

# HP 98730A CE Handbook

HP 9000 Series 300 Computers

HP Part Number 98730-90039



**Hewlett-Packard Company**

3404 East Harmony Road, Fort Collins, Colorado 80525

98730A

# Printing History

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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.

April 1988...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.

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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。

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## Manufacturer's Declaration (Germany Only)

### Herstellerbescheinigung

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## 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:

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### **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.

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### **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.

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### **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.

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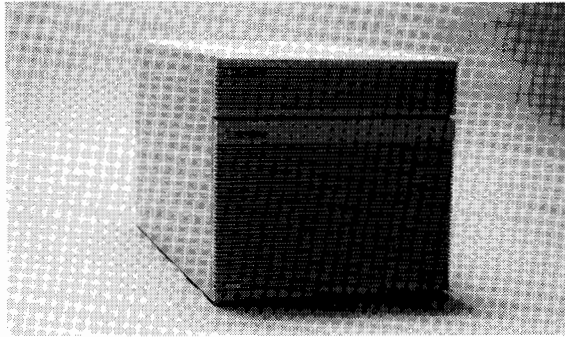
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**Figure 1-1. The HP 98730A Graphics Accelerator**

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## Introduction

The HP 98730A is a high-performance graphics subsystem for the HP 9000 Series 300 and 800 computers. It is an upgrade for the HP 98720A system, providing a 3-10X performance improvement. This graphics accelerator supports a variety of configurations ranging from a simple memory-mapped 8-plane frame buffer plus four overlay planes, to a high-speed graphics accelerator with 24 planes of graphics memory, 2D and 3D transformations, full color rendering and fast hidden surface removal.

The HP 98730A uses the HP 98726A interface card and Local Graphics Bus (LGB) cable when used with an HP 9000 Model 300 computer. It uses the HP A1017A interface card and LGB cable when used with an HP 9000 Model 800 computer.

The HP 98730A drives any HP 1280x1024 High Resolution Color monitor through the Red-Green-Blue (RGB) cable.

Software support is provided with the Starbase 98730 and 98731 (high performance) drivers and HP-UX Revision 6.2 or higher for the Series 300 and HP-UX 3.0 or higher for the Series 800 computers. For the Series 300, Boot ROM C-1 or higher is required.

## **Service Support**

For the HP 98730A, Hewlett-Packard provides On-site Repair service support only. An HP Field Service Engineer goes to the customers site and troubleshoots and repairs the product to the Field Replaceable Unit (FRU) level.

## **Regulatory**

Germany VDE 0730, CISPR.

Canada CSA, IEC.

United States of America FCC Class A standards, UL.

# Site Preparation and Requirements

# 2

## Introduction

Refer to the *HP 9000 Series 200/300/500 Site Preparation Manual*, part number 09000-90041, to prepare the site for the installation of the HP 98730A Graphics Subsystem. The specific information you need is presented below:

## Power Requirements

Power line frequency	47 thru 67 Hz
Switch selected line voltages	90 thru 132 Vac 180 thru 264 Vac
Line fused	8 Amperes/250 Volts
Power consumption	380 Watts maximum for Main Supply 250 Watts maximum for Auxiliary Supply
Heat Dissipation	318.0 kcal/hr (1262 BTU/hr.) for Main Supply 206.1 kcal/hr (818 BTU/hr.) for Auxiliary Supply

## Environmental

Operating temperature	10° thru 55° C (50° thru 131° f)
Storage temperature	-40° thru 75° C (-40° thru 167° f)
Ambient humidity	5% thru 95% relative humidity, noncondensing
Maximum operating altitude	4 600 metres (15 000 feet)
Non-operating altitude	15 300 metres (50 184 feet)

## Physical

Height	312 millimeters (12.3 inches)
Width	570 millimeters (22.4 inches)
Depth	325 millimeters (12.8 inches) Add 101.6 millimeters (4.0 inches) in depth for cables and connectors.
Weight	59 Pounds (Maximum Configuration) 43 Pounds (Minimum Configuration)
Cooling space requirements	101.6 millimeters (4.0 inches) clearance front and back.

## 4 Site Preparation and Requirements

# Installation and Configuration **3**

## HP 98730A Configurations

Every system requires:

- One (1) Full Color Map Board — 98730-66575
- One (1) Frame Buffer Controller — 98730-66571
- One (1) Frame Buffer — 98720-66572
- One (1) Power Supply — 0959-1811

Optional Assemblies include:

- One (1) Power Supply — 0950-1811
- Note: See the table below for power supply requirements.
- One (1) Master Transformation Accelerator — 98730-66577
- One (1) Slave Transformation Accelerator — 98730-66579
- Note: The Slave is optional to the Master board.
- One (1) or two (2) Frame Buffer Boards -- 98720-66572
- One (1) Fast Z-buffer Board --- 98730-66573

**Table 3-1. HP 98730A Configuration Matrix**

Clr Map	FB Control	Buff 0	Buff 1	Buff 2	Fast Z	Master	Slave	Main Pwr	Aux. Pwr
X	X	X						X	
X	X	X	X					X	X
X	X	X	X	X				X	X
X	X	X				X		X	
X	X	X	X			X		X	X
X	X	X	X	X		X		X	X
X	X	X				X	X	X	X
X	X	X	X			X	X	X	X
X	X	X	X	X		X	X	X	X
X	X	X	X	X	X	X	X	X	X

## **6** Installation and Configuration

## Preventative Maintenance

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### Cleaning

Before cleaning the HP 98730A graphics subsystem, unplug the power cord(s) and remove all interconnecting cables. Dampen a clean, soft, lint free cloth with a solution of clean water and mild soap. Wipe the soiled, ensuring that no cleaning solution gets inside the chassis. For cleaning more heavily soiled areas, a 50% solution of clean water and isopropyl alcohol may be used. Then dry with a clean, soft, lint free, dry cloth.

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**CAUTION**

Chemical spray-on cleaners used for appliances and other household applications may damage the finish. These and other chemical cleaners should not be used. CRT displays should be cleaned with clean water only.

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### Dust

The fans on the HP 98730A do not have air filters. In a dusty area, the accumulation of dust may cause heat problems. If necessary, unplug the power cord(s) and all interconnecting cables. Remove the HP 98730A to an appropriate work location (i.e., a table) if necessary. Remove the front covers and top cover as shown in the Troubleshooting and Diagnostics chapter of this manual. Remove all boards, using appropriate static safety measures. Vacuum the interior of the chassis. Gently brush the dust off the boards. Return the boards. Replace the top and front covers. Return the HP 98730A to its working location. Reconnect the interconnect cables and power cable(s). Perform appropriate tests as described in the “Troubleshooting and Diagnostics” chapter of this manual.

## 8 Preventative Maintenance



# Functional Description

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# 5

The HP 98730A is a high-performance graphics display subsystem. It processes graphics commands and data from a Series 300 or Series 800 computer and sends its output to a high-resolution (1280x1024) color monitor. The HP 98730A is shipped with its:

- power cord (one per supply)
- RGB Cable (Red-Blue-Green cable used to connect HP 98730 to monitor) part number 98700-61603.

## **Series 300**

The Local Graphics Bus (LGB) cable (98730-61600), is shipped with the HP 98726A interface card. This cable connects the HP 98730 to the computer interface.

## **Series 800**

The A1017A interface connects to the HP 98730A to a Series 800 computer with the 98720-61603 interface cable.

This chapter is organized in the following manner.

