

**HP  
KAYAK**



**HP Kayak XM600 PC Workstation**  
***Technical Reference Manual***

PC Workstations  
High-Performance Desktops



High-Performance

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## Preface

This manual is a technical reference and BIOS document for engineers and technicians providing system level support. It is assumed that the reader possesses a detailed understanding of AT-compatible microprocessor functions and digital addressing techniques.

Technical information that is readily available from other sources, such as manufacturers' proprietary publications, has not been reproduced.

This manual contains summary information only. For additional reference material, refer to the bibliography on the following page.

For all warning and safety instructions, refer to the user guide delivered with the PC Workstation.

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## Conventions

The following conventions are used throughout this manual to identify specific numeric elements:

Hexadecimal numbers are identified by a lower case h.

For example, 0FFFFFFFh or 32F5h

Binary numbers and bit patterns are identified by a lower case b.

For example, 1101b or 10011011b

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## Bibliography

Online documentation can be obtained from the HP World Wide Web site: [www.hp.com/go/kayaksupport](http://www.hp.com/go/kayaksupport).

- ☐ HP Kayak XM600 PC Workstation *User's Guide* —  
Desktop - D8368-90001.  
Minitower - D8369-90001<sup>1</sup>.
- ☐ HP Kayak XM600 PC Workstation *Troubleshooting Guide* —  
Desktop and Minitower versions are available in English, French,  
Italian, German, Spanish, Swedish and Japanese.
- ☐ HP Kayak XM600 PC Workstation *Technical Notes* — available in  
Desktop and Minitower English versions only.
- ☐ HP Kayak XM600 PC Workstation *Technical Notes* — available in  
Desktop and Minitower English versions only.
- ☐ HP Kayak XU800 PC Workstation *Service Handbook Chapter* —  
available in Desktop and Minitower English versions only.
- ☐ *Image Creation and Recovery CD-ROM* — 5011-6692-xx<sup>2</sup>.

### Extra Information Can Be Obtained At:

- ☐ ELSA GLoria Synergy graphics card  
<http://www.elsa.com>
- ☐ Matrox graphics cards  
<http://www.matrox.com>
- ☐ 3D Labs Oxygen GVX1 graphics card  
<http://www.3dlabs.com>
- ☐ Intel Chipsets. Intel I840 chipset  
<http://developer.intel.com>
- ☐ Intel Pentium III Processor  
<http://developer.intel.com>

- 
1. Also includes information about the HP Kayak XU800 Minitower PC Workstation.
  2. xx = Language code.



## System Overview

This manual describes the *HP Kayak XM600 Desktop and Minitower PC Workstation* and provides detailed system specifications.

This chapter introduces the external features, and lists the specifications and characteristic data of the system. It also provides a summary of the documentation available.

### HP Kayak XM600 PC Workstation Overview

The *HP Kayak XM600 PC Workstation* is based on the ATX form factor. The following table provides an overview of the system.

How to use the table:

	Component is common to more than one model.
	Component is available only on HP Kayak XM600 Desktop PC Workstations.
	Component is available only on HP Kayak XM600 Minitower PC Workstations.

Feature	Description	
	<i>Desktop</i>	<i>Minitower</i>
<b><i>ATX Form Factor System Board</i></b>	Dimensions of 12-inches x 9.6-inches in an ATX package.	Dimensions of 12-inches x 9.6-inches in an Extended-ATX (E-ATX) package
<b><i>Processor</i></b>	<p>All models have support for up to two Intel Pentium®III processor.</p> <p>500 MHz processor with a 100 MHz FSB (Front Side Bus). Processors from 533 MHz and upwards with a 133 MHz FSB.</p> <p>The HP Kayak XM600 PC Workstations include integrated VRMs (Voltage Regulator Module) on the system board. A separate VRM is not required.</p>	
<b><i>Cache Memory (integrated in processor package)</i></b>	<ul style="list-style-type: none"> <li>Level-One: 16 KB code, 16 KB data.</li> <li>Level-Two: 1256 KB or 512 KB.</li> </ul>	
<b><i>External Processor Bus</i></b>	<p>500 MHz, 550MHz with a 100 MHz FSB (Front Side Bus). 600 MHz, 667 MHz, 733 MHz with a 133 MHz FSB.</p>	

## 1 System Overview

### HP Kayak XM600 PC Workstation Overview

Feature	Description	
	Desktop	Minitower
<b>Chipset</b>	Intel® Chipset (I820) including Memory Controller Hub (MCH) Host Bridge, Input/Output Controller Hub (ICH) for input/output sub-system.	
<b>Super I/O Chip</b>	NS 87364.	
<b>BIOS</b> (Basic Input/Output System)	Based on Phoenix core including: <ul style="list-style-type: none"> <li>• 4 M/bits of flash memory.</li> <li>• Support for PCI 2.2 Specification.</li> <li>• Support for RIMM or DIMM memory modules.</li> </ul>	
<b>Firmware - BIOS</b>	Flash EEPROM: Intel's Firmware hub concept.	
<b>HP MaxiLife Utility</b> (available on all models)	Hardware monitoring utility that monitors system components via the I <sup>2</sup> C bus.	Hardware monitoring utility that monitors system components via the I <sup>2</sup> C bus and a LCD status panel.
<b>Operating System</b>	Most models are preloaded with Windows NT® 4.0. There are some models that are preloaded with MS-DOS.	
<b>Main Memory</b>	<p>Models include either:</p> <ul style="list-style-type: none"> <li>• Two RIMM sockets supporting RDRAM memory modules. In a single memory configuration, empty sockets must contain: <ul style="list-style-type: none"> <li>□ RIMM 2, a "RDRAM Continuity Module".</li> <li>□ SDRAM Memory Expansion Card socket, a "RDRAM Terminator Module".</li> </ul> </li> </ul> <p>Models are supplied with non-ECC RDRAM modules.</p> <ul style="list-style-type: none"> <li>• Two DIMM sockets supporting SDRAM 100 MHz memory modules. Models are supplied with non-ECC SDRAM modules. A Memory Expansion Card is supplied uniquely with SDRAM models and is installed in the pre-defined socket on the system board.</li> </ul> <p>Up-to-date memory upgrades are listed on the HP PC Accessories website at:  <a href="http://www.hp.com/go/pcaccessories">http://www.hp.com/go/pcaccessories</a> </p>	

Feature	Description	
	<i>Desktop</i>	<i>Minitower</i>
<b>Mass Storage</b>	<p>Five mass storage shelves supporting:</p> <ul style="list-style-type: none"> <li>• One front-access, third-height, floppy disk drive</li> <li>• Two front-access, half-height, 5.25-inch drives</li> <li>• Two internal 3.5-inch hard disk drives (one full-height, one half-height)</li> </ul>	<p>Seven shelves supporting:</p> <ul style="list-style-type: none"> <li>• Two front-access, third-height 3½-inch (one for the floppy disk drive and one free) (height 1");</li> <li>• Three front-access, half-height, 5¼-inch drives (height 1.0"); Possibility of installing a 3½-inch hard disk drive in one of the 5¼-inch shelves.</li> <li>• Two internal 3½-inch hard disk drives (height 1.0").</li> </ul>
<b>SCSI Controller</b>	Symbios Ultra 2 SCSI PCI card (optional).	
<b>IDE Controller</b>	All models include an integrated Ultra ATA-66 controller that supports up to four IDE devices.	
<b>Video Controllers</b>	<ul style="list-style-type: none"> <li>• ELSA Synergy® II AGP video controller with 32 MB of installed SGRAM video memory (maximum configuration).</li> <li>• Matrox® Millennium G250 AGP video controller with 8 MB SGRAM video memory which can be upgraded to 16 MB.</li> <li>• Matrox Millennium G400-Dual monitor AGP video controller with 16 MB SGRAM video memory (maximum configuration).</li> <li>• 3Dlabs Oxygen® GVX1, 32 MB SGRAM video memory (maximum configuration).</li> </ul>	
<b>Accessory Card Slots</b>	<p>One AGP Pro Universal 4x (Accelerated Graphics Port) slot. Standard AGP cards (25 W maximum) can only be used. Hardware protection prevents any AGP PRO cards from being used.</p>	<p>One AGP Pro Universal 4X 32-bit slot with a maximum power consumption tolerated limited to 50 W.</p>
	<ul style="list-style-type: none"> <li>• Five 32-bit 33 MHz PCI<sup>1</sup> (Peripheral Component Interconnect) slots supporting all bridges and multi-function PCI devices. <ul style="list-style-type: none"> <li>□ PCI slot 5 contains a LAN interface board,</li> <li>□ PCI slot 4 is for a SCSI interface board (some models only).</li> </ul> </li> </ul>	

1. All five PCI slots comply with the PCI Specification 2.2.

## 1 System Overview

### HP Kayak XM600 PC Workstation Overview

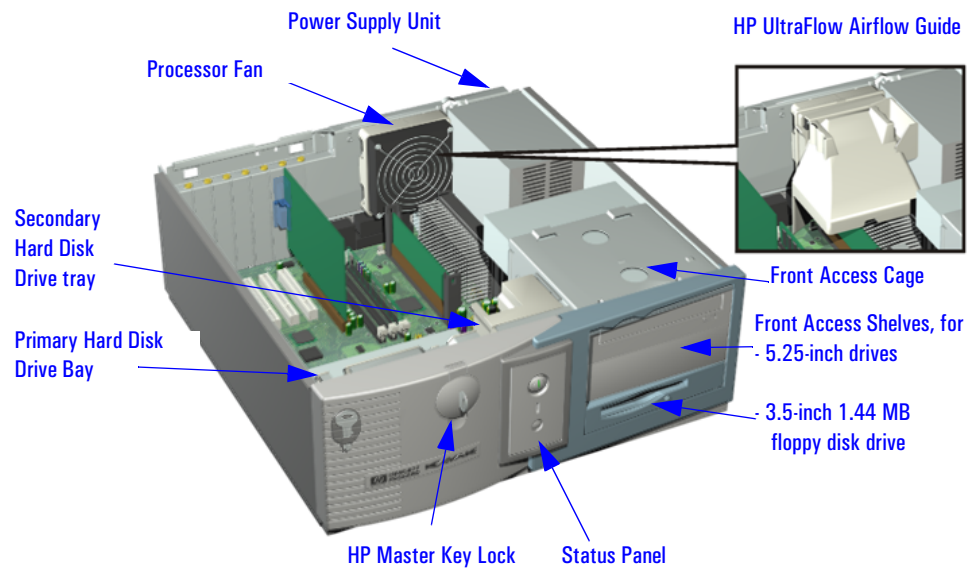
Feature	Description	
	<i>Desktop</i>	<i>Minitower</i>
<b>LAN Card</b>	All models are supplied with an HP 10/100BT PCI Ethernet Adapter LAN card installed in PCI slot 5, supporting Wake-On LAN (WOL) and PCI 2.2 Specification.	
<b>CD-ROM Drive</b>	Models include either an IDE 48X CD-ROM, CD-RW drive or DVD drive.	
<b>Audio</b>	Integrated on the system board CSA4280 audio PCI chip and AC'97 Codec (CS4297) audio.	
<b>HP UltraFlow Cooling System</b>	Cooling system with multiple temperature-regulated fans to optimize cooling. Alert reporting to MaxLife and TopTools.	
<b>System Board Connectors:</b>	<ul style="list-style-type: none"> <li>• One flexible disk drive connector</li> <li>• Two ATA-66 IDE connectors (for up to four IDE devices)</li> <li>• One CD-IN audio connector</li> <li>• AUX connector</li> <li>• Internal speaker connector</li> <li>• One WOL connector</li> <li>• One battery socket</li> <li>• One status panel connector</li> <li>• Power supply connectors</li> <li>• Two fan connectors</li> </ul>	
<b>Rear Connectors (color coded)</b>	<ul style="list-style-type: none"> <li>• Keyboard/Mouse <ul style="list-style-type: none"> <li><input type="checkbox"/> HP enhanced keyboard with mini-DIN connector</li> <li><input type="checkbox"/> HP enhanced scrolling mouse with mini-DIN connector</li> </ul> </li> <li>• 25-pin parallel <ul style="list-style-type: none"> <li><input type="checkbox"/> Mode: Centronics or bidirectional modes (ECP/EPP)</li> <li><input type="checkbox"/> Parallel port: 1 (378h, IRQ 7), 2 (278h, IRQ 5), or Off.</li> </ul> </li> <li>• 9-pin serial (two, buffered) <ul style="list-style-type: none"> <li><input type="checkbox"/> Standard: Two UART 16550 buffered serial ports (both RS-232-C).</li> <li><input type="checkbox"/> Serial Ports A and B: 2F8h (IRQ 3), 2E8h (IRQ 3), 3F8h (IRQ 4), 3E8h (IRQ 4), or Off— (if one port uses 2xxh, the other port must use 3xxh).</li> </ul> </li> <li>• Dual USB connectors</li> <li>• Audio <ul style="list-style-type: none"> <li><input type="checkbox"/> Joystick/Dual MIDI connector</li> <li><input type="checkbox"/> LINE IN jack (3.5 mm)</li> <li><input type="checkbox"/> LINE OUT jack (3.5 mm)</li> <li><input type="checkbox"/> MIC IN jack (3.5 mm)</li> </ul> </li> </ul>	

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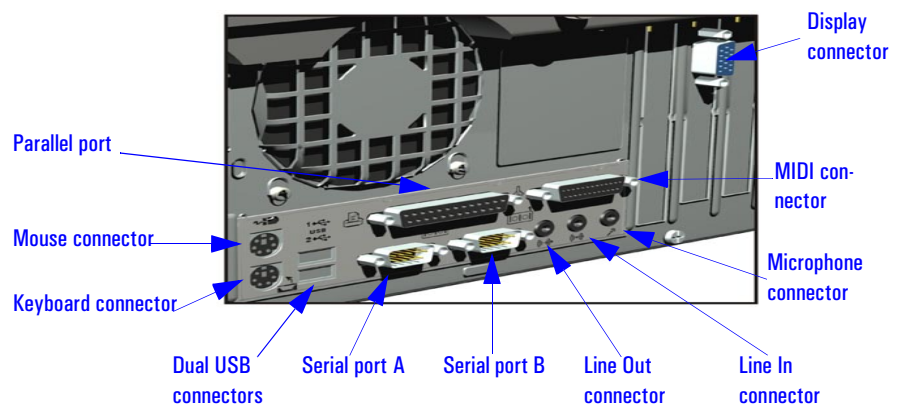
## Package for the Desktop Models

The following two diagrams show the front and rear views of the *HP Kayak XM600 Desktop PC Workstation*.

