HP VISUALIZE Personal Workstation P-Class Technical Reference

HP VISUALIZE Workstations

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Preface

This technical reference provides hardware and BIOS information for the engineers and technicians that support the HP VISUALIZE P-Class Personal Workstation. It is assumed that the reader possesses a detailed understanding of AT-compatible microprocessor functions and digital addressing techniques.

Special Notice for Users

The HP VISUALIZE Personal Workstation is made from a combination of high performance Industry Standard components (for example, the Intel Pentium III processor) and desired HP value added technologies (for example, HP VISUALIZE *fx*+ graphics cards). The HP VISUALIZE Personal Workstation also shares some important technologies with the HP Kayak Workstations, including certain processor system board features. Since these common technologies are used by the HP VISUALIZE Personal Workstations and the HP Kayak Workstations, your HP VISUALIZE Personal Workstation will occasionally make reference to "HP Kayak PC Workstations" or "HP Kayak XA-s." This is particularly true during the initial Power-On Self Test and when you see MaxiLife LCD messages.

Bibliography

The following document is available for the HP VISUALIZE Personal P-Class Workstation: HP VISUALIZE Personal P-Class Workstation User's Guide. For more information, you can go to the following web sites.

- Analog AD1816 (sound card controller)
  `http://www.analog.com/`
- Intel Chipsets. 440GX ACPset (82443GX) and, PIIX4 PCI/ISA Bridge Chip (82371EB)
  `http://developer.intel.com/design/chipsets/index.htm`
- Intel Pentium III Xeon Processor
  `http://developer.intel.com/design/pentiumiii/xeon/datashts`
- SCSI Chips
  `http://www.lsilogic.com/`
- Super I/O
  `http://www.national.com/catalog/`
- Quantum Fireball
  `http://www.quantum.com/products/hdd/`
- Seagate Medalist PRO
  `http://www.seagate.com/disc/`
- IBM UltraStar
  `http://www.storage.ibm.com/hardsoft/menu.htm`
- ELSA Graphics Controllers
  `http://www.elsa.com/`
- Oxygen GVX1 Graphics Controller
  `http://www.3dlabs.com/`

Important Safety Information

WARNING **If you have any doubt that you can lift the HP VISUALIZE Personal Workstation or display safely, do not try to move it without help.**

For your safety, always connect the equipment to a grounded wall outlet. Always use a power cord with a properly grounded plug, such as the one provided with this equipment, or one in compliance with you national regulations. This HP VISUALIZE Personal Workstation is disconnected from the power by removing the power cord from the power outlet. This means the Personal Workstation must be located close to a power outlet that is easily accessible.

For your safety, never remove the HP VISUALIZE Personal Workstation's cover without first removing the power cord from the power outlet, and any connection to the telecommunications network. Always replace the cover on the Personal Workstation before switching it on.

To avoid electric shocks, do not open the power supply. There are no user-serviceable parts inside.

This HP VISUALIZE Personal Workstation is a class 1 laser product. Do not attempt to make any adjustment to the laser units.

Important Ergonomic Information

It is strongly recommended that you read the ergonomic information before using you HP VISUALIZE Personal Workstation. Open the Start menu in the task bar and select HP Info. Then double-click the help topic "Working in Comfort."

Installation Notice

Products designated in the applicable Hewlett-Packard price list as customer-installable can be installed by computer-knowledgeable customers who carefully read and follow the instructions provided. Customers who elect to have the product installed by our field personnel are charged the applicable field installation charge, as covered under the standard terms and conditions. For more information, please contact your local sales representative.

Revision History

The revision history for each edition of the manual is listed below:

Edition	Revision History
E1199	First Printing

Problems, Questions, and Suggestions

If you have any problems or questions with our hardware, software, or documentation, please contact either your HP Response Center or your local HP representative. If you have access to a web browser, you can get the latest software and hardware patches at the following URL:

http://us-support.external.hp.com/

Documentation Conventions

Unless otherwise noted in the text, this guide uses the following symbolic conventions.

user-supplied values	Italic words or characters in syntax and command descriptions represent values that you must supply. Italics are also used in text for emphasis.
`screen display`	Information that the system displays, commands that you must use literally, and path names appear in this typeface.
Enter	Keycaps are presented with a special keycap font as shown in the left column. (In this document, we refer to the **Enter** key. On your keyboard, the key may be labeled either **Enter** or **Return**.)

Electrostatic Discharge (ESD) Precautions

Electrostatic charges can damage the integrated circuits on printed circuit boards. To prevent such damage from occurring, observe the following precautions during board unpacking and installation:

- Stand on a static-free mat.
- Wear a static strap to ensure that any accumulated electrostatic charge is discharged from your body to ground.
- Create a common ground for the equipment you are working on by connecting the static-free mat, static strap, and peripheral units to that piece of equipment.
- Keep uninstalled printed circuit boards in their protective antistatic bags.
- Handle printed circuit boards by their edges, once you have removed them from their protective antistatic bags.

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1 System Overview

This manual describes the HP VISUALIZE Personal P-Class Workstations, and provides detailed system specifications.

This chapter introduces the external features, and lists the specifications and characteristic data of the system. It also summarizes the documentation which is available.

Package for the Minitower Model

Figure 1-1. Front View of Minitower with Cover Removed

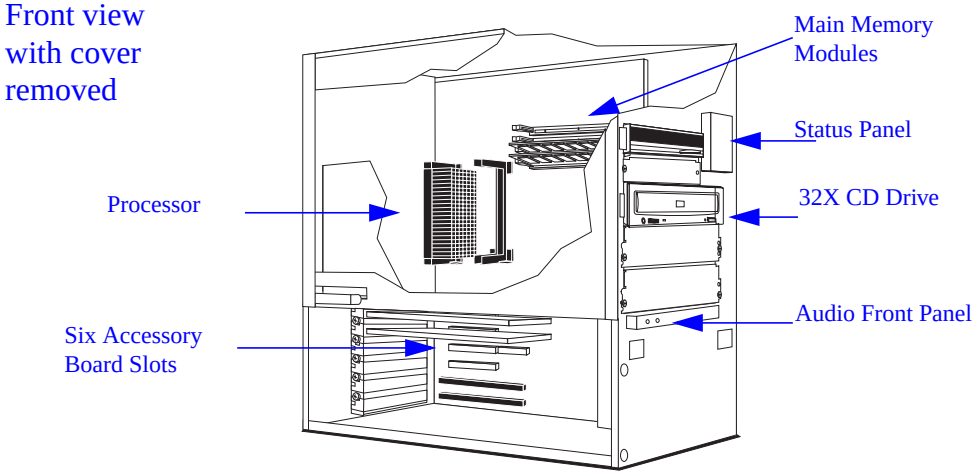
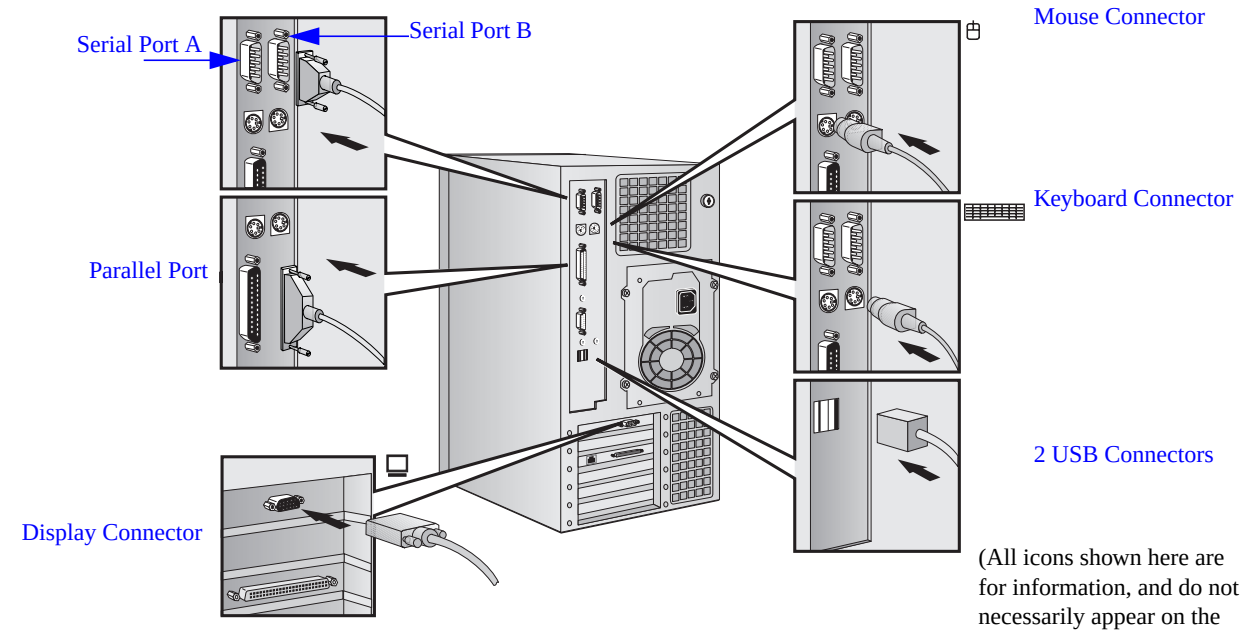


Figure 1-2. Rear View of Minitower



(All icons shown here are for information, and do not necessarily appear on the Personal Workstation).

HP VISUALIZE Personal P-Class Workstation Overview

The following table provides an overview of the HP VISUALIZE Personal P-Class Workstations. The operating system on all models is Windows NT 4.0.

How to use the table:

Table 1-1. Overview of the HP VISUALIZE Personal P-Class Workstation

Component	Description
Microprocessor	Pentium III processor with 512 KB half-frequency (P450, P500, P550, P600) or 256 KB full-frequency (P600C, P650C, P700C) cache memory. Dual processor slots. Single or dual processors.
External Processor Bus (Front Side Bus)	100 MHz FSB
Main Memory	Three DIMM sockets using: 256 MB registered ECC SDRAM to a maximum of 768 MB, 128 MB Non-Buffered ECC SDRAM, 32 MB or 128 MB Non-ECC to a maximum of 384 MB. Registered ECC SDRAM memory modules cannot be mixed with Non-Buffered modules.
Mass Storage	All models have 7 shelves: 5 front-access (two 3 -inch, three 5 -inch); 2 internal (3 -inch). 6.5 or 13 GB 7200 66 MB/s IDE or 9 or 18 GB 10K RPM SCSI hard drives.
Video Controllers	All models are equipped with one of the following graphics controller board: HP VISUALIZE *fx*+2 HP VISUALIZE *fx*+4 HP VISUALIZE *fx*+6 ELSA Gloria Synergy + ELSA Synergy II Oxygen GVX1
Accessory Board Slots	All models have 6 slots: 1 AGP, 3 PCI, 1 ISA, 1 combination ISA/PCI. AGP slot is used for graphics.
Communications	All models have 2 USB (A, B) connectors, 2 serial ports, 1 parallel port
Audio	All models have an Integrated 16-bit Hi-Fi audio processor with music synthesizer and mixer.
CD-ROM Drive	All models include a 32X or 48X speed IDE CD-ROM
HP MaxiLife Utility (available on all models)	Hardware monitoring utility that monitors system components (for example, if you are unable to get the system and display working properly). When an error is detected it is displayed on the dedicated LCD located on the front panel.

Table 1-1. Overview of the HP VISUALIZE Personal P-Class Workstation

Component	Description
Power Supply	Input Voltage: 100-127, 200-240V ~ Input Frequency: 50/60Hz Maximum output power: 260W continuous

Hardware Control Panel

The HP MaxiLife utility is explained in detail in the section “HP MaxiLife” in the chapter “System Board.”

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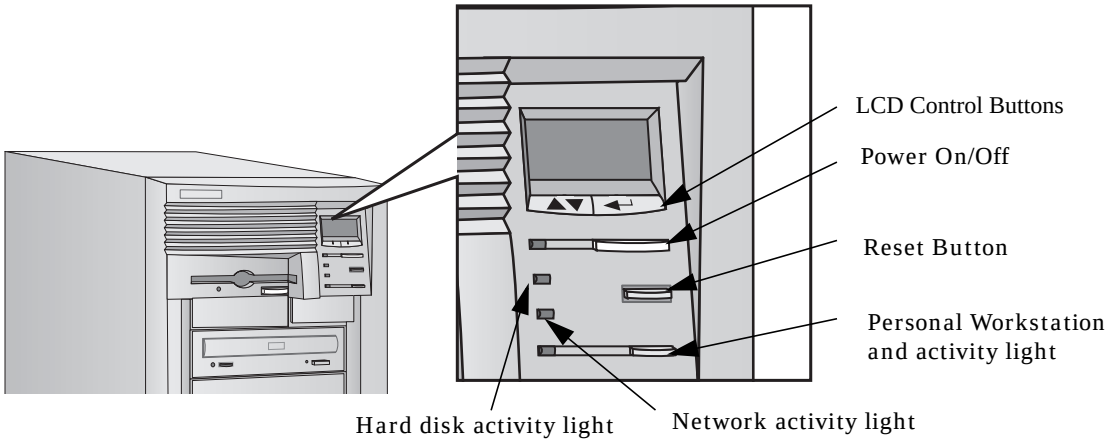
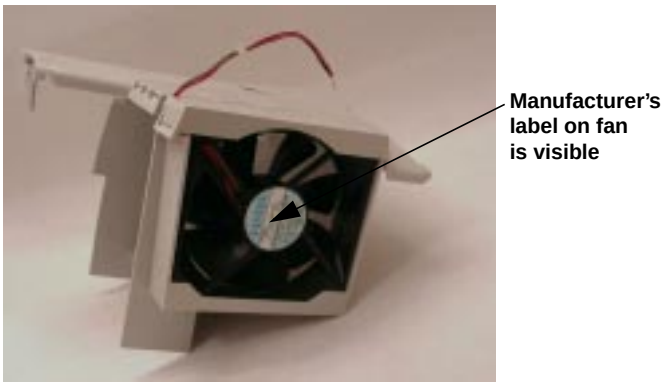
Figure 1-3. Minitower Hardware



Reversing the System Fan for the P600 Processor *Only*

NOTE If you are installing any other speed processor, ignore this procedure.

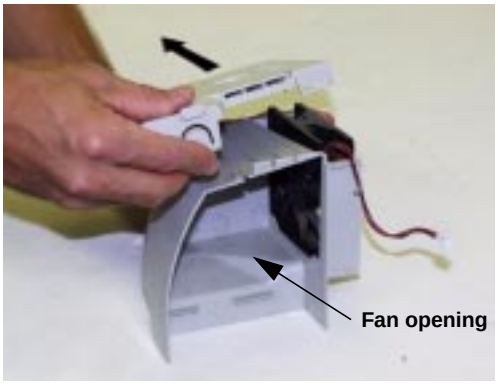
1. Look at the fan in the HP UltraFlow airflow guide. If the fan's label is visible, then you need to reverse the fan. Continue on to step 2 on the next page.



However, if you do *not* see the label, then the fan has already been reversed. Skip the remainder of this procedure.

2. Loosen the top cover of the airflow guide by gently pulling the flanged side outward and releasing the tabs on the base of the airflow guide.

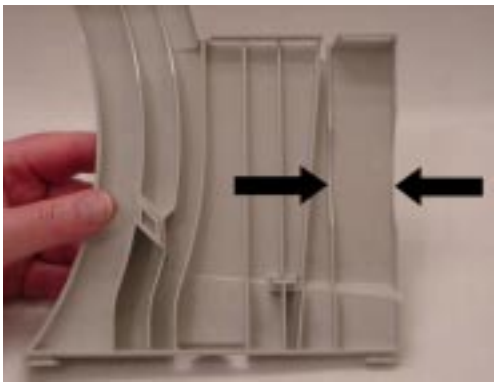
3. Lift the top cover of the airflow guide and firmly push it backwards, away from the fan opening. This releases the top cover from the base of the airflow guide.



4. Remove the fan from the base of the airflow guide.

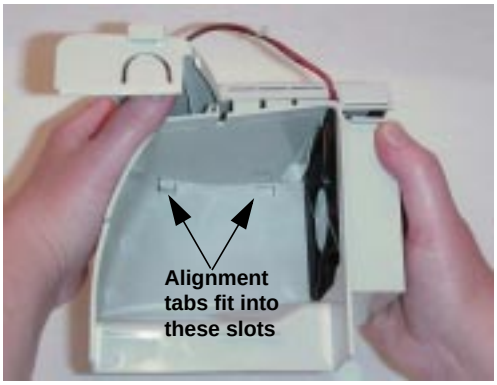
5. Reverse the fan and reinstall it in the base of the airflow guide, with the cable in the orientation shown. When seated correctly, the fan will be between the two ridges in the base of the airflow guide.

Note that there are also corresponding ridges in the top cover of the airflow guide for aligning the fan, as shown on the next page. When the top cover is installed correctly (see step 6), the fan will be between the two ridges in the top cover of the airflow guide, as well.



6. Reinstall the top cover of the airflow guide, as follows:

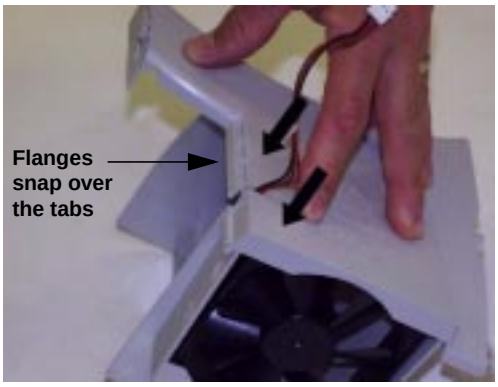
   a. Position the two alignment tabs on the top cover so that they fit into the alignment slots on the side wall of the base. Align the tabs with these slots by looking into the fan opening in the base of the airflow guide.



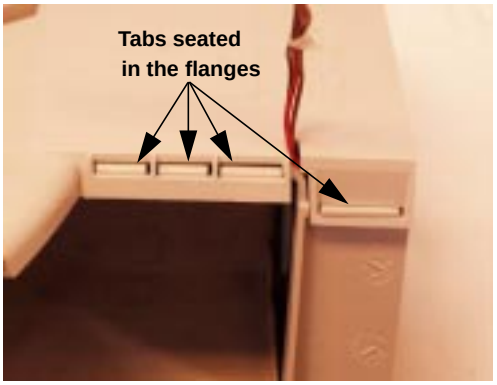
   b. Thread the cable through the notch in the top cover of the airflow guide. This ensures that the cable will not be pinched when the top cover is reinstalled.

   c. Verify that the fan is correctly aligned between the two ridges in the base and the two ridges in the top cover of the airflow guide.

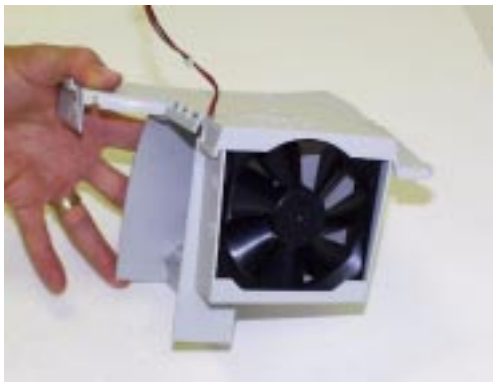
d. Push the top cover downward into position. The flanges on the one side of the top cover snap over the tabs on the base of the airflow guide.



e. Verify that the tabs are properly seated in the flanges.



The fan is now in the reverse position. (The fan's label is not visible.)



Specifications and Characteristics Data

Physical Characteristics

Table 1-2. Physical Characteristics of the Minitower

Minitower	
Characteristic	**Description**
Weight (excluding display and keyboard)	11.34 kilograms (25.2 pounds)
Dimensions	Width: 21.1 cm (8.29 inches) Height: 41.5 cm (16.27 inches) Depth: 42 cm (16.48 inches)
Footprint	0.09 m2 (0.95 ft2)
Keyboard	18 inches (W) by 7 inches (D) by 1.3 inches (H), when flat, or 18 inches (W) by 7 inches (D) by 2 inches (H), when standing

Electrical Specifications

Table 1-3. Electrical Specifications of the Minitower

Minitower						
Parameter	**Total Rating**			**Notes**	**Typical per PCI Accessory Slot**	**Typical per ISA Accessory Slot**
Input voltage	100-127 Vac	200-240 Vac		Selected automatically		
Available Power	260 W					
Voltage range	90-140 Vac	180-264 Vac				
Frequency range	50 Hz to 60 Hz					
Maximum input current	7.5 A					
Inrush Current	Maximum of 90A cold start					
Safety Ground Leakage Current	< 3.5mA					
Efficiency	70% at maximum power output					

Table 1-3. Electrical Specifications of the Minitower

Minitower						
Parameter	**Total Rating**			**Notes**	**Typical per PCI Accessory Slot**	**Typical per ISA Accessory Slot**
Output Voltage Regulation	Min	Nom	Max			
	11.0	12.0	13.0			
	4.8	5.0	5.25			
	3.15	3.3	3.46			
	-4.5	-5.0	-5.5			
	-10.8	-12.0	-13.2			
	4.7	5.0	5.3	(5 VStd By)		
Overvoltage Protection	Not more than 6.5V for 5V output					
	Not more than 16V for 12V output					
	Not more than 4.15V for 3.3V output					
Isolation Voltage	3000Vac primary/secondary					
	1500Vac primary/ground					
Safety Standard	IEC950/UL 1950/CSA950/EN60950					
Output Voltage Regulation	Min	Nom	Max			
Current at +5 V			30 A		5 A	2 A
Current at +3.3 V			30 A	—	7.6 A	—
Total cumulated current on +3.3 V and +5 V			42.5 A	—		
Current at -5 V			0.1 A		—	0.2 A
Current at +5V standby			0.72 A		—	—
Current at +12 V			8 A	—	0.5 A	0.2 A
Current at -12 V			0.5 A	—	0.1 A	0.5 A

An attempt to draw too much current (resulting, for example, from a short circuit across edge-connector pins, or an accessory board that is not suitable for these Personal Workstations), will cause the overload protection in the power supply to be triggered, and the Personal Workstation could fail to boot.

Both power supplies on the desktop and minitower models are new compared to those used on previous platforms (Vectra VL 6/xxx and XA 6/xxx). The difference is at the V standby level, which has been extended to deliver 300mA instead of 100mA. This extra current is required by the 100TX hardware layer so it can perform a remote power-on upon reception of a magic frame. Using an older power supply for a repair will prevent a remote power-on upon reception of a magic frame.

NOTE When the Personal Workstation is turned off with the power button on the front panel, the power consumption falls below 5 Watts, but is not zero. The special on/off method used by this Personal Workstation extends the lifetime of the power supply. To reach zero power consumption in “off” mode, either unplug the Personal Workstation from the power outlet or use a power block with a switch. You should be aware that the Personal Workstation will lose its time settings within a few days if you unplug the Personal Workstation, or switch off the Personal Workstation at the power block.

Environmental Specifications

Table 1-4. Environmental Specifications of the Minitower

Environmental Specifications (System Processing Unit, with Hard Disk)	
Operating Temperature	+5˚C to +35˚C (+ 40˚F to 95˚ F)
Recommended Operating Temperature	+15˚C to +70˚C (+59˚F to +158˚F)
Storage Temperature	-40˚C to +70˚C (-40˚F to +158˚F)
Over Temperature Shutdown	+50˚C (+122˚F)
Operating Humidity	15% to 80% (relative)
Storage Humidity	8% to 80% (relative)
Acoustic noise emission:	(as defined ISO 7779)
Sound power with 5.4 krpm from hard disk drive with 7.2 krpm hard disk drive	 LwA £ 42.1 db LwA £ 45.0 db
Operating Altitude	10000 ft (3100m) max
Storage Altitude	15000ft (4600m) max

Operating temperature and humidity ranges may vary depending upon the mass storage devices installed. High humidity levels can cause improper operation of disk drives. Low humidity levels can aggravate static electricity problems and cause excessive wear of the disk surface.