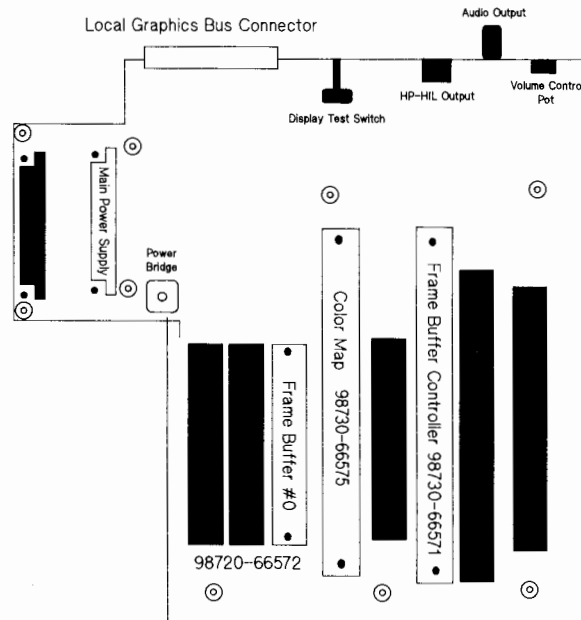
- A minimum system configuration block diagram is presented.
- A maximum system configuration block diagram is presented.
- Each major board is presented and discussed.

## A Minimum Configuration HP 98730A

For a minimum configuration, the following assemblies are used:

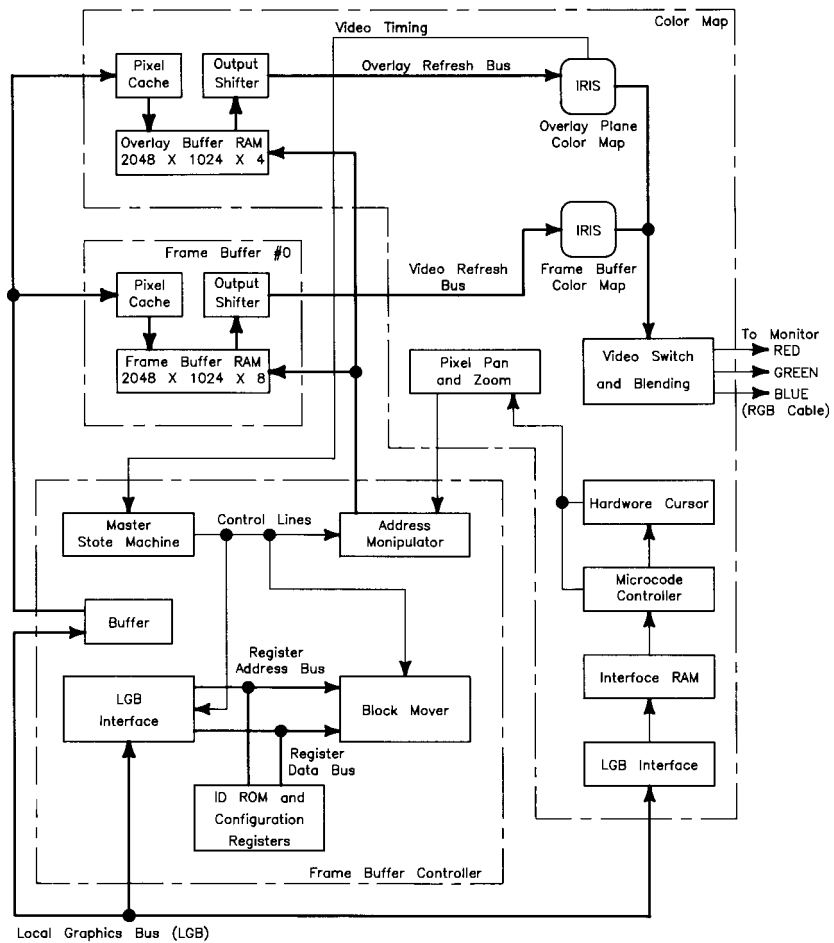
- One Frame Buffer Controller board (98730-66571)
- One Frame Buffer board (98720-66572)
- One Color Map board (98730-66575)
- One Power Supply (0950-1811)

The placement of these boards is slot dependent. The following drawing of the mother board shows the correct location for the boards.



Front

**Figure 5-1. Board Location for Minimum System**

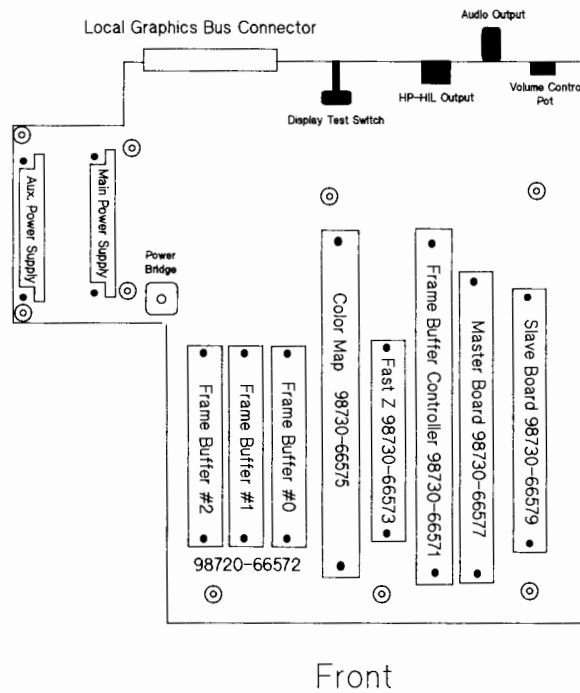


## A Maximum Configuration HP 98730A

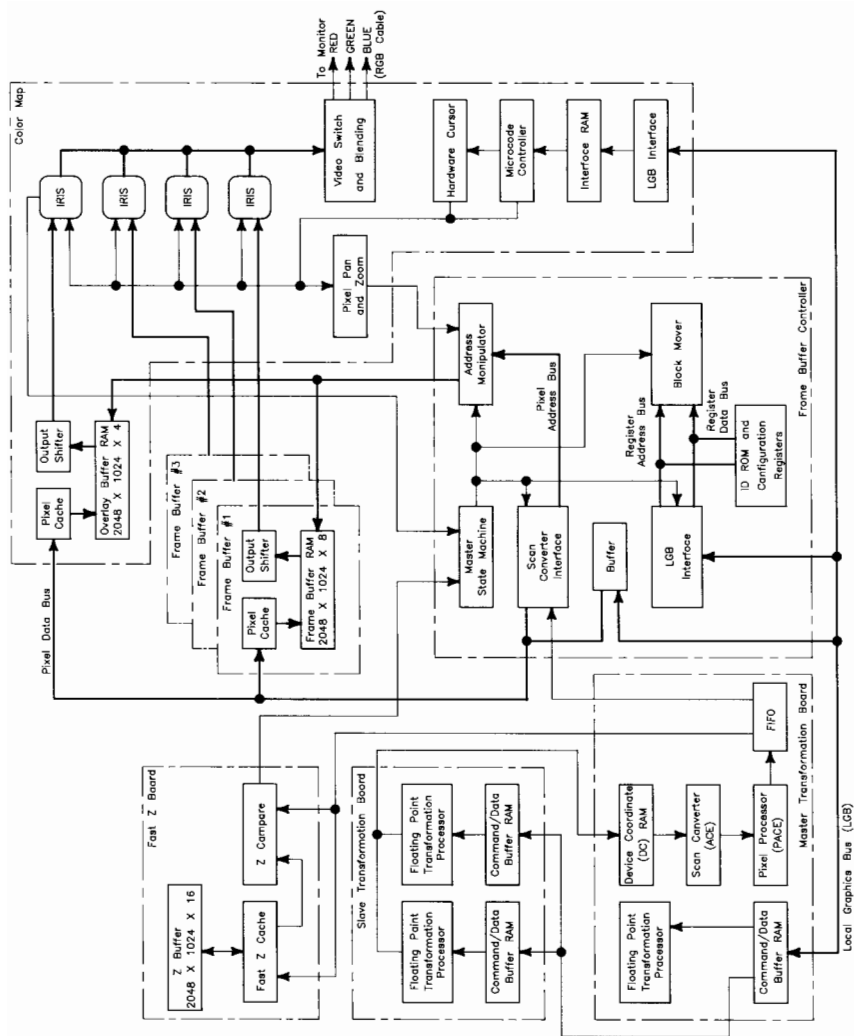
For a maximum configuration, the following assemblies are used:

- One Frame Buffer Controller board (98730-66571)
- Three Frame Buffer boards (98720-66572)
- One Color Map board (98730-66575)
- One Master Transformation Board (98730-66577)
- One Slave Transformation Board (98730-66579)
- One Fast-Z Board (98730-66573)
- Two Power Supplies (0950-1811)

The placement of these boards is slot dependent. The following drawing of the mother board shows the correct location for the boards.



