

Service Handbook

HP 9000 Series 300 Computers
Model 332

HP Part Number 98572-90039



Hewlett-Packard Company

3404 East Harmony Road, Fort Collins, Colorado 80525

NOTICE

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

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

WARRANTY

A copy of the specific warranty terms applicable to your Hewlett-Packard product and replacement parts can be obtained from your local Sales and Service Office.

Copyright © Hewlett-Packard Company 1989

This document contains information which is protected by copyright. All rights are reserved. Reproduction, adaptation, or translation without prior written permission is prohibited, except as allowed under the copyright laws.

Restricted Rights Legend

Use, duplication or disclosure by the U.S. Government Department of Defense is subject to restrictions as set forth in paragraph (b)(3)(ii) of the Rights in Technical Data and Software clause in FAR 52.227-7013.

Copyright © AT&T, Inc. 1980, 1984

Copyright © The Regents of the University of California 1979, 1980, 1983

This software and documentation is based in part on the Fourth Berkeley Software Distribution under license from the Regents of the University of California.

Printing History

New editions of this manual will incorporate all material updated since the previous edition. Update packages may be issued between editions and contain replacement and additional pages to be merged into the manual by the user. Each updated page will be indicated by a revision date at the bottom of the page. A vertical bar in the margin indicates the changes on each page. Note that pages which are rearranged due to changes on a previous page are not considered revised.

The manual printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates which are incorporated at reprint do not cause the date to change.) The manual part number changes when extensive technical changes are incorporated.

February 1989...Edition 1

Notices

Radio Frequency Interference Statements

FCC Statement

**Federal Communications Commission
Radio Frequency Interference Statement
(U.S.A. Only)**

The Federal Communications Commission (in Subpart J of Part 15, Docket 20780) has specified that the following notice be brought to the attention of the users of this product.

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

VCCI Statement (Japan Only)

この装置は、第一種情報装置(商工業地域において使用されるべき情報装置)で商工業地域での電波障害防止を目的とした情報処理装置等電波障害自主規制協議会(VCCI)基準に適合しております。

従って、住宅地域またはその隣接した地域で使用すると、ラジオ、テレビジョン受信機等に受信障害を与えることがあります。

取扱説明書に従って正しい取り扱いをして下さい。

Manufacturer's Declaration (Germany Only)

Herstellerbescheinigung

Hiermit wird bescheinigt, daß dieses Gerät in Übereinstimmung mit den Bestimmungen der Postverfügung 1046/84 funkentstört ist. Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Safety Considerations

WARNINGS, CAUTIONS, and Notes

Warnings, cautions and notes are used throughout this document to alert the user to conditions of importance. They are used as follows:

- **WARNINGS** contain information which, if not observed, could result in injury to personnel or loss of life.
- **CAUTIONS** contain information which, if not observed, could result in damage to or destruction of equipment.
- **Notes** contain information that will assist you in accomplishing the job.

Examples:

WARNING

The power supply presents a hazard to personnel. Extreme care must be taken when connecting voltmeter probes to the test points. De-energize the product by turning it off and removing its power cord before connecting or removing test probes.

CAUTION

The printed circuit assemblies in this product are susceptible to damage by electro-static discharge. Extreme care must be taken when handling printed circuit assemblies. Use an Anti-static Workstation while handling printed circuit assemblies.

Note

Hewlett-Packard supports repair of this product only to the assembly level. The fault is diagnosed to the assembly that is causing the problem. That assembly is then replaced with a new or rebuilt one.

Service Information Locator

On the next page is a Service Information Locator. First, find the information to reference in the left-hand column. Next, move to the right to a chapter number. Last, move up to the abbreviated manual title that has the information documented.

Chapter identifiers in the Locator use the following codes:

Chapter Number:	Numbers, such as 2. Inclusive chapters, such as 4-6.
Appendices:	Letters, such as A for Appendix A.
Entire Manual:	All
Varies:	* (Check Table of Contents or Index.)

Manuals identified in this locator are abbreviated by their initials:

Initials	Manual Title	Part Number
SIM	Model 332 Service Information Manual	98572-90030
SHB	Model 332 Service Handbook	98572-90039
TTM	Series 200/300 Test Tools Manual	09800-90011
SPM	HP 9000 Site Preparation Manual	09000-90041
PIN	Product Installation Note	98560-90648 98560-90649 98560-90650 98561-90000
TDS	Series 300 Technical Data Sheet/Price List	

Service Information Locator

Service Information	SIM	SHB	TTM	SPM	PIN	TDS
Assembly replacement	2					
Block diagrams	1-3	9				
Booting Operating Systems	4					
Computer tests	1, 5	2	1, 2, 3			
Configurations	1,3	3	1,2			All
CS/80 tests	1, 5	5	4			
Electrical requirements	1	1		3, A		*
Environmental requirements	1	2		4, A		*
Functional descriptions	3					
HP-HIL device tests			2, 3			
Installation	2	2		All	All	
I/O Bus architecture	1, 3					
Monitors	1	3		A		*
People who can help				1		
Options/Accessories	1, 3	3			All	*
Ordering spare parts	6	8				
Part numbers	6	8				
Peripherals	1	3				*
Preventive maintenance		2				
Product information	1	1		All	All	All
Product numbers	1	1, 3		A		All
Reference material	7	10				All
Repair Philosophy	1	1				
Self-tests	4, 5	5	1, 2			
Service notes	1	11				
Site preparation		2		All		
System Functional Tests	1, 5	5	1, 3			
Systems	1	3				*
Troubleshooting	5	4	3			
Turn-on	3, 4	4, 5				

Table of Contents

Chapter 1: Product Information

Introduction	1
Hewlett-Packard Support	1
Repair Philosophy	1
Technical Information	3
System Features	3
Serial Numbers	3
Technical Information	4
Electrical	4
Environmental	5
Electromagnetic Interference	5
Regulatory Requirements	5
Physical	5
Shipping Information	6
Processor Board	7
Add-on Memory	7
DIO Bus	8
Standard Tools	9
Computer/System Tests	9

Chapter 2: Environmental/Installation/PM

Environmental	11
Environmental Specifications	11
Electromagnetic Interference	11
Regulatory Requirements	11
Physical	12
Shipping Information	12
Installation	13
Mounting	13
Cabling	13
Preventive Maintenance	14

Chapter 3: Configuration

Bundled Systems	15
Supported Configurations	15
Board Installation Precautions	16
Board Arrangement	17

RAM Configuration	18
Processor Board Configuration Switches	19
HP-HIL Accessories	21
Chapter 4: Troubleshooting	
Initial Troubleshooting Flowchart	23
Dead Unit Troubleshooting Flowchart	24
Live Unit Troubleshooting Flowchart	25
Power Supply Specifications	26
Voltage Indicators.....	26
General Failure Indications	27
Remote Computer Analysis	30
Locating Defective RAM Boards	30
Boot ROM Self-Tests	32
Chapter 5: Computer Tests	
Test Tools	35
Package Contents	35
Chapter 6: Adjustments	37
Chapter 7: Peripherals	
Supported Peripherals List	39
Chapter 8: Parts Lists	
Replacement Parts Information	41
Introduction.....	41
Cooperative Support Program	42
Exchange Parts	42
Part Number Lists	42
Processor Boards	44
Static-Free Bags	45
Electrical Parts	46
Labels	47
External Cables.....	47
Case Parts	49
HP-HIL Devices	50

Chapter 9: Diagrams	
Model 332 Computer Block Diagram	51
Power Supply	52
Power Distribution	53
Processor/RAM Board	54
Typical Add-on Video Board	55
Chapter 10: References	
Related Hardware Documentation	57
Hardware Support Documentation	57
Installation Manuals/Notes	58
Chapter 11: Service Notes	61

Product Information

Introduction

Information in this handbook refers to the HP 9000 Series 300 Model 332 computer. The Model 332 consists of the basic product with product number HP 98572A and several bundles based on the HP 98572A.

Hewlett-Packard Support

Support services and policies mentioned in this section are subject to change. Please consult your local Hewlett-Packard Sales and Service Office for the current support policies.

Repair Philosophy

Field Repair Philosophy for the Model 332 Computer is assembly, or board level. This means that when a failure occurs, the problem is diagnosed to the assembly having the failed part. That assembly is then replaced. Replacement assemblies are available through local HP Sales and Service Offices.

Some assemblies may be exchanged for rebuilt ones. Other assemblies are only available as new ones. Refer to Chapter 8 for information on replacement parts.

Schematics

In support of the repair philosophy, this manual contains information to the assembly level. Schematics are not available for this product.