Documentation

The table below summarizes the availability of documentation that is appropriate to the HP VISUALIZE Personal Workstations.

Only selected publications are available on paper. Most are available as viewable files (which can also be printed) from the HP division support servers.

Table 1-5. Documentation Information

Title	Division Support Server	Online at HP WWW Site (see address below)	Paper-based
HP VISUALIZE Personal P-Class Workstation User's Guide	PDF file	PDF file	A5015-90015
HP VISUALIZE fx Configuration and Troubleshooting Guide	PDF file	PDF file	A5021-90013
HP VISUALIZE fx Texture Module Installation Guide	PDF file	PDF file	A5021-90014
HP VISUALIZE Personal P-Class Workstation Service Handbook	PDF file	PDF file	A5015-90039
Network Administrator's Guide	PDF file	PDF file	No
Using Sound on Your Personal Workstation	PDF file	PDF file	No
ELSA GLoria Synergy+ User's Guide	PDF file	PDF file	A1273-90000
ELSA Synergy II User's Guide	PDF file	PDF file	A1280-90025
Oxygen GVX1 User's Guide	PDF file	PDF file	A6011-90001
Memory Installation Guide	PDF file	PDF file	A5014-90061
Processor Installation Guide	PDF file	PDF file	A5014-90062
Hard Disk Drive Installation Guide	PDF file	PDF file	A5014-90060

Each PDF file (Portable Document Format) can be viewed on the screen by opening the file with Acrobat Reader. To print the document, press Ctrl+P while you have the document on the screen. You can use the page-up, page-down, go to page, and search string functions to read the document on the screen.

Access HP World Wide Web Site

Additional online support documentation, BIOS upgrades and drivers are available from HP's World Wide Web site, at the following address:

World-Wide Web URL:	`http://www.hp.com/go/visualizesupport`

Where to Find the Information

The following table summarizes the availability of information within the HP VISUALIZE Personal Workstation documentation set.

Table 1-6. Location of Information

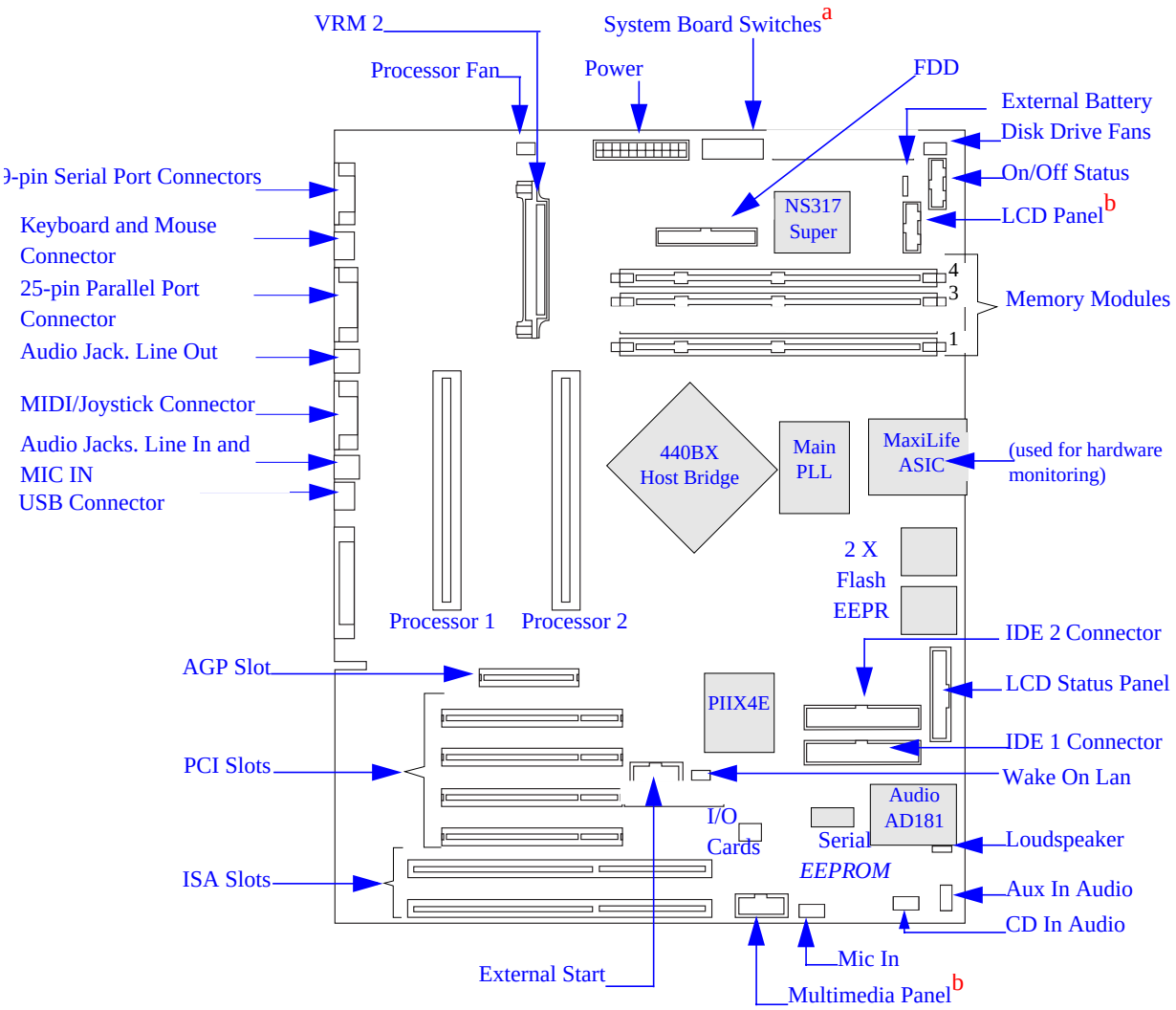
	User Guide	Service Handbook	Technical Reference Manual
Introducing the computer			
Product features	Key features	Exploded view Parts list	Key features
Product model numbers		Product range CPL dates	
Using the computer			
Connecting cables and turning on	Keyboard, mouse, display, network, printer, power		
Finding on-line information	Finding READ.MEs and on-line documentation		
Environmental	Setting Up and Using Your Personal Workstation		System overview
Formal documents	Software license agreement Warranty information		
Upgrading the computer			
Opening the computer	Full details		
Supported accessories	Some part number details	Full PN details	
Replacing accessories	How to install		
Configuring devices	Installing drivers		
Fields and their options within Setup	Key fields		Key fields
Repairing the computer			
Troubleshooting	Basic	Service notes	Advanced
Technical information	Basic		Advanced
System board	Jumpers, switches and connectors	Jumpers, switches and connectors	Jumpers, switches and connectors Chip-set details
BIOS	Basic details		Technical details Memory maps
Power-On Self-Test routines (POST)	Key error codes and suggestions for corrective action		Error codes and suggestions for corrective action Order of tests Complete list
Peripheral Devices			
Audio User's Guide	Setting up and configuring		
LAN Administrator's Guide	Setting up and configuring		

2 System Board

This chapter describes the components of the system board, taking in turn the components of the Processor-Local Bus, the Peripheral Component Interconnect (PCI) bus, the System Management (SM) bus and the Industry Standard Architecture (ISA) bus and the AGP Accelerated Graphics Port Controller.

System Board Overview

The following diagram shows where the different chips and connectors are positioned on the system board for both desktop and minitower models.



a. Refer to the Switch Block Label located on the chassis of the system box for the different system board switch settings.

b. Available only on HP VISUALIZE Personal Workstations.

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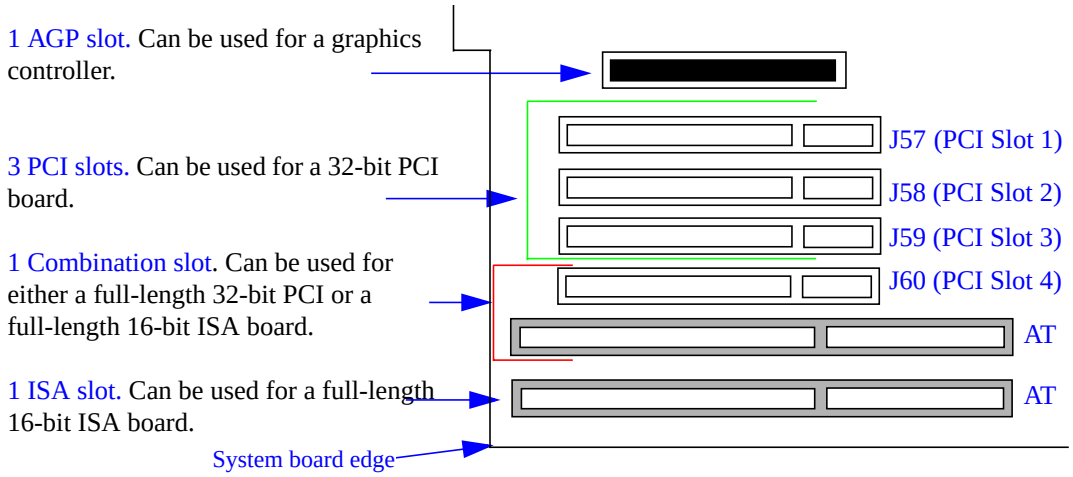
Accessory Board Slots

The following block diagram of the accessory board slots is valid for both desktop and minitower models. Refer to the section “Devices on the PCI Bus” in this chapter for the PCI mapping table.



AGP Accessory Board Slot

The Accelerated Graphics Port (AGP) bus, provides a high performance graphics interface. It uses a 66 MHz base clock, and provides a peak bandwidth of 528 MB/second.

AGP supports several modes, which are listed below. In its basic mode, AGP is very much like a 66 MHz PCI bus; in a more advanced mode, pipelining is added along with special sideband signals, thereby improving the bus performance. A double-clocking mechanism enables data transfers on both rising and falling edges of the clock, which brings the maximum bandwidth to 528 MB/s: 66 MHz x 2 (double-clock) x 4 (bus width = 32 bit).

The different AGP modes include:

- Basic AGP: 66MHz, PCI-like. Bandwidth: 264 MB/s.
- Pipelined AGP: 66MHz + pipeline.
- Sideband AGP: 66MHz + pipeline + sideband signals.
- Full AGP: 133 MHz equivalent (66 MHz with double clocking) + pipeline + sideband signals. Bandwidth: 528 MB/s.

For information about the AGP bus interface, refer to the section “AGP Bus Interface” in this chapter.

PCI Accessory Board Slots

There is a total of four Peripheral Component Interconnect (PCI) slots on the system board. The fourth PCI slot shares the corresponding AT slot (Combo), since the PCI board or an AT board can be installed in it.

The system board and BIOS support the PCI specification 2.1. It fully supports PCI-to-PCI bridges and multi-function PCI devices; and each of the four PCI slots has Master

capabilities. The maximum supported power consumption per slot is 25W, either from the 5V or the 3.3V supply. Total power consumption for the PCI slots must not exceed 60W, which gives an average of 15W per slot.

Some examples of supported and unsupported configurations:

Table 2-1. Examples of Supported and Unsupported PCI Configurations

Number of PCI Accessory boards	Accessory Board Power Consumption	Total Power Supply	Supported
Two	25W + two empty PCI accessory board slots	50W	Yes
Four	15W accessory boards	60W	Yes
Four	The total power consumption for the four PCI slots does not exceed 60W (for example, 19+21+7+13)	60W	Yes
Three	Two 25W + one 15W board[1]	65W	No

1. Total power consumption for the PCI accessory board slots exceeds 60W.

The PCI accessory board slots are numbered 2 to 5 (slot 1 is the AGP slot).

In addition to these four slots, there are two devices connected on the PCI Bus:

- 440BX AGPset chipset, bridge between the Processor Front Side Bus and the PCI bus.
- PIIX4E chip, bridge between the PCI and the AT, USB and IDE buses.

For information about the AGP bus interface, refer to the section “PCI to ISA/EIO Bridge” in this chapter.

ISA Accessory Board Slots

There are two AT slots provided on the system board. One of these two slots shares the corresponding slot with the PCI slot (Combo).

In addition to these two slots, the following devices (refer to the section “Devices on the ISA Bus” in this chapter for more details about devices on the ISA bus) are also connected to the AT bus:

- Ultra I/O (NS87317), which integrates one parallel port, two serial ports, a keyboard and mouse controller (8042), a floppy controller and a battery backed-up Real Time Clock + CMOS (RTC).
- PIIX4E chip, bridge between the PCI and the AT, USB and IDE buses.
- Two flash ROM sockets for 256 or 128 KB ROMs.
- Audio chip (AD 1816 from Analog Device).

For information about the AGP bus interface, refer to section “ISA Bus Interface” in this chapter.

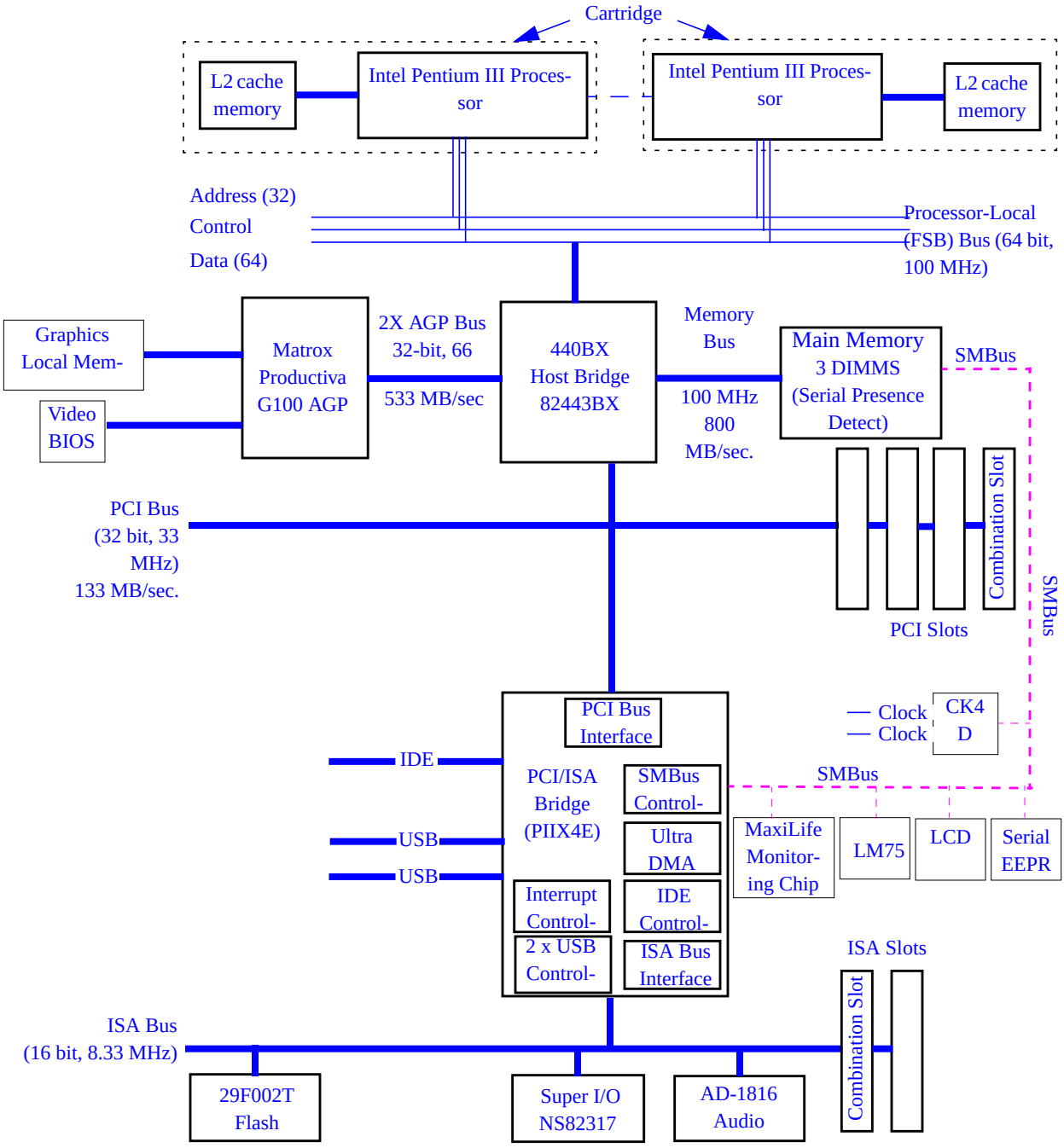
Chipset

The Intel® 440BX AGPset includes the 82443BX Host Bridge/Controller and the 82371EB PIIX4E chip for the I/O subsystem.

- The Host Bridge, also referred to as the North Bridge, is the bridge between four buses: the Processor-Local (GTL) bus, the main memory (SDRAM) bus, the PCI bus and the AGP (graphic) bus. The table in the section “Host Bridge/Controller (82443BX)” in this chapter details the Host Bridge/Controller features.
- The PIIX4E chip, also referred to as the South Bridge, is the bridge between three buses: the PCI bus, the SMBus and the ISA bus. In addition, it contains the IDE controller, USB controller and Power Management logic. The table in the section “PIIX4E (82371EB)” in this chapter details the PIIX4E chip features.

The following block diagram gives an architectural view of the *HP VISUALIZE Personal Workstation* (for frequencies, refer to the table in the section “Bus Frequencies” in this chapter).

Architectural View



Host Bridge/Controller (82443BX)

Table 2-2. Host Bridge/Controller (82443BX)

Feature	Feature
Processor/Host Bus Support • Optimized for Pentium® processor at: 100 MHz system bus frequency. Support for 66 MHz. • Supports full Symmetric Multiprocessor (SMP) Protocol for up to two processors; I/O APIC related buffer management support (WSC# signal). • In-order transaction and dynamic deferred transaction support. • Desktop optimized GTL+ bus driver technology (gated GTL+ receivers for reduced power).	**AGP Interface** • Supports single AGP-compliant device (AGP-66/133 3.3V device). • AGP Specifications Rev. 1.0 compliant. • AGP-data/transaction flow optimized arbitration mechanism. • AGP side-band interface for efficient request pipelining without interfering with the data streams. • AGP-specific data buffering. • Supports concurrent CPU, AGP and PCI Transactions (“expedite”) support.
Integrated DRAM Controller • Up to 768 MB with registered DIMMs. • 64-bit data interface with ECC support (SDRAM only). • Unbuffered and Registered SDRAM (synchronous) DRAM support (x-1-1-1 access at 66 MHz, x-1-1-1 access at 100 MHz). • Enhanced SDRAM Open Page Architecture Support for 16 and 64-Mbit DRAM devices with 2k, 4k and 8k page sizes.	**Power Management Functions** • Stop Clock Grant and Halt special cycle translation (host to PCI bus). • Mobile and “deep Green” Desktop supports for system suspend/resume (i.e., DRAM and power-on suspend). • Dynamic power down of idle DRAM rows. • SDRAM self-refresh power down support in suspend mode. • Independent, internal dynamic clock gating reduces average power dissipation. • Static STOP CLOCK support. • Power-on Suspend mode. • Suspend to DRAM. • ACPI-compliant power management.

Table 2-2. Host Bridge/Controller (82443BX)

Feature	Feature
PCI Bus Interface • PCI Rev. 2.1, 3.3V and 5V, 33 MHz interface compliant. • PCI Parity Generation Support. • Data streaming support from PCI to DRAM. • Delayed Transaction support for PCI-DRAM Reads. • Supports concurrent CPU, AGP and PCI transactions to main memory.	**Supporting I/O Bridge** • System Management Bus (SMB) with support for DIMM Serial Presence Detect (SPD). • PCI-ISA Bridge (PIIX4E). • Power Management Support. • 3.3V core and mixed 5V, 3.3V I/O and interface to the 2.5V CPU signals via open-drain output buffers.
Packaging/Voltage • 492-pin BGA. • 3.3V core and mixed 3.3V and GTL I/O.	

Host Bridge Interface

The Pentium III “Katmai” processor (P450, P500, P550, P600) supports a second level (L2) cache via a back-side bus (BSB) interface. The Pentium III “Coppermine” processor (P600c, P650c, P700c) has on integrated second level cache. All control for the L2 cache is handled by the processor. The Host Bridge provides bus control signals and address paths for transfers between the processors FSB (host bus), PCI bus, AGP and main memory. The Host Bridge supports a 4-deep in-order queue (i.e., supports pipelining of up to four outstanding transaction requests on the host bus). Due to the system concurrency requirements, along with support for pipelining of address requests from the host bus, the Host Bridge supports request queueing for all three interfaces (Host, AGP and PCI).

Host-initiated I/O cycles are decoded to PCI, AGP or PCI configuration space. Host-initiated memory cycles are decoded to PCI, AGP (prefetchable or non-prefetchable memory space) or DRAM (including AGP aperture memory). For memory cycles (Host, PCI or AGP initiated) that target the AGP aperture space in DRAM, the Host Bridge translates the address using the AGP address translation table. Other host cycles forwarded to AGP are defined by the AGP address map.

PCI and AGP initiated cycles that target the AGP graphics aperture are also translated using the AGP aperture translation table. AGP initiated cycles that target the AGP graphics aperture mapped in main memory do not require a snoop cycle on the Host bus, since the coherency of data for that particular memory range will be maintained by the software.

PL Bus Interface

The Host Bridge monitors each cycle that is initiated by the PL bus by the processor, and forwards them to the main memory, PCI bus or AGP bus.

The chip can support one or two Pentium II processors, at up to 100 MHz FSB clock frequency. Refer the section “Devices on the Processor-Local Bus” in this chapter for a

description of the devices on the Processor-Local Bus.

PCI Bus Interface

The PCI bus interface is 3.3V (5V tolerant), 33 MHz PCI 2.1 compliant and supports up to five external PCI masters in addition to the PIIX4E Bridge chip. The PCI-to-DRAM interface can reach a transfer rate of over 100 MByte/sec for streaming reads and over 120 MBytes/sec for streaming writes.

Sequential PL-to-PCI memory write cycles are translated into PCI zero wait state burst cycles. The maximum PCI burst transfer can be between 256 bytes and 4 KB. The chip supports advanced snooping for PCI master bursting, and provides a pre-fetch mechanism dedicated for IDE read.

The PCI arbiter supports PCI bus arbitration for up to six masters using a rotating priority mechanism. Its hidden arbitration scheme minimizes arbitration overhead. Additional logic on the PC Workstation extends the number of fully supported masters to seven (Intel 440BX master not counted). Refer to the section “Devices on the PCI Bus” in this chapter for a description of the devices on the Processor-Local Bus.

AGP Bus Interface

The controller for the AGP (Accelerated Graphics Port) is compatible with the Accelerated Graphics Port Specification, Rev 1.0, and Accelerated Graphics Port Memory Performance Specification, Rev 1.0 (4/12/96).

The Host Bridge supports only a synchronous AGP interface, coupling to the host bus frequency. The AGP characteristics are described in detail in the section “Accelerated Graphics Port (AGP) Controller” in this chapter.

Main Memory Controller

Because the HP VISUALIZE Personal Workstation is equipped with a 100 MHz front-side bus, it therefore uses 100 MHz SDRAM memory modules.

The main memory controller supports three DIMM slots. There are three 168-pin DIMM slots on the system board for installing main memory: slots A, C and D (slot B is not available). Each slot can host a registered or non-buffered SDRAM memory module.

The Host Bridge integrates a main memory controller that supports a 64-bit main memory interface. The DRAM controller supports the following features:

- 100 MHz, 800 MB/sec bandwidth. CAS Latency 2 (CL2) SDRAM ECC DIMM memory modules.
- CL2 technology. This new memory technology reduces memory access time by 1 clock cycle compared to the regular CL3 technology. Using Registered SDRAM memory modules, the HP VISUALIZE Personal Workstation can support a capacity of 768 MB (3 x 256 MB).