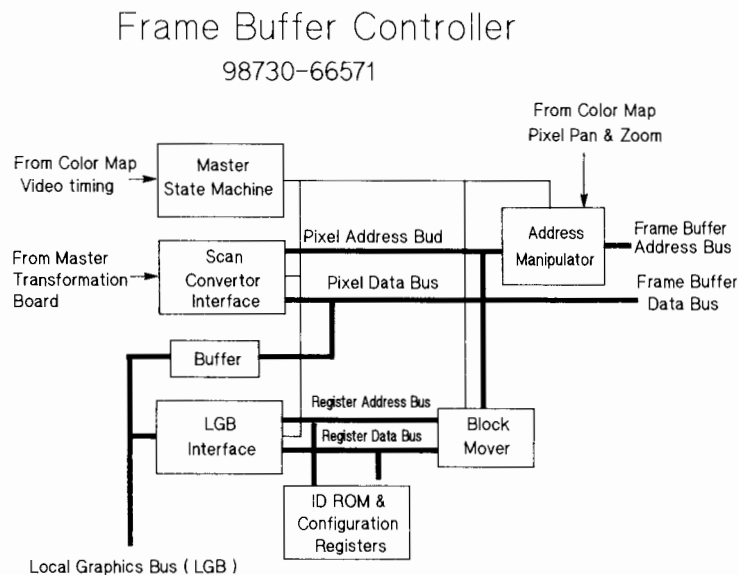
**Figure 5-2. Board Location for Maximum System**



## Frame Buffer Controller (98730-66571)

The Frame Buffer Controller board is responsible for the following functions:

- ID/Font ROM
- Frame Buffer Arbitration (between scan converter, block mover, CPU & refresh)
- Frame Buffer Configuration (fold, write enable, replacement rule, etc.)
- Scan Converter Interface
- Interrupts (vertical retrace and block mover not busy)
- Video & Dynamic Refresh
- Block moves and Repeat Pattern Control
- Z-buffer Control
- Local Graphics Bus Interface

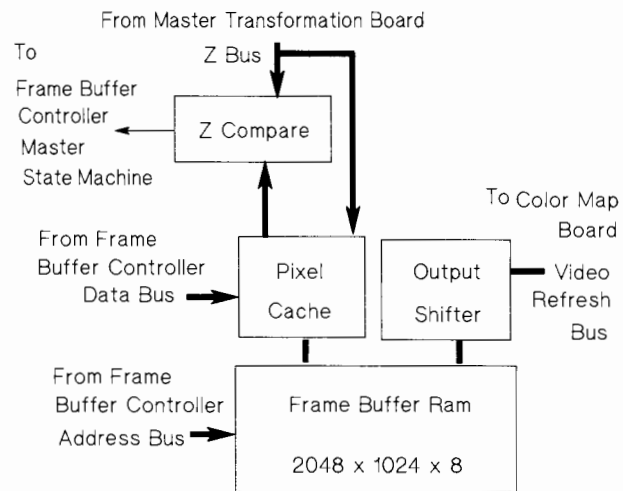


**Figure 5-3. Frame Buffer Controller Block Diagram**

## Frame Buffer (98720-66572)

Frame Buffer functionality includes:

- Bit-Mapped Storage of Display Images
- Tiling
- Hidden Surface Removal (Strip Z-Buffering)



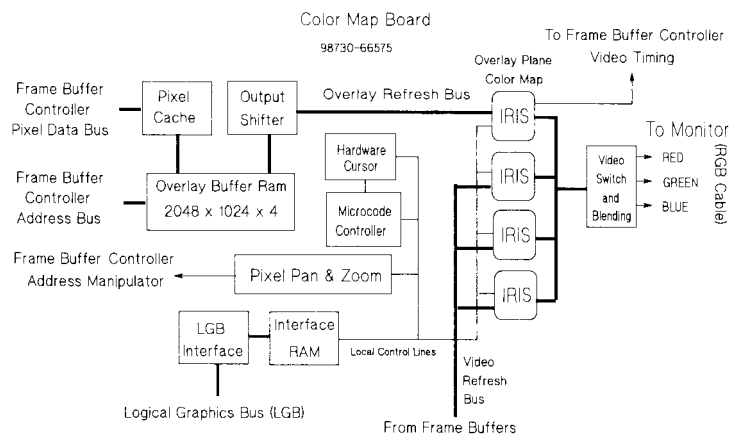
**Figure 5-4. Frame Buffer Board**

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## Color Map (98730-66575)

The color map provides the following functionality:

- Four Overlay Planes
- Four IRIS Color Maps (Three Frame Buffer Color Maps and One Overlay Color Map)
- Image Blending
- Video Timing
- Hardware Cursors
- Pixel Pan and Zoom
- Local Graphics Bus Interface



**Figure 5-5. Color Map Block Diagram**



## Transformation Boards (Master 98730-66577) (Slave 98730-66579)

The Master and Slave Transformation boards provide the following functionality:

- Transform Engine(s) and Scan Converter
- HP Floating Point Transformation Engine (TREIS) - up to 9 Mflops and 73.5 ns cycle time
- Scan Converter (ACE) and Pixel Processor (PACE)
- LGB Interface

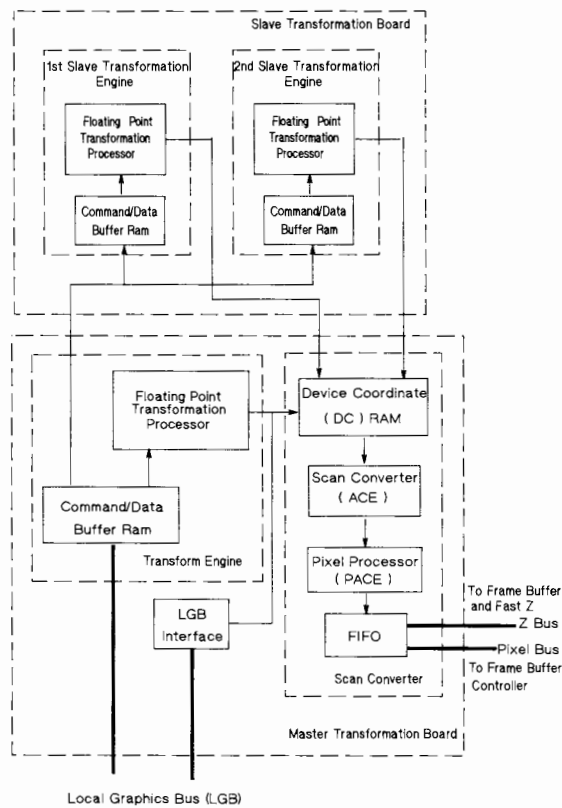


Figure 5-6. Master and Slave Board Block Diagram

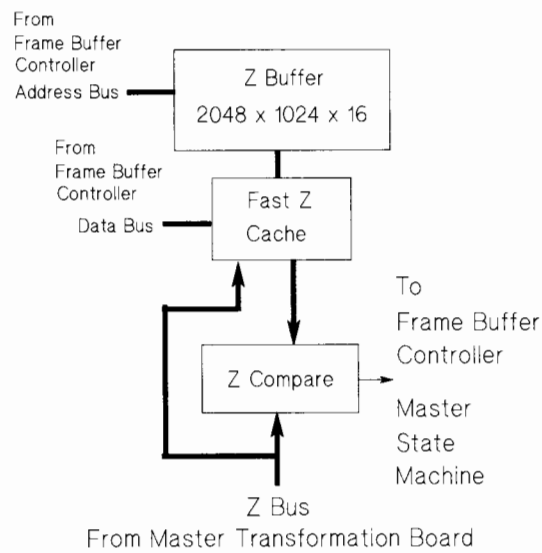
## Fast-Z Board (98730-66573)