Supported Configurations

Only computer systems with Hewlett-Packard approved parts, accessories, peripherals, operating systems and application programs are supported by Hewlett-Packard. Any computer system with other than HP approved hardware or software connected or installed must have the non-HP approved hardware and software removed by the customer before On-Site or Service Center repair is accomplished.

Refer to the Series 300 Configuration Reference Manual (98561-90020) for supported hardware/software products and combinations thereof.

Technical Information

System Features

Table 1-1. Computer Features

Product Number	Description
Model 332 (HP 98572A)	Model 332 system processing unit featuring: MC68030 CPU, 16 MHz Maximum 8 Mbytes of parity-checking RAM Optional MC68882 Floating Point Co-processor, 16 MHz 4 Gbytes Virtual Memory address space 16-bit DIO Bus IEEE-488 HP-IB Interface RS-232C Serial Interface Two channel DMA Controller HP-IB, HP-HIL, and RS-232 adapter cables.

Serial Numbers

Serial No.

2623 A 01234

Location: Behind the power supply access cover on the inside bottom of the chassis.

Description:

5-digit unique identifying number.

Country of Origin Code.

Product Code, decoded as:

First 2 digits + 60 = Last 2 digits of year product was introduced or significantly changed.

Last 2 digits = number of week in year product was introduced or significantly changed.

Technical Information

Electrical

Line voltage/Frequency	120 V ac @ 48-66 Hz 240 V ac @ 48-66 Hz
Fuse	8AF 250V
Backplane Power Available	Total Power Available from motherboard: 95 Watts @ +5 V dc 40 Watts @ +12 V dc 12 Watts @ -12 V dc Each system slot: 23 Watts @ +5 V dc 10 Watts @ +12 V dc 3 Watts @ -12 V dc DIO backplane, all slots combined 23 Watts @ +5 V dc 10 Watts @ +12 V dc 3 Watts @ -12 V dc
Line transient spike immunity (1 nsec rise, 800 nsec duration)	1 KV dc
Power Consumption	250 Watts maximum
Current Requirements	5.0 A @ 120 V ac 3.0 A @ 240 V ac
Maximum Heat Dissipation	853 BTU/hr 250 Kcal/hr
Battery Back-up	Real-Time Clock on Processor Board

Environmental

Operating temperature	0 - 55° C
Operating humidity	5 - 95% relative
Operating altitude	4 572 metres (15 000 feet)

Electromagnetic Interference

Standards met	FCC Class A VCCI Class 2 VDE Class B, VDE 1046/84
---------------	---

Regulatory Requirements

Standards met	UL 478, 5th Edition CSA 154M-1983 IEC 380, 3rd Edition; 435, 2nd Edition
---------------	--

Physical

Dimensions	
Height	130 mm (5.12 inches)
Width	325 mm (12.8 inches)
Length	376 mm (14.8 inches)
Weight	11.8 kg (26 pounds) maximum
Vibration Standard	Meets Class B requirements

Shipping Information

The shipping container for each computer includes the Localization Kit, which includes power cords, fuse, keyboard cable, HP-HIL cable, and Installation Reference.

Shipping Weight	15.9 kg (35 pounds)
Container Dimensions	Width - 502 mm (19.75 inches)
	Length - 559 mm (22 inches)
	Depth - 267 mm (10.5 inches)
	Cube - 0.07 m ³ (2.65 feet ³)

Processor Board

CPU

Type	Motorola MC68030
Clock Frequency	16 MHz
Internal Architecture	32-bit data and address registers
Address range	4 Gbytes virtual mapped to 4 Gbytes physical
Data bus	32-bit synchronous to: 1 to 8 Mbytes On-board RAM
Floating point Co-processor	16-bit synchronous to: DIO devices
Type	Motorola MC68882
Clock Frequency	16 MHz

Add-on Memory

Type	Byte parity error checking
System bus width	32 bits address; 32 bits data
Bandwidth	16.7 Mbyte/sec
Average cycle time	240 nsec read; 300 nsec write
Size	1 to 8 Mbytes, add-on boards furnished in 1 and 4 Mbytes
Minimum RAM	1 Mbyte
Maximum RAM	8 Mbytes (RAM quantities of 1, 2, 4, 5 and 8 Mbytes are supported)

DIO Bus

Width 23 bits address; 16 bits data
Bandwidth 6 Mb/sec

Parallel Interface

Type IEEE 488
Data Rate 370 Kbyte/sec
Connected devices 15 per interface devices supported

Serial Interface

Type RS-232C standard
Connector DB25

Battery-backed

Real-Time Clock

Resolution 10 milliseconds
Accuracy ± 5 seconds/day
Battery type Lithium; 1 year expected life

Keyboard requirements

HP 46021A (ITF) with HP-HIL interface, 107-key low profile with numeric keypad, 8 special-function keys

HP 98203C with HP-HIL interface, 106-key with rotary control knob, including 10 special-function keys.

Standard Tools

The following tools are needed to service the computer and expander:

Table 1-2. Standard Tools

Part/Product Number	Description
(various)	General electronic tools
9300-0933	Anti-static workstation
(various)	#1 Pozidriv Screwdriver
(various)	#2 Pozidriv Screwdriver
HP 3476B	Digital Multimeter
	Floating-point chip extractor, AMP p/n 821566-1

Computer/System Tests

Table 1-3. Series 200/300 Test Tools

Part No.	Description
09800-12700	one 1/4-inch tape
09800-12300	eight 3 1/2-inch disks
09800-12500	eight 5 1/4-inch disks

The tape version consists of one tape and the manual.

The disk versions consist of the manual and these disks:

Series 200 Computer Tests Disk Rev. 1.1

Series 300 Computer Tests Disk Rev. 2.0

Series 200/300 System Functional Tests Disks:

SFT0 Disk Rev. 1.2

SFT1 Disk Rev. 1.2

SFT2 Disk Rev. 1.2

SFT3 Disk Rev. 1.2

SFT4 Disk Rev. 1.2

CS/80 Exerciser Disk Rev. 3.1

Environmental/Installation/PM **2**

Environmental

Environmental Specifications

Operating temperature	0 - 55° C
Operating humidity	5 - 95% relative
Operating altitude	4 572 metres (15 000 feet)
Maximum Heat Dissipation	853 Btu/hr 250 Kcal/hr

Electromagnetic Interference

Standards met	FCC Class A VCCI Class 2 VDE Class B, VDE 1046/84
---------------	---

Regulatory Requirements

Standards met	UL 478, 5th Edition CSA 154M-1983 IEC 380, 3rd Edition; 435, 2nd Edition
---------------	--

Physical

Dimensions	
Height	130 mm (5.12 inches)
Width	325 mm (12.8 inches)
Length	376 mm (14.8 inches)
Weight	11.8 kg (26 pounds) maximum
Vibration Standard	Meets Class B requirements

Shipping Information

The shipping container for each computer includes the Localization Kit, which includes power cords, fuse, keyboard cable, HP-HIL cable, Installation Reference, and Installation Picture-guide.

Shipping Weight	15.9 kg (35 pounds)
Container Dimensions	Width - 502 mm (19.75 inches) Length - 559 mm (22 inches) Depth - 267 mm (10.5 inches) Cube - 0.07 m ³ (2.65 feet ³)

Installation

The Model 332 computer is customer-installable, unless a non-customer-installable peripheral is included in the order.

Mounting

Tabouret or mini-rack, or unmounted (desktop).

Cabling

Table 2-1. Interface and Video Cables

Cable Type	Product Number, Description
Standard HP-IB	HP 10833D, 0,5 metre HP 10833A, 1 metre HP 10833B, 2 metre HP 10833C, 4 metre
9-Pin RS-232C	HP 92221M DTE to DCE HP 92221P DTE to DTE HP 92222F female to female gender converter HP 92222W custom wiring kit
Monochrome Video	5061-6533 2.4-metre, RCA to BNC
RGB Video	8120-3616 BNC to BNC (three needed)
Audio	8120-4704, 3-metre

Preventive Maintenance

The real-time clock contains a lithium battery which should be replaced once a year. The real-time clock is located on the processor board.

Although the battery is available from Hewlett-Packard, it usually can be obtained locally. It is a 3V, 160 mAh battery.

Make	Part Number
Panasonic	BR2325

WARNING

Battery may explode if mistreated. Do not re-charge, disassemble or dispose of in fire.

When changing the battery, remember that the real-time clock will reset to its default state, and it is necessary to set it to the current time. Note also that the battery retainer clip is a conductor, and merely lifting it up without changing the battery will still cause the real-time clock to reset.