NOTE However, it should be noted that non-buffered and registered and ECC memory modules are not compatible with each other, and cannot be mixed.

The Intel 440BX AGP set also provides DIMM plug-and-play support via the Serial

Presence Detect (SPD) mechanism using the SMBus interface. The Host Bridge provides optional data integrity features including ECC in the memory array. During reads from DRAM, the Host Bridge provides error checking and correction of the data. The Host Bridge supports multiple-bit error detection and single-bit error correction when the ECC mode is enabled and single/multi-bit error detection when correction is disabled. During writes to the DRAM, the Host Bridge generates ECC for the data on a QWord basis. Partial QWord writes require a read-modify-write cycle when ECC is enabled.

The memory bus is 72-bits wide, comprised of 64 bits of data and 8 bits of ECC. Refer to the section “Main Memory Bus” in this chapter for more details on the main memory.

Read/Write Buffers

The Host Bridge defines a data buffering scheme to support the required level of concurrent operations and provide adequate sustained bandwidth between the DRAM subsystem and all other system interfaces (CPU, AGP and PCI).

System Clocking

The Host Bridge operates the host interface at 66 MHz or 100 MHz, PCI at 33 MHz and AGP at 66/133 MHz. Coupling between all interfaces and internal logic is done in a synchronous manner.

The Host Bridge is not designed to support host bus frequencies lower than 66 MHz. The clocking scheme uses an external clock synthesizer (which produces reference clocks for the host, AGP and PCI interfaces).

I/O APIC

I/O APIC is used to support dual processors as well as enhanced interrupt processing in the single processor environment. The Host Bridge supports an external status output that can be used to control synchronization of interrupts in configurations that use PIIX4E with stand-alone I/O APIC components.

The PIIX4E, PCI/ISA Bridge Chip (82371EB)

The universal host controller interface (UHCI) chip, known as PIIX4E, is encapsulated in a Ball Grid Array (BGA) package.

The PIIX4E chip is a multi-function PCI device implementing a PCI-to-ISA bridge function, a PCI IDE function, a Universal Bus host/hub function, and an Enhanced Power Management function.

PIIX4E (82371EB)

Table 2-3. PIIX4E (82371EB)

Feature	Feature
Multifunction PCI to ISA Bridge, supports • PCI at 30 MHz and 33 MHz. • PCI Rev 2.1 Specification. • Full ISA or Extended I/O (EIO) Bus. • Full Positive Decode or Subtractive Decode of PCI. • ISA and EIO at of PCI Frequency.	**Enhanced DMA Controller** • Two 82C37 DMA controllers. • Supports PCI DMA with 3 PC/PCI Channels and Distributed DMA Protocols (simultaneously). • Fast Type-F DMA for reduced PCI Bus usage.
Supports both Mobile and Desktop Deep Green Environments • 3.3V Operation with 5V Tolerant Buffers. • Ultra-low Power for Mobile Environments Support. • Power-On Suspend, Suspend to RAM, Suspend to Disk, and Soft-Off System States. • All Registers Readable and Restorable for Proper Resume from 0.V Suspend.	**Interrupt Controller Based on TWo 82C59** • 15 Interrupt support. • Independently programmable for Edge/Level sensitivity. • Supports Optional I/O APIC. • Serial Interrupt Input.
Power Management Logic • Global and Local Device Management. • Suspend and Resume Logic. • Supports Thermal Alarm. • Support for external microcontroller. • Full support for Advanced Configuration and Power Interface (ACPI) Revision 1.0 specification, and OS Directed Power Management.	**USB** • Two USB 1.0 Ports for Serial transfers at 12 or 1.5 Mbit/sec. • Supports Legacy Keyboard and Mouse Software with USB-based Keyboard and Mouse. • Supports UHCI Design Guide.

Table 2-3. PIIX4E (82371EB)

Feature	Feature
Integrated IDE Controller • Independent Timing of up to four drives. • PIO Mode 4 and Bus Master IDE transfers up to 14 Mbytes/sec. • Supports "Ultra DMA/33" Synchronous DMA Mode transfers up to 33 Mbytes/sec. • Integrated 16 x 32-bit buffer for IDE PCI Burst transfers. • Supports Glue-less "Swap-Bay". • Option with Full Electrical Isolation.	**Real Time Clock** • 256-byte battery-backed up CMOS SRAM. • Includes Date Alarm. • Two 8-byte Lockout Ranges.
Timers Based on 82C54 • System Timer, Refresh Request, Speaker Tone Output.	**SMBus** • Host Interface allows CPU to communicate via SMBus. • Slave interface allows external SMBus Master to control Resume Events.
324 mBGA Package.	

PCI to ISA/EIO Bridge

PIIX4E compatible with the PCI Rev. 2.1 specification, as well as the IEEE 996 specification for the ISA (AT) bus. On PCI, PIIX4E operates as a master for various internal modules, such as the USB controller, DMA controller, IDE bus master controller, distributed DMA masters, and on behalf of ISA masters. PIIX4E operates as a slave for its internal registers or for cycles that are passed to the ISA or EIO buses.

ISA Bus Interface

As well as accepting cycles from the PCI bus interface, and translating them for the ISA bus, the ISA bus interface also requests the PCI master bridge to generate PCI cycles on behalf of a DMA or ISA master. The ISA bus interface contains a standard ISA bus controller and data buffering logic. Refer to the section "Devices on the ISA Bus" in this chapter for a description of the devices on the ISA Bus.

SMBus Controller

The System Management (SM) bus is a two-wire serial bus provided by the PIIX4E controller. It runs at a maximum of 16 kHz. The SMBus Host interface allows the CPU to communicate with SMBus slaves and an SMBus Slave interface that allows external masters to activate power management events. The bus also monitors some of the hardware functions of the main board, both during boot-up and run-time. All accesses to the bus are handled by the main processor, via the PIIX4E SMBus registers. Refer to the section "Devices on the SMBus for a description of the devices on the SMBus.

IDE Controller

The PCI master/slave IDE controller (Bus Master capability and synchronous DMA mode), supporting four devices, two on each of the two channels, is described in the section “Devices on the PCI Bus” in this chapter.

Enhanced USB Controller

The USB (Universal Serial Bus) controller provides support for the Universal Host Controller Interface (UHCI). This includes support that allows legacy software to use a USB-based keyboard and mouse. The USB supports two stacked connectors on the back panel. These ports are built into the PIIX4E controller, as standard USB ports. The USB is described in detail in the section “Universal Serial Bus (USB) Controller” in this chapter.

Ultra DMA Controller

The seven-channel DMA controller incorporates the functionality of two 82C37 DMA controllers. Channels 0 to 3 are for 8-bit DMA devices, while channels 5 to 7 are for 16-bit devices (refer to the section “DMA Channel Controllers” in the chapter “HP BIOS”). The channels can be programmed for any of the four transfer modes: the three active modes (single, demand, block) can perform three different types of transfer: read, write and verify. The address generation circuitry supports a 24-bit address for DMA devices.

Interrupt Controller

Based on two 82C59 interrupt controllers. The two interrupt controllers are cascaded so that 14 external and two internal interrupts are possible. In addition, PIIX4E supports a serial interrupt scheme. It also supports the onboard I/O APIC controller 82093AA. A table in the section “Interrupt Controllers” in the chapter “HP BIOS” shows how the master and slave controllers are connected.

Counter / Timer

The chip contains a three-channel 82C54 counter/timer. Three counters are combined to provide the system timer function, refresh request, and speaker tone. The counters use a division of the 14.318 MHz OSC input as the clock source.

Serial EEPROM

This is the non-volatile memory which holds the values for the Setup program (they are no longer stored in the CMOS memory). The Serial EEPROM is described in the section “Serial EEPROM” in this chapter.

Devices on the Processor-Local Bus

The Processor-Local (PL) bus of the Pentium III processors, also referred to as their FSB (Front Side Bus), is implemented in the GTL+ technology. This technology features open-drain signal drivers that are pulled-up to 1.5 V through 56 ohm resistors on both ends of the bus; these resistors also act as bus terminators, and are integrated in the Pentium III processors. If only one processor is installed, a terminating board must be installed in the second processor slot.

NOTE When aPentium III processor is inserted in the second processor slot, the Voltage Regulator Module (VRM) must always be installed in the corresponding VRM slot.

The supported operating frequencies of the GTL+ bus are 66 MHz and 100 MHz. The width of the data bus is 64 bits, while the width of the address is 32 bits.

The control signals of the PL bus allow the implementation of a *"split -transaction"* bus protocol. This allows the Pentium III processor to send its request (for example, for the contents of a given memory address) and then to release the bus, rather than waiting for the result, thereby allowing it to accept another request. The Intel 440BX, as target device, then requests the bus again when it is ready to respond, and sends the requested data packet. Up to four transactions are allowed to be outstanding at any given time.

Intel Pentium III Microprocessor

The Pentium III processor has several high-performance features that enhance performance:

- For the "Katmai" processor (P450, P500, P550, P600) --- dual independent bus architecture, which combines a dedicated 64-bit L2 cache bus (supporting a 512K cache), plus a 64-bit system bus with ECC that enables multiple simultaneous transactions (see "split -transaction" above).

  For the "Coppermine" processor (P600c, P650c, P700c) --- an integrated L2 cache (256k), plus a 64-bit system bus with ECC that enables multiple simultaneous transactions (see "split -transaction" above).

- Intel MMX technology, which gives higher performance for media, communications and 3D applications.
- Dynamic execution to speed up software performance.

The Pentium III processor and cache memory are packaged in a self-contained Single Edge Contact (SECC(2)) cartridge installed in a socket on the system board. This processor is really a daughter card sealed inside a pre-protective housing. The SECC(2) cartridge requires a 242-contact Slot 1 on the system board. It includes a processor chip, and GTL termination resistors.

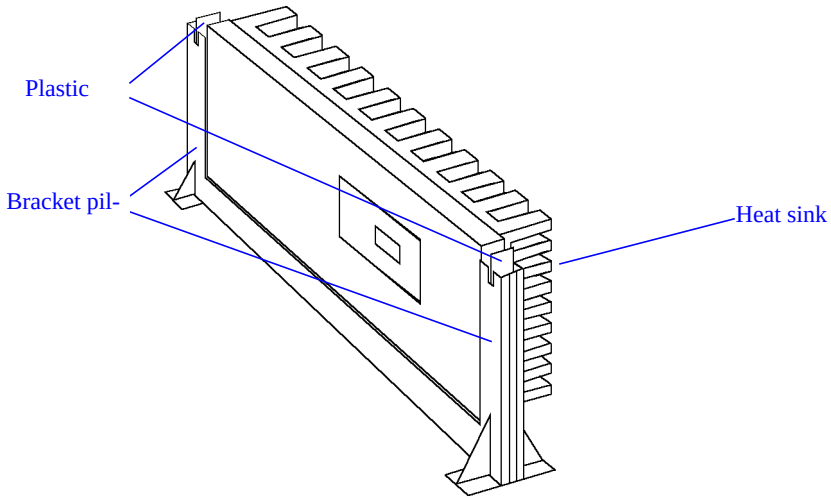
The heat-sink is supplied with the processor, and is bolted to it by the manufacturer. The

module is held in place by a bracket. There are two plastic clips, one on the top of each pillar of the bracket, to hold the processor module in place.

To remove the old processor module:

1. Press the two plastic clips towards each other.
2. Carefully pull the processor module away from its connector on the system board.

Only upgrades, pin compatible with the original processor, manufactured by Intel, are supported.



Bus Frequencies

There is a 14.318 MHz crystal oscillator on the system board. This frequency is multiplied to 100 MHz by a phase-locked loop. This is further scaled by an internal clock multiplier within the processor.

The Processor-Local Bus frequency is automatically set by the processor that is installed on the system board. Clock multiplier ratios, which determine the processor frequency, are hard-coded in all HP VISUALIZE processors. These processors should ignore the settings on switches 3, 4, and 5.

NOTE Switches 3, 4, and 5 are only used to set clock multiplier ratios for processors that do not have hard-coding for frequency. The following table is provided for troubleshooting purposes only.

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Table 2-4. Switch Settings for Bus Frequencies

Processor Frequency	Switch		Processor Local Bus Frequency	PCI Bus Frequency	ISA Bus Frequency	Switch[1]			Frequency Ratio Processor: Local Bus
	1	2				3	4	5	
450 MHz	**Up**	**Up**	100 MHz	33 MHz	8.33 MHz	Down	Up	Down	**4.5 : 1**
500 MHz	**Up**	**Up**	100 MHz	33 MHz	8.33 MHz	Down	Down	Up	**5.5: 1**
550 MHz	**Up**	**Up**	100 MHz	33 MHz	8.33 MHz	Down	Down	Down	**5.5: 1**
600 MHz	**Up**	**Down**	100 MHz	33 MHz	8.33 MHz	Up	Up	Up	**6: 1**
650 MHz	**Up**	**Down**	100 MHz	33 MHz	8.33 MHz	Up	Up	Down	**6.5: 1**
700 MHz	**Up**	**Down**	100 MHz	33 MHz	8.33 MHz	Up	Down	Up	**7: 1**

1. Switches are provided to match the system board to processor frequency when a system board repair is performed.

The computer may execute erratically, if at all, or may overheat, if it is configured to operate at a higher processor speed than the processor is capable of supporting. This can cause damage to the computer.

Setting the switches to operate at a slower speed than the processor is capable of supporting, may cause erratic behavior in some cases, and reduce the instruction throughput in others.

Cache Memory

There are two integrated circuits sealed within a single Pentium III “Katmai” package (P450, P500, P550, P600). One of these contains the Level-2 (L2) cache memory chip; the other contains the processor. The Pentium III “Coppermine” package (P600c, P650c, P700c) has the processor and L2 cache sealed on a single integrated circuit. The processor component in both “Katmai” and “Coppermine” includes Level-1 (L1) cache memory.

The L1 cache memory has a total capacity of 32KB (16 KB data, 16 KB instructions). The L2 cache memory has a capacity of 512 KB (“Katmai”) or 256KB (“Coppermine”). The amount of cache memory is set by Intel at the time of manufacture, and cannot be changed.

Optional Second Microprocessor

The HP VISUALIZE Personal Workstation has dual processing capability. However, not all operating systems support a second processor and, for those that do, the result is not always an increase in system performance. Installing a second processor is only advantageous when the software can make use of parallel activity. In particular, you need to be running a multi-threaded operating system that supports multiprocessing (one that is MPS-ready), such as Windows NT. The Windows NT operating system makes the best use of the Pentium III's 32-bit architecture (though other operating systems will also show some benefit if 32-bit application programs are run). The following table summarizes the supported operating systems:

Table 2-5. Summary of Supported Operating Systems

	Windows NT 4.0 (or greater)	Windows 95
Multi-threaded	Yes	Yes
MPS-ready	Yes	No
32-bit operating system	Yes	Partial[1]
32-bit applications available	Yes	Yes

1. 32-bit operation at the outermost levels, but only 16-bit working internally.

The two processors must be operating at the same processor speed, and both, or neither, must support the processor internal ECC functionality.

Configuring Setup for Multi-Processing

The HP VISUALIZE Personal Workstation supports Symmetric Multi-Processing (SMP). When adding a second processor, it must be made sure that: (a) the "multi-processing" choice has been made in the system Setup; (b) the operating system supports multi-processors.

In the case of Windows NT, it might be necessary to perform an upgrade from the MPS uniprocessor to the MPS multi-processor version.

NOTE The system Setup allows a choice between "mono or multi-processing" operations. The "mono-processing" mode has been implemented in order to support operating systems that rely on the "legacy" interrupt controller 82C59 and are not aware of I/O APIC controller 820093AA operation. Refer to the section "Interrupt Controllers" in the chapter "HP BIOS" for further details.

Main Memory Bus

The memory bus is 72-bits wide, comprised of 64 bits of data and 8 bits of ECC. It is connected to the Main Memory and to the Host Bridge (Intel 440BX) chip.

HP VISUALIZE Personal Workstation is equipped with a 100 MHz front side bus, and therefore uses 100 MHz SDRAM memory. It is also one of the first systems on the market to use CAS Latency 2 SDRAM memory technology, which offers faster data access times compared with the CAS Latency 3. CAS Latency 2 memory performs a burst transfer in 9+1+1+1=12 clock cycles, whereas for CAS Latency 3 the figure is 9+1+1+1+1=13 cycles. The theoretical performance gain is therefore 9%. This is achieved by the shorter latency period.

HP VISUALIZE Personal Workstation models also support another new memory technology called Registered SDRAM. A Registered SDRAM uses the same technology as 66 MHz SDRAMs but runs 50% faster. Using this technology, the HP VISUALIZE Personal Workstation can support up to 768 MB (3 x 256 MB of Registered ECC SDRAM) memory modules. By installing Non-buffered or Non-ECC SDRAM memory modules, a capacity of 384 MB (3 x 128 MB) can be obtained.

The technology of the memory bus of Registered SDRAM is similar to the conventional technology, but the addressing capabilities of the bus have been extended. The extra address and control signals from the bus are temporarily stored in registers on the memory modules. They are then combined with the normal addressing information to identify the memory cells. This means a larger amount of memory can be addressed on each module.

All HP VISUALIZE Personal Workstation models are supplied with one memory module (either 32 MB or 64 MB non-ECC SDRAM) in one of the three DIMM slots, leaving the other slots free for memory upgrades. Refer to the section “DIMM Sockets” in this chapter for information about the DIMM sockets.

NOTE Non-buffered and registered and ECC memory modules are not compatible with each other, and cannot be mixed.

Mixing Memory Modules

Non-buffered and registered ECC modules are not compatible with each other, and cannot be mixed. If they have been mixed, this will be detected in the basic pre-boot tests when you boot the system for the first time. The BIOS checks that the inserted DIMMs are compatible with one another and, if it detects an error, reports it to MaxiLife. The error message (shown below) will then be displayed on the LCD status panel.

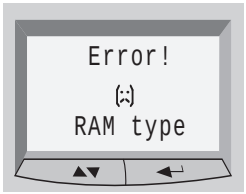


Table 2-6. Memory Comparison

Memory Comparison	Non-ECC	ECC Non-Buffered	256 MB Registered
Any Non-ECC	Y	Y[1]	N
Any ECC Non-Buffered	Y1	Y1	N
256 MB Buffered	N	N	Y

1. All DIMMs will function as Non-ECC.

Error Correcting Code Operation

The error correcting code (ECC) memory of the HP VISUALIZE Personal Workstation allows any single-bit error that occurs in any 72-bit line of memory (64 data bits plus 8 parity bits) to be corrected (automatically and transparently) by the Host Bridge.

The ECC detects single- and dual-bit errors. It can correct single bit errors during SDRAM reads. The corrected data is transmitted to the requester (PCI or CPU) but not written back to the SDRAM. A double-bit error would cause an NMI to be generated, and the Personal Workstation to be halted.

If more bits are faulty within any given 72-bit line, the effect is the same as it would have been without error correction. The effect of executing a faulty instruction is always unpredictable, and might cause the program to 'hang'. The effect of reading a faulty data word is often similarly unpredictable, but can sometimes be tolerated (for instance, it might merely appear as a corrupted pixel on a video display).

Devices on the PCI Bus

Table 2-7. PCI Bus Devices

PCI Device	Device Name	Device Number	Function	AD[xx]	Chip-set Interrupt Connection			
					INTA	INTB	INTC	INTD
PL/PCI bridge	Intel 440BX	0	N/A	N/A	—	—	—	—
Virtual PCI-to-PCI bridge (AGP)	Intel 440BX	1	N/A	N/A	—	—	—	—
PCI/ISA bridge	PIIX4E	7	0	N/A	—	—	—	—
IDE controller			1		—	—	—	—
USB Host controller			2		—	—	—	—
Power Management and SMBus			3		—	—	—	—
PCI slot #1	J57	16	0-7	17	B	C	D	A
PCI slot #2	J58	17	0-7	18	C	D	A	B
PCI slot #3	J59	13	0-7	19	A	B	C	D
PCI slot #4	J60	19	0-7	20	B	C	D	A

The distribution of the interrupt lines is described more fully in the section “PCI Interrupt Request Lines” in the chapter “HP BIOS.”

Integrated Drive Electronics (IDE)

The IDE controller is implemented as part of the PIIX4E chip (the PCI/ISA bridge). It is driven from the PCI bus, and has PCI-Master capability. It supports Enhanced IDE (EIDE) and Standard IDE. To use the Enhanced IDE features the drives must be compliant with Enhanced IDE.

The IDE controller supports two devices (one master and one slave) connected to a single channel. The channel is fitted with an IDE cable with two connectors. HP VISUALIZE Personal Workstations include two IDE connectors (IDE 1 and IDE 2) giving a total of four possible IDE devices. Refer to the section “System Board Overview” in this chapter for their position on the system board.

It is possible to mix a fast and a slow device, such as a hard disk drive and a a CD-ROM, on the same channel without affecting the performance of the fast device. The BIOS automatically determines, the fastest configuration that each device supports. However, in general, the IDE cable is recommended for CD-ROM drives, and the SCSI cables for hard disk drives.

Universal Serial Bus (USB) Controller

The USB controller is implemented as part of the PIIX4E chip. It is accessed through the PCI bus, and provides support for the two stacked USB connectors on the back panel. Over-current detection and protection is provided, but shared between the two ports.

Because the AGP connector defines a USB connection, it is possible to redirect one of the two USB ports to the AGP connector. In this case, the second external USB port is disabled.

USB works only if the USB interface has been enabled within the HP Setup program. Currently, only the Microsoft Windows 95 and Windows NT operating systems provide support for the USB.

The Microsoft Supplement 2.1 software (called USBSupp.exe), which provides support for the Universal Serial Bus, can be obtained from the Hewlett-Packard World Wide Web site (refer to the section “Access HP World Wide Web Site” in the chapter “System Overview”).

Other PCI Accessory Devices

PCI accessory boards are for high-speed peripheral accessories. A network board could already occupy one of the PCI slots. A diagram showing the PCI slots that are available for the minitower models is in the section “Accessory Board Slots” in this chapter.

Plug and Play

The HP VISUALIZE Personal Workstation has a “PnP level 1.0A” BIOS and meets the “Windows 95 Required” level for Plug and Play. Accessory boards which are Plug and Play are automatically configured by the BIOS.

Accelerated Graphics Port (AGP) Controller

The AGP technology was developed as a means to access system memory as a viable alternative to augmenting the memory of the graphics subsystem to meet the needs of high quality 3D graphics applications. All models of HP VISUALIZE Personal Workstation support an AGP (Accelerated Graphics Port) device.

The AGP bus is based upon a 66 MHz, 32 Bit PCI bus architecture, to which several signal groups have been added. These additional signals make it possible to implement the following AGP-specific control and transfer mechanisms:

- Pipelining and sideband addressing. These control mechanisms increase the bus efficiency in relation to the PCI protocol.
- Double clocking (2x mode). This is a transfer mechanism that doubles the peak transfer rate to 528 MB/s, as two 32-Bit words are transferred in each clock period (2 x 32 bits x 66 MHz).