### Front and Side Views



### Rear View



## 1 System Overview

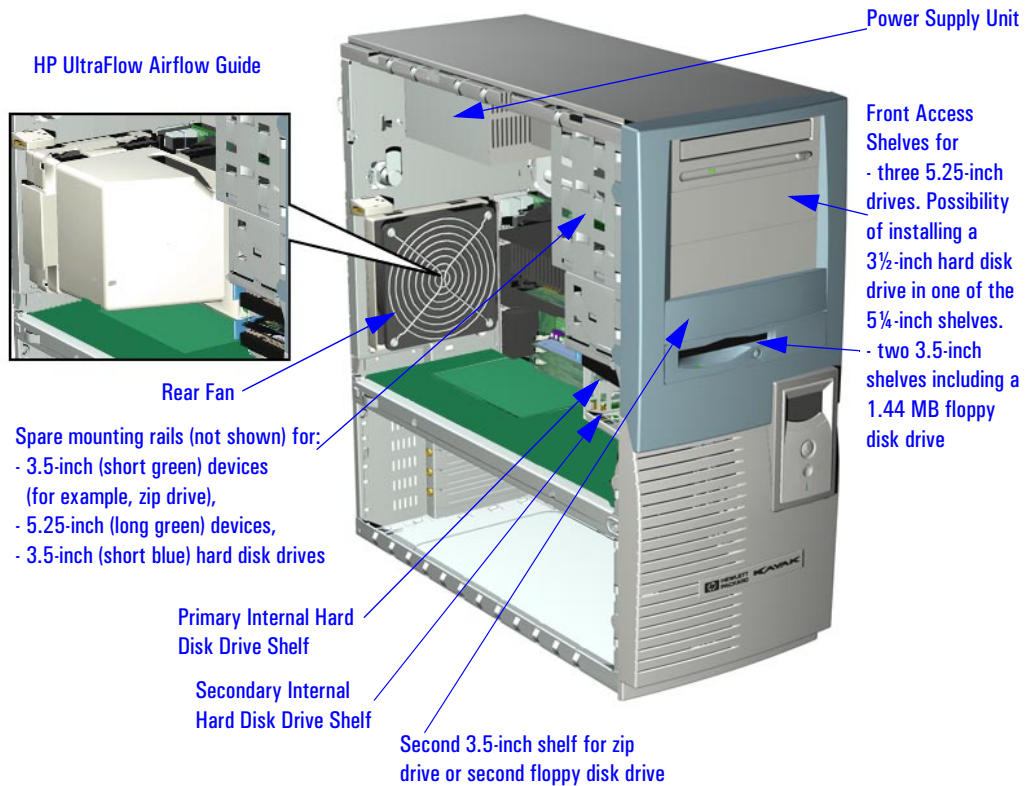
Package for the Minitower Models

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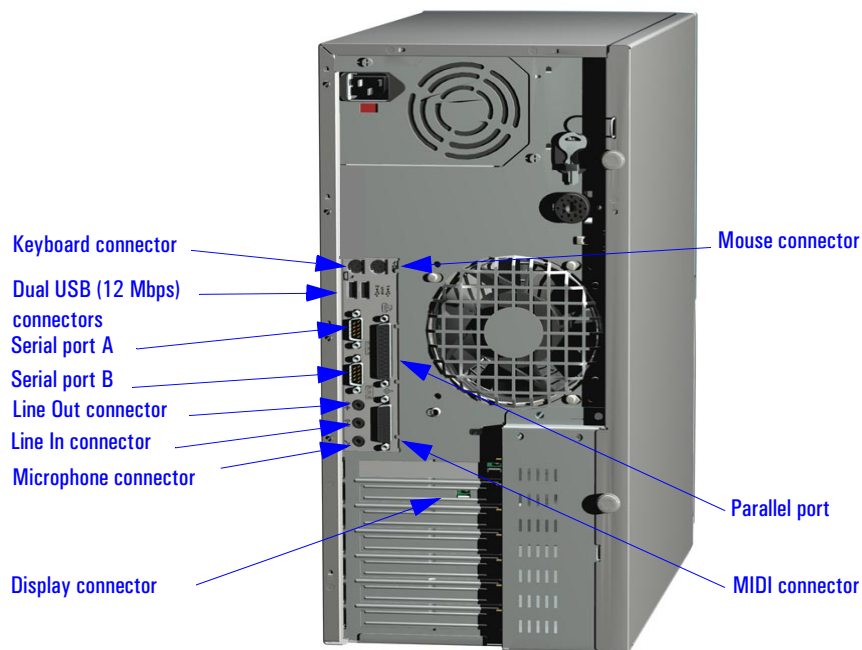
### Package for the Minitower Models

The following two diagrams show the front and rear views of the *HP Kayak XM600 Minitower PC Workstation*.

#### Front and Side Views



## Rear View



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## Internal Features

The core architecture of the *HP Kayak XM600 PC Workstation* is constructed around: Memory Controller Hub (MCH), Input/Output Controller Hub (ICH) and the Host bus.

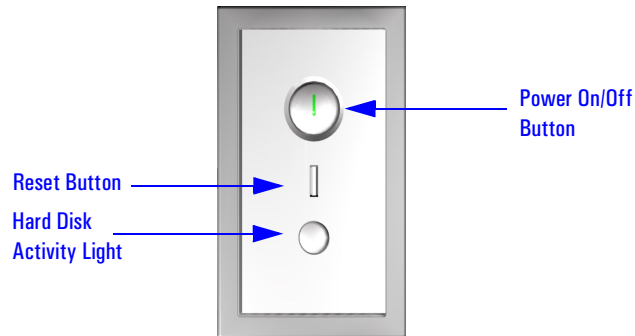
The *HP Kayak XM600 PC Workstation* can support up to two Pentium III processors. This processor is described on [page 67](#).

The components of the system board are described in [chapter 2](#); the video, network and SCSI devices are described in [chapter 3](#); mass storage devices are described in [chapter 4](#); the HP BIOS routines are summarized in [chapter 5](#); and the Power-On Self-Test routines are described in [chapter 6](#).

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## HP Kayak XM600 Desktop Front Panel

The front panel of the *HP Kayak XM600 Desktop PC Workstation* has the following features:



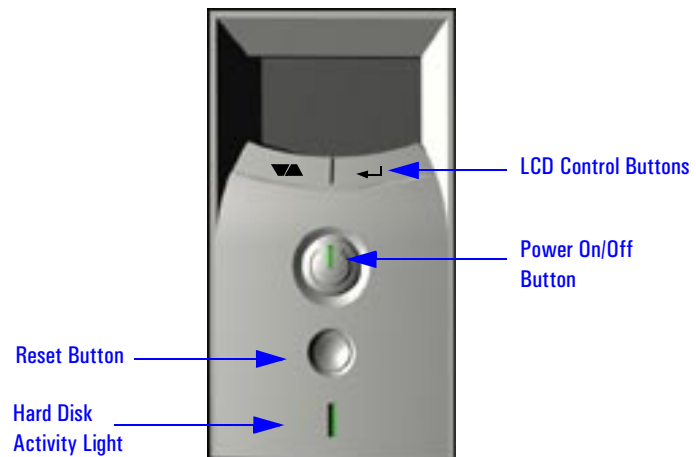
- *On/Off LED*. There are five states:
  - Blank. Indicates that the computer is turned off.
  - Green**. Indicates that the computer is turned on and running correctly.
  - Red**. Indicates that there is a Power-On Self-Test (POST) error.
  - Red flashing**. Indicates that there is a MaxiLife (Diag/Alarm) error.
  - Amber**. Displayed during system reset, system lock, Standby mode (Windows 98) or Suspend mode (Windows 95).
- *Hard disk drive activity LED*. Activated during POST and when the hard disk drive is being accessed.



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## HP Kayak XM600 Minitower Front Panel

The front panel of *HP Kayak XM600 Minitower PC Workstation* has the following features:



- *Liquid Crystal Display (LCD)*. LCD error messages and available menus are described on [page 111](#).
- *On/Off LED*. There are five states:
  - Blank. Indicates that the computer is turned off.
  - Green**. Indicates that the computer is turned on and running correctly.
  - Red**. Indicates that there is a Power-On Self-Test (POST) error.
  - Red flashing**. Indicates that there is a MaxiLife (Diag/Alarm) error.
  - Amber**. Displayed during system reset, system lock, Standby mode (Windows 98) or Suspend mode (Windows 95).
- *Hard disk drive activity LED*. Activated during POST and when the hard disk drive is being accessed.

## 1 System Overview

### HP Kayak XM600 Desktop Specifications and Characteristics

## HP Kayak XM600 Desktop Specifications and Characteristics

### Desktop Physical Characteristics

System Processing Unit	
Weight (excl. keyboard and display):	12.5 kilograms (27.5 pounds).
Dimensions:	45.7 cm max. (D) by 42 cm (W) by 16.2 cm (H) (17.99 inches by 16.53 inches by 6.37 inches).
Footprint:	0.19 m <sup>2</sup> (2.06 sq ft).

### Desktop Electrical Specifications

Parameter	Total Rating		Notes	Maximum per PCI Slots 32-bit 33 MHz	Maximum for AGP Slot <sup>1</sup>
Input voltage	100 - 127 V VAC	200 - 240 V Vac	Switch select	—	—
Input current (max)	7 A	4 A	—	—	—
Output power	200 W		—	—	—
Input frequency	50 to 60 Hz		—	—	—
Available power	200 W		—	65 W combined	25 W (max)
Max current at +12 V	6 A		—	0.5 A	1 A
Max current at -12 V	0.3 A		—	0.1 A	—
Max current at +3.3 V	14 A		—	7.6 A	6 A
Vddq <sup>2</sup>	—		—	—	2 A
Max current at +5 V	22 A		—	5 A	2 A
Max current at -5 V	0.3 A		—	—	—
Max current at +5Vstdby	2 A		—	—	—

1. Standard AGP cards (25 W maximum) can only be used. Hardware protection prevents any AGP PRO cards from being used.
2. Only for I/O buffers.

If the overload protection in the power supply unit is triggered, all power is immediately cut. To reset the power supply unit, remove the power cord and then determine what caused the overload and remedy it. Reconnect the power cord, then reboot the PC Workstation. If an overload happens twice, then there is an undetected short circuit somewhere.

**NOTE**

When the PC Workstation is turned off with the power button on the front panel, the power consumption falls below the low power consumption (refer to the below table), but is not zero. The special on/off method used by this PC Workstation extends the lifetime of the power supply. To reach zero power consumption in "off" mode, either unplug the PC Workstation from the power outlet or use a power block with a switch.

### Desktop Power Consumption and Cooling

The power consumption and acoustics given in the below table is valid for a standard configuration as shipped (one processor, 256 MB of memory, 200 W power supply, one hard disk drive, video card, LAN card)

All information in this section is based on primary power consumptions.

Power consumption - Windows NT:	<b>230 V / 50 Hz and 115 V / 60 Hz</b>
<ul style="list-style-type: none"> <li>Operating with input/output (disk access)</li> </ul>	65 W - 221.7 Btu/h <sup>1</sup>
<ul style="list-style-type: none"> <li>Operating without input/output (idle)</li> </ul>	60 W - 204.7 Btu/h
<ul style="list-style-type: none"> <li>Off with LAN card</li> </ul>	3 W - 10.2 Btu/h

<sup>1.</sup> 1 W = 3.4121 Btu/h

Additional Component:	
<ul style="list-style-type: none"> <li>Processor</li> </ul>	50 W - 170.6 Btu/h
<ul style="list-style-type: none"> <li>SCSI Hard disk drive with input/output access</li> </ul>	23 W - 78.4 Btu/h
<ul style="list-style-type: none"> <li>SCSI Hard disk without input/output access (idle)</li> </ul>	16 W - 54.5 Btu/h
<ul style="list-style-type: none"> <li>PCI card</li> </ul>	10 to 36 W - 64.1 Btu/h to 122.8 Btu/h

## 1 System Overview

### HP Kayak XM600 Desktop Specifications and Characteristics

## Desktop Environmental Specifications

Environmental Specifications (System Processing Unit, with Hard Disk)		
Operating Temperature	+ 10 °C to + 35 °C (+ 50 °F to + 95 °F).	
Storage Temperature	-40 °C to + 70°C (-40 °F to + 158 °F).	
Over Temperature Shutdown	+ 50°C (+ 122°F).	
Operating Humidity	15% to 85% (relative). <sup>1</sup>	
Storage Humidity	8% to 85% (relative). <sup>1</sup>	
Acoustic noise emission (as defined ISO 7779):	<b>Sound Power</b>	<b>Sound Pressure</b>
• Operating	LwA < = 38.3 dB	LpA < = 31.4 dB
• Operating with hard disk access	LwA < = 49.4 dB	LpA < = 44.3 dB
• Operating with floppy disk access	LwA < = 41.8 dB	LpA < = 34.1 dB
Operating Altitude	10000 ft (3100m) max	
Storage Altitude	15000ft (4600m) max	

<sup>1</sup>non condensing conditions.

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.

## HP Kayak XM600 Minitower Specifications and Characteristics

### Minitower Physical Characteristics

System Processing Unit	
Weight (excl. keyboard and display):	14.2 kilograms (31.24 pounds).
Dimensions:	47.0 cm max. (D) by 21.0 cm (W) by 49.0 cm (H) (18.50 inches by 8.26 inches by 19.29 inches).
Footprint:	0.09 m <sup>2</sup> (1.06 sq ft).

### Minitower Electrical Specifications

Parameter	Total Rating		Peak (15 secs.)	Maximum per PCI Slots 32-bit 33 MHz	Maximum for AGP Slot <sup>1</sup>		
					Standard Connector	Extension	Total
Input voltage (Switch select)	100-127 V VAC	200-250 V Vac	—	—	—	—	—
Input current (max)	9 A	4.5 A	—	—	—	—	—
Input frequency	50 to 60 Hz		—	—	—	—	—
Available power	300 W		320 W	100 W for PCI slots and AGP Pro slot			
Max current at +12 V	13.5 A		15 A	0.5 A	1 A	4.2 A	5.2 A
Max current at -12 V	0.8 A		—	0.1 A	—	—	—
Max current at +3.3 V	26 A		—	7.6 A	6 A	7.6 A	13.6 A
Vddq <sup>2</sup>	—		—	—			2 A
Max current at +5 V	32 A		—	5 A			2 A
Max current at -5 V	0.5 A		—	—	—	—	—
Max current at +5Vstdby combined with 3.3 V stdby	2 A		—	1.875 A total on 3.3 V stdby			

1. A maximum of 50 W can be drawn from the AGP Pro slot. The standard part of the AGP Pro connector supplies 25 W (max.) plus 25 W from the connector extension (25 W + 25 W = 50 W). Refer to [page 36](#) for information about the AGP PRO Universal slot.

2. Only for I/O buffers.

## 1 System Overview

### HP Kayak XM600 Minitower Specifications and Characteristics

If the overload protection in the power supply unit is triggered, all power is immediately cut. To reset the power supply unit, remove the power cord and then determine what caused the overload and remedy it. Reconnect the power cord, then reboot the PC Workstation. If an overload happens twice, then there is an undetected short circuit somewhere.

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#### NOTE

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When the PC Workstation is turned off with the power button on the front panel, the power consumption falls below the low power consumption (refer to the below table), but is not zero. The special on/off method used by this PC Workstation extends the lifetime of the power supply. To reach zero power consumption in “off” mode, either unplug the PC Workstation from the power outlet or use a power block with a switch.

### Minitower Power Consumption and Cooling

The power consumption and acoustics given in the below table is valid for a standard configuration as shipped (one processor, 256 MB of memory, 300 W power supply, one hard disk drive, video card, LAN card).

All information in this section is based on primary power consumptions.

Power consumption - Windows NT:	230 V / 50 Hz and 115 V / 60 Hz
<ul style="list-style-type: none"><li>Operating with input/output (disk access)</li></ul>	65 W - 221.7 Btu/h <sup>1</sup>
<ul style="list-style-type: none"><li>Operating without input/output (idle)</li></ul>	60 W - 204.7 Btu/h
<ul style="list-style-type: none"><li>Off with LAN card</li></ul>	3 W - 10.2 Btu/h

<sup>1</sup>: 1 W = 3.4121 Btu/h

Additional Component:	
<ul style="list-style-type: none"><li>Processor</li></ul>	50 W - 170.6 Btu/h
<ul style="list-style-type: none"><li>SCSI Hard disk drive with input/output access</li></ul>	23 W - 78.4 Btu/h
<ul style="list-style-type: none"><li>SCSI Hard disk without input/output access (idle)</li></ul>	16 W - 54.5 Btu/h
<ul style="list-style-type: none"><li>PCI card</li></ul>	10 to 36 W - 64.1 Btu/h to 122.8 Btu/h

## Minitower Environmental Specifications

Environmental Specifications (System Processing Unit, with Hard Disk)		
Operating Temperature	+ 10 °C to + 35 °C (+ 50 °F to + 95 °F).	
Storage Temperature	-40 °C to + 70°C (-40 °F to + 158 °F).	
Over Temperature Shutdown	+ 50°C (+ 122°F)	
Operating Humidity	15% to 85% (relative). <sup>1</sup>	
Storage Humidity	8% to 85% (relative). <sup>1</sup>	
Acoustic noise emission (as defined ISO 7779):	<b>Sound Power</b>	<b>Sound Pressure</b>
• Operating	LwA < = 40.5 dB	LpA < = 25.7 dB
• Operating with hard disk access	LwA < = 41.4 dB	LpA < = 26.5 dB
• Operating with floppy disk access	LwA < = 43.2 dB	LpA < = 30.0 dB
Operating Altitude	10000 ft (3100m) max	
Storage Altitude	15000ft (4600m) max	

<sup>1</sup>non-condensing conditions.