Configuration

Bundled Systems

Refer to the current Model 332 Hardware Price List to determine what HP products are bundled into Model 332 computer systems.

Supported Configurations

Refer to the *Series 300 Configuration Reference Manual (98562-90020)* for the current hardware and software products that are supported.

Board Installation Precautions

CAUTION

Do not use excessive force to seat boards in the system slot connectors.

If excessive force seems to be needed to install a board, remove the board, and inspect the system slot connector for bent pins. Straighten any pins that appear to be bent.

Remove the top cover and all boards above the one that is difficult to seat.

Re-insert the board in the system slot connectors and adjust the position of the board's connector to mate correctly with the slot connector. Carefully seat the board in the connector. Reinstall the other boards the same way and the top cover.

Board Arrangement

Although boards will physically fit in either system slot of the computer (system slots are the wide slots at the bottom of the backplane), they must be arranged in a specific way for in order to minimize RFI/EMI.

The board containing the video driver must go in the **bottom** slot. Thus, a -10 or -12 processor board must go in the bottom slot (unless its video is disabled) and an -11 processor board (or a -10 or -12 processor board with its video disabled) must go in the second slot with the video board in the bottom slot.

RAM Configuration

Model 332 RAM is completely auto-configuring.

Model 332 minimum RAM: at least one RAM board must be installed.
Model 332 maximum RAM is 8 Mbytes.

Since add-on RAM is furnished in 1 and 4 Mbyte quantities and there are two slots for add-on RAM, RAM quantities of 1, 2, 4, 5 and 8 Mbytes are possible and supported.

RAM slots are prioritized. RAM board in slot "A" must be as large as or larger than RAM board in slot "B".

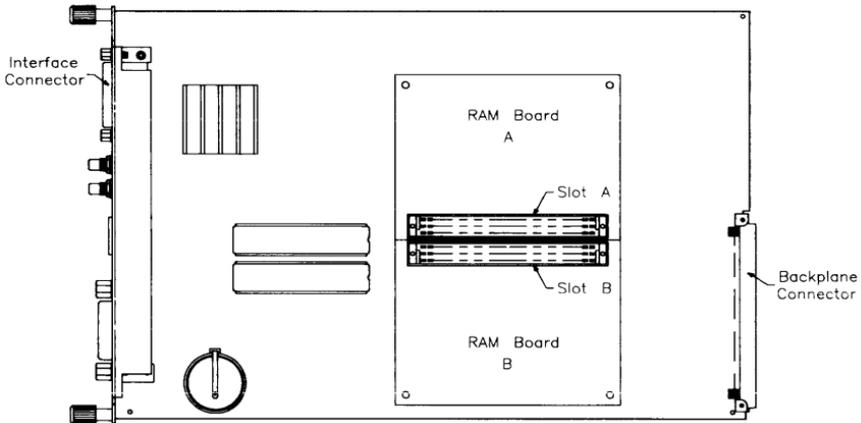


Figure 3-1. RAM Board Slot Prioritization

Processor Board Configuration Switches

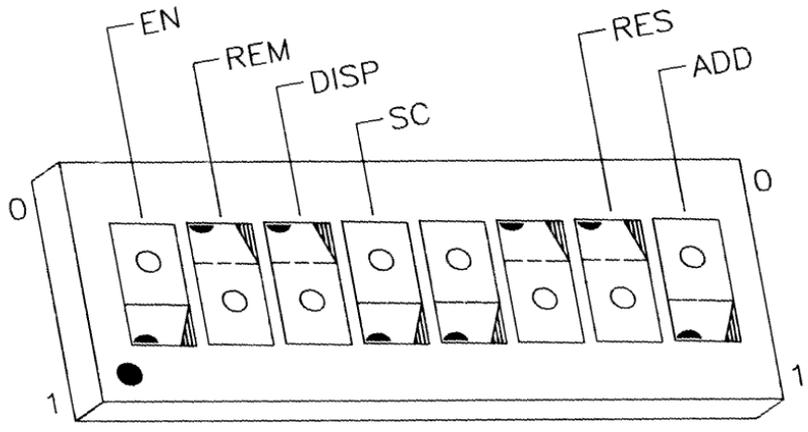


Figure 3-2. Processor Board Configuration Switches

Table 3-1. Processor Board Configuration Switches

Switch Label	Function/How It's Used
EN	RS-232 Control Line Defeat 0 = Control lines defeated 1 = Control lines enabled (Shipped setting)
REM	Remote Terminal Enable 0 = Local Mode (Shipped setting) 1 = Remote Mode
DISP	Processor Board Display Disable 0 = Processor Board Display Enabled (Shipped setting) 1 = Processor Board Display Disabled
SC	Internal HP-IB System Controller 0 = Not System Controller 1 = System Controller (Shipped setting)
blank	Unused
blank	Unused
RES	Graphics Resolution 0 = Medium resolution 1 = High resolution Shipped setting depends on graphics.
ADD	RS-232 in Address Space 0 = RS-232 appears in address space (Shipped setting) 1 = RS-232 does not appear in address space

HP-HIL Accessories

HP-HIL devices are limited to a total of 1 A of current and seven addresses per computer.

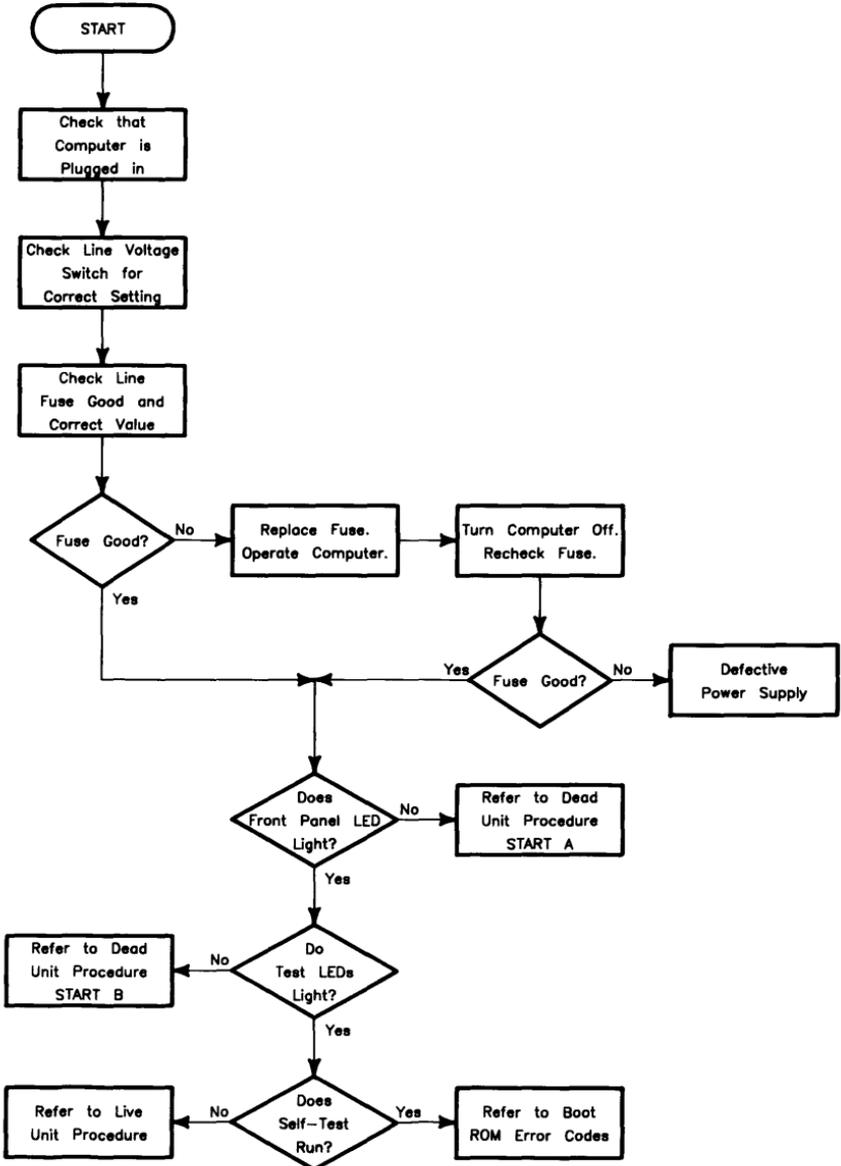
Table 3-2. HP-HIL Devices and Current/Power Requirements

