V_{DD})
5	GND
6	-22 VDC (V_{EE})
7	DU0
8	DU1
9	DU2
10	DU3
11	DL0
12	DL1
13	DL2
14	DL3
15	VFL
16	FL CONT
17	FL VAR
18	FL VSS
19	CON LCD
20	CONVR

Table B-12. LED Connector (CN18)

Pin	Signal
1	POW ON
2	SPEED
3	BAT LOW/CHARGE
4	FULL CHARGE
5	GND
6	CAPS LOCK
7	NUM LOCK
8	SCRL LOCK
9	KEY PAD
10	HDD ON
11	+5 VDC
12	POWER
13	GND



Keyboard Connectors

The following are signal definitions for the two keyboard connectors.

Table B-13. Keyboard Connector A (CN9)

Pin	Signal
1	P0, 0
2	P0, 1
3	P0, 2
4	P0, 3
5	P0, 4
6	P0, 5
7	P0, 6
8	P0, 7

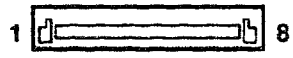
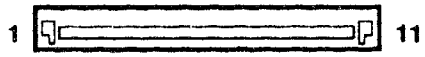


Table B-14. Keyboard Connector B (CN8)

Pin	Signal
1	P1, 4
2	P1, 5
3	P1, 6
4	P2, 0
5	P2, 1
6	P2, 2
7	P2, 3
8	P2, 4
9	P2, 5
10	P2, 6
11	P2, 7



Power Connectors

The following tables and diagrams describe the pin assignments and functions of the power connectors on the DECpc 320P.

Table B-15. DC IN Connector

Pin	Signal
1	+16 VDC
2	GND
3	GND

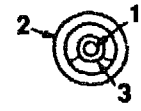


Table B-16. Rechargeable Battery Connector

Pin	Signal
1	VSENSE
2	GND
3	TSENSE
4	ISENSE

Table B-17. Resume Battery Connector

Pin	Signal
1	P1 (+7.2 VDC)
2	GND

C

System Information

Memory Map

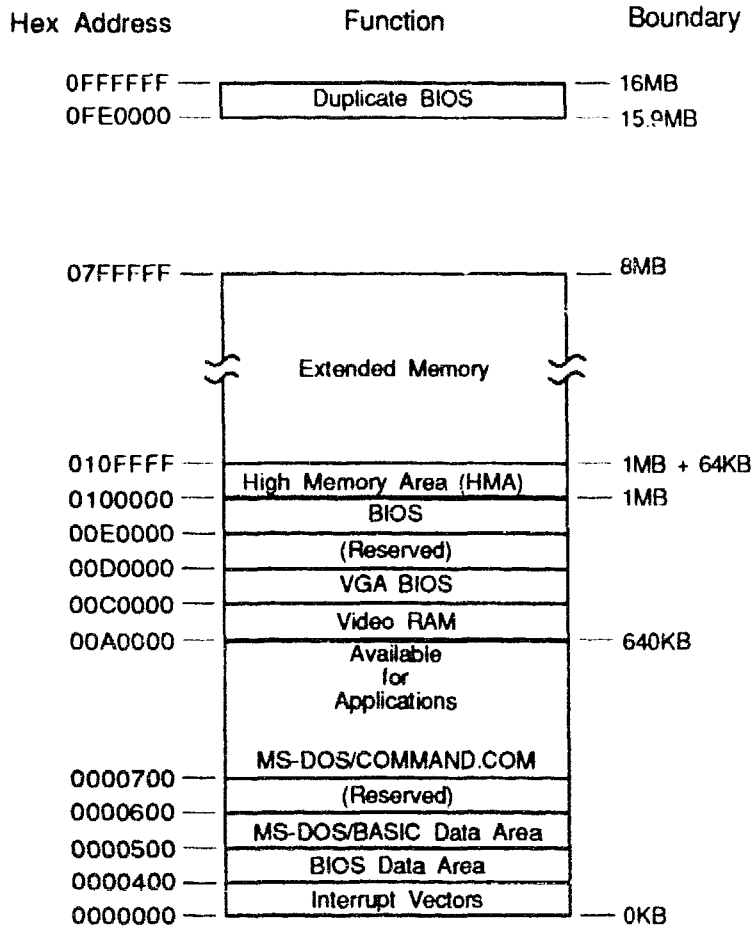


Figure C-1. System memory map

Table C-1. I/O Address Map

Hex Range	Device
0000-001F	DMA Controller 1 (slave)
0020-003F	Interrupt Controller 1 (master)
0024, 0028	Configuration Registers
0040-0043	Counter/Timer
0060	Keyboard Data Port
0061	Port B Register
0064	Keyboard Status Port
0070, 0071	Real-Time Clock/NMI Mask
0080-009F	DMA Page Registers
00A0-00A1	Interrupt Controller 2 (slave)
00C0-00CF	DMA Controller 2 (master)
800000F0-800000FF	Numeric Coprocessor – 387SX (IRQ13)
01F0-01F7	Hard Disk Drive (IRQ14)
02F8-02FF	Serial Port 2/Internal Modem (IRQ3)
0378-037F	Parallel Printer Port (IRQ7)
03B0-03DF	VGA Controller
03F0-03F7	Diskette Drive (IRQ6)
03F8-03FF	Serial Port 1 (IRQ4)