The Fast-Z Board provides the following Functionality:

- Fast Hidden Surface Removal
- $2048 \times 1024 \times 16$ -bit Z-Buffer
- Z values cached in  $16 \times 1$  or  $4 \times 4$  tiles
- Overlapping Tile Reads
- Pipelined Zin/Zout ports for 15 Megapixel Scan Conversion
- Simultaneous Screen Clear and Z set to all 1's

### Fast Z Board

98730-66573



**Figure 5-7. Fast-Z Board Block Diagram**

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## The Power Supply (0950-1811)

The HP 98730A box accommodates two identical power supplies which provide +5V, -5.2V, +12V, and -12V. Each supply has its own detachable power cord. The power supplies have no adjustments, except the line voltage setting.

The main supply powers the Color Map Board, Frame Buffer Controller, Master Board, and the first Frame Buffer Board (FB-0).

The auxiliary power supply is required to power additional Frame Buffers, the Slave Board, and the Fast-Z Board. A summary of the supply specs is given below.

INPUT: 120V setting: 90-132 Volts RMS  
380 W / 6.2 A for supply A  
250 W / 3.8 A for supply B  
240V setting: 180-240 Volts RMS  
380 W / 4.4 A for supply A  
250 W / 2.7 A for supply B  
Line Frequency 47-67 Hz

OUTPUT: (Per supply)  
+5.1 V 9-45 Amps +3% -4%  
+12 V 0-2 Amps +/- 7%  
-12 V 0-2 Amps +/- 7%  
-5.2 V 0-4 Amps +/- 5%



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### Note

The +5.1V output must have a load current of at least 9.0 amps for the other outputs to be within their specifications. This requirement will be met for Supply A if the Frame Buffer Controller and Color Map are both plugged in. For Supply B only 5.1 V is used, so regulation of the other voltages is not important.

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Some have experienced difficulty with the supplies turning on when trying to turn on the system by plugging in the line cords with the power switch on. When both supplies are in the system, either the cords must be inserted at exactly the same time or the power switch must be used.

## Getting Inside

### Tools needed:

One small (1/4 inch) flat-blade screwdriver. One #1 Posidrive screwdriver. One #2 Posidrive screwdriver.

1. If the HP 98730A is the system console, you must shutdown the whole system. Follow the instructions in your System Administrator manual. Shut off the HP 98730A and its monitor.

If the HP 98730A is not the system console, shut off the HP 98730A and its monitor.

2. Disconnect all interconnecting cables and power cables from the HP 98730A.
3. Move the HP 98730A to a convenient work place, i.e., a table or the floor. The box opens from the top, so it must be removed from cabinets or locations that do not allow adequate space to work in.
4. Lower front panel access door. Loosen the two captive screws (small flat blade screwdriver).
5. Lift lower front panel up gently and remove. Remove two screws from front cover (#2 Posidrive screwdriver).
6. Remove two screws from rear bottom sides (#1 Posidrive screwdriver). Push top cover forward to clear ON-OFF Switch.
7. Lift top cover up and off. Remove seven screws from hold-down bracket.
8. Slide catch aside and remove hold-down bracket.

Reverse the above procedure to reinstall the top chassis cover and trim panel.

## **Fan Access**

By removing the top cover, the three fans are available for repair.

## **Power Supply Removal**

After removing the top chassis cover and hold-down bracket, do the following.

1. Remove five rear sub-panel screws. Remove two power module retaining screws for the appropriate supply(ies).
2. Lift out power supply using handle.

Reverse the above procedure to reinstall the power supply.

## **Printed Circuit Boards Removal**

For all boards, except the Color Map board, use the extractor levers located on each end of the board to loosen the printed circuit board from the mother board's connector. When loose, lift the circuit board straight up and out. Be careful not to touch the circuit traces or connector pins. Electrostatic discharge can destroy the electronic assemblies.

Reverse the above process to reinstall the printed circuit boards.

## **Color Map Board Removal**

1. Remove the RGB cable and the nuts from the RGB BNC connectors. Use a 9/16 inch wrench on the nuts.
2. Remove the Color Map Retainer Bracket.
3. Lift the Color Map Board straight up. Do not touch the circuit traces or connector pins.

Reverse the above process to reinstall the Color Map Board.

## Switch Board Removal

1. Remove the top cover, hold-down bracket, and all power supplies.
2. Remove five screws.
3. Slide switch board back into the chassis and lift out

Reverse the above process to reinstall the switch board.

## Mother Board Removal

1. Remove the top cover, hold-down bracket, all power supplies and all printed circuit boards following the directions previously given.
2. Remove 9 screws holding mother board to chassis bottom. Remove two screws holding the LGB connector to the chassis back.
3. Slide the motherboard toward front of chassis until LGB connector clears chassis back. Tilt mother board and remove from chassis.

Reverse the above process to reinstall the mother board.





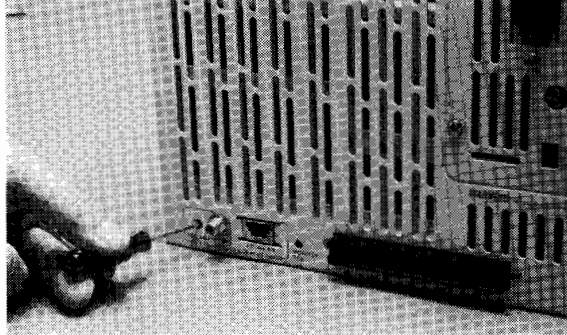


# Adjustments

# 7

## Audio Adjustment

If the HP 98730A is connected to a Series 800 machine and to an HP 46081A Speaker Box (or equivalent) is desired, there is an audio output adjustment. The audio output is adjusted by setting the pot accessed through the hole in back of the HP 98730A chassis. A small flat-blade screw driver or adjustment tool is required to turn the pot.



**Figure 7-1. Speaker Box Audio Adjustment**

## Other Adjustments.

There are no other adjustments for the HP 98730A.

## **26** Adjustments

## Introduction

HP 98730A can be either the computer's console or a peripheral. If used as a peripheral, verify the operation of the computer and other appropriate peripherals before troubleshooting the HP 98730A. The following flow chart is provided to help you identify the tools you need to troubleshoot your system.