Product Number	Device Name	mA	Watts
HP 35723A	Touchscreen Bezel	250	3.0
HP 46021A	ITF Keyboard	100	1.2
HP 46021A	ITF Keyboard	145	1.74
HP 46060A	HP Mouse	200	2.4
HP 46080A	Extension Module	25	0.3
HP 46081A	3 Metre Ext.	25	0.3
HP 46082A/B	15/30 Metre Extension ¹	50	0.6
HP 46083A	Rotary Control Knob	110	1.32
HP 46084A	ID Module	60	0.72
HP 46085A	Control Dials	370	4.2
HP 46086A	Button Box	80	0.96
HP 46087A ²	"A"-Size Digitizer ²	200	2.4
HP 46088A ²	"B"-Size Digitizer ²	200	2.4
HP 46094A	Quadrature Port Device ³	80	1.2
HP 46095A	Three-Button Mouse	80	0.96
HP 92916A	Barcode Reader	100	1.2

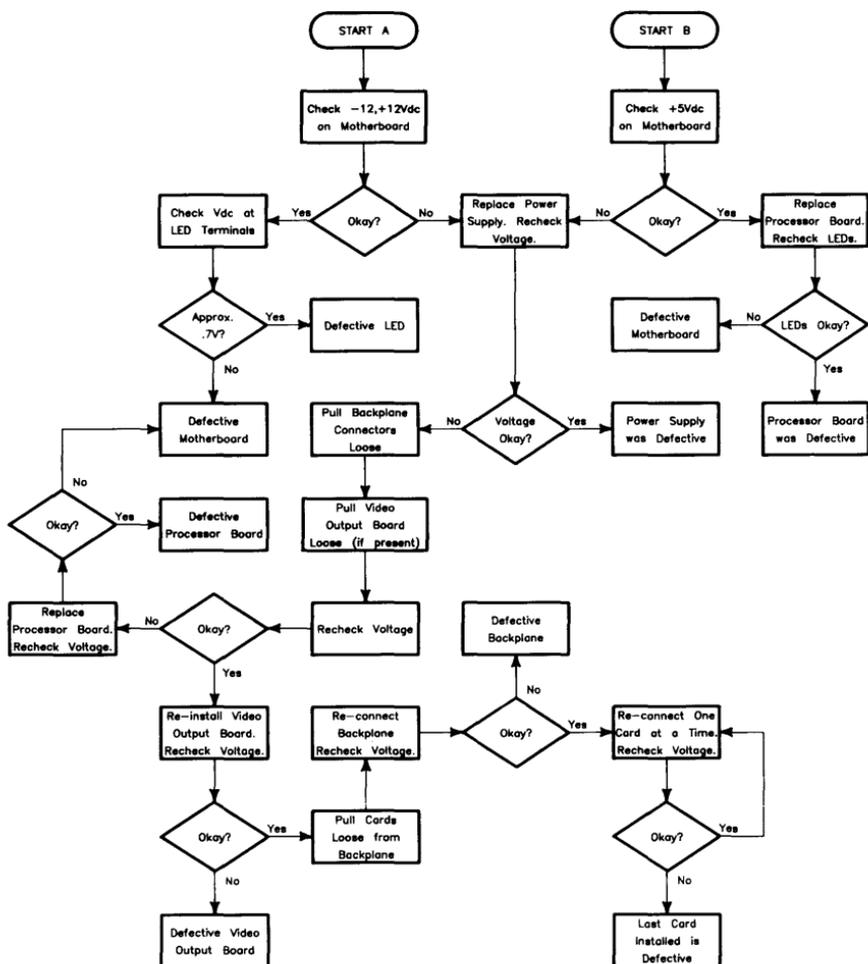
- Notes:
- ¹ Extension cables have two boxes, each draws 25 mA.
 - ² Includes HP 46089A 4-Button Cursor.
 - ³ Port devices require 80 mA; devices attached cannot exceed 120 mA.

Troubleshooting

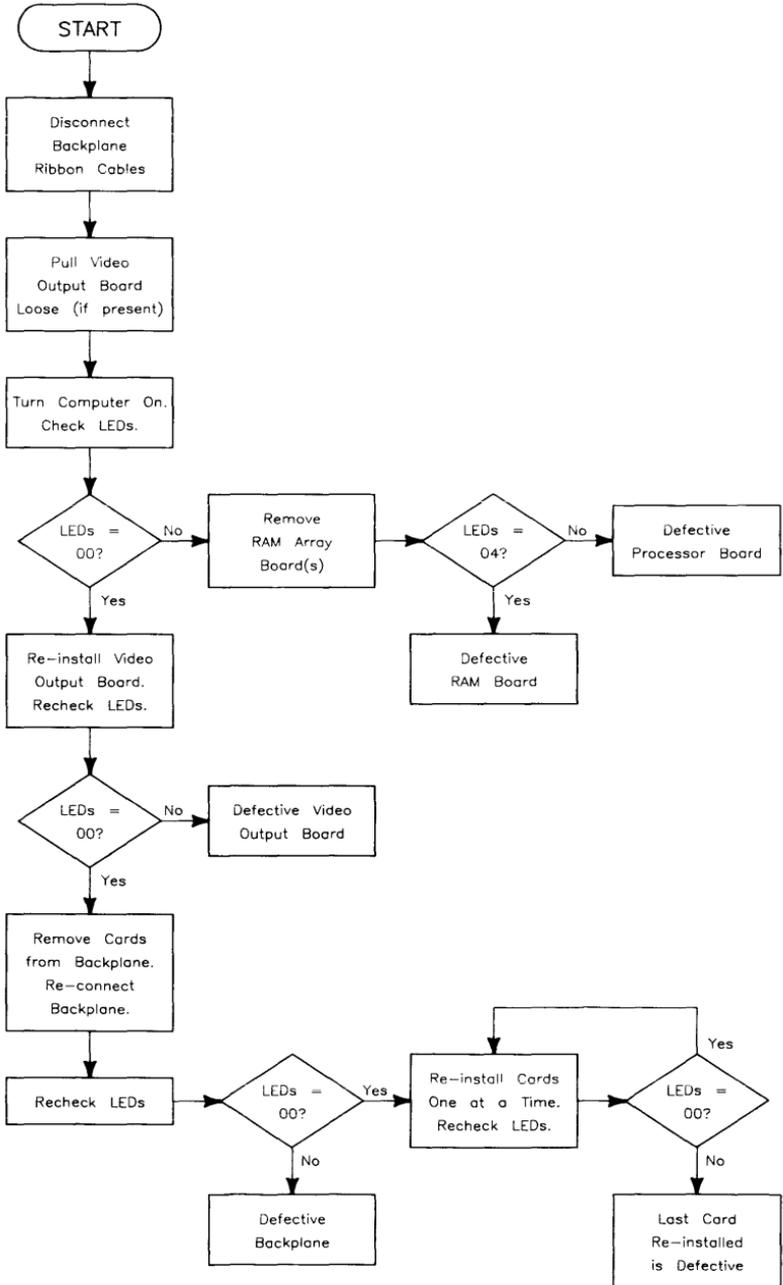
Initial Troubleshooting Flowchart



Dead Unit Troubleshooting Flowchart



Live Unit Troubleshooting Flowchart



Power Supply Specifications

Voltage	Tolerance	Maximum Current
+5 V dc	4.89 to 5.25 V dc	20 A
+12 V	11.86 to 12.72 V dc	3.6 A
-12 V	-11.86 to -12.72 V dc	1.1 A

Voltage Indicators

Voltage	Visual Indication	Physical Indication
-12 V dc	Front Panel "ON" LED Lit	Small Fan Running
+5 V	Self-test LED lit at turn-on.	Small Fan Running
+12 V dc	Front Panel "ON" LED Lit	Large Fan Running

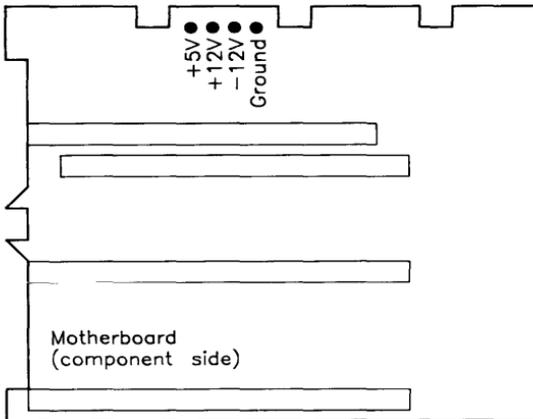


Figure 4-1. Power Supply Test Points

General Failure Indications

Table 4-1. Self-Test LED General Failure Indications

Upper 2 Bits Fail Indicator	LED Code and Failure Description
State Indication Only:	○○SS SSSS Where SS SSSS Indicates State of Power-up
Required Device Missing or DTACK Failure:	○●DD DDDD Where DD DDDD Indicates Device
Failing Device:	●○DD DDDD Where DD DDDD Indicates Device
Special Codes (Special Case Highest Priority Codes):	●●●● ●●●● LEDs Never Accessed (or Unused Code)
	○●●● ●●●● LEDs Failed to DTACK
	○○○○ ○○○● Timer on processor board has failed or is missing.