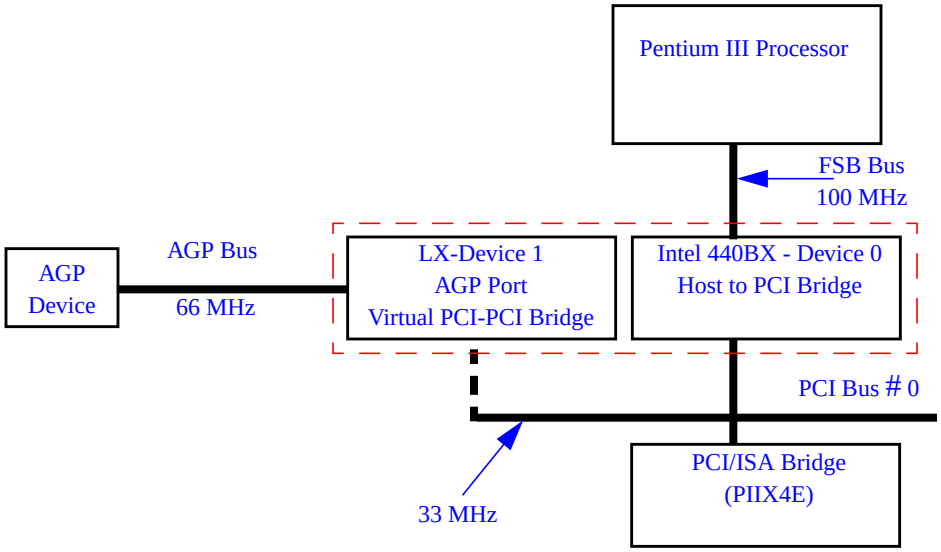
AGP specific transactions always use pipelining. The other two mechanisms can combine independently to pipelining, which leads to the following operating modes:

- FRAME based AGP. Only the PCI protocol is used: 66 MHz, 32 Bits, 3.3V, 264 MB/s peak transfer rate.
- 1 X AGP with pipelining, sideband addressing can be added: 66 MHz, 32 Bits, 3.3V, increased bus efficiency, 264 MB/s peak transfer rate.
- 2 X AGP with pipelining, sideband addressing can be added: 66 MHz double clocked, 32 Bits, 3.3V, increased bus efficiency, 528 MB/s peak transfer rate.

AGP PCI Bus Implementation

In the diagram below, the AGP bus is viewed as a PCI bus with extra data lines.

Figure 2-1. AGP PCI Bus Implementation



Devices on the SMBus

The SMBus is a subset of the I^2C bus. It is a two-wired serial bus which runs at a maximum speed of 400 kHz. It is used to monitor some of the hardware functions of the system board, (such as voltage levels, temperature, fan speed, DIMM presence and type) both at system boot and during normal run-time. It is controlled by the SMBus controller located in the PIIX4E chip.

Table 2-8. Devices on the SMBus

Device	SMBus Address
PIIX4E SMBus Master	10
Serial EEPROM	A8
LM75	90, 92
MaxiLife ASIC	28
SDRAM slot A1	A0
SDRAM slot B1	A4
SDRAM slot B2	A6
PLL	D2

The following devices are connected to the SMBus:

- PIIX4E SMBus Master Controller 16 kHz maximum.
- DIMM sockets.
- SDRAM clock buffer.
- Serial EEPROM.
- Two LM75 temperature sensors.
- MaxiLife for hardware management, bus master controller 400 kHz maximum.
- LCD status panel.

An isolation mechanism is implemented, so that the LM 75 chips, MaxiLife monitoring chip, and the Serial EEPROM can be accessed even when the computer is turned off. These devices are powered through Vcc standby. A debug SMBus connector is also provided on the system board for debug purposes. The PIIX4E and MaxiLife are the two master devices.

PIIX4E SMBus Master Controller

The PIIX4E chip provides an intelligent processor-to-SMBus controller. All access is handled by the processor, through the PIIX4E SMBus interface. Typically, the processor has access to all the devices connected to the SMBus.

DIMM Sockets

Each DIMM socket is connected to the SMBus. The 168-pin DIMM modules used on the HP VISUALIZE Personal Workstation include a 256 byte I2C Serial EEPROM. The first 128 bytes contain general information, including DRAM chips manufacturer, DIMM speed rating, DIMM type, etc. The second 128 bytes of the Serial EEPROM can be used to store data online. This will be used to store such information as ECC errors and possibly some manufacturing related data (date module built or first installed, etc).

SDRAM Clock Buffer

The I2C port of the SDRAM clock buffer is connected to the SMBus. It can be used to stop the unused clocks.

Serial EEPROM

This is the non-volatile memory which holds the default values for the CMOS memory (in the event of battery failure).

When installing a new system board, the Serial EEPROM will have a blank serial number field. This will be detected automatically by the BIOS, which will then prompt the user for the serial number which is printed on the identification label on the back of the Personal Workstation.

The computer uses 8 KBytes of Serial EEPROM implemented within a single chip. Serial EEPROM is ROM in which one byte at a time can be returned to its unprogrammed state by the application of appropriate electrical signals. In effect, it can be made to behave like very slow, non-volatile RAM. It is used for storing the tatoo string, the serial number, and the parameter settings for the Setup program and also MaxiLife firmware.

LM75 Chip

The LM75 chip is a temperature sensor and alarm located on the system board. It is used to measure the temperature in two areas of the Personal Workstation, and to send an alarm to the processor in case of overheating.

Main PLL

The registers of the main PLL are accessed through the SMBus. These registers control the PLL clock signal outputs and are write-only.

WARNING **Writing over the SMBus may be destructive to the PC Workstation, as it allows access to information necessary to the System BIOS, without which the system will not run.**

HP MaxiLife Utility

MaxiLife is a hardware monitoring chip which is resident on the system board. Its responsibility includes On/Off and reset control, status panel management (Lock button,

LEDs), hardware monitoring (temperature and voltage), early diagnostics (CPU, DIMMs, PLLs, boot start), run-time diagnostics (CPU errors, package intrusions), and other miscellaneous functions (such as special OK/FAIL symbols based on a smiling face).

The integrated microprocessor includes a Synopsys cell based on Dallas “8052” equivalent, a 2 KB boot ROM, 256 bytes of data RAM, an I2C cell, an Analog-to-Digital (ADC) with 5 entries, and an additional glue logic for interrupt control, fan regulation, and a status panel control.

MaxiLife downloads its code in 96 milliseconds from an I2C serial EEPROM. The total firmware (MaxiLife 8051-code, running in RAM) size is 5 KB. As it exceeds the 2 KB program RAM space, a paging mechanism will swap code as it is required, based on a 512 byte buffer. The first 2 KB pages of firmware code is critical because it controls the initial power
on/reset to boot the system. This initial page is checked with a null-checksum test and the presence of MaxiLife markers (located just below the 2 KB limit).

If the boot block has been corrupted, the Firmware can start from its ‘crisis’ block. To do this, set the System board switch 10 to the Closed position.

MaxiLife is partially replacing HP ASIC (Little Ben), and provides the necessary hardware monitoring control. However, MaxiLife is not accessible in I/O space or memory space of the system platform, but only through the SMBUS (which is a sub-set of the I2C bus), via the PCI/ISA chipset (PIIX4E South Bridge). Its I2C cell may operate either in Slave or Master mode, switched by firmware, or automatically in case of ‘Arbitration’ loss.

As a monitoring chip, MaxiLife reports critical errors at start-up, and as such is powered by Vstandby (3.3V) power. For MaxiLife to work correctly, the PC Workstation must always be connected to a grounded outlet. This enables the Personal Workstation’s hardware monitoring chip to be active, even if the system has been powered off.

Test Sequence and Error Messages

Refer to the section “MaxiLife Test Sequence and Error Messages” in the chapter “Tests and Error Messages” for detailed information about the different test sequences and error messages.

MaxiLife Architecture

The MaxiLife chip continuously monitors temperature and voltage sensors located in critical regions on the system board. This chip receives data about the various system components via a dedicated I2C bus, which is a reliable communications bus to control the integrated circuit boards.

The LCD Menu

To access the LCD main menu, press one of the LCD keys. This menu is composed of several menu items which are displayed two at a time on the LCD screen. The following menus are available:

- System Info. Obtains information from the BIOS and the system's Serial EEPROM from a previously successful boot. This information includes: product name, BIOS version, serial number, the number of processors and speed, size of memory for each DIMM socket. The BIOS logs information in the serial EEPROM with SYSINFO.COM at the end of the boot.
- Boot Steps. Shows the Power-On Self Test (POST) codes during the system start-up. The POST code is provided by the BIOS and is displayed on the LCD panel as soon as it is available. If the system stops during the start-up, the last successful boot step POST code is displayed on the LCD.

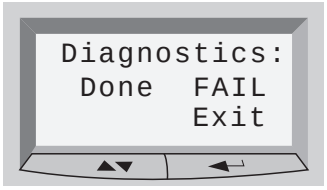
- Diagnostics. Runs a set of diagnostics assessing the system's components (CPU presence, CPU power errors, power supply, clocks, and DIMM presence). To view the test results for each system component, press ▼▲ button. If no errors are detected, a screen will display a smiling face. If an error is detected, an error screen appears indicating the problem.

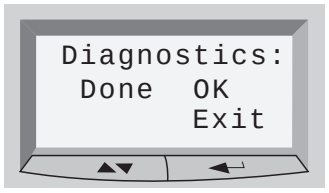
Using MaxiLife When the Computer Is Powered Off

NOTE For MaxiLife to work correctly, the Personal Workstation must always be connected to a grounded outlet.

Even if the computer is powered off (the LCD status panel will be blank), MaxiLife is still running and monitoring the state of the LCD buttons. From this state, the diagnostics program can be run by pressing one of these buttons. When the `Power on` option is selected, the main power supply is started, enabling the hardware monitoring chip to access the status of the computer's components. Although the main power supply has been started, the computer does not continue to complete a normal boot.

The system components are tested in sequence (press the Next button to move on to the following test). When the diagnostics tests are complete, one of the following screens will be displayed:





If no errors are detected, you can exit the test session, and the main power supply will be turned off and the LCD status panel will become blank.

If an error is detected, a short message is displayed on the LCD status panel describing the type of error (memory, processor) that occurred. For example, the message `DIMM FOUND: 0` would be displayed if no memory modules could be located. You can then choose whether to continue viewing the results of the remaining tests.

NOTE If the Diags program is run when the system is off, it returns to the Off state when exiting the test session. On/Off transitions are accompanied with a 'Please wait' screen to allow MaxiLife to power on and off correctly.

Devices on the ISA Bus

Table 2-9. Devices on the ISA Bus

ISA Device	Index	Data
Ultra I/O	2Eh	2Fh

The Super I/O Controller (NS 82317)

The Ultra I/O chip (NS 82317) provides the control for two FDD devices, one serial port and one bidirectional multi-mode parallel port.

Serial / Parallel Communications Ports

The 9-pin serial ports (whose pin layouts are shown in the section “Socket Pin Layouts for Minitower Models” in the chapter “Interface Devices and Mass-Storage Drives”) supports RS-232-C and are buffered by 16550A UARTs, with 16-Byte FIFOs. They can be programmed as COM1, COM2, COM3, COM4, or disabled.

The 25-pin parallel port (also shown in the section “Socket Pin Layouts for Minitower Models” in the chapter “Interface Devices and Mass-Storage Drives”) is Centronics compatible, supporting IEEE 1284. It can be programmed as LPT1, LPT2, or disabled. It can operate in the four following modes:

- ❏ Standard mode (PC/XT, PC/AT, and PS/2 compatible).
- ❏ Bidirectional mode (PC/XT, PC/AT, and PS/2 compatible).
- ❏ Enhanced mode (enhanced parallel port, EPP, compatible).
- ❏ High speed mode (MS/HP extended capabilities port, ECP, compatible).

FDC

The integrated flexible disk controller (FDC) supports any combination of two of the following: tape drives, 3.5-inch flexible disk drives, 5.25-inch flexible disk drives. It is software and register compatible with the 82077AA, and 100% IBM compatible. It has an A and B drive-swapping capability and a non-burst DMA option.

RTC

The real-time clock (RTC) is 146818A-compatible, with an accuracy of 20ppm (parts per million). The configuration RAM is implemented as 256 bytes of CMOS. The RTC operates on a 32.768 kHz crystal and a separate 3V lithium battery that provides up to 7 years of protection.

Keyboard and Mouse Controller

The computer has an 8042-based keyboard and mouse controller. The connector pin layouts are shown in the section “Socket Pin Layouts for Minitower Models” in the chapter “Interface Devices and Mass-Storage Drives.”

Audio Controller

The HP VISUALIZE Personal Workstation has an audio chip (AD1816) integrated on the system board. This single chip is a Plug and Play multimedia audio subsystem for concurrently processing multiple digital streams of 16-bit stereo audio.

Host Interface

The AD1816 audio chip contains all necessary ISA bus logic on chip. This logic includes address decoding for all onboard resources, control and signal interpretation, DMA selection and control logic, IRQ selection and control logic, and all interface configuration logic.

Audio Chip Specifications

The audio chip is driven from the ISA bus, and has the following specifications:

Table 2-10. Audio Chip Specifications

Feature:	Description:
Digitized Sounds	• 16-bit and 8-bit stereo sampling from 4 kHz to 55.2 kHz • Programmable sample rates with 1 Hz resolution • Hardware Full Duplex Conversion • 16-bit software-based real-time audio compression/decompression system
Music Synthesizer	• Integrated OPL3 compatible music synthesizer
Mixer	• AC'97 and MPC-3 audio mixer • Input mixing sources: microphone, LINE In, CD Audio, AUX Audio, and digitized sounds • Output mixing of all audio sources to the LINE Out or integrated PC Workstation speaker • Multiple source recording and Left/Right channels swapping or mixing
Line Input	• Input impedance: 15 kohms • Input range: 0 to 2 Vpp
Line Output	• Stereo output of 5 mW per channel with headphone speakers (impedance >600 ohms)
Audio Front Panel	• Microphone input jack • Stereo output jack • Master volume control potentiometer

Table 2-10. Audio Chip Specifications

Feature:	Description:
Microphone Input	• 20 dB gain preamplifier. The boost can be muted with software • 16-level programmable volume control • Input impedance: 600 ohms • Sensitivity: 30 mVpp to 200 mVpp
Stereo Out Jack	• Impedance: 32 ohms

The headphones jack and the stereo-out (audio) jack can be used interchangeably. The Windows 95 and Windows NT operating systems each have integrated drivers (Directions III).

Flash EEPROM

The Personal Workstation uses 512 KB of Flash EEPROM implemented using two 8-bit ROM chips of 256 KB each. Flash EEPROM is ROM in which the whole memory can be returned to its unprogrammed state by the application of appropriate electrical signals to its pins. It can then be reprogrammed with the latest upgrade firmware.

The System ROM contains the LAN boot firmware and the system BIOS (including the boot code, the ISA and PCI initialization, the Setup program and the Power-On Self-Test routines, video BIOS, and SCSI BIOS plus their error messages). These are summarized in Chapters 4 and 5.

The Flash EEPROMs on the HP VISUALIZE Personal Workstation implement a bootblock feature which allows recovery from a failed attempt at updating the System BIOS. The bootblock contains the minimum system BIOS information necessary to reprogram the Flash EEPROM.

System Board Switches

The Processor-Local Bus frequency is automatically set by the processor that is installed on the system board. Clock multiplier ratios, which determine the processor frequency, are hard-coded in all HP VISUALIZE processors. These processors should ignore the settings on switches 3, 4, and 5.

NOTE Switches 3, 4, and 5 are only used to set clock multiplier ratios for processors that do not have hard-coding for frequency. The following table is provided for troubleshooting.

Table 2-11. System Board Switches

Switch		Switch Function	Default
1	Up	Reserved - Do not use.	Up
2 - 5	-	Bus Frequencies (refer to the subsequent table).	-
6		Retain or clear the CMOS configuration stored in serial EEPROM:	
	Up	Retain CMOS configuration.	Up
	Down	Clear CMOS and reload default values in Setup.	
7		Enable or disable User and System Administrator Passwords stored in EEPROM:	
	Up	Enable passwords.	Up
	Down	Disable /Clear User and Administrator passwords.	
8		Keyboard power-on:	
	Up	Disable keyboard power-on.	Down
	Down	Enable keyboard power-on.	
9		Select PC Workstation package:	
	Up[1]	Minitower	N/A
	Down	Desktop	
10		Boot block:	
	Up	Disable crisis recovery. Normal operation	Up
	Down	Enable crisis recovery. Recovery boot active[2].	

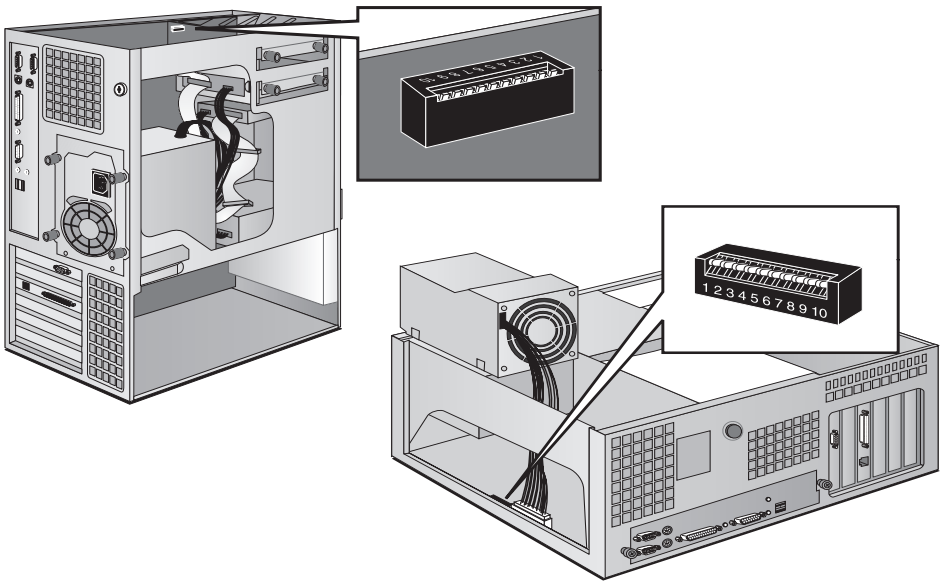
1. The default setting for this switch depends on whether it is for a desktop or minitower model.
2. Refer to the section “BIOS Update Crisis Recovery Procedure” in this chapter for the detailed recovery procedure.

Table 2-12. Switch Setting for the Bus Frequencies

Processor Frequency	Switch		Processor Local Bus Frequency	Switch[1]		
	1	2		3	4	5
450 MHz	Up	Up	100 MHz	Down	Up	Down
500 MHz	Up	Up	100 MHz	Down	Down	Up
550 MHz	Up	Up	100 MHz	Down	Down	Down
600 MHz	Up	Down	100 MHz	Up	Up	Up
650 MHz	Up	Down	100 MHz	Up	Up	Down
700 MHz	Up	Down	100 MHz	Up	Down	Up

1. Switches are provided to match the system board to processor frequency when a system board repair is performed.

The following diagrams show the position of the system board switches on the minitower models.



Other ISA Accessory Devices

ISA accessory boards are for slow peripheral accessories. A diagram showing the ISA slots that are available for the minitower models is shown in the section “Accessory Board Slots.”

Plug and Play

All PCI accessory boards are Plug and Play, although not all ISA boards are. Check the accessory board's documentation if you are unsure.

In general, in a Plug and Play configuration, resources for an ISA board have to be reserved first (using the Setup utility). Then you can plug in your board.

The procedure for installing an ISA accessory board that is not Plug and Play is described in the *User's Guide* that is supplied with the Personal Workstation.

NOTE The Windows NT 4.0 operating system is not Plug and Play. Information given above is only applicable for Plug and Play operating systems (for example, Windows 95).

BIOS Update Crisis Recovery Procedure

If, for example, during a BIOS update process, the procedure is interrupted by a power failure, and the system does not start, you can still recover the situation of a destroyed system BIOS. However, it should be noted that during the recovery procedure, there is no image on the screen, nor access to the keyboard or mouse (only "vital" devices that are required to boot on the floppy are initialized). Follow these steps to recover the BIOS:

- Ensure that you have created a DOS-bootable diskette. This floppy diskette contains all the recovery and system BIOS programming software (phlash.exe, platform.bin and hblxxxyy.Ful). Include the flash command in the autoexec.bat, for example: phlash /mode=3 HK1xyyzz.Ful

  H = HP Professional PC

  K = HP VISUALIZE Personal Workstation (Pentium III models)

  1 = Kayak family

  x = major revision

  yy = minor revision

  zz = language

- Turn off the computer. Set Switch 10 to the Closed position.
- Insert the DOS-bootable diskette.
- Power on the computer.
- During the recovery process, short beeps are emitted. The recover process is finished when there is a much longer beep (after approximately 1 to 2 minutes).
- Power off the computer. Press the power ON/OFF button (for about 5 seconds), until the ON/OFF light switches off. Set switch 10 to the Up position.

NOTE Setting Switch 10 to the Closed position also enables the MaxiLife firmware 'crisis' block if the power cord is unplugged (after approximately 10 seconds). In this case, the LCD status panel is not available and the screen is blank.

Updating the system ROM

The System ROM can be updated with the latest BIOS firmware. This can be downloaded from HP's World Wide Web site:

```
http://www.hp.com/go/visualizesupport
```

To download a BIOS upgrade, connect to the HP Web site and follow the on-screen instructions to download the flash utility programs.

Before updating the System ROM, it is necessary to disable the "PSWRD" switch on the system switches (SW-7), and to type in the System Administrator's Password when starting up the computer. The PCI and PnP information is erased in the process.

Do not switch off the computer until the system BIOS update procedure has completed, successfully or not, otherwise irrecoverable damage to the ROM may be caused. While updating the flash ROM, the power supply switch and the reset button are disabled to prevent accidental interruption of the flash programming process.

3 Interface Devices and Mass-Storage Drives

This chapter describes the integrated SCSI/LAN combo board, which is only used on XA-s desktop models, and the graphics and mass storage which are supplied with the computer. It also summarizes the pin connections on the internal and external connectors.

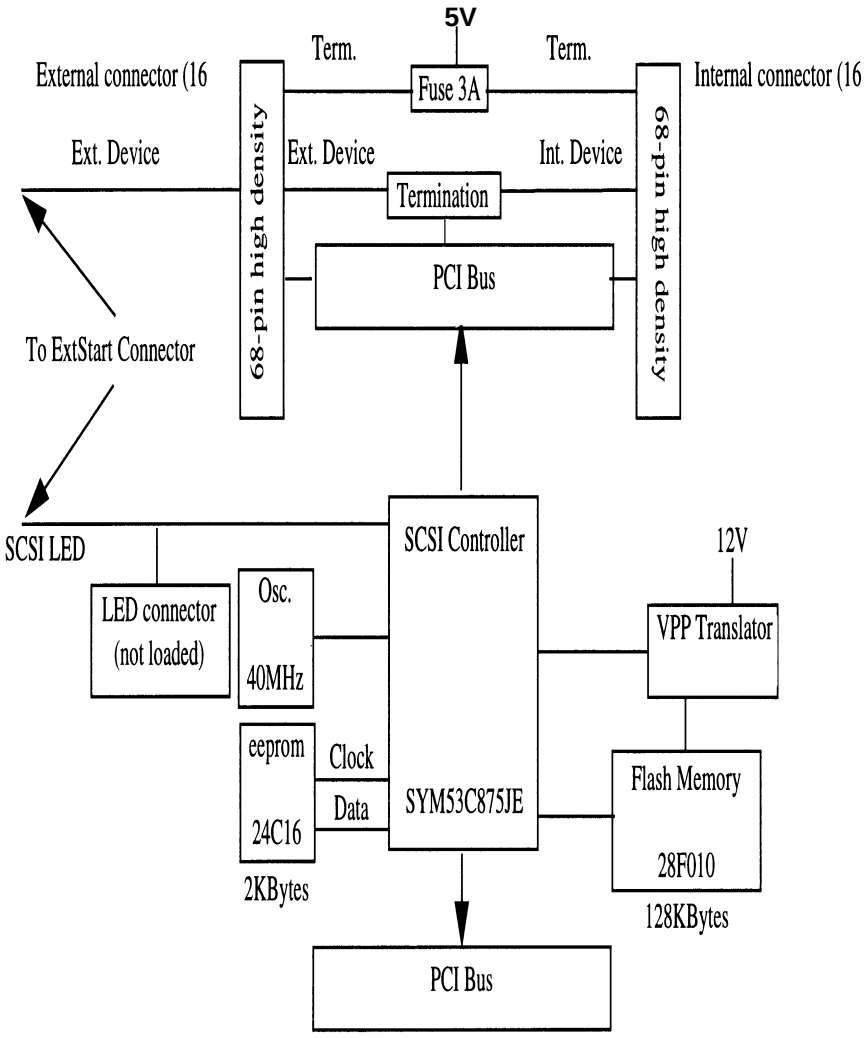
SCSI/LAN Combo Board

Certain HP VISUALIZE Personal Workstations are supplied with an integrated SCSI/10BT/100TX LAN combo board. Even though the SCSI/LAN combo board includes two controllers, only one PCI slot is necessary for installing this board.