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.

## Power Saving and Ergonometry

Depending on the operating system, the following power management types are available:

- *No sleeping state*: Windows NT 4 (Full On and Off).
- *APM*: Windows 95 and Windows 98 SE APM (Full On, Suspend and Off).
- *ACPI*: Windows 98 SE ACPI and Windows 2000 (Full On, Standby, Hibernate, Off).

The following table is valid for both Desktop and Minitower models.

		Windows 2000	Windows 98 SE	Windows NT 4	Windows 95
A P M	<i>Full On</i>	Not Supported by Windows 2000	Supported	Supported	Supported
	<i>Suspend</i>		Supported	Not Supported by Windows NT 4	Supported
	<i>Off</i>		Supported	Supported	Supported
A C P I	<i>Standby (S1 or S3)</i>	Supported (implemented as S3, Suspend to RAM)	Supported (implemented as S1, suspend)	APM only Operating System	
	<i>Hibernate (S4)</i>	Supported	Not Supported		
	<i>Off (S5)</i>	Supported	Supported		



## Desktop Power Saving Modes and Ergonometry for APM Systems

	Full On	Suspend <sup>1</sup>	Off
<b>Processor</b>	Normal speed	Halted	Halted
<b>Display</b>	On	Blanked, < 5 W (typ)	Blanked, < 5 W (typ)
<b>Hard disk drive</b>	Normal speed	Halted	Halted
<b>Power consumption</b>	Supports up to 200 W	< 40 W (230V, 50 Hz) < 21 W (115V, 60 Hz)	(plugged in but turned off) < 5 W (average)
<b>Resume events</b>		Keyboard, network (RWU), modem, USB	Space bar or power button, RPO
<b>Resume delay</b>		A few seconds	Boot delay

1. Not supported by Windows NT 4.

## Desktop Power Saving Modes and Resume Events for ACPI Systems

	Full On (S0)	Suspend (S1)	Suspend to RAM (S3)	Suspend to Disk (S4)	Off (S5)
<b>Processor</b>	Normal speed	Halted	Off	Off	Off
<b>Display</b>	On	Blanked	Off	Off	Off
<b>Hard Disk Drive</b>	Normal speed	Halted	Off	Off	Off
<b>Active Power Planes</b>	VCC VCCAux	VCC VCCAux	Memory VCCAux	VCCAux	VCCAux
<b>Power Consumption</b>	Supports up to 200 W	< 40 W	< 10 W	< 10 W	< 10 W
<b>Resume Events</b>		Power button, LAN, Modem, USB, Scheduler, HP Start Key	Power button, LAN, Modem, Scheduler, HP Start Key	Power button, LAN, Modem, Scheduler, HP Start Key	Power button, HP Start Key
<b>Resume Delay</b>		Instantaneous	Instantaneous	BIOS boot delay	Regular boot delay

## 1 System Overview

### Power Saving and Ergonometry

#### Minitower Power Saving and Ergonometry for APM Systems

	Full On	Suspend <sup>1</sup>	Off
<b>Processor</b>	Normal speed	Halted	Halted
<b>Display</b>	On	Blanked, < 5 W (typ)	Blanked, < 5 W (typ)
<b>Hard disk drive</b>	Normal speed	Halted	Halted
<b>Power consumption</b>	Supports up to 300 W	< 40 W (230V, 50 Hz) < 21 W (115V, 60 Hz)	(plugged in but turned off) < 5 W (average)
<b>Resume events</b>		Keyboard, network (RWU), modem, USB	Space bar or power button, RPO
<b>Resume delay</b>		A few seconds	Boot delay

<sup>1</sup>. Not supported by Windows NT 4.

#### Minitower Power Saving Modes and Resume Events for ACPI Systems

	Full On (S0)	Suspend (S1)	Suspend to RAM (S3)	Suspend to Disk (S4)	Off (S5)
<b>Processor</b>	Normal speed	Halted	Off	Off	Off
<b>Display</b>	On	Blanked	Off	Off	Off
<b>Hard Disk Drive</b>	Normal speed	Halted	Off	Off	Off
<b>Active Power Planes</b>	VCC VCCAux	VCC VCCAux	Memory VCCAux	VCCAux	VCCAux
<b>Power Consumption</b>	Supports up to 300 W	< 40 W	< 10 W	< 10 W	< 10 W
<b>Resume Events</b>		Power button, LAN, Modem, USB, Scheduler, HP Start Key	Power button, LAN, Modem, Scheduler, HP Start Key	Power button, LAN, Modem, Scheduler, HP Start Key	Power button, HP Start Key
<b>Resume Delay</b>		Instantaneous	Instantaneous	BIOS boot delay	Regular 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-6 to **off** 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 shut down, the environment is cleared, and the computer is powered off. *Soft Power Down* is available with Windows NT (when the Soft Power Down utility is used).

## Documentation

The table below summarizes the availability of the documentation that is appropriate to the *HP Kayak XM600 PC Workstation*. Only selected publications are available in paper-based form. Most are available as printable files from the HP website.

Title	Online at HP WWW Site (see address below)	Paper-based
<i>HP Kayak XM600 User's Guide</i>	PDF file	D8368-90101
		D8369-90101 <sup>1</sup>
<i>HP Kayak XM600 Troubleshooting Guide</i>	PDF file	No Desktop version
		No Minitower version
<i>HP Kayak XM600 Training Module</i>	No	No
<i>HP Kayak XM600 Technical Reference Manual</i>	PDF file	No
<i>HP Kayak XM600 Service Handbook Chapter</i>	PDF file	When available, Desktop and Minitower sections will be included in the fourth edition of the Service Handbook
<i>HP Kayak XM600 Technical Notes</i>	PDF file	No Desktop version
		No Minitower version

1. Refer to the Service Handbook Chapter for the availability of the localized monolingual and multilingual *User's Guides*.

### 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:	<a href="http://www.hp.com/go/kayaksupport">http://www.hp.com/go/kayaksupport</a>
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After accessing the site, select HP Kayak XM600 PC Workstation.

## Where to Find the Information

The table below summarizes the availability of information within the *HP Kayak XM600 PC Workstation* documentation set.

	User's Guide	Troubleshooting Guide <sup>1</sup>	Service Handbook	Technical Information	Technical Reference Manual
<b>Introducing the PC</b>					
<i>Product features</i>	Standard configuration.		Exploded view. Parts list.	Configuration.	Key features.
<i>Product model numbers</i>			Product range. CPL dates.		
<i>Environmental</i>	Setting up the PC. Working in comfort.				
<i>Safety Warnings</i>	Electrical, multimedia, safety, unpacking, removing & replacing cover.	Safety.			
<i>Finding on-line information</i>	Preloaded, HP Web sites.	HP Web sites.		HP Web sites.	HP Web sites, others.
<i>Technical information</i>	Basic details.			Advanced.	Advanced.
<i>Formal documents</i>	Certificate of Conformity. Software License agreement.				
<b>Using the PC</b>					
<i>Connecting devices and turning on</i>	Rear panel connectors, starting and stopping.				
<i>BIOS</i>	Basic details.	Updating and recovering.		Memory maps.	Technical details. Memory maps.
<i>Fields and their options within Setup</i>	Basic details. Viewing <i>Setup</i> screen, using, passwords	Basic details.			Complete list.
<i>Manageability</i>	Power management, Software and drivers.				

	User's Guide	Troubleshooting Guide <sup>1</sup>	Service Handbook	Technical Information	Technical Reference Manual
<b>Upgrading the PC</b>					
<i>Opening the PC</i>	Full description.				
<i>Supported accessories</i>			Full PN details		
<i>Installing accessories</i>	Processor(s), memory, accessory boards, mass storage devices.	Error messages, problem solving.			
<i>Configuring devices</i>	Installing devices	Installing devices.		Network connection.	
<i>System board</i>	Installing and removing, connectors and switch settings.	Switch settings.	Jumpers, switches and connectors.	Layout and switch settings.	Jumpers, switches and connectors. Chip-set details.
<b>Repairing the PC</b>					
<i>Troubleshooting</i>	Basic, MaxiLife, hardware diagnoses.	MaxiLife, hardware diagnoses and suggested solutions.	Service notes.		Advanced.
<i>Power-On Self-Test routines (POST)</i>	Basic details.	Error Messages, EMU and suggestions for corrective action.			Error codes and suggestions for corrective action. Order of tests.
<i>Kayak diagnostic utility</i>	HP DiagTools, CD-ROM recovery.	HP DiagTools, CD-ROM recovery			Technical details.

	User's Guide	Troubleshooting Guide <sup>1</sup>	Service Handbook	Technical Information	Technical Reference Manual
<b>Peripheral Devices</b>					
<i>Audio Accessories</i>	Refer to Audio User's Guide for information on setting up and configuring audio accessories.	Refer to online version of Audio User's Guide for information on setting up and configuring audio accessories.			
<i>LAN Accessories</i>	Refer to LAN Administrator's Guide for information on setting up and configuring LAN cards and systems.	Refer to online version (preloaded on hard disk) of LAN Administrator's Guide for information on setting up and configuring LAN cards and systems.			

<sup>1</sup>. For address, ["Access HP World Wide Web Site" on page 28.](#)



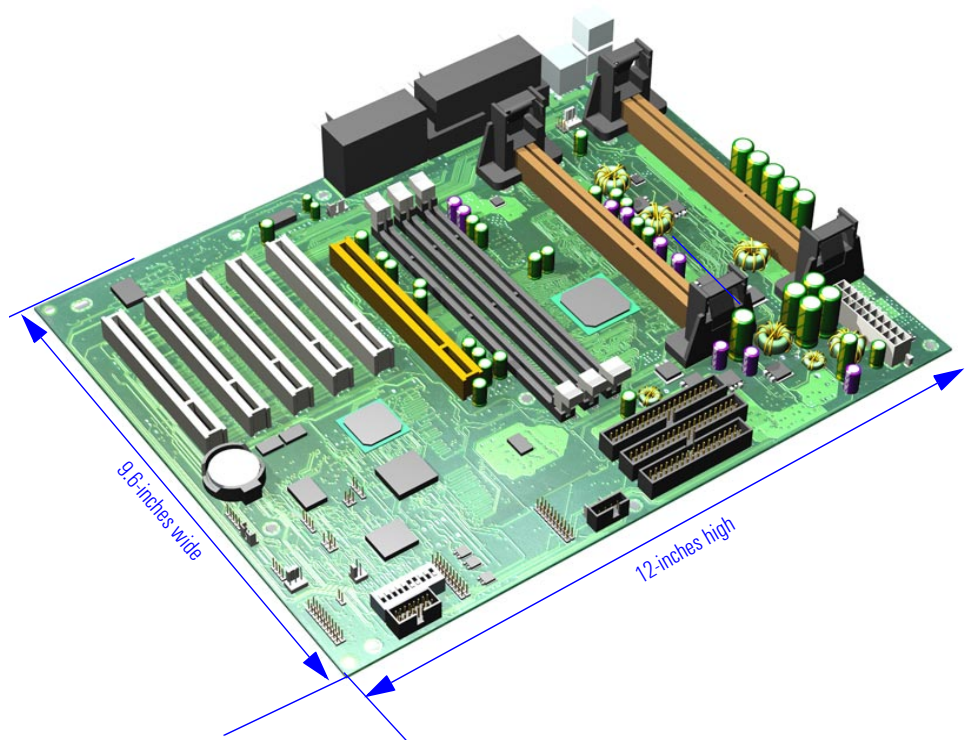


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## System Board

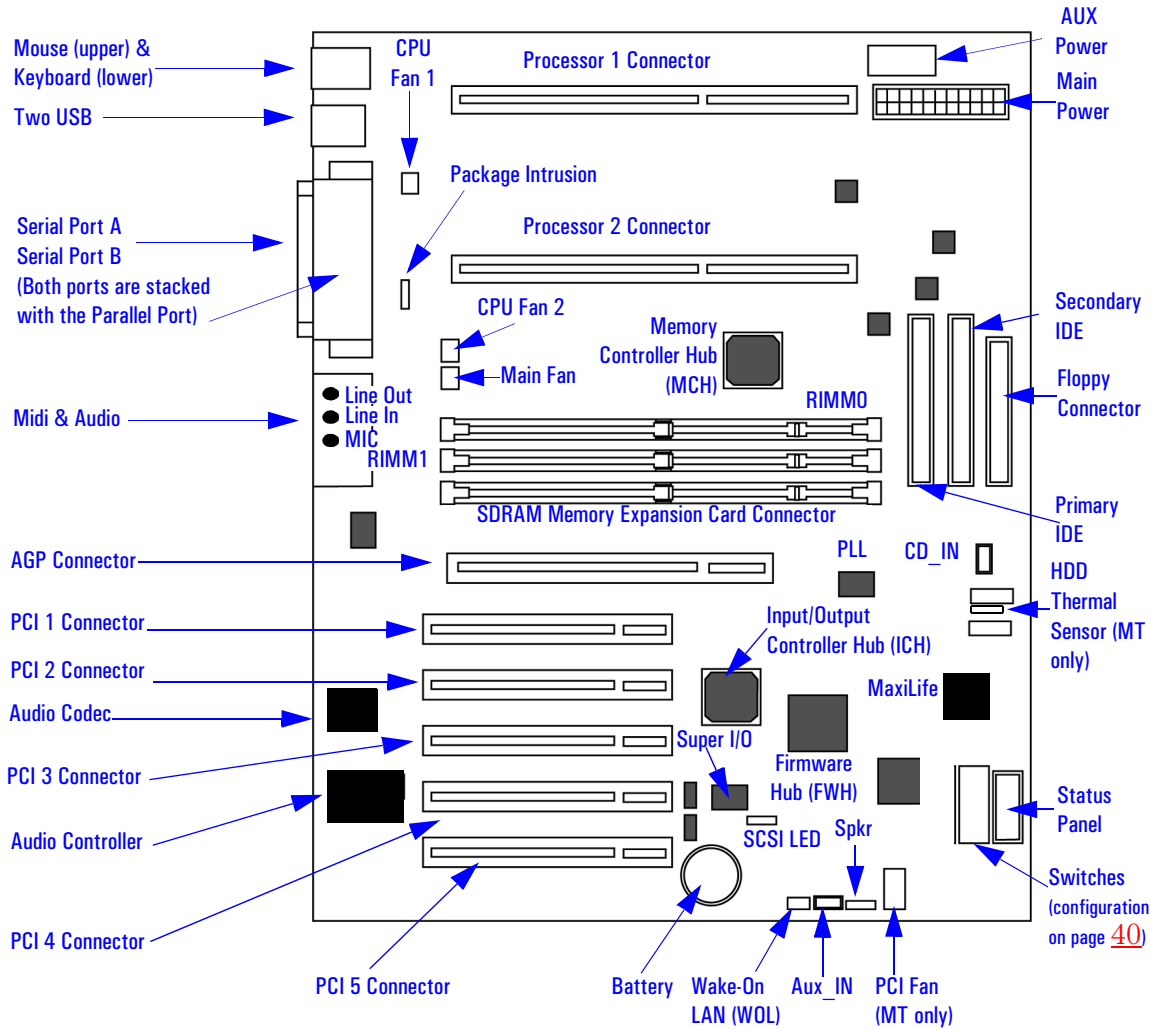
This chapter describes the components of the system board, taking in turn the components of the Memory Controller Hub (MCH), the Input/Output Controller Hub (ICH), FirmWare Hub (FWH) and the Host Bus.

The following diagram shows the *HP Kayak XM600 PC Workstation* system board in detail.