Lower 2 Bits State or Device Codes	LED Code and Failure Description
Miscellaneous (Highest Priority):	XX○○ FFFF Where FFFF indicates Failure (Xs are don't-care bits)
Internal Peripheral Failure (Medium Priority):	XX○● PPPP Where PPPP is Peripheral Number
I/O Card Failure (Lowest Priority):	XX●S SSSS Where S SSSS is Select Code

Table 4-2a. Boot ROM LED Error Codes

(In numerical order):

LEDs	Explanation
○○○○ ○○○○	No failure
○○○○ ○○○●	Failed CPU register test.
○○○○ ○○●●	Failure in top 16 Kbytes of RAM.
○○○○ ○●○○	Top 16 Kbytes of RAM missing or not found by CPU.
○○○○ ●●●○	Failed Boot ROM checksum.
○○○● ○○○●	Failure: Not enough RAM.
○○○● ○○●○	Failure: ROM system.
○○○● ○○●●	Failure: Boot error.
○○○● ○●○○	Failure: OS tried to start loading at too high of an address.
○○○● ○●○●	Failure: Not enough RAM to load OS.

Table 4-2b. Boot ROM LED Error Codes for Interfaces**(In numerical order)**

LEDs	Explanation
○○●○ ○○○○	Failure: 4 ms timer.
○○●○ ○○●○	Failure: Processor board keyboard circuit.
○○●○ ○○●●	Failure: External keyboard circuit.
○○●○ ○●○○	Failure: Internal HP-IB circuit
○○●○ ●○○○	Failure: DMA circuit.
○○●○ ●●○○	Failure - one of these high-res video circuits: Font ROM is bad. Font ROM is not usable. Could not find US ASCII character set.
○○●○ ●●●●	Failure: Video board bit map circuit.
○●○○ ○○○○	Failure: I/O circuit at select code 0. Each successive LED pattern represents an I/O failure at select codes 2 through 30.
○●○○ ●●●●	Failure: I/O circuit at select code 31.

Remote Computer Analysis

The Model 332 computer provides for remote analysis of problems by means of the beeper. To test the computer remotely, follow this procedure:

1. Establish a telephone connection with someone at the location of the computer.
2. Have them hold the receiver near the speaker output of the computer. The speaker is located in most monitors, or in the speaker module.
3. Now have them turn the computer on.
4. The computer will go through its self-test and report problems as a series of beeps. These beeps correlate with the above error codes.
5. A high beep indicates a one and a low beep indicates a zero.

For example, suppose that on power-up a computer emits three low beeps, a high beep, two low beeps and a high beep. This will be of the form xooo ●ooo, where o represents a low beep, ● represents a high beep and x represents an unbeeped high or low. Referring to the table of Boot ROM Error Codes shows a RAM Failure as the probable cause.

Locating Defective RAM Boards

A RAM failure message may be decoded to determine which RAM block caused the failure. RAM failures are presented in this format:

```
Memory Failed at FFE3A900  
W:F58A8C2C,R:F78A8C2C
```

The first three characters of the address can be decoded to determine the failed board. Follow this procedure:

Memory addressing starts from the top of memory, which is FFFFFFFF. The Model 332 supports up to 8 Mbytes of RAM. Thus, the lowest RAM address is FF800000. Thus, the board prefixes (or first three characters of the address) are limited to FF8, FF9, FFA, FFB, FFC, FFD, FFE and FFF. Since all RAM boards contain at least 1 Mbyte, each board prefix is entirely contained on one board.

To determine which slot contains the defective board, use this table:

Prefix	Defective Board is in Slot:
FF8	B
FF9	B
FFA	B
FFB	B
FFC	A
FFD	A
FFE	A if 4 MByte board in slot A; B otherwise
FFF	A

Table 4-3. Decoding RAM Error Messages

In the example above, the prefix is FFE. Thus, the error occurred in the second megabyte from the top. If slot A contains a 4 Mbyte board, the second megabyte is on it. If slot A contains a 1 Mbyte board, the second megabyte must be on the next board down, in slot B.

Boot ROM Self-Tests

Table 4-4a. LED State Codes In Numerical Order

LEDs	Explanation
oooo oooo	No failure
oooo ooo●	Failed CPU register test.
oooo oo●o	Testing top 16 Kbytes of RAM.
oooo oo●●	Failure in top 16 Kbytes of RAM.
oooo ●oo○	Top 16 Kbytes of RAM missing or not found by CPU.
oooo ●o●●	Searching for user-supplied Extension ROM.
oooo ●●●o	Start executing Extension ROM instructions.
oooo ●●●●	Starting Test Vector list.
oooo ●○○○	Resetting all interfaces.
oooo ●○○●	Searching for alpha video circuits.
oooo ●○●o	Testing RAM for I/O on-board test code.
oooo ●○●●	I/O on-board test code running.
oooo ●●○○	Internal BMD checksum.
oooo ●●●o	DIO-II console testing.
oooo ●●●●	Failed Boot ROM checksum.
oooo ●●●●	Pre-loading RAM for main test.
ooo● oooo	RAM Testing.
ooo● ooo●	Failure: Not enough RAM.
ooo● oo●o	Failure: ROM system.
ooo● oo●●	Failure: Boot error.
ooo● oo○○	Failure: OS loading address too high.
ooo● oo●●	Failure: Not enough RAM to load OS.

Table 4-4b. LED State Codes for Interfaces In Numerical Order

LEDs	Explanation
○○●○ ○○○○	Failure: 4 ms timer.
○○●○ ○●●○	Failure: Processor board keyboard circuit.
○○●○ ○●●●	Failure: External keyboard circuit.
○○●○ ○●○○	Failure: Internal HP-IB circuit.
○○●○ ●○○○	Failure: DMA circuit.
○○●○ ●●○○	Failure - one of these high-res video circuits: Font ROM is bad. Font ROM is not usable. Could not find US ASCII character set.
○○●○ ●●●●	Failure: Video board bit map circuit.
○●○○ ○○○○	Failure: I/O circuit at select code 0. Each successive LED pattern represents an I/O failure at select codes 2 through 30.
○●○○ ●●●●	Failure: I/O circuit at select code 31.

Computer Tests

Test Tools

Package Contents

The combined Series 200/300 Test Tools software package is provided on these media:

Media	Part Number
one 1/4-inch tape	09800-12700
eight 3 1/2-inch disks	09800-12300

The tape version consists of one tape and the manual.

The disk version consist of the manual and these disks:

Series 200 Computer Tests Disk Rev. 1.1

Series 300 Computer Tests Disk Rev. 3.1

Series 200/300 System Functional Tests Disks:

SFT0 Disk Rev. 1.2

SFT1 Disk Rev. 1.2

SFT2 Disk Rev. 1.2

SFT3 Disk Rev. 1.2

SFT4 Disk Rev. 1.2

CS/80 Exerciser Disk Rev. 3.1

Note

Revision 3.0 of the Series 300 Computer Tests is completely functional on the Model 332. However, it doesn't adequately test one area of the Model 332.

Revision 3.0 does not test the 1 Mbyte RAM array board. It does test the 4 Mbyte RAM board. The 1 Mbyte board is tested by the somewhat less extensive routines in the boot ROM.

Thus, if you seriously suspect a 1 Mbyte RAM board even though it passes the Revision 3.0 Computer Tests, replace it temporarily and see if the problem goes away.

Adjustments

6

There are no adjustments in the computer. For adjustments to the monitor, refer to the monitor's Service Manual or Handbook.

Peripherals

Supported Peripherals List

Due to constant changes of supported peripherals, this information is published separately in the *Series 300 Configuration Reference Manual* (part number 98561-90020).

The Model 332 Hardware Technical Data Sheet and Hardware Pricing List also have supported peripheral information.

Parts Lists

Replacement Parts Information

Introduction

Field replaceable parts are listed in this chapter for the computers and expanders. Components, such as ICs, are not available for field repair.

Parts are available direct from:

Corporate Parts Center
333 Logue Avenue
Mountain View, California 94042 USA
Telephone: (415) 968-9200

Parts may be ordered through your local HP Sales and Service Office. To help get parts as soon as possible, please write the address and telephone number of your local HP Office in the spaces below.