The LAN and SCSI controllers access the PCI bus through a PCI bridge. The SCSI and PCI functionalities are contained within the Symbios Logic SYM53C875JE PCI-SCSI I/O Processor chip.

The following hardware functional diagram shows the SCSI part of the SCSI/LAN Combo board.

Figure 3-1. SCSI Part of the SCSI/LAN Combo Board



PCI Interface

The PCI interface operates as a 32-bit DMA bus master. The connection is made through the edge connector. The signal definitions and pin numbers conform to the PCI Local Bus Specification Revision 2.0 standard. The PCI interface conforms to the PCI universal signaling environment for a 5 volt PCI bus.

SCSI Interface

The Symbios Logic SYM5C875JE PCI-SCSI I/O Processor chip connects the SCSI bus directly and generates timing and protocol in compliance with the SCSI standard.

The SCSI interface operates as a 16-bit, synchronous or asynchronous, single-ended bus, and supports Ultra SCSI protocols and 16-bit arbitration. The interface is made through two (and only two) of the following connectors: J7, J3 and J4.

Table 3-1. SCSI Interface Connectors

Connector	Description	Location
J7	Shielded 68-pin high density right-angle receptacle.	Protrudes through the rear panel bracket.
J3	68-pin high density right-angle receptacle.	Internal connector at the end of the board.
J4	External Start, SCSI Led and External SCSI cable detection.	Internal connector at the bottom right-hand-side of the Combo card.

Ultra Wide (16-bit) SCSI Connector

The Ultra wide 16-bit SCSI connector is for internal devices and has an address range from 0 to 15, with the SCSI address 0 used by the first SCSI hard disk drive and SCSI address 7 reserved for the integrated SCSI controller (the default for wide and narrow SCSI devices).

Data is transferred at 40 MB per second on a 16-bit wide, single-ended bus. The controller is fitted with a 16-bit SCSI flat cable with four or five connectors, plus a SCSI termination device.

The internal SCSI connector on the SCSI/LAN combo board is wide, so that. to plug in a narrow cable, a specific wide-to-narrow SCSI converter must be used. This integrates data terminators on the higher data bus (8-bit - 15-bit) to provide a proper termination on the SCSI channel.

By default, the internal SCSI bus is configured to run in Ultra-SCSI mode (providing a maximum band-width of 40 MB/s). The user may configure the SCSI system using the SCSI Configuration Utility, included in the system BIOS. This utility is described in more detail in the section “Symbios Logic SCSI Configuration Utility” in the chapter “HP BIOS.”

SCSI-configured-automatically (SCAM) support is provided at level 2, for Plug and Play. However, hot swap is not supported. The controller is BBS compliant.

SCSI/PCI LAN Combo Board Features

Table 3-2. SCSI/PCI LAN Combo Board Features

Interface	Features
PCI Interface	Full 32-bit DMA bus master.
	Zero wait-state bus master data bursts.
	Universal PCI bus voltage support.
SCSI Interface	16-bit single ended.
	Automatically enabled active termination
	Fast and Ultra SCSI data transfer capability.
	SCSI TERMPWR source with auto-resetting circuit breaker
	SCAM (SCSI Configured AutoMatically).
	Serial NVRAM (Non-Volatile RAM) for configuration utility and SCAM.
	Flash BIOS.
	Fast and Ultra SCSI controlled by external SCSI cable detection. Ultra speed requires 1.5m maximum SCSI bus.

10BT/100TX LAN Controller

The embedded 10BT/100TX LAN controller supports the following standards: 100 Mbits per second over 2-pair, category-5, unshielded twisted pair (UTP), or shielded twisted pair (STP); 10 BaseT, 10 Mbits per second, ISO 8802-3 (IEEE 802.3 standard).

On the rear panel there is one RJ-45 connector. There is a LED which indicates the LAN connection status as follows:

- Off - when there is no Autonegotiation response (for example, when the LAN cable is not connected to the network HUB.
- Blinking - during Autonegotiation
- Green (ON) - the connection has passed the Autonegotiation and a link has been established between the LAN adapter and the network HUB/Switch.

The LAN adapter contains a connector to which an internal LAN cable may be connected to the external start connector on the system board, necessary for the use of the Remote Power On feature, described in detail in the *User's Guide* provided with the PC Workstation. The LAN adapter that uses the Remote Power On feature must be installed nearer the processors than any other supplementary LAN adapter card.

NOTE Refer to the *User's Guide* for details concerning system configuration changes necessary after installing a LAN adapter.

10BT/100TX LAN Features

Table 3-3. 10BT/100TX LAN Features

Feature:	Description:
LAN Controller	AMD PCNET-Fast chip
RJ45 Connector	10BT/100TX autonegotiation
Remote Boot	Protocols integrated in System BIOS
ExtStart Connector	• Connection to CPU board • LAN remote power on signals
Remote Power On	• Full remote power on with Magic Packet
Remote Wake Up	• Wake Up from Suspend state with Magic Packet

Remote Power On

Remote Power On (RPO) is available at 10 and 100 Mbits per second.

Vstandby Requirements for Supporting RPO

The Vstandby requirements for HP network cards supporting RPO, are:

A power supply able to deliver at least 250mA on Vstandby output. This is the case for all HP VISUALIZE systems.

Optional Bootrom Socket

It is possible to add a flash device on the network card socket with a specific LAN bootrom code. This new bootrom code will be seen and mapped automatically by the system BIOS instead of the embedded version (system BIOS).

NOTE At the time this TRM was produced, there was no flashing tool available to allow you to update the bootrom content in the flash on the LAN adapter. A flashing tool for any AMD-based card may be available, but in order to use this tool on HP cards, only `29fxxx` flash devices must be used. At present, no test has been carried out using this tool on HP cards.

Flash / ROM Devices

The 10BT/100TX card provides a PLCC 32-pin socket and any size of flash device can be used up to 256KB.

Installing Two LAN Remote Power On Cards

From a network standpoint, it is possible to install two LAN RPO cards, and both cards will be functional (for example, from the operating system, it will be possible to have two LAN cards up and running at the same time).

However, there are restrictions due to the remote manageability boot features implementation. To support these features, an internal cable is required between the LAN card and the system board. However, only one card can be attached to this cable, so that remote manageability features are supported on one card only.

The problem is that with current BIOS and hardware implementation it is not possible to identify to which card the cable is attached and this may result in having none of the remote capabilities working properly. Also, remote boot can only work on one card.

Therefore, if a customer wants to use two HP LAN cards without using HP LAN enhanced features (Remote boot, Remote power on), there is no problem. However, if there is a requirement to use the HP LAN-enhanced features, it is not possible, at the present time, to use the two LAN cards on one system.

Even though it is possible to install two LAN Remote Power On cards in the computer, only one card is seen by the operating system.

Mass-Storage Drives

The IDE controller is described in the section “Integrated Drive Electronics (IDE)” in the chapter “System Board.” The flexible disk controller is described in the section “FDC” in the chapter “System Board.”

Hard Disk Drives

The following table lists the 3.5-inch hard disk drives that are supplied on an internal shelf in some models only.

Table 3-4. Hard Disk Drives (3.5-Inch)

	6.5 GB Ultra-ATA 33 7.2k rpm	9.1 GB UW-SCSI 10K rpm
HP part number	A5024-69001	A5025-69001
Manufacturer		Seagate
Product name		Cheetah 9LP
Average seek time	9.5/10.5 ms	5.4 ms
Revolutions per minute (RPM)	7200	10000
Average Latency	4.17 ms	0.98 ms
Maximum internal transfer rate	33 MB/s	14.4 - 21 MB/s
Maximum external transfer rate	NA	NA

Flexible Disk Drives

Both desktop and minitower models are supplied with the new bezel-less version of the drive (either Sony or Alps).

CD Drives

Most models have a 32 Max IDE CD drive supplied in a 5.25-inch front-access shelf ATAPI, supporting ATAPI commands and with audio playback capability. It can play any standard CD-Audio disks, in addition to CD-ROM disks, conforming to optical and mechanical standards as specified in the Red and Yellow Book.

Features of the Panasonic CD Drive (CD-585-B)

- Application Disc type (confirmed by Red, Yellow, Green, Orange Book).
- CD-ROM data disk (Mode 1 and Mode 2).
- Photo-CD Multisession.
- CD Audio disk.
- Mixed mode CD-ROM disk (data and audio).
- CD-ROM XA, CD-I, CD-Extra, CD-R, CD-RW.

Table 3-5. Features of the Panasonic CD Drive (CD-585-B)

	Description
HP product number	D4384A
Disk Diameter	120 mm
Data Block Size	2,048 bytes (Mode-1) 2,336 bytes (Mode-2)
Storage Capacity	650 Mbytes (Mode-1) 742 Mbytes (Mode-2)
Read Mode	Full CAV[1] 14X to 32X
Burst Transfer Rate	PIO mode 4 - 16.6 Mbytes/s maximum Single Word DMA Mode 2 - 8.3 Mbytes/s maximum Multi Word DMA Mode 2 - 16.6 Mbytes/s maximum.
Access Time	Average Stroke (1 / 3) 110 ms Full Stroke 180 ms
Data Error Rate	Less than 10-12 (Mode-1) Less than 10-9 (Mode-2)[2]
Spin Up Time	From standby mode. Typical 6s to drive ready mode With tray loading. Typical 8.5s to drive ready mode.[3]
Buffer Memory Size	128 kbytes

1. CAV = Constant Angular Velocity
2. It is assumed that raw error rate of disk is 10-3 in the worst case. This excludes “retries”.
3. Photo-CD (Multisession) is not applicable.

If a disk is still in the drive after power failure or drive failure, it can be retrieved by inserting a stout wire, such as the end of a straightened paper-clip, into the small hole at the bottom of the door.

Connectors and Sockets

Table 3-6. IDE and Flexible Disk Drive Connectors

IDE Connector			
Pin	**Signal**	**Pin**	**Signal**
1	Reset#	2	Ground
3	HD7	4	HD8
5	HD6	6	HD9
7	HD5	8	HD10
9	HD4	10	HD11
11	HD3	12	HD12
13	HD2	14	HD13
15	HD1	16	HD14
17	HD0	18	HD15
19	Ground 7	20	orientation key
21	DMARQ	22	Ground 2
23	DIOW#	24	Ground 3
25	DIOR#	26	Ground 4
27	IORDY	28	CSEL
29	DMACK#	30	Ground 5
31	INTRQ	32	IOCS16#
33	DA1	34	PDIAG#
35	DA0	36	DA2
37	CS1FX	38	CS3FX
39	DASP#	40	Ground 6

Flexible Disk Drive Data Connector			
Pin	**Signal**	**Pin**	**Signal**
1	Ground	2	LDENSEL#
3	Ground	4	Microfloppy
5	Ground	6	EDENSEL
7	Ground	8	INDX#
9	Ground	10	MTEN1#
11	Ground	12	DRSEL0#
13	Ground	14	DRSEL1#
15	Ground	16	DTEN0#
17	Ground	18	DIR#
19	Ground	20	STP#
21	Ground	22	WRDATA#
23	Ground	24	WREN#
25	Ground	26	TRK0#
27	Ground	28	WRPRDT#
29	Ground	30	RDDATA#
31	Ground	32	HDSEL1#
33	Ground	34	DSKCHG#

Table 3-7. USB Stacked Connector

USB Stacked Connector			
Pin	**Signal**	**Pin**	**Signal**
1	USB0 Power	2	USB0 Neg.
3	USB0 Pos.	4	Chassis Ground
5	USB1 Power	6	USB1 Neg.
7	USB1 Pos.	8	Chassis Ground
9	Chassis Ground	10	Chassis Ground
11	Chassis Ground	12	Chassis Ground

Table 3-8. Power Supply Connector and Battery Pack Connector

Power Supply Connector for System Board			
Pin	**Signal**	**Pin**	**Signal**
1	PwrGood	2	
3	Remote On	4	Ground
5	Ground	6	Ground
7	+12 Volt supply	8	5V STDBY
9	+5 Volt supply	10	+5 Volt supply
11	+5 Volt supply	12	-12 Volt supply
13	-5 Volt supply	14	Low Power
15	-12 Volt supply	16	+12 Volt supply

Battery Pack Connector	
Pin	**Signal**
1	VBAT
2	
3	NC
4	Ground

Table 3-9. Power Supply 3V3 for System and PCI Wakeup Connector

Power Supply 3V3 for System			
Pin	**Signal**	**Pin**	**Signal**
1	Ground	2	Ground
3	Ground	4	+ 3V3 Volt supply
5	+ 3V3 Volt supply	6	+ 3V3 Volt supply

PCI Wakeup (J25)	
Pin	**Signal**
1	Ground
2	PCI Wakeup
3	Ground

Table 3-10. ExtStart Connector and Fan Connector on Backplane

ExtStart Connector (J24)			
Pin	**Signal**	**Pin**	**Signal**
1	SCSI Led	2	Ultra SCSI
3	Ring	4	Ground
5	LAN Wake	6	VStandby Modem
7	Enable Remote On	8	LAN Start
9	External Reset	10	LAN Led
11	VStandby	12	
13	Not connected	14	Not connected

Fan Connector	
Pin	**Signal**
1	Ground
2	12V Power
3	Control Signal

Table 3-11. Internal Audio Connectors

CD AUDIO Connector		
Pin	**Signal**	**I/O**
1	Analog Ground	-
2	CD Right Channel	IN
3	Analog Ground	-
4	CD Left Channel	IN

AUX Connector		
Pin	**Signal**	**I/O**
1	Analog Ground	-
2	AUX Right Channel	IN
3	Analog Ground	-
4	AUX Left Channel	IN

Audio Front Panel Connector		
Pin	Signal	I/O
1	Analog Ground	-
2	Key Way	-
3	Front Panel Input Left	IN
4	Front Panel Return Left	OUT
5	Front panel Input Right	IN
6	Front Panel Return Right	OUT
7	Reserved	-
8	Analog Ground	-
9	Reserved	-
10	Reserved	-

Front Panel Microphone Connector		
Pin	Signal	I/O
1	MIC Signal + Power (tip)	IN
2	Analog Ground	-
3	MIC Signal + Power (ring)	-

External Audio Connectors

On the Personal Workstation there is a Headphone Out jack and Microphone In jack on the Audio Front Panel. A Line In jack, Line Out jack and Mic In jack connector are located on the rear panel. These external jacks are standard connectors.

Table 3-12. Internal Speaker Connector and Package Intrusion Connector

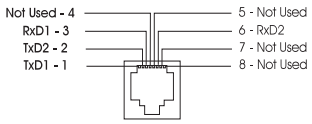
Internal Speaker (J18)	
Pin	**Signal**
1	Speaker Signal
2	Speaker Signal

Package Intrusion (J8)	
Pin	**Signal**
1	Open detect
2	Ground

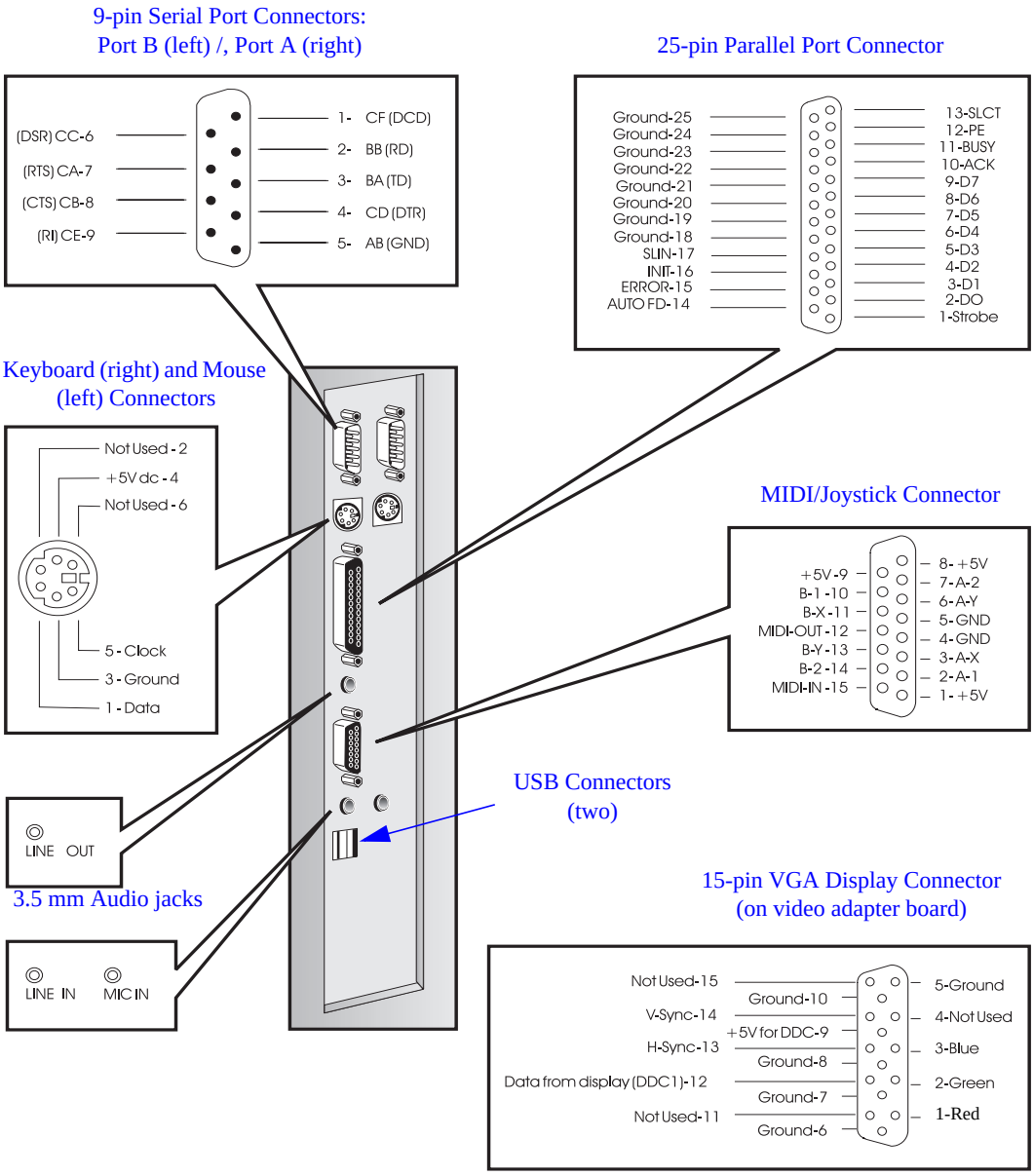
Table 3-13. VGA DB15 Connector

VGA DB Connector Pins		
Pin	**Standard VGA**	**DDC2B**
1	Analog RED	Analog RED
2	Analog GREEN	Analog GREEN
3	Analog BLUE	Analog BLUE
4	Monitor ID2	Monitor ID2
5	n/c	DDC return
6	Analog RED return	Analog RED
7	Analog GREEN return	Analog GREEN
8	Analog BLUE return	Analog BLUE
9	n/c	VCC supply (optional)
10	Digital ground	Digital ground
11	Monitor ID 0	Monitor ID 0
12	Monitor ID 1	Data:SDA
13	HSYNC	HSYNC
14	VSYNC	VSYNC
15	n/c	Clock:SCL

Ethernet UTP Connector



Socket Pin Layouts for Minitower Models



4 HP BIOS

The *Setup* program and BIOS are summarized in the two sections of this chapter. The POST routines are described in the chapter “Test and Error Messages.”

HP/Phoenix BIOS Summary

The System ROM contains the POST (Power-On Self-Test) routines, and the BIOS: the System BIOS, video BIOS, and low option ROM. This chapter, together with the following one, give an overview of the following aspects:

- menu-driven Setup with context-sensitive help, described next in this chapter.
- The address space, with details of the interrupts used, described at the end of this chapter.
- The Power-On-Self-Test or POST, which is the sequence of tests the computer performs to ensure that the system is functioning correctly, described in the next chapter.

The system BIOS is identified by the version number `H01xyyzz` (refer to the section “BIOS Update Crisis Recovery Procedure” in the chapter “System Board” for a definition). The procedure for updating the System ROM firmware is described in the section “Updating the System ROM” in the chapter “System Board.”

Note that the messages in this section make reference to the “HP Kayak Workstation.” For an explanation of this, see the section “Special Notice for Users” in the Preface of this document.

Using the HP Setup Program

To run the *Setup* program, press **F2** while the initial “Kayak” logo is displayed immediately after restarting the Personal Workstation.

Alternatively, press **Esc** to view the summary configuration screen. By default, this remains on the screen for 20 seconds, but by pressing **F5** once, it can be held on the screen indefinitely until **F1** is pressed again.

The band along the top of the Setup screen offers the following menus: **Main**, **Advanced**, **Security**, **Boot**, **Power** and **Exit**. These are selected using the left and right arrow keys. For a more complete description, see the *User's Guide* that was supplied with the Personal Workstation.

Main Menu

The **Main** menu presents a list of fields, for example, “PnP Operating System” (selects whether the BIOS or Plug and Play operating system configures Plug and Play devices); “Reset Configuration Data”; “System Time” “System Date” and “Key Click”.

By default the “Reset Configuration Data”, item is set to No. Selecting Yes, will clear the system configuration data.

Advanced Menu

The **Advanced** menu does not have the same structure as the **Main** menu and **Power** menu. Instead of presenting a list of fields, it offers a list of sub-menus. The **Advanced** menu contains the following sub-menus:

- **Processors, Memory and Cache**. Configures processor, memory caching, and processor cache error correction (if supported by the supplied processor).
- **Flexible Disk Drives**. Enables or disables the on-board flexible disk controller.
- **IDE Devices**. Configures IDE devices.
- **Internal SCSI 16bits (Adaptec)**. Enables or disables the 16-bit Adaptec integrated SCSI interface (refer to the section “Sub-BIOS Systems for SCSI Controllers” in this chapter).
- **Integrated I/O Ports**. Enables or disables the on-board parallel and serial ports at the specified address.
- **External and Internal SCSI 16/8-bit (Symbios) Interface**. Enables or disables the integrated SCSI Symbios interface (refer to the section “Sub-BIOS Systems for SCSI Controllers” in this chapter).
- **Integrated Network Interface**. Enables or disables the integrated network interface. This feature must be enabled when an ethernet card is installed.
- **Integrated USB Interface**. Enable or disable the integrated USB (Universal Serial Bus) interface. You can also redirect the second USB connection to a special AGP board (for example, a USB monitor).
- **Integrated Audio Interface**. Enables or disables the audio interface. This feature is useful on non plug-and-play operating systems, because the integrated audio chip is plug-and-play.
- **PCI Slot Configuration**. Sets the PCI Bus Master bit through the BIOS. This could be necessary for some older PCI accessory boards.
- **ISA Resource Exclusion**. Reserves interrupts for legacy ISA devices to prevent conflict with PCI/PnP devices.