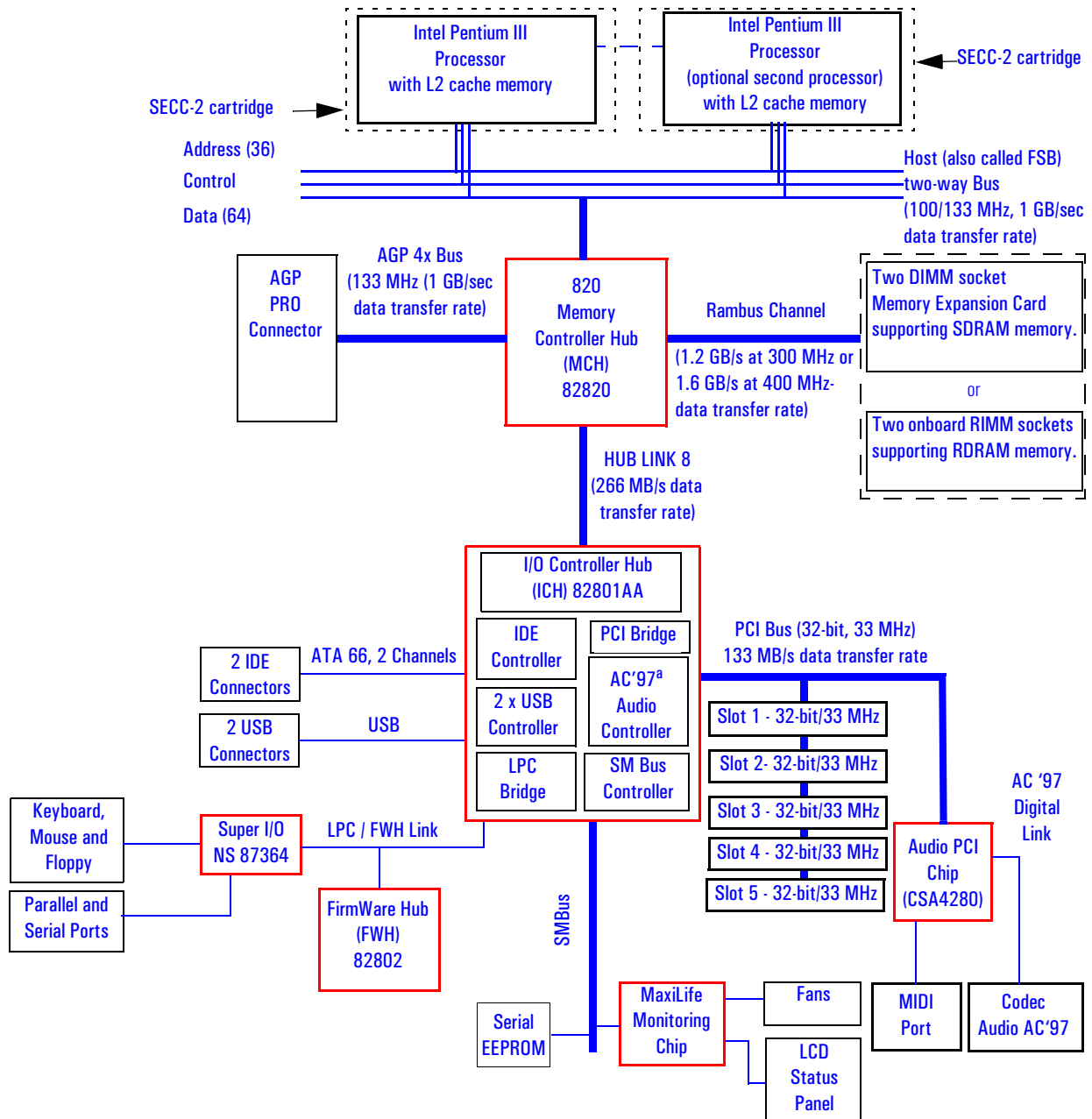


## System Board Overview

The following diagram shows where the different chips and connectors are located on the system board.



## Architectural View



a. It should be noted that the AC'97 Audio Controller is not used. The PCI CS4280 and CS4297 audio is a full PCI solution that is independent of the ICH core logic.

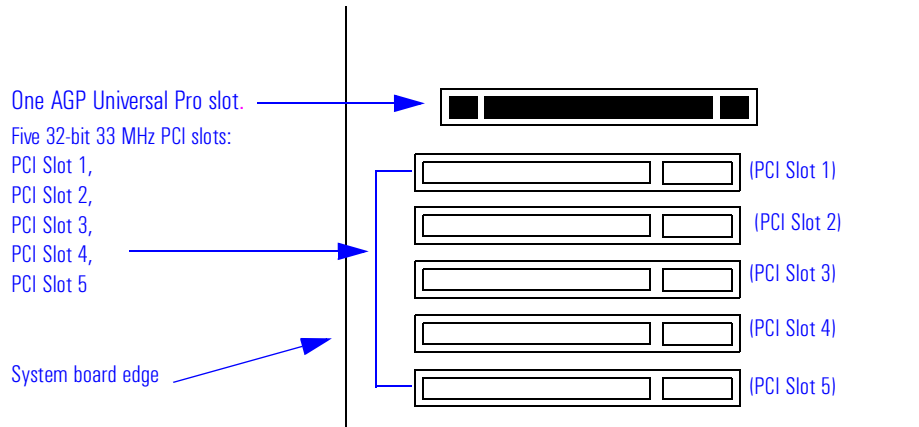
## 2 System Board

### Accessory Board Slots

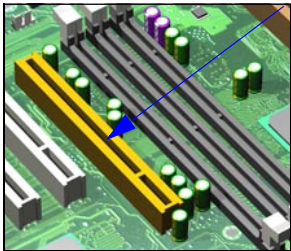
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## Accessory Board Slots

The following block diagram shows the position of the accessory board slots on the system board.



### AGP Pro Universal Slot (Minitower Models)



Minitower models of the HP Kayak XM600 are equipped with a single AGP (Accelerated Graphics Port) Pro Universal graphics slot.

The AGP Pro Universal slot provides the ultimate graphics performance for high-end graphics cards, combining AGP 4X bandwidth (with data transfer rates up to 1056 MB/sec) with the ability to accept high-end graphics cards drawing up to 50 W of power.

To accommodate AGP Pro graphics cards, the AGP PRO Universal slot connector is wider than the standard AGP 4X connector. Additional pins have been added at both ends of the connector to meet the increased power requirements of AGP Pro graphics cards.

The AGP Pro Universal slot connector still accepts all existing 3.3 V and 1.5 V AGP cards.

An AGP Pro card may draw power either from the existing part of the AGP Pro connector, the extended part, or a combination of the two. In all cases, the maximum power that may be drawn by an AGP Pro card is limited to

50 W in the Minitower models. Power on the existing part of the connector is delivered on 5.0 V and 3.3 V rails. Power on the extension is delivered on the 12 V and 3.3 V rails.

Either standard AGP graphics cards or AGP Pro graphics cards < 50 Watts of power can be used (below 25W a standard AGP connector may be used), with power being provided through 3.3 V, 5 V, or 12 V power rails.

#### NOTE

AGP Pro graphics cards drawing between 50W and 110W (“high-power” AGP Pro cards) **cannot** be used in the slot.

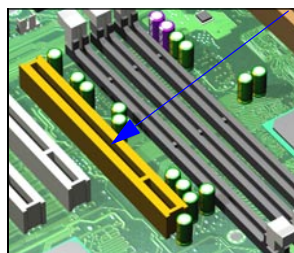
The AGP Pro Universal slot is backwards compatible with both AGP 1x and 2.x modes (using 3.3 V or 1.5 V signalling), and AGP 4x mode (where 1.5 V signalling is required).

AGP Operating Mode	AGP Video Card				
	AGP 3.3 V	AGP 1.5 V	AGP Pro		
	≤ 25 W	≤ 25 W	≤ 25 W	≤ 50 W	≤ 110W
PCI-type	yes	yes	yes	yes	no
AGP 1x <sup>1</sup>	yes	yes	yes	yes	no
AGP 2x <sup>1</sup>	yes	yes	yes	yes	no
AGP 4x <sup>1</sup>	no	yes	yes	yes	no

<sup>1</sup>. With or without sideband addressing.

The AGP interface and bus are explained on [page 44](#).

### AGP Pro Universal Slot (Desktop Models)



Desktop models of the HP Kayak XM600 are equipped with a single AGP (Accelerated Graphics Port) Pro Universal graphics slot.

The connector accepts only standard (≤ 25 W) AGP graphics cards. AGP Pro cards (> 25 W) cannot be used — a hardware detection prevents the PC Workstation from booting.

The AGP 4x graphics controller provides a high-performance graphics interface. It uses a 66.6 MHz base clock, and provides a peak bandwidth of 1056 MB/second in AGP 4x mode.

AGP 4x mode transfers data at twice the speed of AGP 2x mode, which is itself twice the speed of the basic AGP 1x mode. This is achieved by multiplying the 66 MHz AGP clock frequency, so that four packets of data are transferred on each cycle (transfers on both rising and falling edges of

## 2 System Board

### Accessory Board Slots

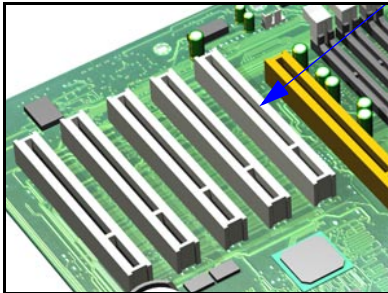
the clock speed). Each packet of data contains four bytes, giving a transfer rate of 66.6 MHz x 4 (quad-clock mechanism) x 4 bytes, a maximum bandwidth of 1056 MB/s.

AGP Operating Mode	AGP Video Card				
	AGP 3.3 V	AGP 1.5 V	AGP Pro		
	≤ 25 W	≤ 25 W	≤ 25 W	≤ 50 W	≤ 110W
PCI-type	yes	yes	no	no	no
AGP 1x <sup>1</sup>	yes	yes	no	no	no
AGP 2x <sup>1</sup>	yes	yes	no	no	no
AGP 4x <sup>1</sup>	no	yes	no	no	no

1. With or without sideband addressing.

The AGP interface and bus are explained on [page 44](#).

### PCI Slots



There is a total of five Peripheral Component Interconnect (PCI) 32-bit, 33 MHz connectors on the system board.

The PCI slots accept 3.3 V and 5 V PCI 32-bit 33 MHz cards, and Universal PCI cards (which are 3.3 V or 5 V compatible). Refer to the table on the following page for the different PCI board installations.

If an AGP Pro graphics card is present in the AGP Pro graphics slot (Minitower models only), the PCI slot nearest the AGP slot cannot be used.

The maximum supported power consumption per slot is 25W, either from the 5V or the 3.3V supply and must respect the electrical specifications of the PCI 2.2 specification. Total power consumption for the PCI slots must not exceed 60 W.

The power consumption of each PCI board is automatically reported to the system through the two Presence Detect pins of each PCI slot. These pins code the following cases:

- No accessory board in the PCI slot.
- 7 W maximum PCI board in the PCI slot.
- 15 W maximum PCI board in the PCI slot.
- 25 W maximum PCI board in the PCI slot.

The following table shows the various PCI board installations for the different PCI slots:

PCI Slot	PCI Card					
	3.3 V and 5 V		Universal (3.3 V or 5 V compatible)			
	32-bit/ 33 MHz	64-bit/ 33 MHz	32-bit/ 33 MHz or 66 MHz		64-bit/ 33 MHz or 66 MHz	
<b>Slots 1, 2, 3, 4 &amp; 5 5 V, 32-bit/33 MHz</b>	<i>yes</i>	<i>yes</i> <sup>1</sup>	<i>yes</i>	<i>yes</i> <sup>2</sup>	<i>yes</i> <sup>1</sup>	<i>yes</i> <sup>2</sup>

- <sup>1.</sup> A 64-bit card can be installed in a 32-bit slot. However, this card will only operate in 32-bit mode.
- <sup>2.</sup> A 66 Mhz card can be installed in a 33 MHz slot. However, this card will only operate in 33 MHz mode.

The system board and BIOS support the PCI specification 2.2. This specification supports PCI-to-PCI bridges and multi-function PCI devices, and each of the five PCI slots have Master capabilities.

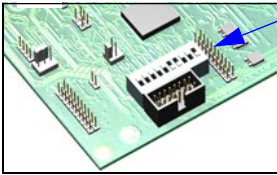
The PCI slots are connected to the ICH PCI 32-bit 33 MHz bus. In addition to these PCI slots, the following devices are also connected to the PCI Bus:

- ICH (Input/Output Controller Hub) chip, bridge between the MCH (Memory Controller Hub), USB ports and IDE buses.
- Digital audio CS4280 controller.

The PCI 32-bit 33 MHz bus is explained on [page 55](#).

## 2 System Board

### System Board Switches



### System Board Switches

There are ten system board switches used for configuration, numbered from 1 to 10. Some switches are reserved and should not be modified, otherwise it could lead to a system failure.

Switch	Default Position	To Configure:
1-5	<b>OFF</b>	Reserved. <i>Do not change the default setting.</i>
6	<b>ON</b>	<a href="#">Enables keyboard power-on.</a> OFF disables this option.
7	<b>OFF</b>	ON enables BIOS recovery mode at next boot. <a href="#">Enables normal modes.</a>
8	<b>OFF</b>	ON clears CMOS memory at next boot. <a href="#">Retains CMOS memory.</a>
9	<b>OFF</b>	ON clears the passwords at next boot. <a href="#">Enables User and System Administrator passwords.</a>
10	<i>depends on the chassis type</i>	ON = minitower OFF = desktop.

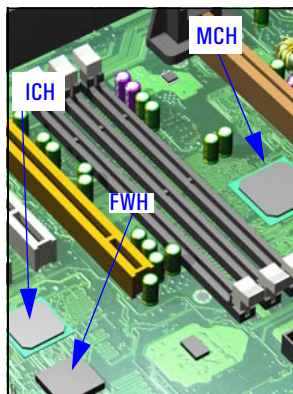
#### NOTE

A limited number of early HP Kayak XM600 system boards have 20 configuration switches. Switches 11-20 are reserved and should be set as follows: 12,13,15 and 16 to ON, others to OFF



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## Chipset

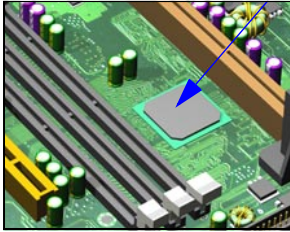


The Intel® 820 chipset supports RDRAM memory technology and system bus speeds up to 133 MHz, while delivering significant graphics performance enhancements through its AGP 4x graphics interface. It is comprised of the following:

- The 82820 Memory Controller Hub (MCH) provides the CPU interface, DRAM interface, and AGP interface in the 820 chipset platform. The MCH supports up to two processors. The table on [page 43](#) details the MCH chip features.
- The 82801 I/O Controller Hub (ICH) utilizes Intel® Accelerated Hub Architecture to make a direct connection from the graphics and memory to the integrated AC97 controller, the ATA66 controller, dual USB ports, and PCI add-in cards. The table on [page 51](#) details the ICH chip features.
- The 82802 Firmware Hub (FWH) stores system BIOS and video BIOS, as well as the Intel® Random Number Generator (RNG). The Intel RNG provides truly random numbers to enable stronger encryption, digital signing, and security protocols. The table on [page 64](#) details the FWH features.