Name: _____

Address: _____

City, State ZIP: _____

Telephone: _____

Cooperative Support Program

HP's Cooperative Support Program is available for customers that can provide technical assistance, manual updates, and other helpful information for hardware support. Your local HP Sales and Service Office can provide the information for this support service.

Exchange Parts

Exchange parts are available for some items at a reduced cost. When an exchange part is ordered, your account will be charged for a new part. Customers have 15 days to return the failed part to receive credit for the difference between a new and exchange part.

Please return failed exchange parts to your local HP Sales and Service Office as soon as possible. Place them in anti-static bags (see Parts List for part numbers) and package them securely in a sturdy container. It's a good idea to save the containers and static-free bags you receive parts in and use them to ship parts in.

Part Number Lists

The parts listed in this section apply to the Model 332 computer only. Although the HP 98568A expander is usable with the Model 332, it is not included since it is covered extensively in the Model 310 support materials. Various interfaces, accessories and HP-HIL devices are also listed.

Printed Circuit Boards

Exchange Part No.	New Part No.	Description	Notes
	0950-1760	Power supply (without switch shaft)	
98572-69510	98572-66510	Medium-res video Processor board	
98572-69511	98572-66511	Processor board (no video)	
98572-69510	98572-66512	High-res video Processor board	
98269-69521	98269-66521	1 Mbyte add-on RAM board	
98269-69524	98269-66524	4 Mbyte add-on RAM board	
	98562-66501	Motherboard	
	98562-66506	2-slot DIO backplane	
98542-69570	98542-66570	Medium-res monochrome video board	
98543-69570	98543-66570	Medium-res color video board	
98544-69570	98544-66570	High-res monochrome video board	
98546-69571	98546-66571	Display compatibility video card	
98204-69577	98204-66577	Display compatibility graphics card	
98547-69570	98547-66570	High-res color video board	
98548-69570	98548-66570	High-res monochrome video board	
98549-69570	98549-66570	High-res color video board	
98550-69572	98550-66572	High-res color video board	

Processor Boards

Note that only two of the three processor boards are supplied as replacements. The medium-resolution video processor board (98572-69510) can be converted into either of the other two boards and is the replacement board for the high-resolution video processor board (98572-69512). Conversion details are listed immediately following this section. Note also that several items attach directly to the processor board and must be removed from a defective one before it is returned to the Corporate Parts Center or other HP entity.

The add-on RAM board is a separate assembly. You must always remove the add-on RAM board(s). There will always be at least one and there may be two.

The optional floating-point coprocessor IC is a separate assembly. Check to see if one is installed on the board. If so, remove it and reinstall it on the replacement board. You will need a special tool. It is the AMP 6810, part number 821566-1.

Converting to a 98572-66512 Board

To convert the -10 processor board to a -12 processor board, do the following:

- Change the position of the Graphics Resolution switch (segment 7, labelled RES) to a 1 (toward the board edge).
- Swap the display crystal ICs on the two boards.
- Swap the display video ROMs on the two boards.

Converting to a 98572-66511 Board

To convert the -10 processor board into a -11 processor board, disable the video. That is, change the position of the Video Disable switch (segment 3, labelled DISP) to a 1 (toward the board edge).

Here is a drawing showing the location of these items:

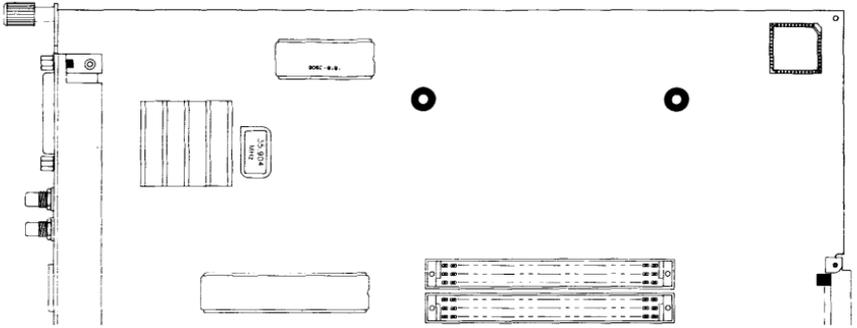


Figure 8-1. Locating Processor Board Components

Here is how to tell the video resolution of a processor board:

Resolution	ROM Part No.	Crystal Frequency
Medium	1818-3908	35.904 MHz
High	5180-1334	64.1088 MHz

Static-Free Bags

Part No.	Description	Notes
9222-0978	9-inch by 10-inch cushioned pouch, for DIO-width cards	
9222-0980	9-inch by 15-inch cushioned pouch, for system-width boards	

Electrical Parts

Miscellaneous Electrical Parts

Part No.	Description	Notes
1820-6334	68882 floating-point co-processor	
1250-0781	BNC coax adaptor	
5180-0410	Large fan	
5180-1303	Small fan	
5180-0407	LED cable assembly	
98561-61601	DIO Bus cable (short)	
98561-61602	DIO Bus cable (long)	
98561-61604	RS-232 cable	

Labels

Part No.	Description	Notes
98562-84002	Identification Label	
5958-4325	UL Info Label	
7120-3428	CSA Label	
7121-4858	Service Warning Label	
7121-4733	Serial Label	
7124-2083	Voltage warning label	
7121-4859	Fuse Rating Label	
98562-84005	Battery Warning Label	
5955-8036	Computer compliance label	
5955-8037	Peripheral compliance label	
9320-5673	Blank ID# label	

External Cables

Part No.	Description	Notes
8120-3616	Color Cable	
8120-4704	Audio Cable, RCA-RCA	
09920-61602	<u>Interface Cable</u>	
8120-4483	Video Cable	
1252-1112	Adaptor, RCA-earphone	
HP 98290	Color Cable, High-resolution	
5061-6533	Video Cable, RCA-RCA	