Security

Sub-menus are presented for changing the characteristics and values of the System Administrator Password, User Password, Hardware Protection and Boot Device Security. The Security Menu contains the following sub-menus:

- **User Password**. This password can only be set when an administrator password has been set. The User Password prevents unauthorized use of the computer.
- **Administrator Password**. This password prevents unauthorized access to the computer's configuration. It can also be used to start the computer.
- **Hardware Protection**. The following devices can have their accesses unlocked/locked: Integrated Flexible Disk Controller, Integrated IDE Controller, Integrated Data Communications Ports.
- **Boot Devices Security**. Selects whether the computer can be started over the network. It also selects which devices are to be used for booting up the system. The option Disabled prevents unauthorized use of a device to start the computer.

Boot Menu

Select the order of the devices from which you want the BIOS to attempt to boot the operating system. During POST, if the BIOS is unsuccessful at booting from one device, it will then try the next one on the Boot Device Priority list until an operating system is found.

The QuickBoot Mode option allows the system to skip certain tests while booting. This decreases the time needed to boot the system.

Power Menu

This menu allows you to set the standby delay. It also allows the system administrator to decide whether the mouse is enabled as a means of reactivating the system from Standby. It is also possible to specify whether the space-bar is enabled as a means of reactivating the system from Off.

Symbios Logic SCSI Configuration Utility

NOTE The Symbios Logic SCSI Configuration Utility is only applicable for devices connected to the 16-bit integrated Ultra-wide SCSI controller on the LAN+SCSI Combo Board. Up to a total of 15 devices (internal and external) can be supported by this controller via a 16-bit wide external connector and an 8-bit narrow internal cable.

The Symbios Logic SCSI Configuration Utility lets you view and change the default configuration for the host adapter, and all SCSI devices connected to it, or for individual SCSI devices. If, while using this utility, you accidentally disable all the controllers, pressing **F6** during the POST (after the memory test) lets you recover and configure settings.

Default Settings You Can Change

The following two tables show the configuration settings that can be changed. The first table shows the global settings which impact the host adapter and all SCSI devices connected to it. The second table shows the device settings which apply to individual devices.

Table 4-1. Global Settings that Impact the Host Adapter and All SCSI Devices

Settings for the Host Adapter and All Devices	Default Settings
SCAM Support	On
Parity Checking	Enabled
Host Adapter SCSI ID	7
Scan Order	Low to High (0-Max)

Table 4-2. Device Settings that Apply to Individual Devices

Settings for Individual SCSI Devices	Default Settings
Synchronous Transfer Rate (MB/s)	40
Data Width	16
Disconnect	On
Read Write I/O Timeout (seconds)	10
Scan for Devices at Boot Time	Yes
Scan for SCSI LUNs	Yes
Queue Tags	On

Starting the SCSI Configuration Utility

You access the SCSI Configuration Utility by pressing **F6** when the message `Press F6 to start Configuration Utility...` is displayed during the PC Workstation's start-up routine. A further message is then displayed: `Please wait, invoking Configuration Utility...` before the **Main** menu of the Symbios Logic SCSI Configuration utility appears.

The Symbios Logic SCSI Configuration Utility is described in detail in the *User's Guide* supplied with the Personal Workstation.

Power Saving

Table 4-3. Power Saving Modes

	Full On	Standby	Suspend	Shutdown
Processor	Normal speed	Normal speed	Halted	Halted
Display	On	Blanked, <30 W, on models with integrated graphics	Blanked, <5 W (typ)	Blanked, <5 W (typ)
Hard disk drive	Normal speed	Normal speed	Halted	Halted
Power consumption	24 W to 62 W depending on configuration & activity	<30 W (230V, 50 Hz) <27 W (115V, 60 Hz)	<25 W (230V, 50 Hz) <21 W (115V, 60 Hz)	<5 W (plugged in but turned off)
Resume events		Keyboard, mouse	Keyboard, network (RPO)	Space bar
Resume delay		Instantaneous	a few seconds	Boot delay

Power-On from Space-Bar

The power-on from the space-bar function is enabled provided that:

- The computer is connected to a Power-On keyboard (recognizable by the Power-On icon on the space bar).
- The function has not been disabled by setting SW-8 to open on the system board switches.
- The function has not been disabled in the “Power” menu of the Setup program.

Soft Power Down

When the user requests the operating system to shutdown, the environment is cleared, and the computer is powered off. Soft Power Down is available with the Windows NT and Windows 95 operating systems.

BIOS Addresses

This section provides a summary of the main features of the HP system BIOS. This is software that provides an interface between the computer hardware and the operating system.

The procedure for updating the System ROM firmware is described in the section “Updating the System ROM” in the chapter “System Board.”

System Memory Map

Reserved memory used by accessory boards must be located in the area from C8000h to EFFFFh.

Table 4-4. System Memory Map

0000 0000 - 0000 03FF	Real-mode IDT
0000 0400 - 0000 04FF	BIOS Data Area
0000 0500 - 0009 FC00	Used by Operating System
0009 FC00 - 0009 FFFF	Extended BIOS Data Area
000A_0000 - 000B_FFFF	Video RAM or SMRAM (not visible unless in SMM)
000C 0000 - 000C 7FFF	Video ROM (VGA ROM)
000C 8000 - 000F FFFF	Adapter ROM, RAM, memory-mapped registers, BIOS
10 0000 - FF FFFF	Memory (1 MB to 16 MB)
100 0000 - 1FF FFFF	Memory (16 MB to 32 MB)
200 0000 - 3FF FFFF	Memory (32 MB to 64 MB)
400 0000 - 1FFF FFFF	Memory (64 MB to 512 MB)
FEE0 0000 - FEE0 0FFF	Local APIC
FEF0 0000 - FEF0 0FFF	I/O APIC
FFFE 0000 - FFFF FFFF	128 KB BIOS (Flash)

HP I/O Port Map (I/O Addresses Used by the System[1])

Peripheral devices, accessory devices and system controllers are accessed via the system I/O space, which is not located in system memory space. The 64 KB of addressable I/O space comprises 8-bit and 16-bit registers (called I/O ports) located in the various system components. When installing an accessory board, ensure that the I/O address space selected is in the free area of the space reserved for accessory boards (100h to 3FFh).

NOTE Although the Setup program can be used to change some of the settings, the following address map is not completely BIOS dependent, but is determined partly by the operating system. Note that some of the I/O addresses are allocated dynamically.

Table 4-5. HP I/O Port Map

Default Values for I/O Address Ports	Function
0000 - 000F	DMA controller 1
0020 - 0021	Master interrupt controller (8259)
002E - 002F	NS-317 Configuration registers
0040 - 0043	Timer 1
0060, 0064	Keyboard controller (reset, slow A20)
0061	Port B (speaker, NMI status and control)
0070	Bit 7: NMI mask register
0070 - 0071	RTC and CMOS data
0080	Manufacturing port (POST card)
0081 - 0083, 008F	DMA low page register
0092	PS/2 reset and Fast A20
00A0 - 00A1	Slave interrupt controller
00C0 - 00DF	DMA controller 2
00E0 - 00EF	NS 317 GPIO
00F0 - 00FF	Co-processor error
0130 - 013F	AD1816 sound system
0170 - 0177	IDE secondary channel
01F0 - 01F7	IDE primary channel
0200 - 0207	AD1816 Joystick port
0220 - 0232	AD1816 Soundblaster
0278 - 027F	LPT 2
02E8 - 02EF	Serial port 4 (COM4)
02F8 - 02FF	Serial port 2 (COM2)
0372 - 0377	IDE secondary channel, secondary flexible disk drive
0378 - 037A	LPT1
0330 - 0333	AD1816 Ad-lib (FM)

1. If configured.

Table 4-5. HP I/O Port Map

Default Values for I/O Address Ports	Function
03B0 - 03DF	VGA
03E8 - 03EF	COM3
03F0 - 03F5	Flexible disk drive controller
03F6	IDE primary channel
03F7	Flexible disk drive controller
03F8 - 03FF	COM1
04D0 - 04D1	Interrupt edge/level control
0678 - 067B	LPT2 ECP
0778 - 077B	LPT1 ECP
0CF8 - 0CFF	PCI configuration space

DMA Channel Controllers

Only “I/O-to-memory” and “memory-to-I/O” transfers are allowed. “I/O-to-I/O” and “memory-to-memory” transfers are disallowed by the hardware configuration. The system controller supports seven DMA channels, each with a page register used to extend the addressing range of the channel to 16 MB. The following table summarizes how the DMA channels are allocated.

Table 4-6. Summary Of How The DMA Channels Are Allocated

DMA controller	
Channel	**Function**
DMA 0	AD1816 Capture
DMA 1	AD1816 Playback
DMA 2	NS317 Flexible disk controller
DMA 3	NS317 LPT ECP
DMA 4	Used to cascade DMA channels 0-3
DMA 5	Free
DMA 6	Free
DMA 7	Free

Interrupt Controllers

The system has an APIC (82093AA) I/O interrupt controller and two 82C59 “legacy” interrupt controllers.

The following table shows how the “legacy” interrupts are connected to the APIC controller. The Interrupt Requests (IRQ) are numbered sequentially, starting with the master controller, and followed by the slave (both of 82C59 type).

NOTE Although the Setup program can be used to change some of the settings, the following address map is not completely BIOS dependent, but is determined partly by the operating system. Note that some of the I/O addresses are allocated dynamically.

Table 4-7. The Relationship of the “Legacy” Interrupts to the APIC Controller

I/O APIC Input	IRQ	Interrupt Request Description
INTIN0	INTR	
INTIN1	IRQ1	NS317 Keyboard Controller
INTIN2	IRQ0	PIIX4 System Timer
INTIN3	IRQ3	NS317 COM2, COM4
INTIN4	IRQ4	NS317 COM1, COM3
INTIN5	IRQ5	AD1816, LPT2
INTIN6	IRQ6	NS317 Flexible Disk Controller
INTIN7	IRQ7	NS317 LPT1
INTIN8	IRQ8	NS317 RTC
INTIN9	IRQ9	MIDI Port
INTIN10	IRQ10	
INTIN11	IRQ11	AD1816 MIDI
INTIN12	IRQ12	NS317 Mouse
INTIN13	not connected	
INTIN14	IRQ14	PIIX4E IDE Channel 1
INTIN15	IRQ15	PIIX4E IDE Channel 2
INTIN16	PCINTA	
INTIN17	PCINTB	
INTIN18	PCINTC	
INTIN19	PCINTD	
INTIN20	TFPC IRQ	
INTIN21	SCI IRQ	
INTIN22	not connected	
INTIN23	PIIX4 SM	

There are three major interrupt modes available:

- *PIC mode*: This “Legacy” mode uses only the 82C59 interrupt controllers. Therefore, only one processor can be supported in this mode. The system can be forced to operate in this mode by selecting “mono-processing” in the system setup.
- *Virtual wire mode*: On the HP VISUALIZE Personal Workstations, this mode is implemented using the 82C59 interrupt and the I/O APIC controller 82093AA. This mode is used during boot time, if the choice “multi-processing” has been selected in the system setup. The virtual wire mode allows the transition to the “symmetric I/O mode”. In the virtual wire mode, only one processor operates.
- *Symmetric I/O mode*: This mode is implemented using the I/O APIC controller 82093AA and allows the operating system to perform Symmetric Multi-Processing (SMP) operations (refer also to item 2 above). For further information about Multi-Processing, refer to the section “Configuring Setup For Multi-Processing” in the chapter “System Board.”

NOTE In “PIC mode” and “virtual wire mode”, the PCI interrupts are routed inside the 82C59 to ISA interrupts. In the “symmetric I/O mode”, the PCI and ISA interrupts are used by the 82093AA and are handled in a separate manner.

PCI Interrupt Request Lines

PCI devices generate interrupt requests using up to four PCI interrupt request lines (INTA#, INTB#, INTC#, and INTD#).

PCI interrupts can be shared; several devices can use the same interrupt. However, optimal system performance is reached when minimizing the sharing of interrupts. Refer to the section “Devices on the PCI Bus” in the chapter “System Board” for a table of the PCI device interrupts.

5 Tests and Error Messages

This chapter describes the MaxiLife firmware test sequences and error messages, the Power-On Self-Test (POST) routines, which are contained in the computer's ROM BIOS, the error messages which can result, and the suggestions for corrective action.

MaxiLife Test Sequence and Error Messages

When the Personal Workstation is turned on (pressing the ON/OFF button), the system initiates the normal start-up sequence which is composed of the following steps:

- Basic pre-boot diagnostics.
- BIOS launch.
- POST phase.
- Operating System boot phase.

Note that the messages in this section make reference to the “HP Kayak Workstation.” For an explanation of this, see the section “Special Notice for Users” in the Preface of this document.

If any errors are detected during the start-up sequence, MaxiLife will not necessarily ‘freeze’ the system. However, some critical hardware errors are fatal to the system and will prevent the system from starting (for example, ‘Power’, and ‘Board PLL’ are serious malfunctions that will prevent the CPU to work correctly).

Errors that are not so critical (for example, ‘CPU Socket’ for missing terminator, or ‘NO RAM’) will be detected both during pre-boot diagnostics and POST where the BIOS boot process will abort after beeping. The MaxiLife LCD status panel will display the error. Some errors, such as the ‘RAM type’ error, are only detected during POST sequence, and will entail the same abort process.

Finally, while the Personal Workstation is working, fan and temperature controls can be reported (for example, a fan error will be reported if a fan cable is not connected). This type of error disappears dynamically when the problem has been fixed (for example, the fan cable has been reconnected).

The different diagnostics are described below.

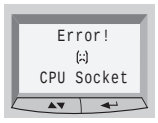
Basic Pre-boot Diagnostics

The first diagnostic (called basic pre-boot diagnostics) is run to check the presence of the processor(s) or terminators, VRMs, power supply, CPU Board PLL and DIMMs.

The pre-boot diagnostic tests are run in order of priority with respect to their importance to computer functions. Refer to the table “Basic Pre-boot Diagnostics” in this section for the test sequence, failure message and action to take to solve any problems.

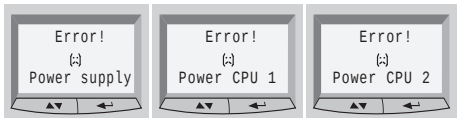
The first detected error displays a message on the LCD status panel. If this happens, one of the following screens could appear.

Presence of CPUs or Terminators in the Processor Slots



Missing or incorrectly installed CPU or Termina-

Control of Some Voltages: VRMs, 12V

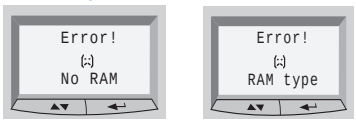


VRM or CPU power supply are not connected. If an Error! Power is displayed, the likely cause could be that the power supply is not connected, or the VRM is installed with an unpopulated CPU socket (unsupported configuration).

Control of the CPU Board

CPU Board is not connected, or the system board needs replacing.

Number and Compatibility of DIMMs



No Dimms are detected.

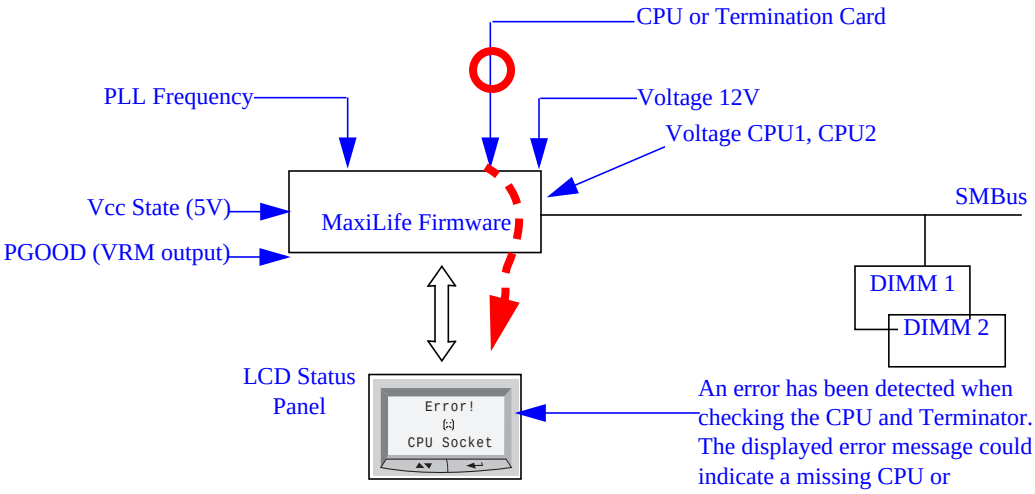
Installed DIMMs are not compatible. This is in fact the BIOS that is checking the

Video Board

Video board is not installed.
This test is executed by the BIOS.

The following diagram shows how the Pre-boot Diagnostics works when it encounters an error.

Figure 5-1. How Pre-boot Diagnostics Works When It Encounters An Error



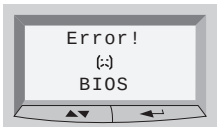
The following table shows the test sequence carried out, the type of error message, and the action to take.

Table 5-1. Basic Pre-boot Diagnostics

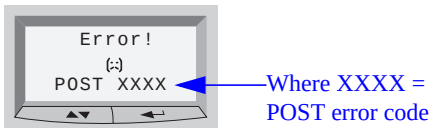
Test	Error Code	Action to Take
Presence of either CPU or Terminator in the processor slot.	CPU SOCKET	Check CPUs and Terminator and VRM of installed processor.
Control of some voltages: VRMs, 12V	POWER SUPPLY	Check the power supply connectors, VRM, CPU. In a single processor system, check that no VRM is plugged into the VRM connector. The error message could also show: Power CPU1 and Power CPU2.
Test of the correct power signals to the CPU. The power supply may be OK, whereas the VRM is not.	POWER	Check that the processor and terminator are correctly installed. Check the power supply connectors, VRM, CPU. In a single processor system, check that no VRM is plugged into the VRM connector. Check or replace the VRM. Check the power supply unit connectors.
Check the system board clock generators (PLL).	BOARD PLL	Check the power supply connector. Replace the system board (PLL clock generator).
Number of installed DIMMs	NO RAM	Check that the memory module is correctly installed in the memory socket.
Compatibility of DIMMs. The BIOS checks that the inserted DIMMs are both compatible with one another, and compatible with the Front Side Bus frequency.	RAM TYPE	Check the installed memory modules. This error occurs when mixing incompatible memory modules, or when mixing Unbuffered and Registered memory modules.
Availability of video controller. It is checked by the BIOS. If an error is detected, it is not a fatal one and the BIOS will continue its execution normally.	NO VIDEO	Check that the video controller is correctly installed. Note: No error is detected if a monitor is not connected to an installed video controller. This is not a fatal error and the BIOS will continue its normal execution.

Post Test Sequence and Post Error Codes

In order to check that the CPU is able to run the BIOS boot code (POST phase) from the first CPU instructions through to DIMM detection, MaxiLife firmware waits for a synchronization event from the BIOS. Any failure that prevents the execution of the firmware will therefore trigger the BIOS error and will display the following message on the LCD status panel.



Then, the BIOS executes the Power-On Self Test (POST) sequence. In this phase, MaxiLife waits for any error messages that the BIOS may issue. If such an error occurs, then a screen similar to the following example is displayed. The error code that appears on the LCD status panel is the same as the one that appears on the Personal Workstation screen.If the POST issues several error codes, only the last one is visible on the LCD status panel.



The following diagrams show the different BIOS-generated errors.

Figure 5-2. Examples of BIOS-generated Errors

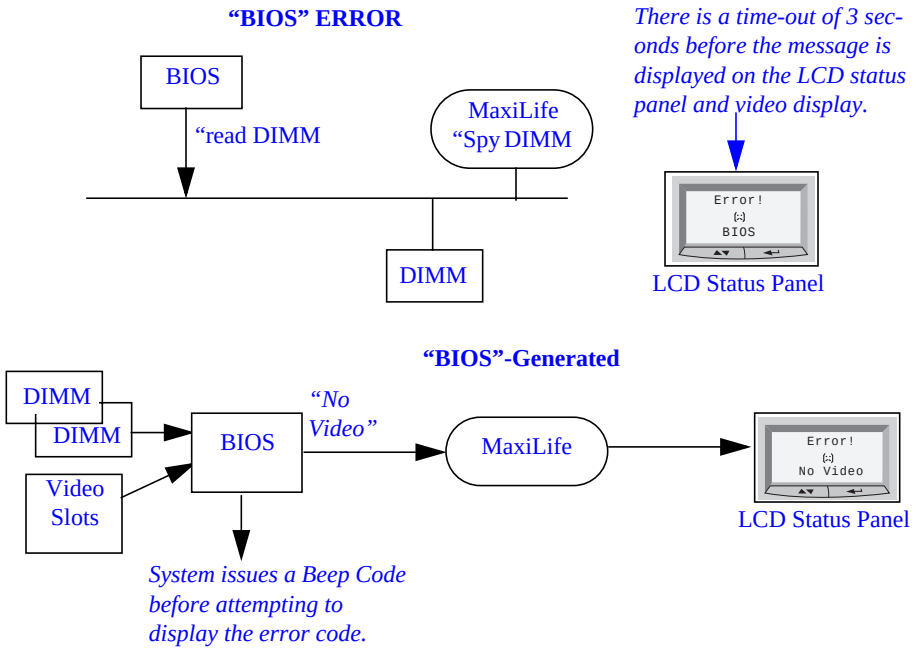


Table 5-2. Post Test Sequence and Post Error Codes

Test	Error Code	Action to Take
In order to detect whether the CPU is able to run a given code, MaxiLife waits for a synchronization event from the BIOS. Any failure that prevents the execution of the firmware will trigger an error.	BIOS	Flash the latest version of the system BIOS by using the system recovery procedure. Set switch 10 to the down position. Check that the RAM is correctly installed. Check that the CPU is firmly inserted.
The BIOS then executes the Power On Self Test (POST) sequence. In this phase, MaxiLife waits for any error messages that the BIOS may issue.	POST XXXX	If the screen is working, you can obtain the meaning of the error by typing "Enter" at the end of the POST. Or, you can check the list of errors available on the HP World-Wide Web support page: `http://www.hp.com/go/VISUALIZESUPPORT`

Operating System Boot Phase

If no error message has been displayed at this stage of the system start-up by the BIOS, the operating system is launched and the LCD status panel will display the system platform and a “smiling icon.”

Run-Time Errors

During the normal usage of the Personal Workstation, MaxiLife continually checks some of the vital system parameters. These include: temperature errors, fan malfunctions, power voltage drops, board PLL problems and CPU problems.

If several alarms or errors are active at the same time, they will be displayed by cycling every second through four “alarm sources”, with one error cause for each source:

- Pre-boot diagnostics.
- Run-Time error 1.
- Run-Time error 2.
- POST error.

The run-time errors are organized into two different sources.

Run-Time error 1: “Temperature I/O slot”, “Power errors”, “Fan CPU”, “Board PLL”.

Run-Time error 2: “Temperature disk”, “Temperature CPU”, “Fan disk”, “Fan I/O slot”, “CPU error”.

If both fan for disks and I/O slot are not connected (both are run-time error 1), only the “Fan disk” (run-time error 2) will be displayed.