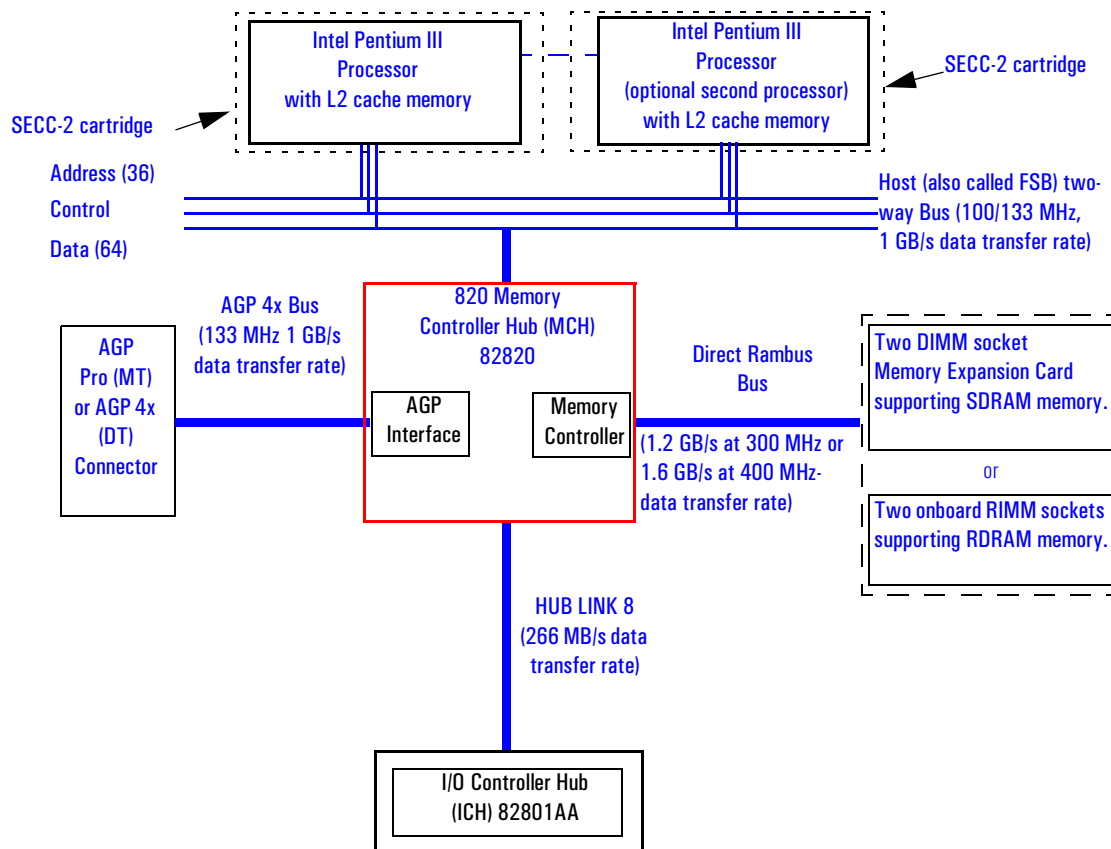
## 2 System Board

### Memory Controller Hub (MCH) 82820



The MCH Host Bridge/Controller is contained in a 324-pin Ball Grid Array (BGA) package and is the bridge between the Host bus, Direct Rambus channel (main memory), AGP 4x graphic bus, Hub Link 8-bit and Hub Link 16-bit.

The following figure shows an example of the system block diagram using the MCH.



The following table shows the features that are available in the MCH Host Bridge/Controller.

Feature	Feature
<ul style="list-style-type: none"> <li>Processor/Host Bus: <ul style="list-style-type: none"> <li><input type="checkbox"/> Supports Pentium III processor configuration at both 100 MHz and 133 MHz bus speeds</li> <li><input type="checkbox"/> Supports Symmetric Multiprocessing Protocol (SMP) for up to two processors</li> <li><input type="checkbox"/> APIC related buffer management support</li> <li><input type="checkbox"/> Supports 32-bit host bus addressing</li> <li><input type="checkbox"/> Supports 6-deep In-Order Queue</li> <li><input type="checkbox"/> AGTL+ bus driver technology (gated)</li> <li><input type="checkbox"/> AGTL+ receivers for reduced power</li> <li><input type="checkbox"/> Supports single-ended AGTL+ termination in uniprocessor configuration</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Accelerated Graphics Port (AGP) Interface: <ul style="list-style-type: none"> <li><input type="checkbox"/> Supports a single AGP device (either via a connector or on the system board)</li> <li><input type="checkbox"/> Supports AGP 2.0, including 1x/2x/4x AGP data transfers, 1.5V and 3.3V signaling, and 2x/4x Fast Write protocol</li> <li><input type="checkbox"/> AGP Universal Connector support via dual mode buffers</li> <li><input type="checkbox"/> AGP PIPE# or SB accesses to DRAM not snooped</li> <li><input type="checkbox"/> AGP FRAME# accesses to DRAM are snooped</li> <li><input type="checkbox"/> High priority access support</li> <li><input type="checkbox"/> Hierarchical PCI configuration mechanism</li> <li><input type="checkbox"/> Delayed transaction support for AGP-to-DRAM reads using AGP FRAME# protocol</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>Memory Controller</li> </ul> <p><b>Direct Rambus:</b></p> <ul style="list-style-type: none"> <li>Direct Rambus Memory Controller, supporting: <ul style="list-style-type: none"> <li><input type="checkbox"/> Single Direct Rambus Channel</li> <li><input type="checkbox"/> Supports PC700, and PC800 Direct Rambus DRAM modules</li> <li><input type="checkbox"/> Maximum memory array size up to 256 MB using 64Mb/72Mb, 512 MB using 128Mb/144Mb, 1 GB using 256Mb/288Mb DRAM technology</li> <li><input type="checkbox"/> Supports up to 32 Direct Rambus devices per channel</li> <li><input type="checkbox"/> Supports a maximum DRAM address decode space of 4 GB</li> <li><input type="checkbox"/> Configurable optional ECC operation: <ul style="list-style-type: none"> <li>- ECC with single bit Error Correction and multiple bit Error Detection</li> <li>- Single bit errors corrected and written back to memory (auto-scrubbing)</li> <li>- Parity mode not supported</li> </ul> </li> </ul> </li> </ul>	<p><b>SDRAM:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Up to 1 GB of SDRAM</li> <li><input type="checkbox"/> Interleaved 100 MHz support.</li> <li><input type="checkbox"/> Non-Interleaved 100 MHz support.</li> <li><input type="checkbox"/> Both registered and unbuffered DIMMs are supported.</li> <li><input type="checkbox"/> Up to 4 rows or 2 DS DIMMs per MTH.</li> <li><input type="checkbox"/> Up to 8 simultaneous open pages: <ul style="list-style-type: none"> <li>— 2 KByte page size support for 64 Mbit SDRAM devices.</li> <li>— 4 KByte - 16 KByte page sizes supporting 64 MBit to 256 Mbit SDRAM devices.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>Hub Link 8-bit Interface to ICH: <ul style="list-style-type: none"> <li><input type="checkbox"/> Private interconnect between the MCH and ICH.</li> </ul> </li> </ul>	

## 2 System Board

### Memory Controller Hub (MCH) 82820

Feature	Feature
<ul style="list-style-type: none"><li>• Power Management:<ul style="list-style-type: none"><li><input type="checkbox"/> SMRAM space re-mapping to A0000h (128 KB)</li><li><input type="checkbox"/> Supports HSEG and TSEG cacheable extended SMRAM space<ul style="list-style-type: none"><li>- 128 KB HSEG at 0FEEA0000h remapped to A0000h</li><li>- TSEG is 128 KB/256 KB/512 KB/1 MB at the top of memory</li><li>- No maximum DRAM limit to use extended SMM</li></ul></li><li><input type="checkbox"/> SMRAM accesses from AGP or the hub interface are not allowed</li><li><input type="checkbox"/> Suspend to DRAM (STR) support</li><li><input type="checkbox"/> ACPI Rev 1.0 compliant power management</li><li><input type="checkbox"/> APM Rev 1.2 compliant power management</li></ul></li></ul>	<ul style="list-style-type: none"><li>• Arbitration:<ul style="list-style-type: none"><li><input type="checkbox"/> Distributed Arbitration Model for Optimum Concurrency Support.</li><li><input type="checkbox"/> Concurrent operations of host, hub interface, AGP and memory buses supported via a dedicated arbitration and data buffering logic.</li></ul></li></ul>
<ul style="list-style-type: none"><li>• 324-pin BGA MCH package.</li></ul>	<ul style="list-style-type: none"><li>• Input/Output Device Support:<ul style="list-style-type: none"><li><input type="checkbox"/> Input/Output Controller Hub (ICH).</li></ul></li></ul>

### MCH Interface

The MCH interface provides bus control signals and address paths for transfers between the processors on the Host bus (FSB), Direct Rambus channel and AGP 4x bus.

The MCH allows the processor to access up to 4 GB of memory. It also provides an 8-deep In-Order Queue supporting up to eight outstanding transaction requests on the host bus.

The MCH can support one or two Pentium III processors, at FSB frequencies of 100/133 MHz using GTL+ signalling. Refer to [page 66](#) for a description of the devices on the Host bus.

### Accelerated Graphics Port (AGP) Bus Interface

A controller for the AGP4x (Accelerated Graphics Port) slot is integrated in the MCH. The AGP Bus interface is compatible with the Accelerated Graphics Port Specification, Rev 2.0, operating at 133 MHz, and supporting up to 1 GB/sec data transfer rates. The MCH supports only a synchronous AGP interface, coupling to the Host bus frequency.

### AGP 4x Bus

The AGP bus is a dedicated bus for the graphics subsystem, which meets the needs of high quality 3D graphics applications. It has a direct link to the MCH.

The AGP bus is based upon a 133 MHz, 32-bit PCI bus architecture, to which several signal groups provide AGP-specific control and transfer mechanisms.

Pipelining is added along with special sideband signals, increasing the efficiency of the AGP bus. Thus, you come closer to the theoretical maximum bandwidth. Although the maximum transfer rate is never exceeded, the overall transfer rate is increased.

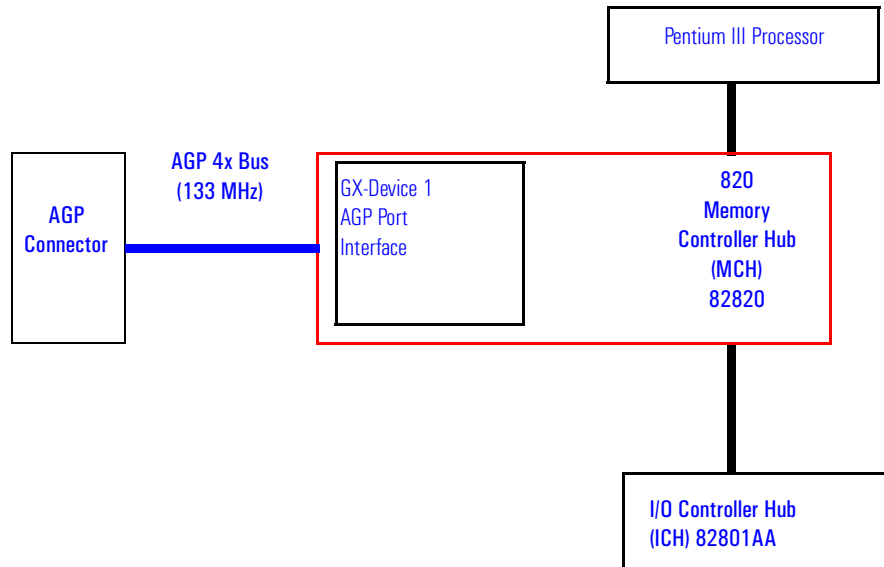
AGP specific transactions always use pipelining. This control mechanism increases the bus efficiency for data transfer. Sideband Addressing (SBA) may also be used by AGP transaction requests which also increases the bus efficiency for data transfer. These two mechanisms can combine independently to pipelining, which leads to the following operating modes:

- FRAME- based AGP. Only the PCI protocol is used: 66 MHz, 32-bits, 3.3 V, 266 MB/s peak transfer rate.
- AGP 1X with pipelining, sideband addressing can be added: uses 66 MHz, 32-bits, 3.3 V, increased bus efficiency, 266 MB/s peak transfer rate.
- AGP 2X with pipelining, sideband addressing can be added: 66 MHz double clocked, 32-bits, 3.3 V, increased bus efficiency, 533 MB/s peak transfer rate.
- AGP 4X with pipelining, sideband addressing can be added: 133 MHz quad clocked, 32-bits, 1.5 V, increased bus efficiency, 1066 MB/s peak transfer rate

## 2 System Board

Memory Controller Hub (MCH) 82820

### AGP PCI Bus Implementation



### Main Memory Controller

The main memory controller is integrated in the MCH supporting a single Direct Rambus channel.

### DRAM Interface

The MCH provides optional Host bus error checking for data, address, request and response signals. 300 MHz, 356 MHz and 400 MHz Direct Rambus devices are supported in any of 64, 128 or 256 Mbit technology. 64 and 128 Mbit RDRAMs use page sizes of 1 kbyte, while 256 Mb devices target 1 kbyte or 2 kbyte pages.

A maximum number of 32 Rambus devices (64 Mb technology implies 512 Mb maximum in 16 Mb increments, 256 Mb technology implies 1 GB maximum in 256 Mb increments) are supported on the Direct Rambus channel without external logic.

The MCH also provides optional data integrity features including ECC in the memory array. During DRAM writes, ECC is generated on a QWord (64 bit) basis. During DRAM reads, the MCH supports multiple-bit error detection and single-bit error correction when the ECC mode is enabled.

MCH will scrub single bit errors by writing the corrected value back into DRAM for all reads when hardware scrubbing is enabled. This, however, does not include reads launched in order to satisfy an AGP aperture translation.

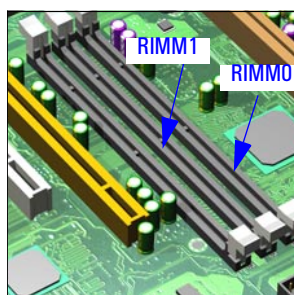
ECC can only be enabled when all RDRAM devices are populated in a system that supports the extra two data bits used to store the ECC code.

### Rambus Channel

The single Direct Rambus Channel is a 16-bit wide bidirectional bus—commands and data can be transferred in both directions simultaneously. The Rambus Channel is connected to the Memory Expansion Card connector and to the MCH chip.

The channel runs at 300 or 400 MHz and supports up to 32 Rambus devices (individual chips) and one MTH (Memory Translator Hub) for DIMM sockets. The maximum available data bandwidth is 1.6GB/sec at 400 MHz.

### RIMM Memory Slots



RDRAM models of the *HP Kayak XM600* have two RIMM memory sockets, RIMM0 and RIMM1, available for installing RDRAM memory modules

If RDRAM memory is being used, there must be no Memory Expansion Card in the SDRAM Memory Expansion Card Socket.

A maximum of two RDRAM modules can be installed in the *HP Kayak XM600 PC Workstation*.

If only one RDRAM module is being used, it must be inserted in RIMM0 (the socket nearest the processor). A Continuity module must be inserted in the RIMM1 socket and an RDRAM Terminator Module in the third memory socket (reserved for Memory Expansion Card).

If two RDRAM modules are installed, they must be inserted in the two sockets nearest the processor (RIMM0 and RIMM1) and an RDRAM Terminator Module in the third memory socket.

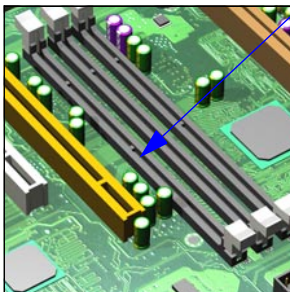
An RDRAM module must never be inserted in the SDRAM Memory Expansion Card socket—if it is, an error message will be displayed during the POST phase and the system will not boot.

## 2 System Board

Memory Controller Hub (MCH) 82820

RDRAM models of the HP Kayak XM600 PC Workstation are supplied with 128 MB of RDRAM unbuffered ECC main memory installed in the RIMM0 socket. Memory upgrades are available in 64 MB, 128 MB, 256 MB RDRAM modules.

### SDRAM Memory Expansion Card Slot



SDRAM models of the *HP Kayak XM600* are supplied with a Memory Expansion Card supporting two Synchronized Dynamic RAM (SDRAM) 100 MHz memory modules.

The MTH (Memory Translator Hub) provides support for two double-sided 100 MHz SDRAM DIMM sockets.

The Memory Expansion Card is installed in a reserved socket on the system board (the socket furthest from the processor(s)). This is not to be confused with the AGP card or a PCI card (it is retained in a similar manner, so is easy to mistake).