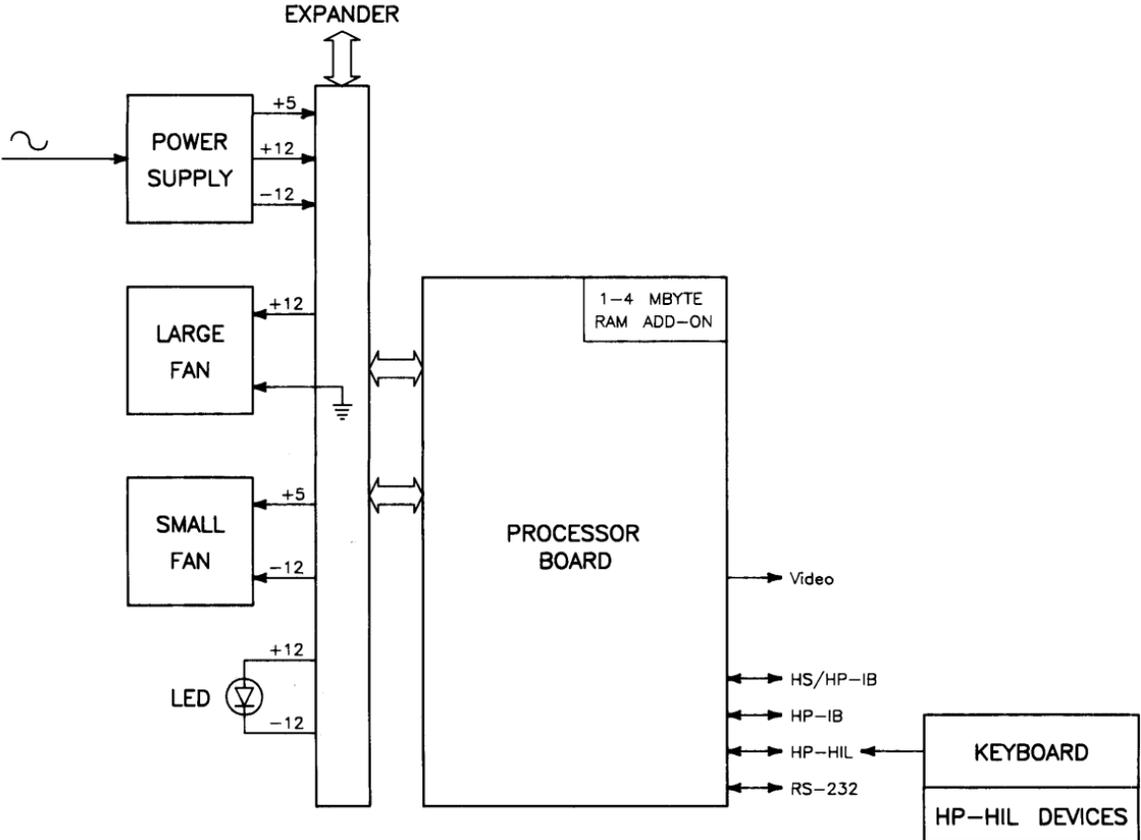
Computer Case Parts List

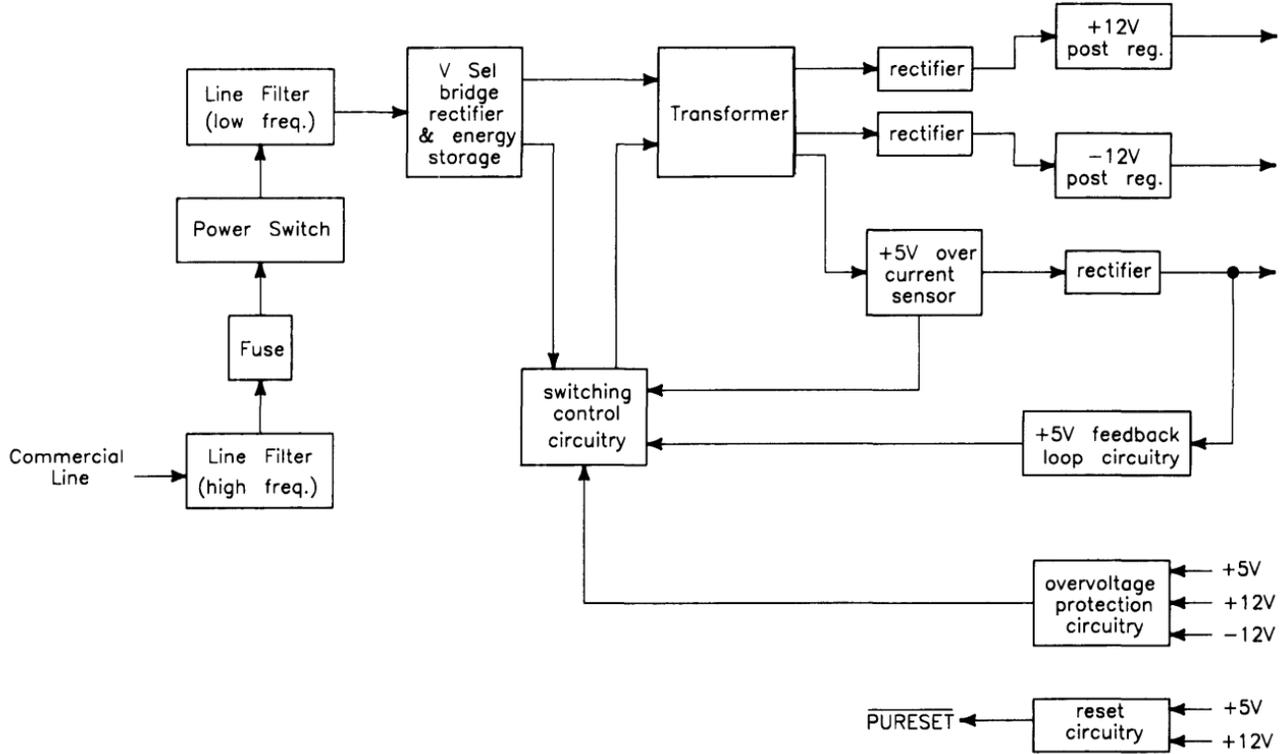
Ref.	Part No.	Description	Notes
1	5001-9009	Top cover	
2	5041-2413	Front panel	
3	5001-3700	Power supply cover	
4	5001-3696	Chassis	
5	98561-04107	DIO slot cover plate	
6	5001-9016	System slot cover plate	
7	5041-2412	Power switch shaft	
8	5041-1203	ON-OFF pushbutton	
9	09121-48303	Moulded foot	
10	0403-0379	PC board guide	
11	5001-9001	LED bracket	
12	5001-9011	Fan plate	
13	09817-47700	Light pipe	
14	98561-61601	Short ribbon cable	
15	98561-61602	Long ribbon cable	
16	0380-0012	Round spacer, 0.875-in. long	
17	0403-0427	Mounting foot bumper	
18	5041-2420	Top cover insulator	
19	5180-0409	Spring clip	
20	8160-0389	Double RFI finger	
21	5001-3694	Card guide bracket	
22	98561-66500	Four-slot backplane	
23	5001-3694	Card cage brace	
24	5001-3695	Card cage brace	
25	5041-2414	Card guide	
26	0515-0219	Screw M3 × 6, flat head	
27	0515-0389	Screw M3.3 × 8, pan head, ext. lock washer	
	0515-0536	Screw M3 × 0.5, machine	
	0515-0990	Screw M3 × 3.5, pan head, ext. lock washer	
	0515-1146	Screw M3 × 6, pan head patch	

HP-HIL Devices

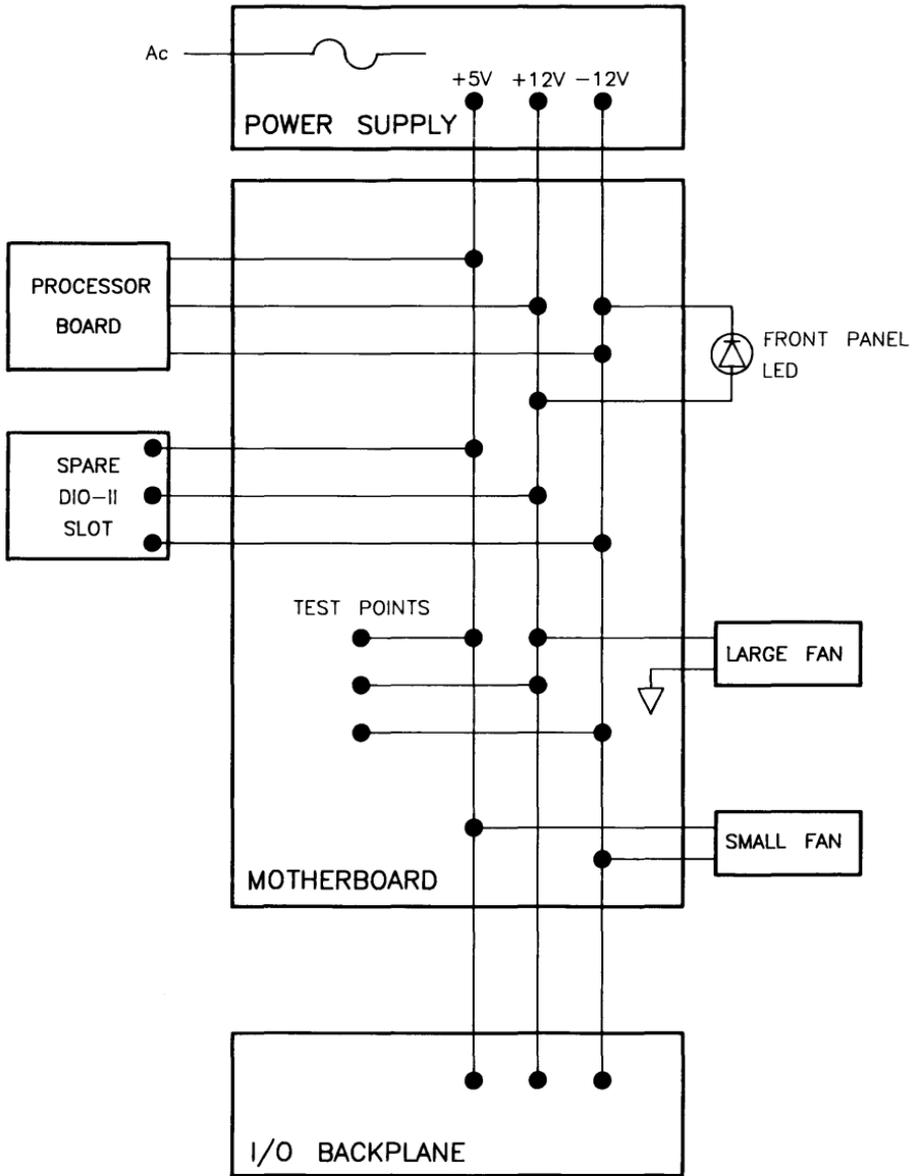
Exchange Part No.	New Part No.	Description	Notes
35723-69003	35723-66003	Touchscreen PC board	
	46021-60201	ASCII Keyboard	
	46020-60001	Keyboard Cable	
	46080-61601	Video Cable, 3-conductor	
	46081-61601	2.4-metre extension cable	
	46082-61601	Short audio cable	
	46082-61602	30-metre audio extension cable	
	46082-61603	30-metre video cable	
	46082-61604	15-metre remote cable	
	46082-61605	15-metre video cable	
	46083-61601	Short audio cable	
	46083-67901	Switch cap assembly	
	HP 46085A	Control dials	
	46085-85000	Overlay	
	0403-0430	Moulded foot	
	QEDS-7099	RPG Pot assembly	
	5041-2416	RPG knob	
	HP 46084A	ID module	
	HP 46086A	Button box	
	HP 46087A	"A" size digitizer	
	HP 46088A	"B" size digitizer	
	HP 46094A	Quadrature port device	
	HP 46095A	3-button mouse	
HP 46060A	HP Mouse		
HP 92916A	Bar code reader		