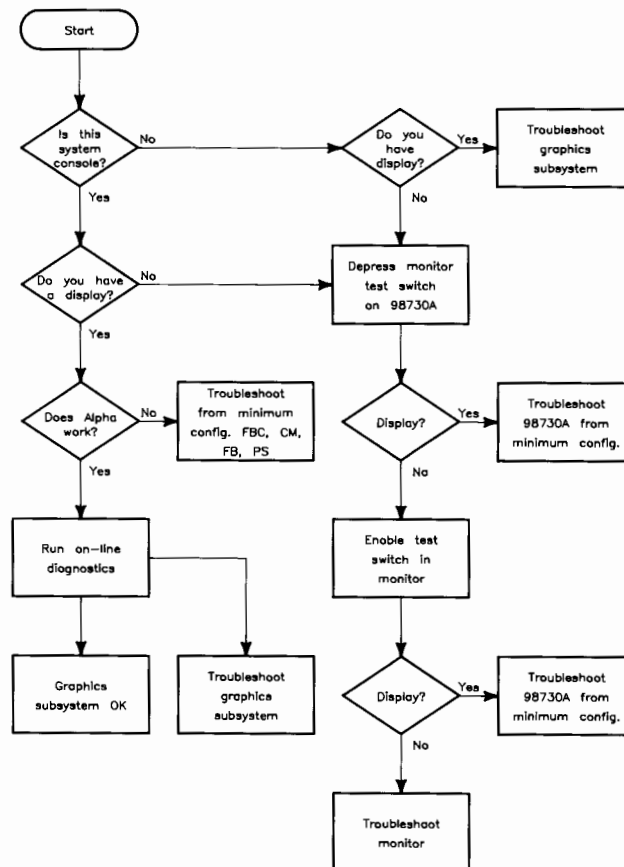


Figure 8-1. Troubleshooting Flow Chart

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## Quick Checks Before Troubleshooting

Here are some quick checks that can be made if the HP 98730A fails at initial turn on.

- Check that the power-on LED comes on and that the fans are running when the power switch is pressed. If no power is indicated:
  - Insure that the power supply's line select switch is in the correct position (120 or 230).
  - Insure that the power cables are properly attached and that there is power from the outlets.
  - Insure that the fuse(s) are good.

If you still do not have power, you may need to open the box. Follow the instructions in *Chapter 6 Removal and Replacement*. The switch board LEDs can be seen by opening the front panel door.

- The switch board has eight LEDs as shown below. These LEDs indicate problem areas with respect to the power supply(ies). A fault will shut down the power supply(ies) for 4 seconds. The power supplies will then automatically try to restart for 2 seconds. If the fault still exists, the supply(ies) are again shut down. This condition is called "Hiccup Mode." When this happens, check the switch card for further information.

**Table 8-1. The Switch Boards LEDs**

Main	Main AC OK	→ [G] [R]	← Fan open fault
Supply LEDs	Main OK	→ [G] [R]	← Main Supply Fault
Auxiliary	Aux. OK	→ [G] [R]	← Auxiliary Supply Fault
Supply LEDs	Aux. AC OK	→ [G] [R]	← Fan open fault

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## Series 300 I/O Testing

I/O testing is done by the Boot ROM accessing code found in the IODC ROM located on the HP 98726A interface board. The primary goal of the Series 300 IODC ROM code is to accurately test the hardware used by the HP-UX Integrated Terminal Emulator (ITE). It is presumed that if the ITE is functioning, then more sophisticated diagnostics can be run to test the entire machine. All failures are reported twice, once to the system console, and once to the built in LEDs on the interface board. Since the device under test is often the system console, it is quite possible that a failure in the HP 98730A will not be able to produce an error message, hence the need for the LED display. Eight LEDs are used to indicate error status and/or current active test module. These LEDs are located on the HP 98726A interface board. Due to the location of the LEDs on the interface, you may have to move the interface to the top slot in the computer and remove the computer's cover to observe the LED's activity.

IODC testing provides a high level of confidence that the HP 98730A subsystem is functioning to a usable level. Testing is limited to hardware required by the Integrated Terminal Emulator, therefore, most of the hardware is **not** tested.

At boot time, the Boot ROM (Rev C.1 or later), loads the test code into main memory from the IODC ROM located on the interface board. Machine control alternates between the Boot ROM and test code. During the time test code is in control, all accesses to the HP 98730A are contained within try/recover blocks to guard against unexpected events. Six test modules are called in sequence by the Boot ROM, five of the modules do testing, while the sixth merely reports the final status. During testing, the current module number is always displayed on the interface LEDs. After completion of the 'LAST' module, LEDs display error conditions found during the test. In a functional device, all LEDs are OFF.

### What's Tested

IODC code attempts to test a strictly limited set of hardware defined mainly by the Integrated Terminal Emulator (ITE). Specific hardware tested includes the following:

- Series 300 Interface board, HP 98726A (98730-66580)
  - Registers 1, 2 and 3
  - Full 32-bit data bus thru the LGB to the Frame Buffer Controller.
  - 20-bit address path thru the LGB to the overlay plane.
- Frame Buffer Controller board, (98730-66571)
  - LGB reads and writes to Frame Buffers overlay planes using bytes, words, and long words.
  - Fast window moves using rep rules \$00, \$FF.
  - Slow window moves using rep rules \$00, \$33, \$66, \$CC, \$FF.
- Color Map board, (98730-66575)
  - Color Map ALU
  - IRIS Color Map driven by the overlay planes
  - Color Map overlay plane memory.

In addition to the explicitly tested hardware, some hardware is implicitly tested. This includes items such as the LGB Interface Cable, power supplies, IODC ROM, and Display ROM, plus assorted registers. The end result is that only the system used by the ITE is well exercised and tested.

The analog path from the IRIS color map to the video connector is not tested. If IRIS can be written and correctly read back, then the assumption is made that the analog outputs of the color DACs are functioning. To verify the path to the monitor, press the test switch located on the HP 98730A's Mother board and accessed at the back of the HP 98730A chassis. This test switch latches all output high and should provide a white raster on the monitor. Further testing of the video path can be made with the diagnostic tests found in

`/usr/CE.utilities/98730`

These diagnostic tests are discussed later in this chapter.

## 30 Troubleshooting and Diagnostics

### LED Definition

There are eight LEDs to report errors. Power-On-Reset lights all LEDs. This is the only time all LEDs are lit simultaneously. Simple system resets do not effect the LEDs. The only way to change LED status is to explicitly write to the LEDs or power cycling the CPU box. When tracking down hardware problems, power cycle the CPU and watch the LEDs, if the Boot ROM can see the HP 98730A then it will try to load test code. If the test code cannot be checksummed, it will not be started and all eight LEDs will stay ON. Operating test code will flash LEDs during testing and eventually stop with an error indication. LEDs are defined in table 8-2, with LED #1 being the leftmost LED as seen through the rear panel grill of the HP 98726A interface board. You may have to move the interface to the top slot in the computer and remove the computer's cover to observe the LED's activity.

**Table 8-2. LED Definitions**

Label	LED
1	1 (Left)
2	2
4	3
Bus Error	4
Unknown	5
Color Map	6
FBC	7
Interface	8 (Right)

*1, 2, and 4* These LEDs report the current active test module number. If the test ever crashes or hangs, (this is never supposed to happen) before the 'LAST' test module executes, then a module number of the crashed test is displayed on these LEDs. Final error information will be unavailable, but the module number is a guide to what might have happened. Read the LEDs in straight binary format. Figure 8-3 shows the module number and the test module name.

**Table 8-3. Module Number to Module Name Conversion**

Module Number	Module Name
1	Initialize
2	Fbc_test
3	Cm_alu
4	Cm_iris
5	Block_mover
6	Last

*Bus Error* This LED is lit any time test code encounters a system bus error or hits a trap forcing execution of a 'RECOVER' statement. Bus Error is likely to be lit in combination with another LED.

*Unknown* This LED is lit any time the test code is unable to make sense out of an error condition. The current version of the code never uses this LED.

*Color Map, FBC, and Interface* These LEDs report errors attributed to a Field Replaceable Unit (FRU). Much work has been done to isolate failures to a specific FRU. Given the constraints of space, execution time, development time, and machine architecture, it is possible that some failures may light more than one LED. In this case, the code only indicates a problem exists, the CE must trouble shoot to the FRU level. FBC stands for Frame Buffer Controller.