When the Memory Expansion Card is installed, the two unused RIMM sockets (RIMM0 and RIMM1) must be filled with RDRAM continuity modules. *Never leave these sockets empty and do not insert RDRAM modules in them.*

If two memory modules are installed in the Memory Expansion Card, and they do not have identical capacities, then the module with the highest capacity must be installed in the memory socket nearest to the system board.

If only one memory module is installed, it can be installed in either socket.

The unused socket should be left empty; no continuity module or terminator is required.

The MTH allows bridging of a single SDRAM channel on to the Direct Rambus channel. The MTH also translates RDRAM and SDRAM protocols, thus enabling the DIMM Memory Expansion Card to be used on the Rambus channel.

SDRAM models of the *HP Kayak XM600 PC Workstation* are supplied with 128 MB of SDRAM unbuffered non-ECC main memory. Memory upgrades are available in 64 MB, 128 MB, 256 MB unbuffered 100 MHz non-ECC SDRAM modules.

The MTH provides support for two double-sided 100 MHz SDRAM DIMM sockets. Each DIMM socket is connected to the SMBus and is described on [page 59](#).



**Read/Write Buffers**

The MCH 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 MCH operates the host interface at 100 MHz or 133 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 clocking scheme uses an external clock synthesizer (which produces reference clocks for the host, AGP and PCI interfaces).

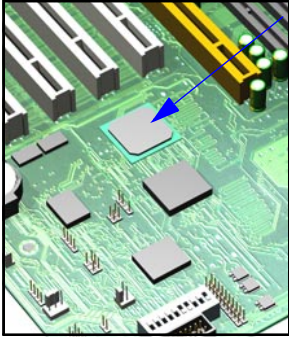
**I/O APIC**

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

## 2 System Board

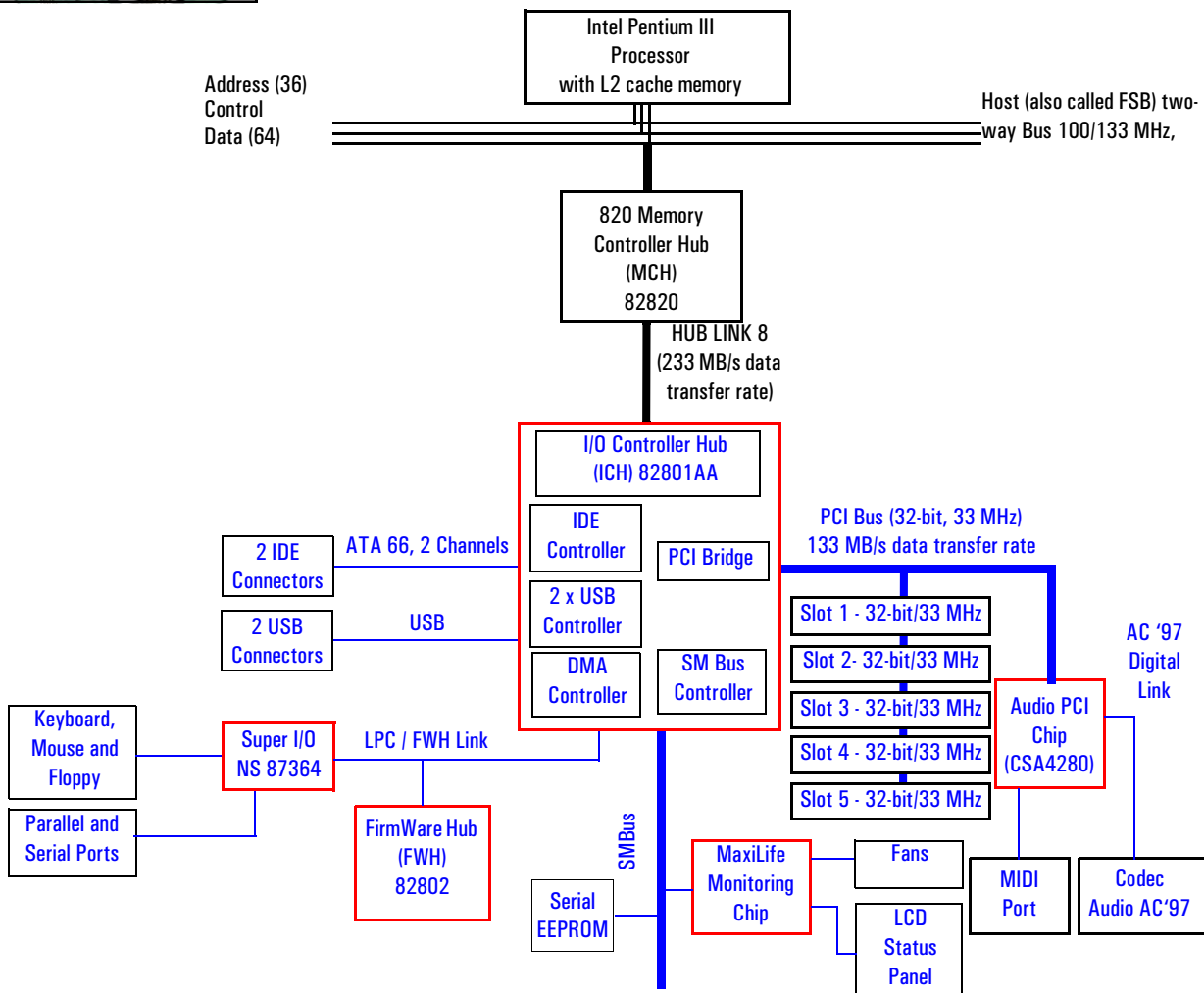
The Input/Output Controller Hub (82801AA)

### The Input/Output Controller Hub (82801AA)



The ICH, is encapsulated in a 241-pin Ball Grid Array (BGA) package and is located on the system board just underneath the Memory Expansion Card Connector. It provides the interface between the PCI bridge (PCI Rev. 2.2 compliant with support for 32-bit 33 MHz PCI operations), PCI-to-LPC (Low Pin Count) bridge, IDE controller, USB controller, SMBus controller and AC'97 controller.

The ICH functions and capabilities are discussed in detail later on in this section. The following figure shows an example of the system block diagram using the ICH.



The following table shows the available ICH features.

Feature	Feature
<ul style="list-style-type: none"> <li>Multi-function PCI Bus Interface: <ul style="list-style-type: none"> <li><input type="checkbox"/> PCI at 32-bit 33 MHz.</li> <li><input type="checkbox"/> PCI Rev 2.2 Specification.</li> <li><input type="checkbox"/> 133 Mbyte/sec data transfer rate.</li> <li><input type="checkbox"/> Master PCI Device Support for up to six devices.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Enhanced DMA Controller: <ul style="list-style-type: none"> <li><input type="checkbox"/> Two 82C37 DMA controllers.</li> <li><input type="checkbox"/> PCI DMA with 2 PC/PCI Channels in pairs.</li> <li><input type="checkbox"/> LPC DMA.</li> <li><input type="checkbox"/> DMA Collection Buffer to provide Type-F DMA performance for all DMA channels.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>USB: <ul style="list-style-type: none"> <li><input type="checkbox"/> USB revision 1.1 compliant.</li> <li><input type="checkbox"/> UHCI Implementation with Two USB Ports for serial transfers at 12 or 1.5 Mbit/sec.</li> <li><input type="checkbox"/> Wake-up from sleeping states (S1).</li> <li><input type="checkbox"/> Legacy keyboard/mouse software.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Interrupt Controller: <ul style="list-style-type: none"> <li><input type="checkbox"/> Two cascaded 82C59 controllers.</li> <li><input type="checkbox"/> Integrated I/O APIC capability.</li> <li><input type="checkbox"/> 15 Interrupt support in 8259 Mode, 24 supported in I/O APIC mode.</li> <li><input type="checkbox"/> Serial Interrupt Protocol.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>Power Management Logic: <ul style="list-style-type: none"> <li><input type="checkbox"/> ACPI 1.0 compliant.</li> <li><input type="checkbox"/> Support for APM-based legacy power management for non-ACPI implementations.</li> <li><input type="checkbox"/> ACPI defined power states (S1, S3, S4, S5).</li> <li><input type="checkbox"/> ACPI power management timer.</li> <li><input type="checkbox"/> SMI generation.</li> <li><input type="checkbox"/> All registers readable/restorable for proper resume from 0 V suspend states.</li> <li><input type="checkbox"/> PCI PME#.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Integrated IDE Controller: <ul style="list-style-type: none"> <li><input type="checkbox"/> Independent Timing of up to four drives.</li> <li><input type="checkbox"/> Ultra ATA/66 Mode (66 Mbytes/sec).</li> <li><input type="checkbox"/> Ultra ATA/33 Mode (33 Mbytes/sec).</li> <li><input type="checkbox"/> PIO Mode 4 transfers up to 14 Mbytes/sec.</li> <li><input type="checkbox"/> Separate IDE connections for Primary and Secondary cables.</li> <li><input type="checkbox"/> Integrated 16 x 32-bit buffer for IDE PCI Burst transfers.</li> <li><input type="checkbox"/> Write Ping-Pong Buffer for faster write performances.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>Real-Time Clock: <ul style="list-style-type: none"> <li><input type="checkbox"/> 256-byte battery-backed CMOS RAM.</li> <li><input type="checkbox"/> Hardware implementation to indicate Century Rollover.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>System TCO Reduction Circuits: <ul style="list-style-type: none"> <li><input type="checkbox"/> Timers to Generate SMI# and Reset Upon.</li> <li><input type="checkbox"/> Timers to Detect Improper Processor Reset.</li> <li><input type="checkbox"/> Integrated Processor Frequency Strap Logic.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>Timers Based on 82C54: <ul style="list-style-type: none"> <li><input type="checkbox"/> System Timer, Refresh Request, Speaker Tone Output.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>SMBus: <ul style="list-style-type: none"> <li><input type="checkbox"/> Host Interface allows processor to communicate via SMBus.</li> <li><input type="checkbox"/> Compatible with 2-wire I<sup>2</sup>C bus.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>System Timer, Refresh Request, Speaker Tone Output.</li> </ul>	<ul style="list-style-type: none"> <li>GPIO: <ul style="list-style-type: none"> <li><input type="checkbox"/> TTL, Open-Drain, Inversion.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>FirmWare Hub (FWH) interface.</li> </ul>	<ul style="list-style-type: none"> <li>3.3 V operation with 5 V Tolerant Buffers for IDE and PCI signals.</li> </ul>
<ul style="list-style-type: none"> <li>241 BGA Package.</li> </ul>	<ul style="list-style-type: none"> <li>Alert-On-LAN (AOL) support.</li> </ul>

## 2 System Board

The Input/Output Controller Hub (82801AA)

### ICH Architecture

The ICH interface architecture ensures that the I/O subsystems, both PCI and the integrated input/output features (for example: IDE, AC'97 and USB) receive the adequate bandwidths.

To achieve this, by placing the I/O bridge directly on the ICH interface, and no longer on the PCI bus, the ICH architecture ensures that both the input/output functions integrated into the ICH and the PCI peripherals obtain the bandwidth necessary for peak performance.

### ICH PCI Bus Interface

The ICH PCI provides the interface to a PCI bus interface operating at 33 MHz. This interface implementation is compliant with PCI Rev 2.2 Specification, supporting up to six external PCI masters in addition to the ICH requests and AC'97 controller. The PCI bus can reach a data transfer rate of 133 MBytes/sec. The maximum PCI burst transfer can be between 256 bytes and 4 KB. It also supports advanced snooping for PCI master bursting, and provides a pre-fetch mechanism dedicated for IDE read.

Refer to [page 70](#) for a description of the devices on the ICH.

### SMBus Controller

The System Management (SM) bus is a two-wire serial bus. It runs at a maximum of 100 kHz. The SMBus Host interface allows the processor to communicate with SMBus slaves. The bus connects to sensor devices that monitor some of the hardware functions of the system board, both during system boot and run-time.

Refer to [page 57](#) for a description of the devices on the SMBus, or to [page 60](#) for information on the MaxiLife ASIC.

### Low Pin Count Interface

The ICH implements the LPC interface 1.0 specification.

### Enhanced USB Controller

The USB (Universal Serial Bus) controller provides enhanced 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 rear panel. These ports are built into the ICH, as standard USB ports.

The ICH is USB revision 1.1 compliant.

USB works only if the USB interface has been enabled within the HP *Setup* program. Currently, only the Microsoft Windows 95 and Windows 98 operating systems provide support for the USB.

The Microsoft Supplement 2.1 software (called **USBSupp.exe**), which provides support for the Universal Serial Bus for Windows 95 Software Release (SR) 2.0, can be obtained from the Hewlett-Packard World Wide Web site at: <http://www.hp.com/go/kayaksupport>.

### AC'97 Controller

This controller, even though available in the ICH, is not used. The HP Kayak PC Workstation uses the dedicated dual chip PCI solution of the CS4280 audio controller and the CS4297 Codec Audio Codec '97 (AC'97).

Refer to [page 56](#) for information about the CS4280 and CS4297 audio solution.

### IDE Controller

The IDE controller is implemented as part of the ICH chip and has PCI-Master capability. Two independent ATA/66 IDE channels are provided with two connectors per channel. Two IDE devices (one master and one slave) can be connected per channel. In order to guarantee data transfer integrity, Ultra-ATA cables must be used for Ultra-ATA modes (Ultra-ATA/33 and Ultra-ATA/66).

The PIO IDE transfers of up to 14 Mbytes/sec and Bus Master IDE transfer rates of up to 66 Mbytes/sec are supported. The IDE controller integrates 16 x 32-bit buffers for optimal transfers.

It is possible to mix a fast and a slow device, such as a hard disk drive and 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.

### DMA Controller

The seven-channel DMA controller incorporates the functionality of two 82C37 DMA controllers. Channels 0 to 3 are for 8-bit count-by-byte transfers, while channels 5 to 7 are for 16-bit count-by-word transfers (refer to table on [page 108](#) for allocated DMA channel allocations). Any two of the seven DMA channels can be programmed to support fast Type-F transfers.

The ICH DMA controller supports the LPC (Low Pin Count) DMA. Single, Demand, Verify and Incremental modes are supported on the LPC interface. Channels 0-3 are 8-bit, while channels 5-7 are 16-bit. Channel 4 is reserved as a generic bus master request.

## 2 System Board

The Input/Output Controller Hub (82801AA)

### Interrupt Controller

The Interrupt controller is equivalent in function to the two 82C59 interrupt controllers. The two interrupt controllers are cascaded so that 14 external and two internal interrupts are possible. In addition, the ICH supports a serial interrupt scheme and also implements the I/O APIC controller. A table on [page 109](#) shows how the master and slave controllers are connected.

### Timer/Counter Block

The timer/counter block contains three counters that are equivalent in function to those found in one 82C54 programmable interval counter/timer. These three counters are combined to provide the system timer function, and speaker tone. The 14.318 MHz oscillator input provides the clock source for these three counters.

### Advanced Programmable Interrupt Controller

Incorporated in the ICH, the APIC can be used in either single-processor or multi-processor systems, while the standard interrupt controller is used in single-processor systems.

### Real-Time Clock

The RTC is 146818A-compatible, with 256 bytes of CMOS. The RTC performs two key functions: keeping track of the time of day and storing system data.

The RTC operates on a 32.768 kHz crystal and a separate 3V lithium battery that provides up to 5 years of protection. It also supports two lockable memory ranges. By setting bits in the configuration space, two 8-byte ranges can be locked to read and write accesses. This prevents unauthorized reading of passwords or other security information. Another feature is a date alarm allowing for a schedule wake-up event up to 30 days in advance.