Model 332 Computer Block Diagram

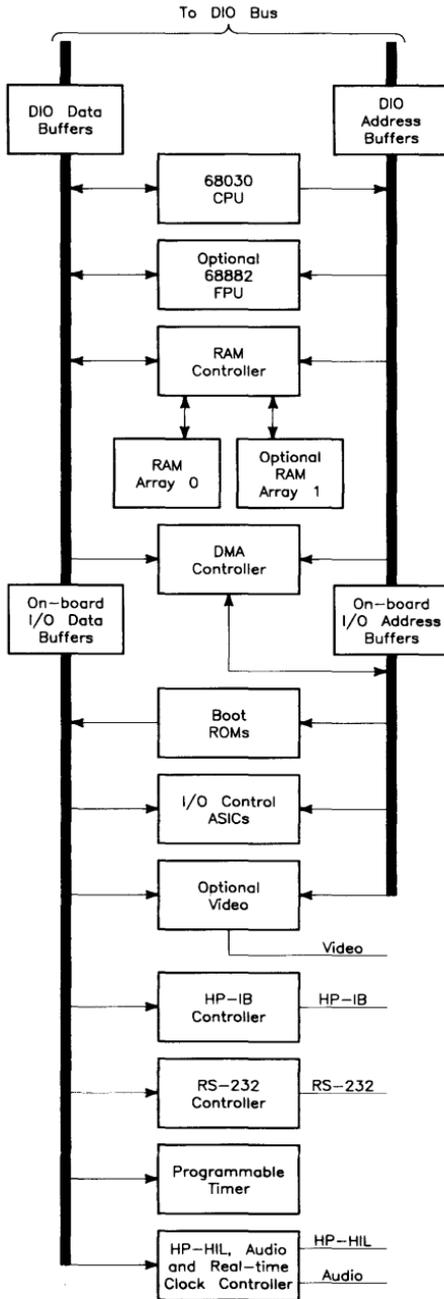


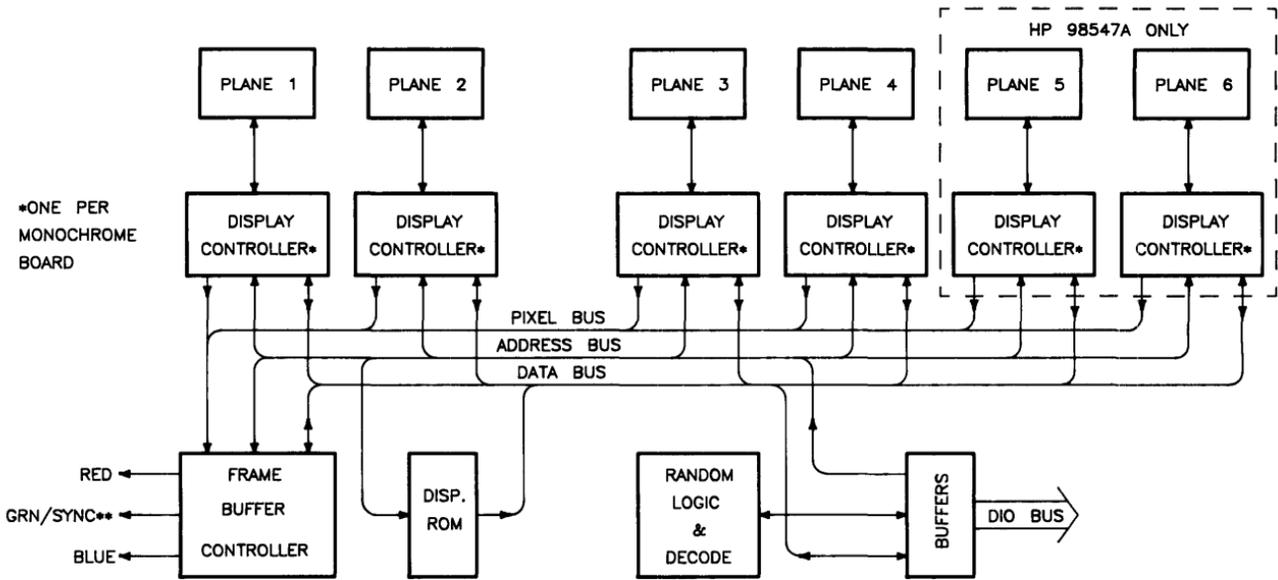


Power Distribution



Processor/RAM Board





*ONE PER MONOCHROME BOARD

**COMPOSITE VIDEO ON MONOCHROME BOARDS. RED/BLUE/GREEN ONLY ON COLOR BOARDS.

Related Hardware Documentation

Hardware Support Documentation

Table 10-1. Hardware Support Documentation

Printed Pages Part Number	Manual Title
09000-90041	HP 9000 Series 200/300/500 Site Preparation Manual
09800-90001	HP 9000 Series 200/300 Test Tools Manual
98561-90020	Series 300 Configuration Reference Manual
98572-90030	HP 9000 Series 300 Model 332 Service Information Manual
98572-90039	HP 9000 Series 300 Model 332 Service Handbook

Installation Manuals/Notes

Table 10-2a. Installation Manuals/Notes

Printed Pages Part Number	Manual Title
5958-4342	HP 98542/3/4/5A Video Board Installation Note
98548-90000	HP 98548A Color Video Board Familiarization Guide
98549-90000	HP 98549A Graphics Interface Familiarization Guide
98549-90800	HP 98549A Graphics Interface Familiarization Guide Update
98550-90000	HP 98550A Graphics Interface Familiarization Guide
98550-90800	HP 98550A Graphics Interface Familiarization Guide Update
5958-4343	HP 98569A Rack-Mount Kit Installation Note
5958-4344	HP 98567A Rack-Mount Kit Installation Note
5958-4351	HP 98567B Rack-Mount Kit Installation Note
98243-90602	HP 98243C Model 310-to-332 Upgrade Installation Note
98284-90601	HP 98284A MC68882 Floating Point Unit Chip Installation Note
98285-90601	HP 98285A Graphics Upgrade Kit Installation Note
98269-90600	HP 98269A/B RAM Board Installation Note
98546-90600	HP 98546A Display Compatibility Interface Installation Note
98548-90601	HP 98548A Color Interface Installation Note
98549-90602	HP 98549A Color Video Board Installation Note
98550-90603	HP 98550A Color Video Board Installation Note
98568-90600	HP 98568A Eight-Slot Bus Expander Installation Note

Table 10-2b. Installation Manuals/Notes (cont.)

Printed Pages Part Number	Manual Title
98622-90000	HP 98622A GPIO Installation Manual
98623-90000	HP 98623A BCD Installation Note
98624-90000	HP 98624A HP-IB Installation Note
98625-90000	HP 98625A/B Disk Interface Installation Manual
98626-90000	HP 98626A RS-232 Installation Manual
98627-90000	HP 98627A Color Video Interface Installation Manual
98628-90001	HP 98628/98691 Datacomm Installation Manual
98630-90000	HP 98630A Breadboard Installation Manual

Table 10-3. Documentation Binders

Binder Part Number	Description
9282-1077	1-inch, 3-ring, 8.5 by 11-inch page size, 300 pages
9282-1078	1.5-inch, 3-ring, 8.5 by 11-inch page size, 350 pages
9282-1079	2-inch, 3-ring, 8.5 by 11-inch page size, 600 pages
9282-1080	2.5-inch, 3-ring, 8.5 by 11-inch page size, 750 pages
9282-1081	1-inch, 3-ring, 7 by 8.5-inch page size, 300 pages
9282-1082	1.25-inch, 3-ring, 7 by 8.5-inch page size, 450 pages
9282-1080	1.5-inch, 3-ring, 7 by 8.5-inch page size, 600 pages



**HP Part Number
98572-90039**

Microfiche No. 98572-99039
Requires Binder No. 9282-0683
Printed in U.S.A. E0289



98572-90039
For Internal Use Only