## System Console Messages

Table 8-4. System Console Messages

Message	Meaning
HP98730 Bus Error	Reported any time a bus error or any system trap is executed while the test code is running.
HP98726A Interface Failure	Failure attributed to the interface board.
HP98730A FBC Read/Write Error	Failure attributed to the Frame Buffer Controller board. An error was found while doing write then read testing.
HP98730 FBC Block Move Error	Failure attributed to the Frame Buffer Controller board. An error was detected while testing the block mover.
HP98730 CMAP Memory Error	Failure attributed to the color map board overlay plane display memory.
HP98730 CMAP ALU Error	Failure attributed to the color map board. An error was found while testing the color map ALU.
HP98730 CMAP Read/Write Error	Failure attributed to the color map board. An error was found during write then read testing.
HP98730 NOT Functional	This message is reported by the 'LAST' test module if an error has been detected in any test module.
HP98730 Functional	This message is reported by the 'LAST' test module if no errors have been detected.

---

## CE.utilities Diagnostic Tests

You must have superuser capability (be root) to use the diagnostic tests in

```
/usr/CE.utilities/98730
```

To become root, get the proper password from the appropriate System Administrator and enter:

```
su
<root_password>
```

Move to the HP 98730A tests directory with:

```
cd /usr/CE.utilities/98730
```

A help file is provided. To read the help file, enter:

```
./help
```

The following information is presented:

```
This directory contains utilities to test HP 98730A (DaVinci) Graphics
subsystem. To run this utility type:
```

```
./START
```

```
If the START program fails, you may need to execute the diagnostic test
command string with a manual system configuration. This is done by
using the information obtained with the execution of:
```

```
./davucode/field x x ./davucode
```

```
This will give you the syntax for the diagnostic test command line.
```

## Autoconfigured Test Execution (START)

The following procedure will cause an autoconfigured execution of the diagnostic tests. If your system is not functioning to a level allowing autoconfiguration, you must use the procedure described in the `.help` help file and in the following section.

```
*****"
***                               ***"
*** Welcome to the 98730A series test code! ***"
***                               ***"
*****"

Creating daVinci Test Code Device Files.

Configuration Information:

Default - HP 98730 is console device,
          HP 98726 interface jumper J1 is in the $200K position,
          HP 98726 switches are set for $560K (01010110).

If this is your configuration? (Yes or No)"
```

If your HP 98730A is the system console, answer `yes`. You will then be asked how many tests you want executed.

If you answer `no`, then the following questions are asked to determine your system configuration.

```
I need to know your current configuration.

Is your interface switch set for DIO1 or DIO2?
If switch 1 = 0 (DIO1) answer with 1
If switch 1 = 1 (DIO2) answer with 2
```

If your HP 98726A is configured in DIO1 space, answer `1`.

If your HP 98726A is configured in DIO2 space, answer `2`.



If your HP 98726A is configured in DIO1 space, answer the following three questions about the interface's switch and jumper settings. After you answer these questions, you will be asked how many times the tests should be executed.

```
What is switch 3? (1 or 0)
1

What is hex value of switches 4,5,6 and 7?
(0 through f)
f

Is your jumper set for $200K or $800K?"
(Enter 2 for 200 or 8 for 800)"
2
```

If your HP 98726A is configured in DIO2 space, answer the following two questions about the interface's switch and jumper settings. After you answer these questions, you will be asked how many times the tests should be executed.

```
What is switch 2? (1 or 0)
1

What is hex value of switches 3,4,5 and 6?
(0 through f)
a
```

---

#### Note

The switches used to determine the hex value asked for in the above questions are DIFFERENT for DIO1 and DIO2 space. The jumper J1 is ignored in DIO2 space.

---

Next, questions about test execution are asked. The third question about the Display saved/restored should be answered **yes** only if the HP 98730 is the system console.

How many times do you want the test(s) run ('.' = infinite)?

Do you want the test to abort on first error? (Yes or No)  
no

Do you want the Display saved/restored when the test(s)  
overwrite the display buffers. (Yes or No)  
no

Now to select the test(s) to execute.

```
Please select the test(s) you desire to run."

ALL TESTS ..... 1
Interface Test ..... 2
Visual Tests ..... 3
Master Board Logic ..... 4
Master/Slave Transformations .. 5
Color Map Logic ..... 6
Scan Conversion ..... 7
Frame Buffer Control Logic .... 8
Frame Buffer 0 RAM ..... 9
Frame Buffer 1 RAM ..... 10
Frame Buffer 2 RAM ..... 11
Strip Z Buffer Logic ..... 12
Fast Z Buffer Logic ..... 13
Fast Z Buffer RAM ..... 14
Overlay Frame Buffer Ram ..... 15
Install Test - Demos ..... 16
DONE ..... 99

1
```

**Case 1:** A 1 will cause all test to be executed. An implied choice of 99 (DONE) is made automatically.

**Case 2:** To execute several tests, select the tests you want one at a time. After each selection, the menu is redisplayed. To terminate the selection process, select choice 99.

When you have completed your test selection, the following message is printed.

```
Select code is <your_select_code>
```

<your\_select\_code> is the select code you entered earlier.

Next, a listing of the boards that are recognized in the system. For a complete system, the message would look like the following:

Auto configuring test system.

```
98730-66573 Present (Fast Z Buffer)
98720-66572 Present (Frame Buffer 2)
98720-66573 Present (Frame Buffer 1)
98720-66573 Present (Frame Buffer 0)
98730-66577 Present (Master)
98730-66579 Present (Slave)
98730-66575 Present (High-Performance Color Map)
```

[Hit return to continue]

### Automatic Configuration

Auto Configuration can show failure in two ways:

1. If one line is unreadable, or says that the board is bad, the auto configure program tried to identify that board, and could not. That board should be replaced.
2. If the entire message is unreadable, the auto configure could not identify any of the boards. First, try removing the boards necessary to make the HP 98730A a minimum system (Color Map, Frame Buffer #0, the main power supply and Frame Buffer Controller board), then, re-run the test.

If the display look appropriate, press the continue key to continue.



Next, a list of disabled test is shown. The contents of this list will vary depending upon what tests are selected and will always contain the list of test that are "under development" that are always disabled.

```
Disable Test : 'S300 Test ROM Checksum'  
Disable Test : 'Engine 1 CDRAM Bank X'  
Disable Test : 'Engine 1 CDRAM Bank Y'  
Disable Test : 'Engine 2 CDRAM Bank X'  
Disable Test : 'Engine 2 CDRAM Bank Y'  
Disable Test : 'Engine 3 CDRAM Bank X'  
Disable Test : 'Engine 3 CDRAM Bank Y'  
Disable Test : 'Color Map IRIS'  
Disable Test : 'Color Map IRIS Registers'  
Disable Test : 'Color Map Crosshair CRC'  
Disable Test : 'Color Map Rband Line CRC'  
Disable Test : 'Color Map Rband Rect CRC'  
Disable Test : 'Color Map Sprite CRC'  
Disable Test : 'Cmap 1-k Mode'
```

[Hit return to continue]

The tests now begin.

```
*****  
*   DaVinci FIELD Test   *  
*   Loop Number    1    *  
*****  
  
Test: LGB/DIO Interface Card      (pass)  
Test: S300 Test ROM Checksum      (skip)  
Test: Color Map CRC Registers     (pass)  
  
:
```



## Executing Visual Tests

The diagnostic tests are designed to allow unsupervised testing. The default visual tests execute with **no** output sent to the display. Each of the five visual tests execute without output to the display. During each test, the display goes blank. If you execute test selection test 3 (visual tests), the following occurs:

```
*****
* DaVinci FIELD Test *
* Loop Number 1 *
*****

Test: LGB/DIO Interface Card (skip)
.
.

Test: Matr/Slv DATARAM via Treis (pass)
Test: Matr/Slv CDRAM_X via Treis (pass)
Test: Matr/Slv CDRAM_Y via Treis (pass)
Test: DCRAM_X via Master Treis (pass)
Test: DCRAM_Y via Master Treis (pass)
.
.

Test: Starbase Demo Glass1 (skip)

DAVINCI TEST PROGRAM COMPLETED NORMALLY

$
```

To see the patterns the visual tests generate, press the break key any time after the tests start. This will interrupt the tests and give you the menu shown below.

```
* Break Key Command Interpreter: Enter single key command.
* ! = Execute /bin/sh.
* U = Execute ucdb
* C = Continue executing tests.
* A = Abort now.
* Q = Continue and don't Quit after current test loop.
* v = Enable VISUAL tests following current test (i loop).
* V = Enable VISUAL tests looping.
* T = Enable - Cycle on current TEST.
* s = Display Statistics file '<statistics_file_name'.
* S = Print Statistics file.
* r = Display Data Base file '<database_file_name'.
* R = Print Data Base file.
* M = Add MEMO to data base file.
* >
```

Select `v` or `V` to begin VISUAL visual tests. Most of the patterns generated by these tests are very difficult to describe. The following is a best try at describing them.