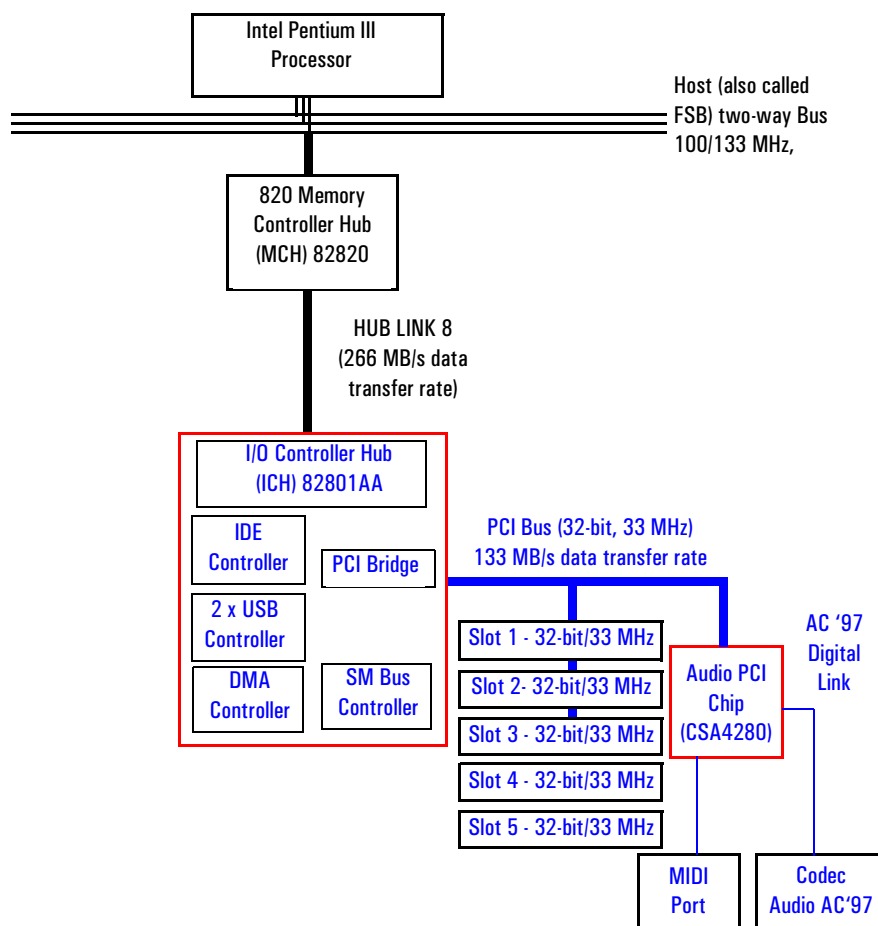
### Enhanced Power Management

The ICH's power management functions include enhanced clock control, local and global monitoring support for 14 individual devices, and various low-power (suspend) states. A hardware-based thermal management circuit permits software-independent entry points for low-power states.

The ICH includes full support for the Advanced Configuration and Power Interface (ACPI) specifications.

## Devices on the PCI 32-bit 33 MHz Bus

The following devices are connected to the PCI 32-bit 33 MHz bus.



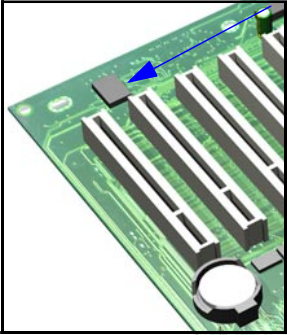
## PCI 32-bit/33 MHz Slots

There are five 32-bit/33 MHz PCI slots accepting 5 V PCI cards and Universal PCI cards (support for 3.3 V or 5 V). A LAN card is installed in PCI Slot 5. On some models, a SCSI controller card is installed in PCI Slot 4. PCI slots are explained in detail on [page 38](#).

## 2 System Board

The Input/Output Controller Hub (82801AA)

### Dual Chip PCI Audio Solution



The integrated PCI audio solution in the PC Workstation is a dual-chip solution made up of the CrystalClear™ CS4280 PCI audio controller and the CrystalClear CS4297 Audio Codec '97 (AC'97).

The CS4280 PCI audio controller interfaces with the PCI bus and performs all digital operations such as sample rate conversions and synthesis. The CS4297 AC'97 chip mixes and processes all the analog signals.

The interface between audio PCI chip and the audio codec is known as the AC'97 Digital Link.

#### CS4280 PCI Audio Interface Features

- PCI Version 2.1 Bus Master.
- Windows ® 95, Windows 98, Windows NT 4.0, Windows NT 2000 Drivers.
- Compliant with PC'99.
- MPU-401 interface, FM synthesizer, and Game Port.
- Full duplex operation.
- Advanced Power Management (PPMI).

#### CS4297 Audio Codec'97 Features

- AC'97 1.03 compatibility.
- Sophisticated mixed signal technology.
- 18-bit stereo full-duplex Codec with fixed 48kHz sampling rate.
- High quality differential CD input.
- Mono microphone input.
- Two analog line-level stereo inputs for LINE IN and CD (or VIDEO) connection.
- Single stereo line level output.
- Extensive power management support.
- Meets Microsoft's PC'99 audio performance requirements.



## Audio Chip Specifications

Feature	Description
<i>Digitized Sounds</i>	<ul style="list-style-type: none"> <li>• 16-bit and 8-bit stereo sampling from 4 kHz to 48 kHz.</li> <li>• Hardware Full Duplex Conversion.</li> <li>• 16-bit software-based real-time audio compression/decompression system.</li> </ul>
<i>Music Synthesizer</i>	<ul style="list-style-type: none"> <li>• Integrated OPL3 compatible music synthesizer.</li> </ul>
<i>Mixer</i>	<ul style="list-style-type: none"> <li>• MPC-3 audio mixer.</li> <li>• Input mixing sources: microphone, LINE In, CD Audio, AUX Audio, and digitized sounds.</li> <li>• Output mixing of all audio sources to the LINE Out or integrated PC Workstation speaker.</li> <li>• Multiple source recording and Left/Right channels balance.</li> </ul>
<i>Line Input</i>	<ul style="list-style-type: none"> <li>• Input impedance: 17k <math>\Omega</math> (ohms).</li> <li>• Input range: 0 to 2.83 Vpp</li> </ul>
<i>Line Output</i>	<ul style="list-style-type: none"> <li>• Stereo output of 100 mW per channel with headphone speakers (impedance 32 <math>\Omega</math>).</li> <li>• Output impedance: 570 <math>\Omega</math>.</li> <li>• Output range: 0 to 2.83 Vpp.</li> </ul>
<i>Microphone Input</i>	<ul style="list-style-type: none"> <li>• 20 dB gain preamplifier. The boost can be muted with software.</li> <li>• 32-level programmable volume control.</li> <li>• Input impedance: 600 <math>\Omega</math>.</li> <li>• Sensitivity: 30 mVpp to 283 mVpp.</li> </ul>
<i>Stereo Out Jack</i>	<ul style="list-style-type: none"> <li>• Impedance: 32 <math>\Omega</math>.</li> </ul>

## Devices on the SMBus

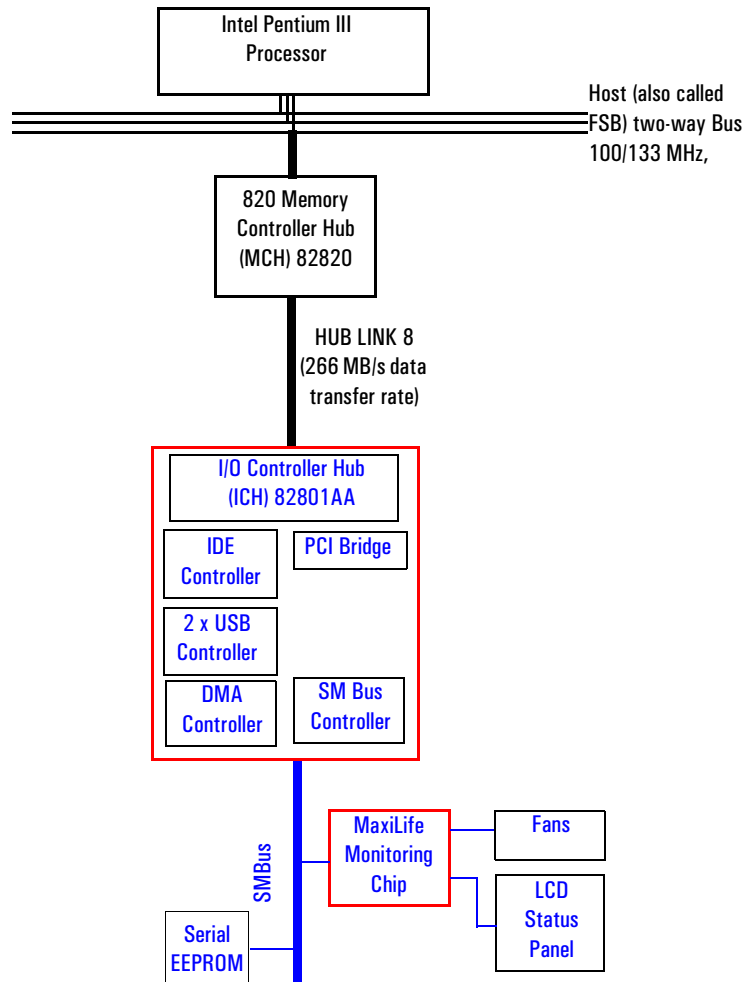
The SMBus is a subset of the I<sup>2</sup>C bus. It is a two-wired serial bus which runs at a maximum speed of 100 kHz. It is used to monitor some of the hardware functions of the system board (such as voltage levels, temperature, fan speed, memory presence and type), both at system boot and during normal run-time. It is controlled by the SMBus controller located in the ICH. The following devices are connected to the SMBus:

- LCD status panel.
- One Serial EEPROM MaxiLife (also includes backup values of CMOS settings).

## 2 System Board

The Input/Output Controller Hub (82801AA)

- PCI slot 5, thus supporting Alert-On LAN (AOL).
- ICH SMBus Master Controller 16 kHz maximum.
- MaxiLife for hardware management, bus master controller.
- RIMM or DIMM serial EEPROM.
- Hardware Monitoring ASIC.



### ICH SMBus Master Controller

The ICH provides an intelligent processor-to-SMBus controller. All access performed to the SMBus is done through the ICH 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 include a 256 byte I<sup>2</sup>C Serial EEPROM. The first 128 bytes contain general information, including the DRAM chips' manufacturer's name, DIMM speed rating, DIMM type, etc. The second 128 bytes of the Serial EEPROM can be used to store data online.

**RIMM Sockets**

Each RIMM socket is connected to the SMBus. The 168-pin RIMM modules include a 256 byte I<sup>2</sup>C Serial EEPROM. The first 128 bytes contain general information, including the DRAM chips' manufacturer's name, RIMM speed rating, RIMM type, etc. The second 128 bytes of the Serial EEPROM can be used to store data online.

**Hardware Monitoring ASIC**

The Hardware Monitoring ASIC chip is a sensor dedicated to the processor temperature. This chip uses the thermal diodes integrated into each processor cartridge and makes the temperature information available through the SMBus.

**SDRAM Clock Buffer**

The I<sup>2</sup>C 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 PC Workstation. The computer uses 16KBytes of Serial EEPROM implemented within two chips. 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 tattoo string, the serial number, and the parameter settings for the *Setup* program as well as MaxiLife firmware.

**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. 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.

## 2 System Board

The Input/Output Controller Hub (82801AA)

### HP MaxiLife Hardware Monitoring Chip

MaxiLife is a hardware monitoring chip which is resident on the system board. Its responsibility includes On/Off and reset control, status panel management (LEDs), hardware monitoring (temperature and voltage), early diagnostics (CPU, memory, PLLs, boot start), run-time diagnostics (CPU errors), and other miscellaneous functions (such as special OK/FAIL symbols based on a smiling face for the Kayak XM600 Minitower models).

The integrated microprocessor includes a Synopsys cell based on Dallas “8052” equivalent, a 2 KB boot ROM, 256 bytes of data RAM, an I<sup>2</sup>C 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 I<sup>2</sup>C serial EEPROM. The total firmware (MaxiLife 8051-code, running in RAM) size is 14 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).

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 I<sup>2</sup>C bus), via the ICH. Its I<sup>2</sup>C cell may operate either in Slave or Master mode, switched by firmware, or automatically in the event of ‘Arbitration’ loss.

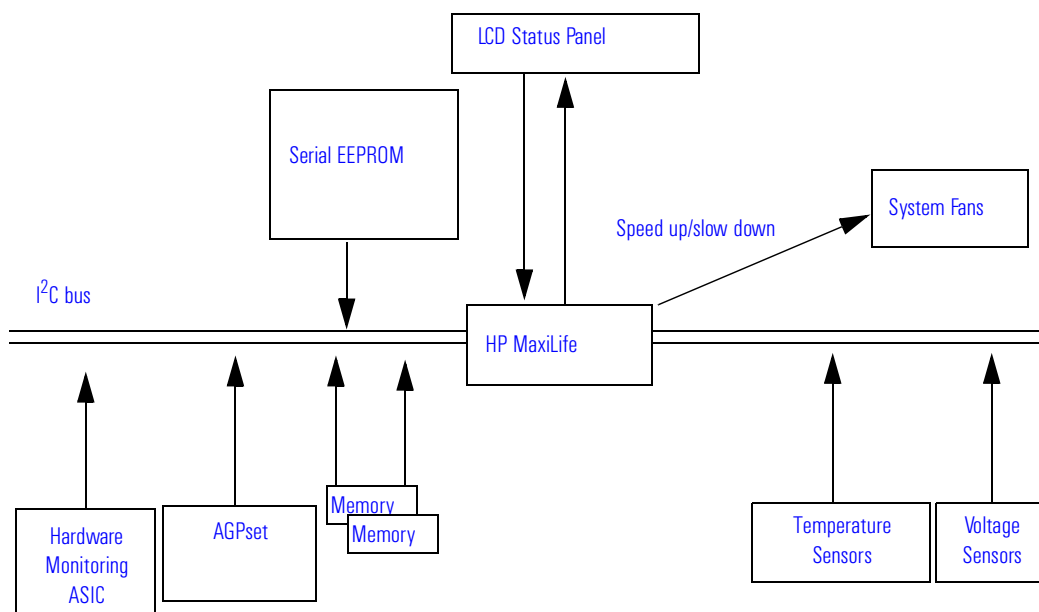
As a monitoring chip, MaxiLife reports critical errors at start-up, and is therefore powered by Vstandby (3.3V) power. For MaxiLife to work correctly, the PC Workstation must always be connected to a grounded outlet. This enables the PC Workstation’s hardware monitoring chip to be active, even if the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

### Test Sequence and Error Messages

Refer to [“MaxiLife Test Sequence and Error Messages” on page 111](#) 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 I<sup>2</sup>C bus, which is a reliable communications bus to control the integrated circuit boards.