Table 5-3. Run-Time Errors

Test	Error Code	Action to Take
During normal usage of the Personal Workstation, HP MaxiLife continually checks vital system parameters. If an error should occur, a message would be automatically displayed on the LCD panel.	FAN CPU	Check the connection of the corresponding component, which could be: “Temp IO slot”, “Power errors, “Fan CPU”, “Board PLL”, “Temp disk”, “Temp CPU”, “Fan disk”, “Fan IO slot”, “CPU error”.[1]

1. Special cases: Board PLL = System board needs replacing. CPU error = Reset or power off the system to recover.

Main Menu

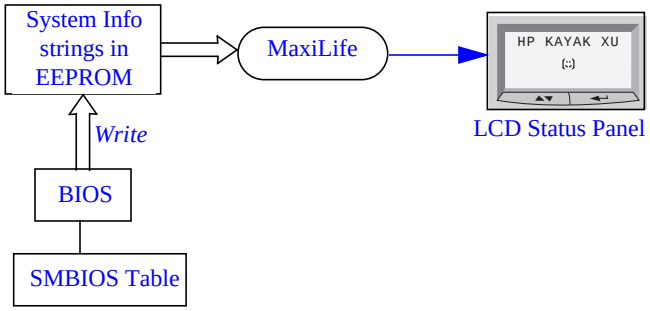
The main menu is displayed when any of the LCD buttons from are pressed (MaxiLife LCD status panel can be accessed even though the Personal Workstation is turned off). The **Main** menu comprises of three sub-menus: System Info, Boot Steps and Diagnostics.

System Info

Obtains information from the BIOS and the system's Serial EEPROM from a previously successful boot. This information includes: product name (this will read "Kayak XU" even though this is an HP VISUALIZE Personal Workstation), BIOS version, serial number, number of processors and speed, size of memory for each DIMM socket.

The following diagram shows how the System Info obtains its information.

Figure 5-3. How System Info Obtains Its Information



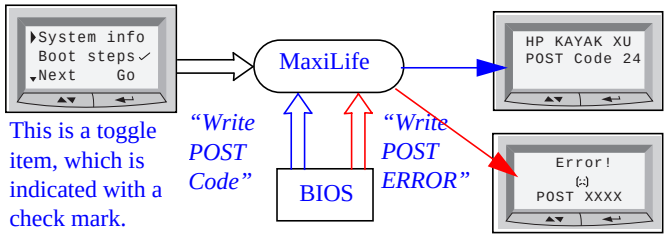
Boot Steps

Shows the Power-On Self-Test (POST) codes during the system start-up. The POST code is provided by the BIOS and is displayed on the LCD panel as soon as it is available. If the system stops during the start-up, the last successful boot step POST code is displayed on the LCD. When Boot Steps is selected, the POST step will be shown on the LCD status panel during the subsequent boot processes.

To ensure that MaxiLife is ready to display the first POST codes as soon as possible, the Pre-boot diagnostics are not executed when the system is booted with the Boot Steps option selected.

The following diagram shows how Boot Steps obtains its information from the BIOS, and then displays a POST error if needed.

Figure 5-4. Boot Steps Information



Diagnostics

Runs a set of diagnostics assessing the system's components. Results of the tests are displayed on the LCD status panel, one after another when the LCD ▼▲ buttons are pressed.

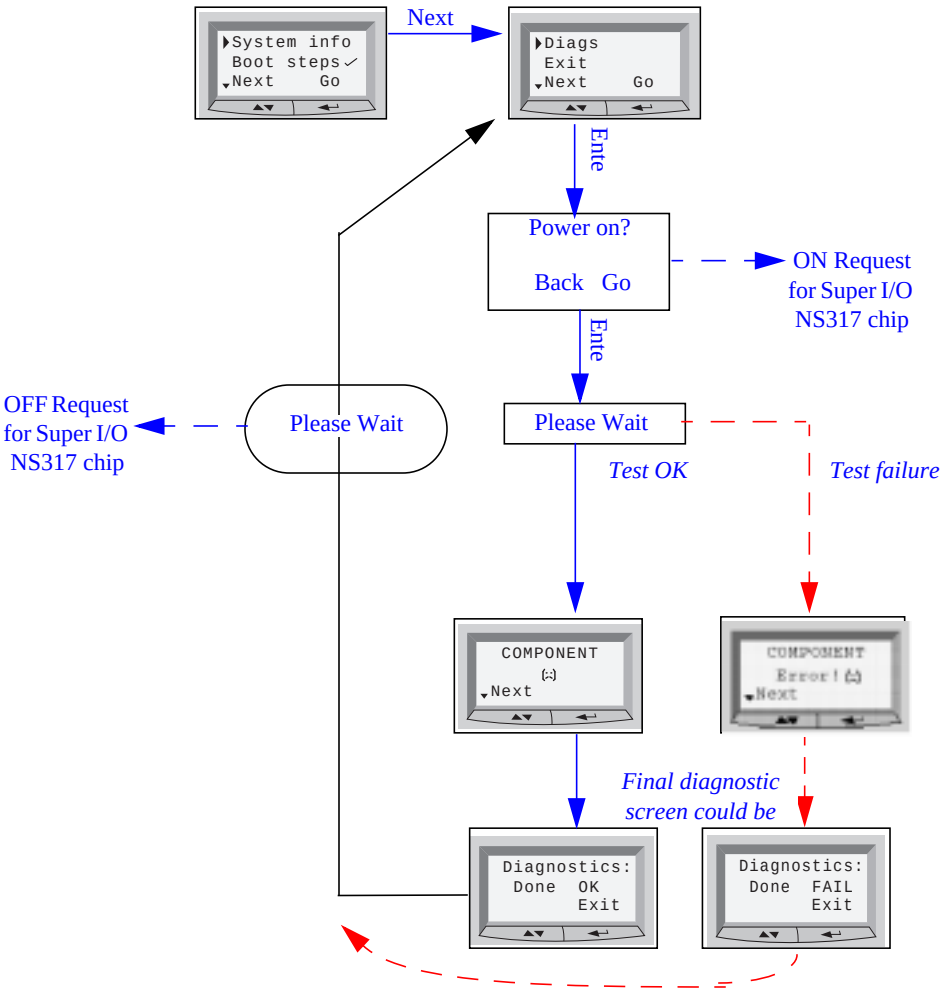
For MaxiLife to access the status of some of the components, the power supply has to be in the ON state. If the system is turned off when Diags is launched, a menu will be displayed, requesting an authorization to power on the Personal Workstation. It is possible to cancel the diagnostic process and return to the previous state by pressing the LCD key labelled "Back". When "GO" is selected, the main power supply is started but the Personal Workstation is not allowed to do a normal boot. The purpose of this is to allow only these devices that can be tested to answer the diagnostic request from MaxiLife.

Components are tested in sequence when the "Next" button is pressed. When they have all been checked, a diagnostic screen is shown. Depending on the result of the diagnostics, the screen could indicate either:
OK or FAIL.

At the end of the test, you can exit the diagnostic mode by pressing the ↵ LCD button. If the power supply was off when the diagnostics was started, it will be turned off again.

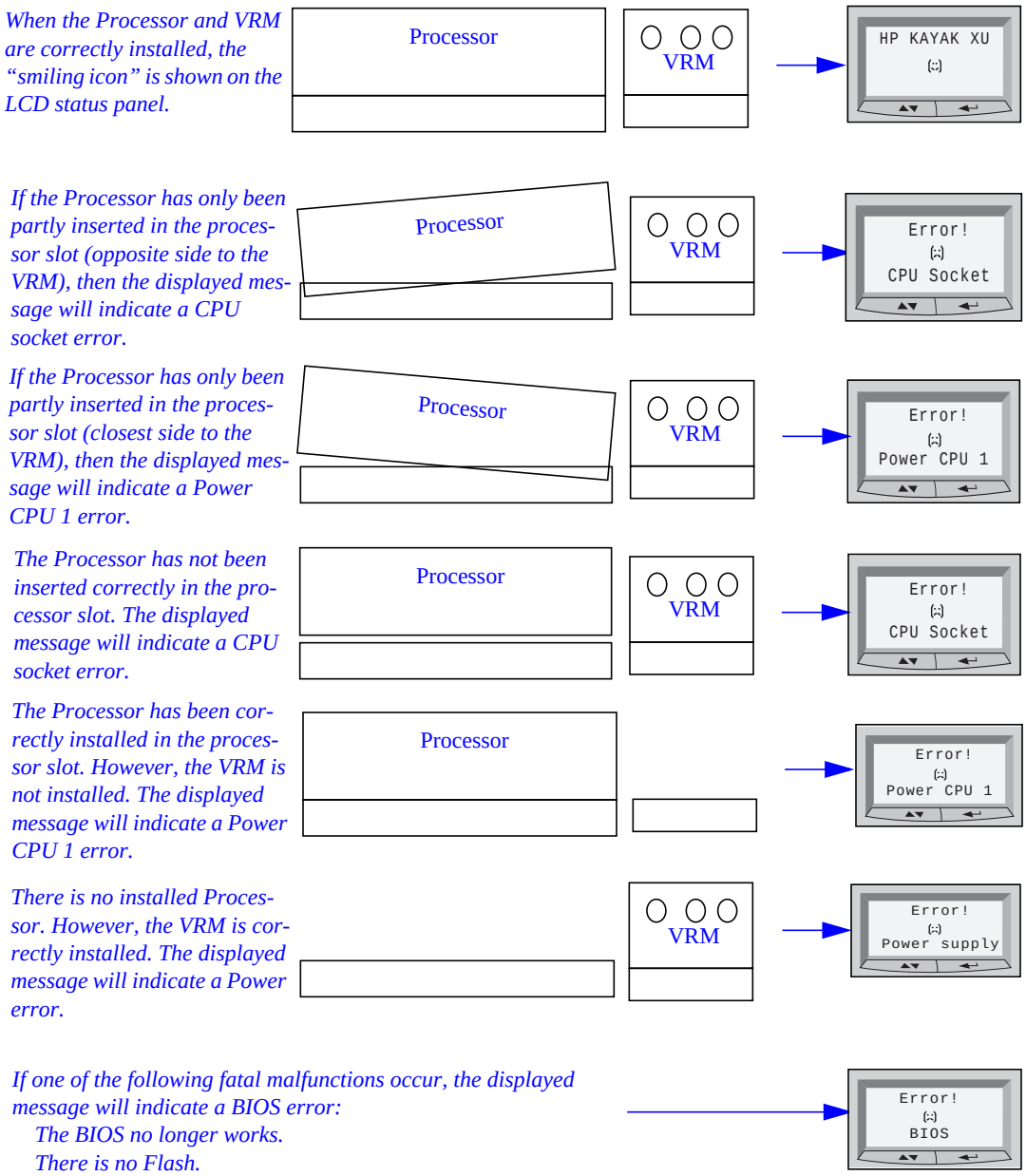
The following diagram shows how the “Power On” is activated when the main power supply of the Personal Workstation is turned off.

Figure 5-5. Activation of “Power On”



Typical Diagnostic Error Messages

Figure 5-6. Typical Diagnostic Error Messages



The components tested are described in the following table:

Table 5-4. Main Menu Diagnostics

Test	Error Code	Action to Take
Presence of either CPU or Terminator in the processor slot.	CPU SOCKET	Check CPUs and Terminator. Check the VRM if a second processor is installed.
Control of some voltages: VRMs, 12V	POWER SUPPLY	Check the power supply connectors, CPU. Check the VRM if a second processor is installed. The error message could also show: Power CPU1 and Power CPU2.
Test of the correct power signals to the CPU. The power supply may be OK, whereas the VRM is not.	POWER	Check CPUs and Terminator. Check the VRM if a second processor is installed. In a single processor system, check that no VRM is plugged into the second VRM connector (this could be the likely cause). Check or replace the VRM, if a second processor is installed. Check the power supply unit connectors.
Check frequency of the system board (PLL).	BOARD PLL	Check the power supply connector. Replace the system board (PLL clock generator).
Number of installed DIMMs	NO RAM	Check that the memory module is correctly installed in the memory socket.
Compatibility of DIMMs. The BIOS checks that the inserted DIMMs are both compatible with one another, and compatible with the Front Side Bus frequency.	RAM TYPE	Check the installed memory modules. This error occurs when mixing incompatible memory modules, or when mixing Unbuffered and Registered memory modules.

Additional Information About MaxiLife

For more information about MaxiLife, refer to the HP World Wide Web site:

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http://www.hp.com/go/visualizesupport
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Order in Which the Tests Are Performed

Each time the system is powered on, or a reset is performed, the POST is executed. The POST process verifies the basic functionality of the system components and initializes certain system parameters.

The POST starts by displaying a graphic screen of the HP Personal Workstation's logo when the Personal Workstation is restarted. If you wish to view the POST details, press Esc to get the HP Summary Screen.

If the POST detects an error, the error message are displayed inside a view system errors screen, in which the error message utility (EMU) not only displays the error diagnosis, but the suggestions for corrective action (refer to the section "Error Message Summary" in this chapter for a brief summary). Error codes are no longer displayed.

Devices, such as memory and newly installed hard disks, are configured automatically. The user is not requested to confirm the change. Newly removed hard disks are detected, and the user is prompted to confirm the new configuration by pressing F4. Note, though, that the POST does not detect when a *hard disk drive* has been otherwise changed.

During the POST, the BIOS and other ROM data is copied into high-speed shadow RAM. The shadow RAM is addressed at the same physical location as the original ROM in a manner which is completely transparent to applications. It therefore appears to behave as very fast ROM. This technique provides faster access to the system BIOS firmware.

An example of an Error Code Message

This example explains the different coding messages that appear in the lower left corner of the screen when the POST detects an error during start-up.

For example, if the error **0101 - 52** is displayed.

0101 Post Error Code failure. This error code is accompanied by a short message. For this example, the message "keyboard error" is displayed. A table listing the error codes, causes and symptoms is in the section "Error Message Summary" in this chapter

52 Post Checkpoint Code. This checkpoint code indicates that a test has failed at this stage of the POST. A table listing the error codes, and POST routine descriptions is in the section "POST Checkpoint Codes."

POST Checkpoint Codes

The following table lists the POST checkpoint codes written at the start of each test.

Checkpoint Code	POST Routine Description
02h	Verify Real Mode
03h	Disable Non-Maskable Interrupt (NMI)

Checkpoint Code	POST Routine Description
04h	Get CPU type
06h	Initialize system hardware
08h	Initialize chipset with initial POST values
09h	Set IN POST flag
0Ah	Initialize CPU registers
0Bh	Enable CPU cache
0Ch	Initialize caches to initial POST values
0Eh	Initialize I/O component
0Fh	Initialize the local bus IDE
10h	Initialize Power Management
11h	Load alternate registers with initial POST values
12h	Restore CPU control word during warm boot
13h	Initialize PCI Bus Mastering devices
14h	Initialize keyboard controller
16h	BIOS ROM Checksum
17h	Initialize cache before memory autosize
18h	8254 timer initialization
1Ah	8237 DMA controller initialization
1Ch	Reset Programmable Interrupt Controller
20h	Test DRAM Refresh
22h	Test 8742 Keyboard Controller
24h	Set ES segment register to 4 GB
26h	Enable A20 line
28h	Autosize DRAM
29h	Initialize POST Memory Manager

Checkpoint Code	POST Routine Description
2Ah	Clear 512 KB base RAM
2Ch	RAM failure on address line xxxx*
2Eh	RAM failure on data bits xxxx* of high byte of memory bus
2Fh	Enable cache before system BIOS shadow
30h	RAM failure on data bits xxxx* of high byte of memory bus
32h	Test CPU bus-clock frequency
33h	Initialize Phoenix Dispatch Manager
36h	Warm start shutdown
38h	Shadow system BIOS ROM
3Ah	Autosize cache
3Ch	Advanced configuration of chipset registers
3Dh	Load alternate registers with CMOS values
42h	Initialize interrupt vectors
45h	POST device initialization
46h	Check ROM copyright notice
48h	Check video configuration against CMOS
49h	Initialize PCI bus and devices
4Ah	Initialize all video adapters in system
4Bh	QuietBoot start (optional)
4Ch	Shadow Video BIOS ROM
4Eh	Display BIOS copyright notice
50h	Display CPU type and speed
51h	Initialize EISA board
52h	Test keyboard
54h	Set key click if enabled

Checkpoint Code	POST Routine Description
58h	Test for unexpected interrupts
59h	Initialize POST display service
5Ah	Display prompt “Press F2 to enter SETUP”
5Bh	Disable CPU cache
5Ch	Test RAM between 512 and 640 KB
60h	Test extended memory
62h	Test extended memory address lines
64h	Jump to UserPatch1
66h	Configure advanced cache registers
67h	Initialize Multi Processor APIC
68h	Enable external and CPU caches
69h	Setup System Management Mode (SMM) area
6Ah	Display external L2 cache size
6Bh	Load custom defaults (optional)
6Ch	Display shadow-area message
6Eh	Display possible high address for UMB recovery
70h	Display error messages
72h	Check for configuration errors
76h	Check for keyboard errors
7Ch	Set up hardware interrupt vectors
7Eh	Initialize coprocessor if present
80h	Disable onboard Super I/O ports and IRQs
81h	Late POST device initialization
82h	Detect and install external RS 232 ports
83h	Configure non-MCD IDE controllers

Checkpoint Code	POST Routine Description
84h	Detect and install external parallel ports
85h	Initialize PC-compatible PnP ISA devices
86h	Re-initialize onboard I/O ports
87h	Configure motherboard Configurable Devices (optional)
88h	Initialize BIOS Data Area
89h	Enable Non-Maskable Interrupts (NMIs)
8Ah	Initialize Extended BIOS Data Area
8Bh	Test and initialize PS/2 mouse
8Ch	Initialize floppy controller
8Fh	Determine number of ATA drives (optional)
90h	Initialize hard disk controllers
91h	Initialize local-bus hard disk controllers
92h	Jump to UsersPatch2
93h	Build MPTABLE for multi-processor boards
95h	Install CD ROM for boot
96h	Clear huge ES segment register
97h	Fixup Multi Processor table
98h	Search for option ROMs. One long, two short beeps on checksum failure
99h	Check for SMART drive (optional)
9Ah	Shadow option ROMs
9Ch	Set up Power Management
9Dh	Initialize security engine (optional)
9Eh	Enable hardware interrupts
9Fh	Determine number of ATA and SCSI drives
A0h	Set time of day

Checkpoint Code	POST Routine Description
A2h	Check key lock
A4h	Initialize typematic rate
A8h	Erase F2 prompt
AAh	Scan for F2 key stroke
ACh	Enter SETUP
AEh	Clear boot flag
B0h	Check for errors
B2h	POST done - prepare to boot operating system
B4H	One short beep before boot
B5H	Terminate QuietBoot (optional)
B6h	Check password (optional)
B9h	Prepare boot
BAh	Initialize DMI parameters
BBh	Initialize PnP Option ROMs
BCh	Clear parity checkers
BDh	Display MultiBoot menu
BEh	Clear screen (optional)
BFh	Check virus and backup reminders
C0h	Try to boot with INT 19
C1h	Initialize POST Error Manager (PEM)
C2h	Initialize error logging
C3h	Initialize error display function
C4h	Initialize system error handling
C5h	Plug and Play Dual CMOS (optional)
C6h	Initialize notebook docking (optional)
C7h	Initialize notebook docking late

Checkpoint Code	POST Routine Description
C8h	Force check (optional)
C9h	Extended checksum (optional)
D2h	Unknown interrupt
The following are for boot block in Flash ROM	
E0h	Initialize the chipset
E1h	Initialize the bridge
E2h	Initialize the CPU
E3h	Initialize system timer
E4h	Initialize system I/O
E5h	Check force recovery boot
E6h	Checksum BIOS ROM
E7h	Go to BIOS
E8h	Set Huge Segment
E9h	Initialize Multi Processor
EAh	Initialize OEM special code
EBh	Initialize PIC and DMA
ECh	Initialize Memory type
EDh	Initialize Memory size
EEh	Shadow Boot Block
EFh	System memory test
F0h	Initialize interrupt vectors
F1h	Initialize Run Time Clock
F2h	Initialize video
F3h	Initialize system management mode
F4h	Output one beep before boot
F5h	Boot to Mini DOS

Checkpoint Code	POST Routine Description
F6h	Clear Huge segment
F7h	Boot to Full DOS

Error Message Summary

The Error Message Utility or EMU (.COM application written in C language) is to provide full screen online help messages (localized) on most common POST errors. When an error is generated in POST during the boot process, EMU is run by typing ENTER. The entry point of each EMU message is a 4-digits error code generated by POST.

If the POST reports an error, one of the following four error categories will be displayed.

Category #1: if the error requires Setup to be run, the POST should prompt:

<F1= Continue>, <F2= Setup>, <Enter= View System Error>

and pause. (Refer to autoconfig specification for more details on POST prompts)

Category #2: if the error is only a warning (i.e. key stuck), the POST should prompt:

<Enter= View System Error>

for 2 seconds then boot. (Refer to autoconfig specification for more details on POST prompts)

Category #3: if the error occurs because a device has been unplugged or removed, the POST should prompt :

"If errors are reported because one or more of the listed components have been removed, press <F4> to validate the changes."

<F1= Continue>, <F2= Setup>, <F4= Validate Change>, <Enter= View System Error>

and pause. (Refer to autoconfig specification for more details on POST prompts)

Category #4: if the error is serious, the POST should prompt:

The BIOS has detected a serious problem that prevents your Personal Workstation from booting."

<F2= Setup>, <Enter= View System Error>

and stop. Only the setup and the EMU can be run. The BIOS must never boot on HDD.

The following table lists the error codes, causes and symptoms, and the accompanying short messages that are displayed in the upper left corner of the screen.

Table 5-5. Error Codes, Causes and Symptoms

Code #	Cause / Symptom	Short message (US)
0000h	Any POST error that is not listed below	System error
0010h	CMOS Checksum error (if no Serial EEProm)	Incorrect CMOS Checksum
0011h	Date and Time (CMOS backed up from SE2P)	Date and Time Lost
0012h	Personal Workstation configuration lost (both SE2P and CMOS lost)	Incorrect Personal Workstation Configuration
0020h	Any POST error regarding an AT option ROM	Option ROM Error
0021h	Any POST error regarding an external PCI card issue	PCI Error
0022h	Any POST error regarding an AT PnP issue	ISA P1P Error
0030h	Unsupported CPU speed switch setting	Wrong CPU Speed Setting
0040h	Serial number corrupted (bad checksum or null #)	Invalid Personal Workstation Serial Number
0041	Product flag not initialized or bad	Invalid Internal product type
0050h	Fan not connected (according to CPU)	Fan Not Connected
0060h	RPO initialization failure	Remote Power On Error
0100h	Keyboard stuck key	Keyboard Error
0101h	Keyboard self-test failure	Keyboard Error
0102h	Keyboard controller I/O access failure	Keyboard Error
0103h	Keyboard not connected	Keyboard Not Connected
0105h	Mouse self-test failure	Mouse Error
0106h	Mouse not detected (but configured in CMOS)	Mouse Error
0108h	Mouse and Keyboard connectors reversed	Keyboard and Mouse Error
0200h	Conflict on serial port (@, IRQ)	Serial Port Error
0201h	Conflict on parallel port (@, IRQ, DMA)	Parallel Port Error
0300h	Floppy A: self-test failure	Flexible Disk Drive A Error
0301h	Floppy B: self-test failure	Flexible Disk Drive B Error

Table 5-5. Error Codes, Causes and Symptoms

Code #	Cause / Symptom	Short message (US)
0310h	Floppy A: not detected (but configured in CMOS)	Flexible Disk Drive Error
0311h	Floppy B: not detected (but configured in CMOS)	Flexible Disk Drive Error
0305h	Floppy A: plugged on Floppy B: connector	Flexible Disk Drive Error
0306h	General failure on floppy controller	Flexible Disk Drive Error
0307h	Conflict on floppy disk controller	Flexible Disk Drive Error
0400h	CD-ROM test failure	CD-ROM Error
0401h	CD-ROM not detected (but configured in CMOS)	CD-ROM Error
0500h	General failure on HDD onboard primary ctrl	IDE Device Error
0501h	General failure on HDD onboard secondary ctrl	IDE Device Error
0510h	HDD # 0 self-test error	IDE Device # 0 Error
0511h	HDD # 1 self-test error	IDE Device # 1 Error
0512h	HDD # 2 self-test error	IDE Device # 2 Error
0513h	HDD # 3 self-test error	IDE Device # 3 Error
0520h	HDD # 0 not detected (but configured in CMOS)	IDE Device # 0 Error
0521h	HDD # 1 not detected (but configured in CMOS)	IDE Device # 1 Error
0522h	HDD # 2 not detected (but configured in CMOS)	IDE Device # 2 Error
0523h	HDD # 3 not detected (but configured in CMOS)	IDE Device # 3 Error
0530h	Found a drive on slave connector only (primary)	IDE Device Error
0531h	Found a drive on slave connector only (secondary)	IDE Device Error
0540h	Conflict on hard disk controller	IDE Device Error
0600h	Found less video memory than configured in CMOS	Video Memory Error
0700h	Found less DRAM memory than at previous boot	System Memory Error

Table 5-5. Error Codes, Causes and Symptoms

Code #	Cause / Symptom	Short message (US)
0711h	Defective SIMM (module 1, bank 1)	System Memory Error
0712h	Defective SIMM (module 2, bank 1)	System Memory Error
0721h	Defective SIMM (module 1, bank 2)	System Memory Error
0722h	Defective SIMM (module 2, bank 2)	System Memory Error
0731h	Defective SIMM (module 1, bank 3)	System Memory Error
0732h	Defective SIMM (module 2, bank 3)	System Memory Error
0800h	Found lower cache size than configured	System Cache Error
0801h	Cache self-test failure	System Cache Error
0900h	Lan (Chanteclerc) self-test failure	Integrated LAN Error
0901h	Lan (Chanteclerc) not detected (but enabled in Setup)	Integrated LAN Error
0A00h	Plug and Play video auto-setting failure (DDC hang)	DDC Video Error

The following table summarizes the most significant of the problems that can be reported.