When you execute the visual tests, and answer `Y` to the questions

Visual Check: Enter `Y` if display is correct, otherwise `No`

the following pattern is presented. If you answer `N`, any other test modules in the current test are skipped.

```
*****
* Visual Test Looping Enabled *
* Test Continued *
*****

*****
* Suspending NON-Visual Tests *
* Invoking Visual Tests *
*****

Test: Cmap Zoom
```

*A set of five white squares are turned red, one at a time.*

Visual Check: Enter Y if display is correct, otherwise No  
Y  
  
(pass)  
Test: Cmap Pan

*A blue band moves horizontally across screen,  
then vertically up screen.*

Visual Check: Enter Y if display is correct, otherwise No  
Y  
  
(pass)  
Test: Cmap Blink

*A blinking red square inside a non-blinking green square inside  
a non-blinking blue square.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

*A Three concentric blinking squares.*

Visual Check: Enter Y if display is correct, otherwise No  
Y  
  
(pass)  
Test: Cmap Blinking Overlays

*1 non-blinking red square and three blinking red squares,  
each in a colored column.*



Visual Check: Enter Y if display is correct, otherwise No  
Y

*1 blinking red/blue square and three non-blinking squares, one yellow, one blue and one magenta.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

*Four blinking squares:  
Red/Green, Blue/Yellow, Black/White and Magenta/Cyan*

Visual Check: Enter Y if display is correct, otherwise No  
Y

(pass)  
Test: Cmap Vdrive Cad

*Blue square and single blue rectangle.  
Next, a green square and two green rectangles.  
Next, a red square and three red rectangles.  
Next, a white square and one blue, two green and  
three red rectangles.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

(pass)  
Test: Cmap Vdrive Image

*Overlapping red opaque squares.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

*Overlapping green opaque squares.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

*Overlapping blue opaque squares.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

*Overlapping red, green and blue opaque squares,  
making a white square.*

Visual Check: Enter Y if display is correct, otherwise No  
Y  
  
(pass)  
Test: Cmap Match

*Three red squares placed to make a red column.  
Next, three green squares placed to make a green column.  
Next, three blue squares placed to make a blue column.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

*Three brown squares placed to make a brown column.  
Next, three green squares placed to make a green column.  
Next, three blue squares placed to make a blue column.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

(pass)  
Test: Cmap Refresh Stuck Low

*Four red-green-blue dashed vertical lines.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

(pass)  
Test: Cmap Refresh Stuck High

*Four red-green-blue dashed vertical lines.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

(pass)  
Test: Cmap Crosshair

*Red crosshair traveling along a white spiral turning the spiral green.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

(pass)

Test: Cmap Rband Line

*A white circle turned blue by a red sweep line. Looks like a clock's second hand*

Visual Check: Enter Y if display is correct, otherwise No  
Y

(pass)

Test: Cmap Rband Rect

*Red square traveling along white line pattern, turning the pattern blue.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

(pass)

Test: Cmap Sprite

*A Yellow smiles face traveling along a white line pattern, turning the white line pattern purple. At the end of the pattern, the smiles face turns to a devil face with blinking white eyes and a black mouth.*



Visual Check: Enter Y if display is correct, otherwise No  
Y

(pass)  
Test: Visual Fast Window Move

*Lots of white rectangles. A double black cross is main feature.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

(pass)  
Test: Visual Slow Window Move

*Lots of white rectangles and triangles.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

(pass)  
Test: Visual Pace Clipping

*Two squares with colored corners shaded to the center.  
One in the upper-left quadrant and one in the lower-right quadrant.  
Two squares with gray corners shaded to the center.  
One in the upper-right quadrant and one in the lower-left quadrant.*

Visual Check: Enter Y if display is correct, otherwise No  
Y

(pass)  
Test: Visual Pace Dither

*Two squares with colored corners shaded to the center.  
One in the upper-left quadrant and one in the lower-right quadrant.*



Visual Check: Enter Y if display is correct, otherwise No  
Y  
  
(pass)  
Test: Visual Pace Transparency

*Two squares with colored corners shaded to the center.  
One in the upper-left quadrant and one in the lower-right quadrant.*

Visual Check: Enter Y if display is correct, otherwise No  
Y  
  
(pass)  
Test: Visual Pace Gamma

*Two squares with colored corners shaded to the center.  
One in the upper-left quadrant and one in the lower-right quadrant.*

Visual Check: Enter Y if display is correct, otherwise No  
Y  
  
(pass)  
Test: Visual Pace Valve

*One large square with colored corners shaded to the center.*

## Manual Test Execution

To manually configure the test program, execute the following statement:

```
./davucode/field x x ./davucode
```

This provides detailed instructions on the command string used to execute the diagnostics tests. The command string requires 12 parameters. The parameters are:

- Parameter 0 Absolute location of test code. Since your current directory is `/usr/CE.utilities/98730`, this parameter is `./davucode/field`.
- Parameter 1 This is the HP 98726A interface configuration in the form `0x000stf` where:  
If Switch 1 is set to DIO1 then:  
s = switch 3 (1 or 0)  
t = hex value of switches 4, 5, 6 and 7 (0 thru f)  
f = Jumper J1's setting (2 for \$200K or 8 for \$800K)  
If Switch 1 is set to DIO2 then:  
s = switch 2 (1 or 0)  
t = hex value of switches 3, 4, 5 and 6 (0 thru f)  
f = no value
- Parameter 2 This value is `VOLVOIII`.
- Parameter 3 This is the location of the `disable.T` file. It should be `./davucode`.
- Parameter 4 This is the name of the test file. This should be `disable.T` or the filename you gave to a modified copy of `disable.T`. To modify `disable.T`, **remove** the # from in front of the test(s) **you do not want executed**. All tests commented (#) out will be executed. Be aware that several tests are "under development". These non-existent tests are listed without being commented out (#) at the end of your `disable.T` file. When you executed this command string, you will have a list of all "Disabled Files". This list contains the names of all test that will **not** be executed and should be ignored.

- Parameter 5 This is an eight (8) bit configuration string or a period (.) for Auto-Configuration. The bits are:  
 bit0 = Color Map = Must be a 1  
 bit1 = Slave Board = 1 if present, 0 if not  
 bit2 = Master Board = 1 if present, 0 if not  
 bit3 = Frame Buffer 0 = Must be a 1  
 bit4 = Frame Buffer 1 = 1 if present, 0 if not  
 bit5 = Frame Buffer 2 = M if present, 0 if not  
 bit6 = Fast Z Board = 1 if present, 0 if no  
 bit7 = Frame Buffer Controller = Must be a 1
- Parameter 6 This is the error log filename. Use any filename you like.
- Parameter 7 This is the number of times you want the tests executed. A period (.) means infinity.
- Parameter 8 This is a Yes or No parameter that answers the question, "Do you want test results stored in the data base R\*?" Normally this is *y*.
- Parameter 9 This is a Yes or No parameter that answers the question, "Do you want extra test results stored in the data base R\*?" Normally this is *y*.
- Parameter 10 This is a Yes or No parameter that answers the question, "Do you want the test to terminate with the first error found?" Normally this is *n*.
- Parameter 11 This must be *y*.
- Parameter 12 This is a Yes or No parameter that specifies if the screen should be saved before tests that destroy the displayed information and then restore it after the test. If your HP 98730A is **not** the system console, answer *n*. If it is system console, you make a choice.