D

Exploded View

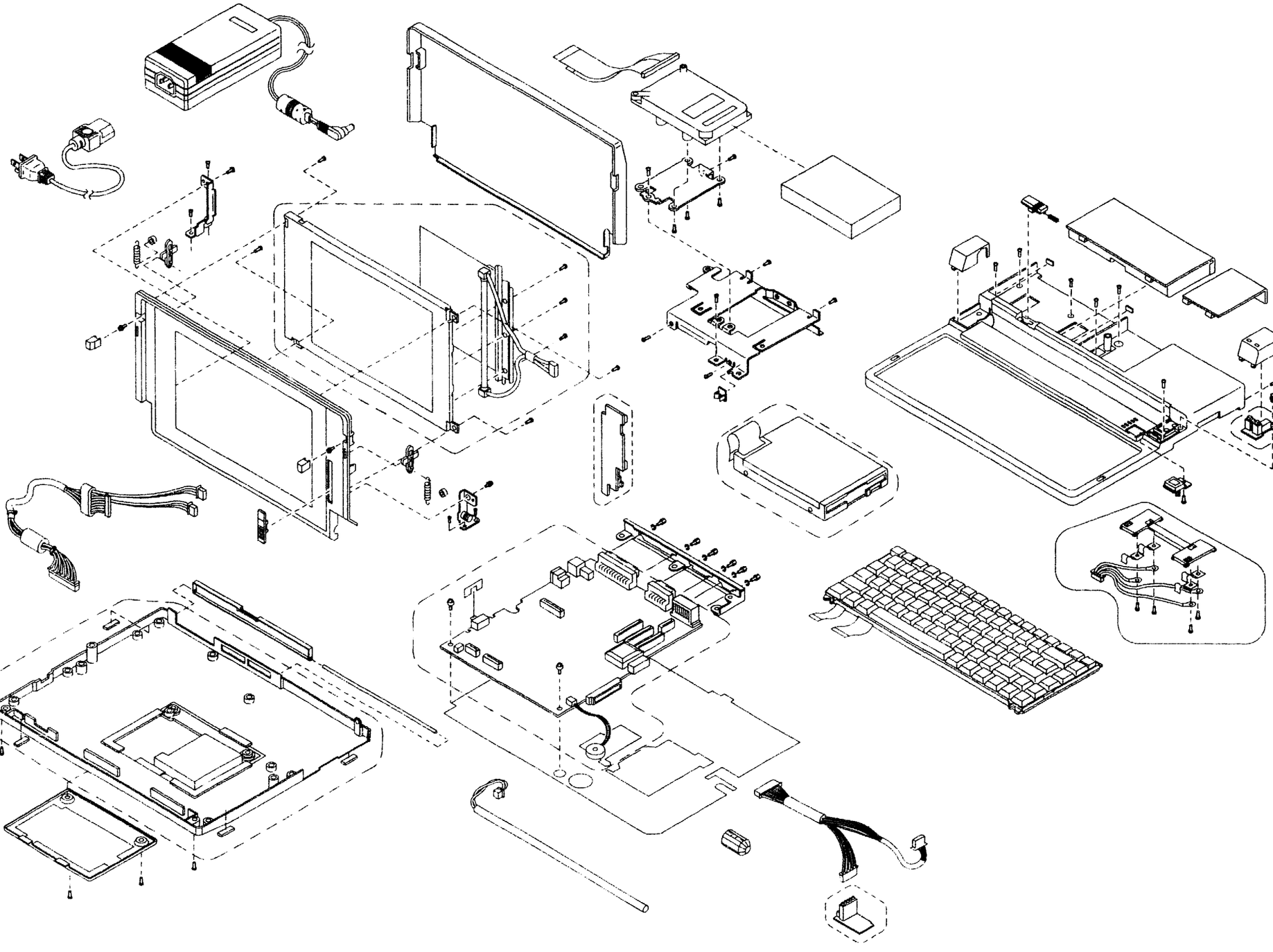


Figure D-1. DECpc 320P exploded view