Table 5-6. Summary of the Most Significant Problems That Can Be Reported

Message	Explanation or Suggestions for Corrective Action
Operating system not found	Check whether the disk, HDD, FDD or CD-ROM disk drive is connected. If it is connected, check that it is detected by POST. Check that your boot device is enabled on the Setup Security menu. If the problem persists, check that the boot device contains the operating system.
Missing operating system	If you have configured HDD user parameters, check that they are correct. Otherwise, use HDD type “Auto” parameters.
Resource Allocation Conflict -PCI device 0079 on system board	Clear CMOS.
Video Plug and Play interrupted or failed. Re-enable in Setup and try again	You may have powered your computer Off/On too quickly and the computer turned off Video plug and play as a protection.
System CMOS checksum bad - run Setup	CMOS contents have changed between 2 power-on sessions. Run Setup for configuration.
No message, system “hangs”	Check that the main memory modules are correctly set in their sockets.
Other	An error message may be displayed and the computer may “hang” for 20 seconds and then beep. The POST is probably checking for a mass storage device which it cannot find and the computer is in Time-out Mode. After Time-out, run Setup to check the configuration.
4 - 4 - 2 - 4 (Beep code)	Switch 10 is not correctly set or flash is corrupted. The BIOS update crisis recovery procedure is to be used.

Beep Codes

If a terminal error occurs during POST, the system issues a beep code before attempting to display the error in the upper left corner of the screen. Beep codes are useful for identifying the error when the system is unable to display the error message.

Beep Pattern	Beep Code	Numeric Code	Description
— - - - - - -	1-2-2-3	16h	BIOS ROM checksum failure
— - - - — —	1-3-1-1	20h	DRAM refresh test failure
— - - - — - - -	1-3-1-3	22h	8742 Keyboard controller test failure
— - - - — - - -	1-3-3-1	28h	Memory initialization error
— - - - - - - - —	1-3-4-1	2Ch	RAM failure on address line xxxx[1]
— - - - - - - - - - -	1-3-4-3	2Eh	RAM failure on data bits xxxx1 of low byte of memory bus
- - — - - - - -	2-1-2-3	46h	ROM copyright notice check failure
- - - - - - - —	2-2-3-1	58h	Unexpected interrupts test failure
— - -	1-2	98h	Video configuration failure or option ROMs checksum failure
- - - - - - - - - - - - - - - -	4-4-2-4	F7	Crisis Recovery Failure
-	1	B4h	This does not indicate an error. There is one short beep before system start-up.

1. If the BIOS detects error 2C or 2E (base 512K RAM error), it displays an additional word-bitmap (xxxx) indicating the address line or bits that failed. For example, “2C 0002” means address line 1 (bit one set) has failed. “2E 1020” means data bits 12 and 5 (bits 12 and 5 set) have failed in the lower 16 bits.

A Regulatory Information and Warranty

DECLARATION OF CONFORMITY
according to ISO/IEC Guide 22 and EN 4501 4

Manufacturer's Name: **HEWLETT-PACKARD**

Manufacturer's Address: **5 Avenue Raymond Chanas**
38320 Eybens
FRANCE

Declares that the product:

Product Name: **P-Class/X-Class HP VISUALIZE Personal Workstation**
Model Number: **MT Model**

Conforms to the following Product Specifications:

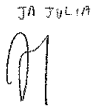
SAFETY **International: IEC 950: 1991+A1+A2+A3 +4**
Europe: EN 60950: 1992+A1+A2+A3

EMC **CISPR 22: 1993**

EN 55022: 1994 Class B

EN 50082-1: 1992
IEC 801-2: 1992 / prEN 55024-2: 1992 - 4 kV CD, 8 kV AD
IEC 801-3: 1984 / prEN 55024-3: 1991 - 3 V/m
IEC 801-4: 1988 / prEN 55024-4: 1992 - 0.5 kV Signal Lines, 1 kV Power Lines
IEC 555-2: 1982+A1:1985 / EN 60555-2: 1987
IEC 1000-3-3: 1994 / EN 61000-3-3: 1995

Supplementary information: The product herewith complies with the requirements of the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC both amended by the Directive 93/68/EEC and carries the CE marking accordingly.



Grenoble
June 1998

Jean-Marc JULIA
Product Quality Manager

Regulatory Information

FCC (for USA only)

Federal Communications Commission Radio Frequency Interference Statement
Warning:
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates and uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by one or more of the following measures:

- reorient or relocate the receiving antenna
- increase the separation between the equipment and the receiver
- connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- consult the dealer or an experienced radio/TV technician for help.

Hewlett-Packard's FCC Compliance Tests were conducted with HP-supported peripheral devices and HP shielded cables, such as those you receive with your system. Changes or modifications not expressly approved by Hewlett-Packard could void the user's authority to operate the equipment.

Notice for Canada

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.
Cet appareil numérique de la Class B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Safety Warning for the USA and Canada

If the power cord is not supplied with the computer, select the proper power cord according to your local national electric code.
USA: use a UL listed type SVT detachable power cord.

Canada: use a CSA certified detachable power cord.

For your safety, never remove the PC's cover without first removing the power cord and any connection to a telecommunication network. Always replace the cover before switching on again.

Si le cordon secteur n'est pas livré avec votre ordinateur, utiliser un cordon secteur en accord avec votre code electrique national.
USA: utiliser un cordon secteur "UL listed," de type SVT.
Canada: utiliser un cordon secteur certifié CSA.

Pour votre sécurité, ne jamais retirer le capot de l'ordinateur sans avoir préalablement débranché le cordon secteur et toute connection à un réseau de télecommunication. N'oubliez pas de replacer le capot avant de rebrancher le cordon secteur.

Notice for the United Kingdom

The HP VISUALIZE Personal Workstations are approved under approval number NS/G/1234/J/100003 for indirect connection to Public Telecommunication Systems within the United Kingdom.

Notice for the Netherlands

Bij dit apparaat zijn batterijen geleverd. Wanneer deze leeg zijn, moet U ze niet weggooien maar inleveren als KCA.

Notice for Germany

Wenn die Batterie nicht korrekt eingebaut wird, besteht Explosionsgefahr. Zu ihrer eigenen Sicherheit sollten Sie nicht versuchen, die Batterie wiederaufzuladen, zu zerlegen oder die alte Batterie zu verbrennen. Tauschen Sie die Batterie nur gegen den gleichen oder ähnlichen Typ aus, der vom Hersteller empfohlen wird. Bei der in diesem PC intergrierten Batterie handelts sich um eine Lithium-Batterie, die keine Schwermetalle enthält. Batterien und Akkumulatoren gehören nicht in den Hausmüll. Sie verden vom Hersteller, Händler oder deren Beauftragten kostenlos zurückgenommen, um sie einer Verwertung bzw. Entsorgung zuzuführen.

Noise Declaration for Germany

Lärmangabe nach Maschinenlärmverordnung - 3 GSGV (Deutschland) LpA < 70 db am Arbeitsplatz normaler Betrieb nach EN27779: 11.92.

Notice for Japan

この装置は，情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＢ情報技術装置です。この装置は，家庭環境で使用することを目的としていますが，この装置がラジオやテレビジョン受信機に近接して使用されると，受信障害を引き起こすことがあります。
取り扱い説明書に従って正しい取り扱いをして下さい。

This equipment is in the Class B category information technology equipment based on the rules of the Voluntary Control Council For Interference by Information Technology Equipment (VCCI). Although aimed for residential area operation, radio interference may be caused when used near a radio or TV receiver. Read the instructions for correct operation.

Notice for Korea

사용자 안내문 (B급 기기)

이 기기는 비업무용으로 전자파장해검정을 받은 기기로서, 주거지역에서는 물론 모든 지역에서 사용할 수 있습니다.

Recycling Your PC

HP has a strong commitment toward the environment. Your HP Personal Computer has been designed to respect the environment as much as possible.

HP can also take your old PC back for recycling when it reaches the end of its useful life.

HP has a product take-back program in several countries. The collected equipment is sent to one of HP's recycling facilities in Europe or the USA. As many parts as possible are reused. The remainder is recycled. Special care is taken for batteries and other potentially toxic substances, which are reduced into non-harmful components through a special chemical process.

If you require more details about HP's product take-back program, contact your dealer or your nearest HP Sales Office.

HP Hardware Warranty

Important: This is your hardware product warranty statement. Please, read it carefully.

Warranty terms may be different in your country. If so, your Authorized HP Dealer or Hewlett-Packard Sales and Service Office can give you details.

HP products may contain remanufactured parts equivalent to new in performance or may have been subject to incidental use.

HP products external to the system processor unit —such as external storage subsystems, displays, printers, and other peripherals— are covered by the applicable warranties for those products; HP software is covered by the HP Software Product Limited Warranty

FOR CONSUMER TRANSACTIONS IN AUSTRALIA AND NEW ZEALAND: THE WARRANTY TERMS CONTAINED IN THIS STATEMENT, EXCEPT TO THE EXTENT LAWFULLY PERMITTED, DO NOT EXCLUDE, RESTRICT OR MODIFY AND ARE IN ADDITION TO THE MANDATORY STATUTORY RIGHTS APPLICABLE TO THE SALE OF THIS PRODUCT TO YOU.

Three Year Limited Hardware Warranty

Hewlett-Packard (HP) warrants this hardware product against defects in materials and workmanship for a period of three years from receipt by the original end-user purchaser.

The three year warranty includes on-site service during the first year of use (free parts and labor), and parts service provided by an HP Service Center or a participating Authorized HP Personal Computer Dealer Repair Center, during the second and third years of use.

If HP receives notice of above defined defects during the warranty period, HP will either, at its option, repair or replace products, which prove to be defective.

Should HP be unable to repair or replace the product within a reasonable amount of time, the customer's alternate exclusive remedy shall be a refund of the purchase price upon return of the product.

The system processor unit, keyboard, mouse, and Hewlett-Packard

accessories inside the system processor unit —such as video adapters, mass storage devices, and interface controllers— are covered by this warranty.

This warranty is extended worldwide under certain conditions (please check with your local HP office) to products purchased from HP or an Authorized HP Personal Computer Dealer which are reshipped by the original purchaser either for use by the original purchaser or provided as an incidental part of systems integrated by the original purchaser. When available in the country of use, service is provided in the same manner as if the product was purchased in that country and can only be provided in countries where the product is designed to operate. If the product is not normally sold by HP in the country of use, it must be returned to the country of purchase for service. Response time for on-site service, and parts delivery turn-around time for parts service, are subject to changes from standard conditions based upon non-local
parts availability.

Limitation of Warranty

The above warranty shall not apply to defects resulting from: misuse; unauthorized modification; operation or storage outside the environmental specifications for the product; in-transit damage; improper maintenance; or defects resulting from use of non-HP software, accessories, media, supplies, consumables, or such items not designed for use with the product.

Reloading the bundled or pre-loaded software on your Personal Workstation is not covered by the HP warranty.

HP MAKES NO OTHER EXPRESS WARRANTY, WHETHER WRITTEN OR ORAL, WITH RESPECT TO THIS PRODUCT. ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS IS LIMITED TO THE THREE-YEAR DURATION OF THIS WRITTEN WARRANTY. SOME STATES OR PROVINCES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

This warranty gives you specific legal rights, and you may also have other rights, which vary, from state to state, or province to province.

Limitation of Liability and Remedies

THE REMEDIES PROVIDED ABOVE ARE THE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT SHALL HP BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON WARRANTY, CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

The foregoing limitation of liability shall not apply in the event that any HP product sold hereunder is determined by a court of competent jurisdiction to be defective and to have directly caused bodily injury, death, or property damage; provided, that in no event shall HP's liability for property damage exceed the greater of $50,000 or the purchase price of the specific product that caused such damage.

Some states or provinces do not allow the exclusion or limitation of incidental or consequential damages —including lost profit— so the above limitation or exclusion may not apply to you.

Obtaining On-Site Warranty Service

To obtain on-site warranty service, the customer must contact an HP Sales and Service Office (in the US, call the HP Customer Support Center at (970) 635-1000) or a participating Authorized HP Personal Computer Dealer Repair Center. The customer must be prepared to supply proof of the purchase date.

The system processor unit, keyboard, mouse, and Hewlett-Packard accessories inside the system processor unit —such as video adapters, mass storage devices, and interface controllers— are covered by this warranty.

During the on-site warranty period, customer-replaceable components may be serviced through expedited part shipment. In this event, HP will prepay shipping charges, duty, and taxes; provide telephone assistance on replacement of the component when necessary; and pay shipping charges, duty, and taxes for any part that HP asks to be returned.

On-site visits caused by non-Hewlett-Packard products —whether internal or external to the system processor unit— are subject to standard per-incident travel and labor charges.

On-site service for this product is restricted or unavailable in certain locations. In HP Excluded Travel Areas— areas where geographical obstacles, undeveloped roads, or unsuitable public transportation

prohibit routine travel— service is provided on a negotiated basis at extra charge.

Response time for HP on-site service in an HP Service Travel Area is normally next business day (excluding HP holidays) for HP Travel Zones 1-3 (generally 100 miles or 160 Km from the HP office). Response time is second business day for Zones 4 and 5 (200 miles, 320 Km); third business day for Zone 6 (300 miles, 480 Km); and negotiated beyond Zone 6. Worldwide Customer Support Travel information is available from any HP Sales and Service Office.

Travel restrictions and response time for dealer or distributor service are defined by the participating dealer or distributor.

Service contracts which provide after-hour or weekend coverage, faster response time, or service in an Excluded Travel Area are often available from HP, an authorized dealer, or authorized distributor at additional charge.

Customer Responsibilities

The customer may be required to run HP-supplied diagnostic programs before an on-site visit or replacement part will be dispatched.

The customer is responsible for the security of its proprietary and confidential information and for maintaining a procedure external to the products for reconstruction of lost or altered files, data, or programs.

The customer must provide: access to the product; adequate working space and facilities within a reasonable distance of the product; access to and use of all information and facilities determined necessary by HP to service the product; and operating supplies and consumables such as the customer would use during normal operation.

A representative of the customer must be present at all times. The customer must state if the product is being used in an environment which poses a potential health hazard to repair personnel; HP or the servicing dealer may require that the product be maintained by customer personnel under direct HP or dealer supervision.

Obtaining Parts Warranty Service

When parts warranty service applies, the customer may be required to run HP-supplied diagnostic programs before a replacement part will be dispatched. The customer must be prepared to supply proof of purchase.

The customer shall return some defective parts upon HP demand. In that case, HP will prepay shipping charges for parts returned to the HP parts service center.

HP Telephone Support Services

HP Free telephone support for your Personal Workstation is available during the first year from date of purchase. This service will also provide technical assistance with the basic configuration and setup of your HP VISUALIZE Personal Workstation and for the bundled or pre-loaded operating system.

Telephone support is available at the end of the first year from date of purchase, via the Lifeline program, which is a fee-based service (North America and Europe only).

HP does NOT provide telephone support for Personal Workstations configured as network servers. We recommend HP NetServers for your network server requirements.

(Rev. 17/03/98)

HP Software Product License Agreement and Limited Warranty

Your HP VISUALIZE Personal Workstation contains preinstalled software programs. Please read the Software License Agreement before proceeding.

CAREFULLY READ THIS LICENSE AGREEMENT AND LIMITED WARRANTY STATEMENT BEFORE PROCEEDING TO OPERATE THIS EQUIPMENT. RIGHTS IN THE SOFTWARE ARE OFFERED ONLY ON THE CONDITION THAT THE CUSTOMER AGREES TO ALL TERMS AND CONDITIONS OF THE LICENSE AGREEMENT. PROCEEDING TO OPERATE THE EQUIPMENT INDICATES YOUR ACCEPTANCE OF THESE TERMS AND CONDITIONS. IF YOU DO NOT AGREE WITH THE TERMS OF THE LICENSE AGREEMENT, YOU MUST NOW EITHER REMOVE THE SOFTWARE FROM YOUR HARD DISK DRIVE AND DESTROY THE MASTER DISKETTES, OR RETURN THE COMPLETE COMPUTER AND SOFTWARE FOR A FULL REFUND.

PROCEEDING WITH CONFIGURATION SIGNIFIES YOUR ACCEPTANCE OF THE LICENSE TERMS.

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UNLESS OTHERWISE STATED BELOW, THIS HP SOFTWARE PRODUCT LICENSE AGREEMENT SHALL GOVERN THE USE OF ALL SOFTWARE THAT IS PROVIDED TO YOU, THE CUSTOMER, AS PART OF THE HP COMPUTER PRODUCT. IT SHALL SUPERSEDE ANY NON-HP SOFTWARE LICENSE TERMS THAT MAY BE FOUND ON-LINE, OR IN ANY DOCUMENTATION OR OTHER MATERIALS CONTAINED IN THE COMPUTER PRODUCT PACKAGING.

Note: Operating System Software by Microsoft is licensed to you under the Microsoft End User License Agreement (EULA) contained in the Microsoft documentation.

The following License Terms govern the use of the software:

USE. Customer may use the software on any one computer. Customer may not network the software or otherwise use it on more than one computer. Customer may not reverse assemble or decompile the software unless authorized by law.

COPIES AND ADAPTATIONS. Customer may make copies or adaptations of the software (a) for archival purposes or (b) when copying or adaptation is an essential step in the use of the software with a computer so long as the copies and adaptations are used in no other manner.

OWNERSHIP. Customer agrees that he/she does not have any title or ownership of the software, other than ownership of the physical media. Customer acknowledges and agrees that the software is copyrighted and protected under the copyright laws. Customer acknowledges and agrees that the software may have been developed by a third party software supplier named in the copyright notices included with the software, who shall be authorized to hold the Customer responsible for any copyright infringement or violation of this Agreement.

PRODUCT RECOVERY CD-ROM. If your computer was shipped with a product recovery CD-ROM: (i) The product recovery CD-ROM and/or support utility software may only be used for restoring the hard disk of the HP computer with which the product recovery CD-ROM was originally provided.(ii) The use of any operating system software by Microsoft contained in any such product recovery CD-ROM shall be governed by the Microsoft End User License Agreement (EULA).

TRANSFER OF RIGHTS IN SOFTWARE. Customer may transfer rights in the software to a third party only as part of the transfer of all rights

and only if Customer obtains the prior agreement of the third party to be bound by the terms of this License Agreement. Upon such a transfer, Customer agrees that his/her rights in the software are terminated and that he/she will either destroy his/her copies and adaptations or deliver them to the third party.

SUBLICENSING AND DISTRIBUTION. Customer may not lease, sublicense the software or distribute copies or adaptations of the software to the public in physical media or by telecommunication without the prior written consent of Hewlett-Packard.

TERMINATION. Hewlett-Packard may terminate this software license for failure to comply with any of these terms provided Hewlett-Packard has requested Customer to cure the failure and Customer has failed to do so within thirty (30) days of such notice.

UPDATES AND UPGRADES. Customer agrees that the software does not include updates and upgrades which may be available from Hewlett-Packard under a separate support agreement.

EXPORT CLAUSE. Customer agrees not to export or re-export the software or any copy or adaptation in violation of the U.S. Export Administration regulations or other applicable regulation.

U.S. GOVERNMENT RESTRICTED RIGHTS. Use, duplication, or disclosure by the U.S. Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause in DFARS 252.227-7013. Hewlett-Packard Company, 3000 Hanover Street, Palo Alto, CA94304 U.S.A. Rights for non-DOD U.S. Government Departments and Agencies are as set forth in FAR 52.227-19(c)(1,2).

HP Software Product Limited Warranty

THIS HP SOFTWARE PRODUCT LIMITED WARRANTY SHALL COVER ALL SOFTWARE THAT IS PROVIDED TO YOU, THE CUSTOMER, AS PART OF THE HP COMPUTER PRODUCT, INCLUDING ANY OPERATING SYSTEM SOFTWARE. IT SHALL SUPERSEDE ANY NON-HP WARRANTY TERMS THAT MAY BE FOUND ON-LINE, OR IN ANY DOCUMENTATION OR OTHER MATERIALS CONTAINED IN THE COMPUTER PRODUCT PACKAGING.

Ninety-Day Limited Software Warranty. HP warrants for a period of NINETY (90) DAYS from the date of the purchase that the software

product will execute its programming instructions when all files are properly installed. HP does not warrant that the software will be uninterrupted or error free. In the event that this software product fails to execute its programming instructions during the warranty period, Customer's remedy shall be a refund or repair. Should HP be unable to replace the media within a reasonable amount of time, Customer's alternate remedy shall be a refund of the purchase price upon return of the product and all copies.

Removable Media (If supplied). HP warrants the removable media, if supplied, upon which this product is recorded to be free from defects in materials and workmanship under normal use for a period of NINETY (90) DAYS from the date of purchase. In the event the media proves to be defective during the warranty period, Customer's remedy shall be to return the media to HP for replacement. Should HP be unable to replace the media within a reasonable amount of time, Customer's alternate remedy shall be a refund of the purchase price upon return of the product and destruction of all other non removable media copies of the software product.

Notice of Warranty Claims. Customer must notify HP in writing of any warranty claim not later than thirty (30) days after the expiration of the warranty period.

Limitation of Warranty. HP makes no other express warranty, whether written or oral with respect to this product. Any implied warranty of merchantability or fitness for a particular purpose is limited to the 90-day duration of this written warranty. Some states or provinces do not allow limitations on how long an implied warranty lasts, so the above limitation or exclusion may not apply to you. This warranty gives specific legal rights, and you may also have other rights which vary from state to state, or province to province.

Limitation of Liability and Remedies. THE REMEDIES PROVIDED ABOVE ARE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT SHALL HP BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING LOST PROFIT) WHETHER BASED ON WARRANTY, CONTRACT, TORT OR ANY OTHER LEGAL THEORY. Some states or provinces do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Obtaining Warranty Service. Warranty service may be obtained from the nearest HP sales office or other location indicated in the owner's manual or service booklet.

Consumer transactions in Australia and the United Kingdom: The disclaimers and limitations above shall not apply and shall not affect the statutory rights of a Consumer.

(Rev. 19/11/96)

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