An example for testing a minimum system using a modified `disable.t` file named `testit` is shown below.

```
./davucode/field 0x0001f8 VOLVOII ./davucode ./testit . RESULTS 1 Y N N Y N
```





## Replaceable Parts

---

# 9

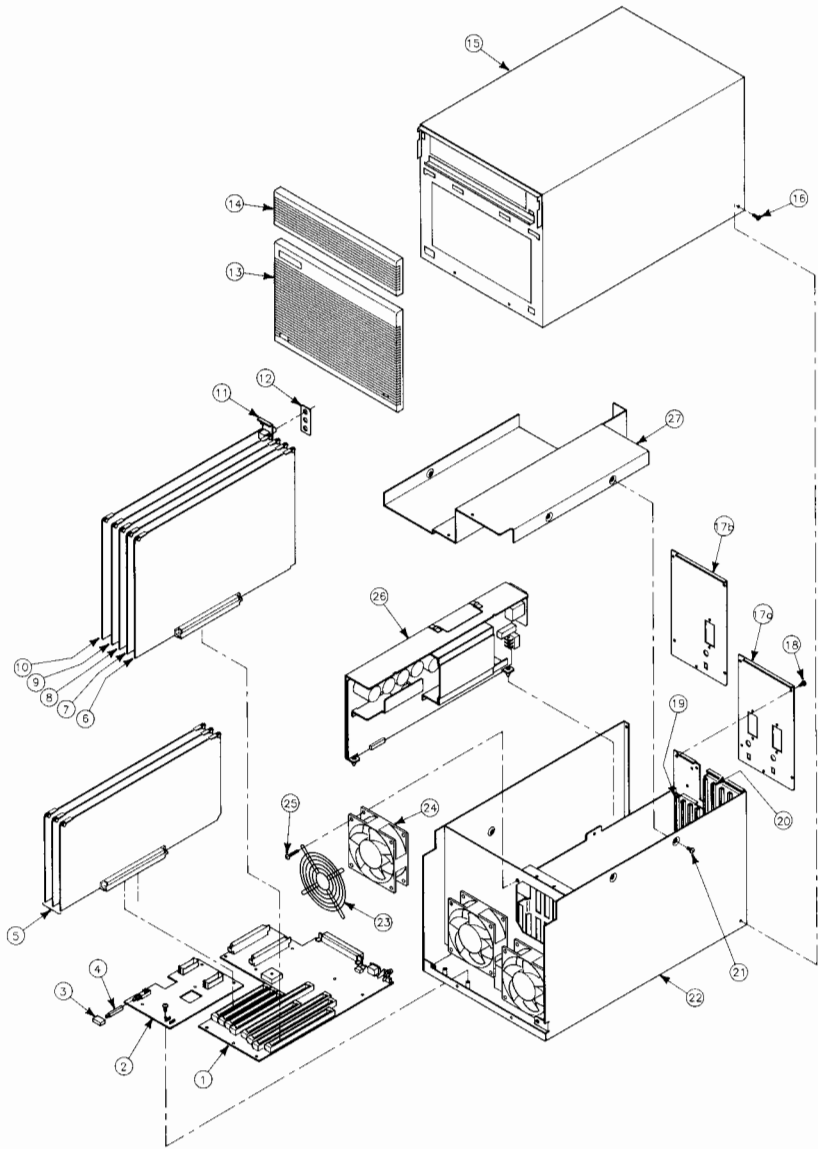
Use standard ordering procedures.

Replaceable parts and assemblies may be ordered from Hewlett-Packard Support Materials Organization. Their address is:

Support Materials Organization (SMO)  
3625 Cincinnati Avenue  
Rocklin, California 95677  
Telephone (916) 786-8000

Part numbers in the form xxxxx-69xxx refer to rebuilt assemblies that are available on an exchange basis. Numbers in the form xxxxx-66xxx, -67xxx, or -68xxx refer to new assemblies. All printed circuit boards listed are fully loaded boards. Blank printed circuit boards are not available.

# HP 98730 Replaceable Parts



Draw #	Part #	Qty	Description	Exch
1	98730-66501	1	Mother Board	Yes
2	98730-66542	1	Switch Board	Yes
3	09850-48301	1	Power Button	Yes
4	98720-66572	1	Power Button Shaft	Yes
5	98720-66572	1-3	Frame Buffer	Yes
6	98730-66579	1	Slave Transformation Board	Yes
7	98730-66577	1	Master Transformation Board	Yes
8	98730-66571	1	Frame Buffer Controller Board	Yes
9	98730-66573	1	Fast Z Board	Yes
10	98730-66575	1	Deluxe Color Map Board	Yes
11	1250-2075	1	Hex nut	No
12	98730-01211	1	Color Map Retainer	No
13	98730-64301	1	Large Front Panel	No
14	98730-64302	1	Small Front Panel	No
15	98730-60600	1	Top Cover	No
16	0515-0907	2	Small Screw	No
17a	98730-60201	1	Dual Power Supply Rear Cover	No
17b	98730-60200	1	Single Power Supply Rear Cover	No
18	0515-1040	11	Large Screw	No
19	0403-0421	1	Small PC Card Guide	No
20	0403-0569	1	Large PC Card Guide	No
21	0515-1040	9	Large Machine Screw	No
22	98730-0460	1	Main Chassis	No
23	3160-0422	3	Fan Grill	No
24	5180-1811	3	Fan	No
25	0515-1671	6	Long Screw for Fan	No
26	0950-1811	1-2	Power Supply	Yes
27	98730-01200	1	Hold Down Bracket	No
	98700-61603	1	Red-Green-Blue Cable	N

## Miscellaneous Part Numbers

HP Part Number	Description
2110-0055	Fuse, 4A/250V
0400-0056	Grommet, Snap
09817-61602	LED Cable Assembly
1450-0625	LED Retainer
2190-0016	Lock Washer
2950-0001	Hex Nut
5955-8036	Label -
5958-4325	Label - UL
7120-3428	Label - CSA-HP
7120-6157	Label - Danger Voltage
7121-4733	Label -
7124-2083	Label - Warning Voltage
98730-84703	2-inch Rubber Bumper
6960-0139	Plastic Feet



## Introduction

Use this section to keep reference notes and other reference documents.

## Documentation

The following documentation is related to the HP 98730A, its interface card and output monitors.

**Table 10-1. Documentation**

Part Number	Document
98730-90030	HP 98730A Hardware Support Document
98730-90039	HP 98730 CE Handbook
98730-90600	HP 98730 Installation Guide
98726-90600	HP 98726 Interface Installation Guide
A1017-90600	HP A1017 Interface Installation Guide
98784-90030	HP 98782A/98784A Hardware Support Document
98784-90600	HP 98784A Installation Note
98751-90000	HP 98751A/98752A Familiarization Guide
98752-90602	HP 98752A Installation Note
98789-90000	HP 98789A Familiarization Guide
98789-90602	HP 98789A Installation Note





## Introduction

Use this section to store system configuration, installation, modification and update information for your HP 98730A systems.



## Introduction

This section is provided as a storage location for system maps, network diagrams, and other information that does not have another home.