**NOTE**

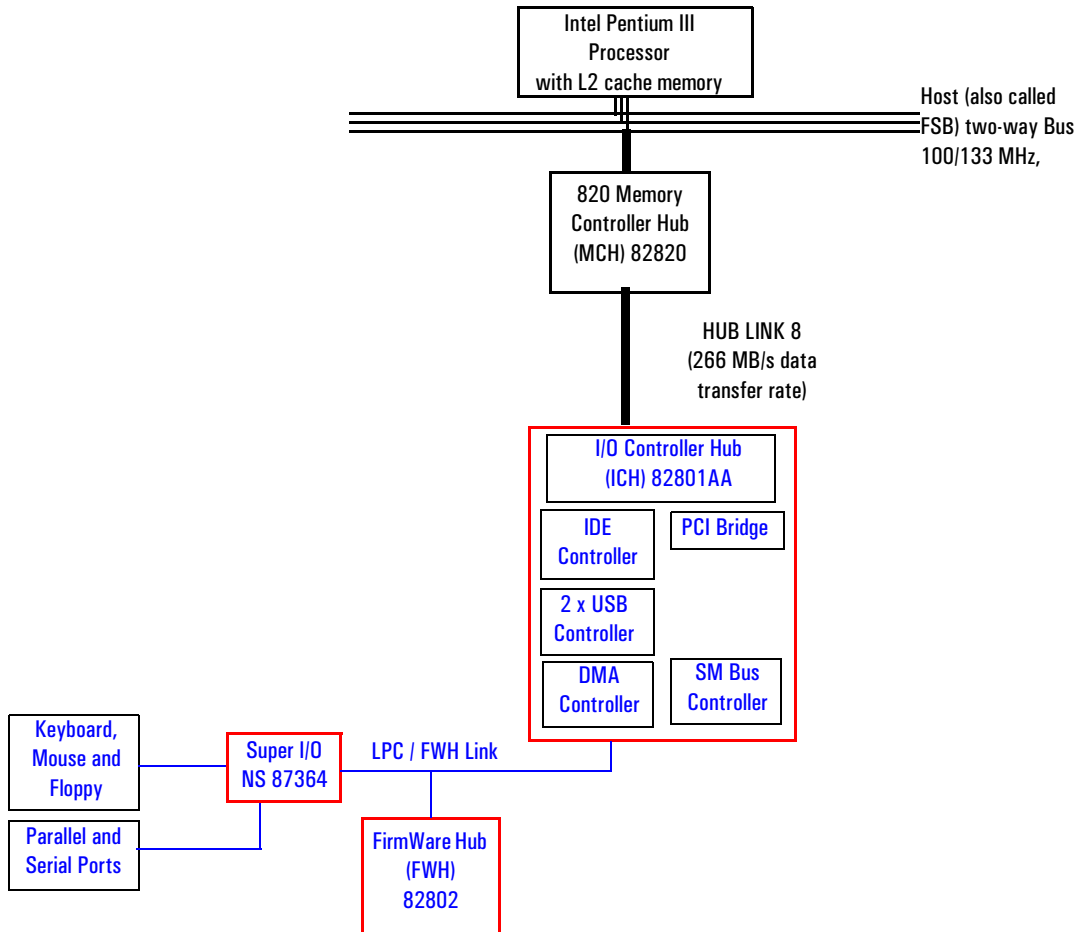
MaxiLife is powered by VSTBY. This means that it is functional as soon as the power cord is plugged in. For MaxiLife to work correctly, the PC Workstation must always be connected to a grounded outlet.

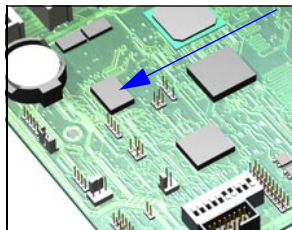
## 2 System Board

The Input/Output Controller Hub (82801AA)

### Devices on the Low Pin Count Bus

The following devices are connected to the LPC bus.





### The Super I/O Controller (NS 87364)

The *Super I/O* chip (NS 87364) provides the control for two FDD devices, two serial ports, one bidirectional multi-mode parallel port, and a keyboard and mouse controller.

Device	Index	Data
Ultra I/O	2Eh	2Fh

### Serial / Parallel Communications Ports

The 9-pin serial ports (whose pin layouts are depicted on [page 136](#)) 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 depicted on [page 137](#)) 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).

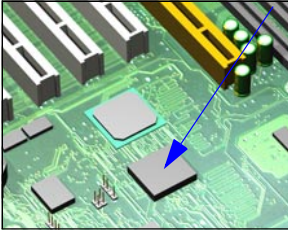
### FDC

The integrated *floppy 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.

### Keyboard and Mouse Controller

The computer has an 8042-based keyboard and mouse controller. The connector pin layouts are shown on [page 135](#).

## FirmWare Hub (82802AA)



The FWH (also known as flash memory) is connected to the low pin count (LPC) bus. It contains 4 Mbit (512 kB) of flash memory.

The hardware features of the FWH include: a Random Number Generator (RNG), five General Purpose Inputs (GPI), register-based block locking and hardware-based locking. An integrated combination of logic features and non-volatile memory enables better protection for the storage and update of system code and data, adds flexibility through additional GPIs, and allows for quicker introduction of security/manageability features.

The following table shows the available FWH features.

Feature	Feature
<ul style="list-style-type: none"> <li>Platform Compatibility:               <ul style="list-style-type: none"> <li><input type="checkbox"/> Enables security-enhanced platform infrastructure.</li> <li><input type="checkbox"/> Part of the Intel 820 chipset.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Two Configurable Interfaces:               <ul style="list-style-type: none"> <li><input type="checkbox"/> FirmWare Hub interface for system operation.</li> <li><input type="checkbox"/> Address/Address Multiplexed (A/A Mux) interface.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>FirmWare Hub Interface Mode:               <ul style="list-style-type: none"> <li><input type="checkbox"/> Five-signal communication interface supporting x8 reads and writes.</li> <li><input type="checkbox"/> Register-based read and write protection for each code/data storage blocks.</li> <li><input type="checkbox"/> Five additional GPIs for system design and flexibility.</li> <li><input type="checkbox"/> A hardware RNG (Random Number Generator).</li> <li><input type="checkbox"/> Integrated CUI (Command User Interface) for requesting access to locking, programming and erasing options. It also handles requests for data residing in status, ID and block lock registers.</li> <li><input type="checkbox"/> Operates with 33 MHz PCI clock and 3.3 V input/output.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>4 Mbits of Flash Memory for system code/data non-volatile storage:               <ul style="list-style-type: none"> <li><input type="checkbox"/> Symmetrically blocked, 64 Kbyte memory sections.</li> <li><input type="checkbox"/> Automated byte program and block erase through an integrated WSM (Write State Machine).</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>A/A Mux Interface/Mode, supporting:               <ul style="list-style-type: none"> <li><input type="checkbox"/> 11-pin multiplexed address and 8-pin data I/O interface.</li> <li><input type="checkbox"/> Fast on-board or out-of-system programming.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Power Supply Specifications:               <ul style="list-style-type: none"> <li><input type="checkbox"/> Vcc: 3.3 V +/- 0.3 V.</li> <li><input type="checkbox"/> Vpp: 3.3 V and 12 V for fast programming, 80 ns.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>Industry Standard Packages:               <ul style="list-style-type: none"> <li><input type="checkbox"/> 40-Lead TSOP or 32-Lead PLCC.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Case Temperature Operating Range.</li> </ul>



The FWH includes two hardware interfaces:

- FirmWare Hub interface.
- Address/Address Multiplexed (A/A Mux) interface.

The IC (Interface Configuration) pin on the FWH provides the control between these interfaces. The interface mode needs to be selected prior to power-up or before return from reset (RST# or INIT# low to high transition).

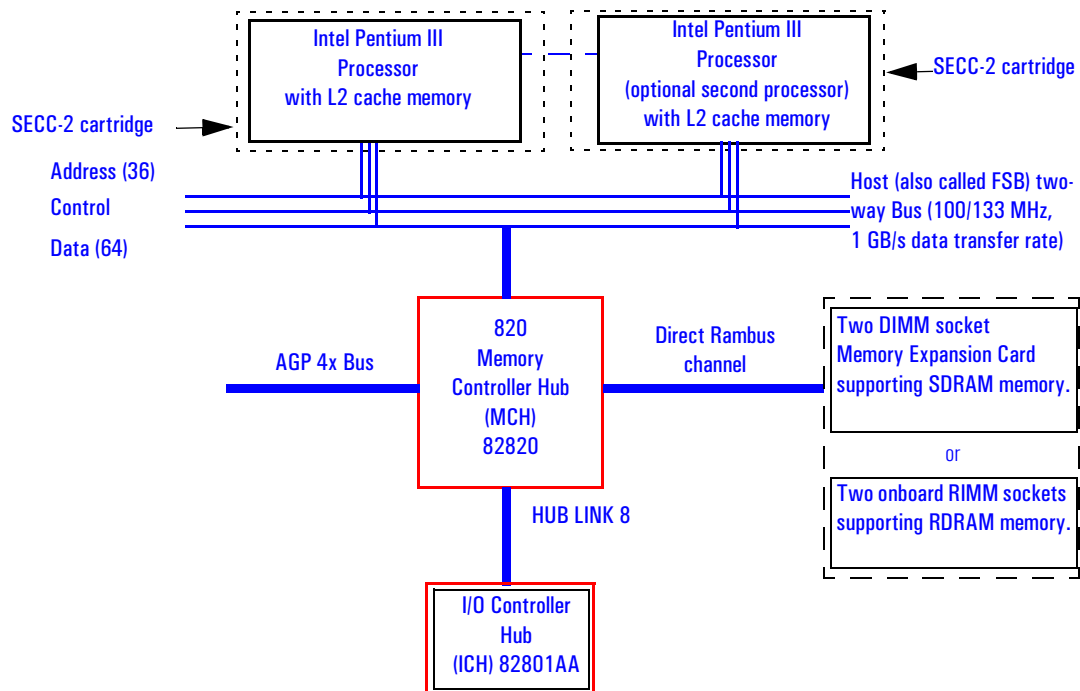
The FWH interface works with the ICH during system operation, while the A/A Mux interface is designed as a programming interface for component pre-programming.

An internal CUI (Command User Interface) serves as the control center between the FWH and A/A Mux interfaces, and internal operation of the non-volatile memory. A valid command sequence written to the CUI initiates device automation. An internal WSM (Write State Machine) automatically executes the algorithms and timings necessary for block erase and program operations.

## Host Bus

The Host bus of the Pentium III processors, also referred to as the FSB (Front Side Bus), is implemented in the AGTL (Assisted Gunning Transceiver Logic)+ technology. This technology features open-drain signal drivers that are pulled-up to 1.5 V through resistors at bus extremities; these resistors also act as bus terminators, and are integrated in the processor.

If only one processor is installed, a processor terminating card must be installed in the second processor slot.



The supported operating frequencies of the AGTL+ bus are 100 MHz or 133 MHz. The width of the data bus is 64 bits, while the width of the address is 36 bits. Along with the operating frequencies, the processor voltage is set automatically.

The control signals of the Host 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 MCH, 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.

For the Host bus to run at 133 MHz while respecting the specified signal and timings, a distributed mechanism is used on each AGTL+ signal. The bus is routed with a “Y” topology.

### Intel Pentium III Processor

*HP Kayak XM600 PC Workstations* are supplied with a Pentium III processor and an integrated VRM (Voltage Regulator Module) on the system board. Because these PC Workstations do not have any VRM sockets, a VRM does not need to be installed.

The Pentium III processor has several features that enhance performance:

- Dual Independent Bus architecture, which combines a dedicated 64-bit L2 cache bus (supporting level cache sizes of 128 KB or 512 KB) plus a 64-bit system bus.
- MMX technology, which gives higher performance for media, communications and 3D applications.
- Dynamic execution to speed up software performance.
- Internet Streaming SIMD Extensions for enhanced floating point and 3D application performance.
- Processor Serial Number is an electronic number incorporated in the processor. If enabled, the Processor Serial Number can serve as a means of identifying the system. By default, this option is set to Disabled in the *Setup* program.
- Uses multiple low-power states, such as AutoHALT, Stop-Grant, Sleep and Deep Sleep to conserve power during idle times.

The Pentium III processor (core and cache memory) is packaged in a self-contained Single Edge Contact Cartridge (SECC-2) installed in a Slot 1 processor slot. The SECC-2 cartridge requires a 242-contact Slot 1 connector on the system board. It includes a processor core chip, tag and data SRAMS, and AGTL+ termination resistors.

### Processor Clock

The 100/133 MHz Host Bus clock is provided by a PLL. The processor core clock is derived from the Host Bus by applying a “ratio”. This ratio is programmed by the system board. The processor then applies this ratio to the Host Bus clock to generate its CPU core frequency.

## 2 System Board

### Host Bus

In a dual-processor system, the CPU core to FSB frequency ratio is always the same for the two processors ensuring that the two processors will always run at the same speed.

#### Bus Frequencies

There is a 14.318 MHz crystal oscillator on the system board. This frequency is multiplied to 133 MHz by a phase-locked loop. This is further scaled by an internal clock multiplier within the processor. The bus frequency and the processor voltage are set automatically.

#### Voltage Regulation Module (VRM)

Two VRMs are integrated on the system board complying with VRM specification, rev. 8.2 and 8.4. High-current and low voltage processors are supported.

Processors require a dedicated power voltage to supply the CPU core and L2 cache. Each processor codes through Voltage Identification (VID) pins with a required voltage level of 1.5 V to 3.5 V. Each VID set is decoded by the VRM on the system board that in return supplies the required power voltage to the processor. It should be noted, however, that voltage may vary from one processor model to another.

### Optional Second Processor

Single processor models can be upgraded to a dual processor system by installing a second processor in the vacant slot. The second processor must be a Pentium III processor for Slot 1 of the same speed and Level 2 cache memory capacity as the first, and same Level 2 cache voltage.

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#### NOTE

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When upgrading a processor or installing a second processor, the processor type and speed is automatically recognized by the BIOS. This means that no particular switch settings are required.

Upgrading a single processor to a dual processor system on Windows NT platforms is made easier with the HP DualExpress! application which is included in the HP processor application kit.

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 32-bit architecture (though other operating systems will also show some benefit if 32-bit application programs are run).

The two processors must be operating at the same speed.

## Configuring for Multi-Processing

*HP Kayak XM600 PC Workstations* support Symmetric Multi-Processing (SMP). When adding a second processor, it is automatically detected so there is no specific configuration required.

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 operation. Refer to [page 110](#) for further details.

## Cache Memory

There can be two integrated circuits sealed within a single Pentium III package. One of these contains the Level-2 (L2) cache memory chip; the other contains the processor, which itself includes Level-1 (L1) cache memory.

The L1 cache memory has a total capacity of 32KB (16 KB data, 16 KB instructions). Depending on the model, the L2 cache memory could have a capacity of 512 KB or i256 KB, and is composed of four-way set-associative static RAM. Data is stored in lines of 32 bytes (256 bits). Thus two consecutive 128-bit transfers with the main memory are involved in each transaction.

The L2 cache is composed of a TagRam and Burst-pipelined Synchronous Static RAM (BSRAM) memories and is implemented with multiple die. Transfer rates between the processor's core and L2 cache can be either:

- Same as the processor core clock frequency (full speed) for i256 KB and scale with the processor core frequency.
- One-half the processor core clock frequency for 512 KB and scale with the processor core frequency.

Both the TagRam and BSRAM receive clocked data directly from the processor's core.

The processor includes a dedicated L2 cache bus, thus maintaining the dual independent bus architecture to deliver high bus bandwidth and high performance.

The amount of cache memory is set by Intel at the time of manufacture, and cannot be changed.

## 2 System Board

### Assigned Device Interrupts

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## Assigned Device Interrupts

### Input/Output Controller Hub Interrupts

Device	REQ/ GNT	ID	IDSEL AD[xx]	Chip-set Interrupt Connection			
				INTA	INTB	INTC	INTD
CS4280 Audio Controller	0	5	21	—	A	—	—
USB Controller <sup>1</sup>	—	—	—	—	—	—	A
AGP slot	—	0	16	A	B	—	—
PCI 32-bit slot #1	5	6	22	C	D	A	B
PCI 32-bit slot #2	4	8	24	A	B	C	D
PCI 32-bit slot #3	3	9	25	D	A	B	C
PCI 32-bit slot #4 (SCSI controller on some models)	2	10	26	C	D	A	B
PCI 32-bit slot #5 (LAN card)	1	11	27	B	C	D	A

<sup>1.</sup> The USB interrupt is connected within the ICH to intD.

## Interface Cards

This chapter describes the graphics, network and SCSI devices that are supplied with the *HP Kayak XM600 PC Workstation*.

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### Graphics Cards

*HP Kayak XM600 PC Workstation* models are supplied with a graphics card. This graphics card is one of the following, depending on the PC Workstation model:

- Matrox Millennium G250.
- Matrox Millennium G400.
- 3Dlabs Oxygen GVX1.
- ELSA Synergy™ II.

#### Matrox Millennium G250 Graphics Card

The Matrox Millennium G250 graphics card has a total of 8 MB of installed video memory, which can be upgraded to a maximum of 16 MB.

The Matrox Millennium G250 on-board MGA G-250 processor communicates directly with the Pentium II processor along the AGP 2X bus. The controller can be characterized as follows:

- Supports full AGP 2X mode
  - Graphics controller in 272-pin BGA (Ball Grid Array) package
  - Integrated 64-bit, 250 MHz RAMDAC
  - New, high-performance triangle setup engine to off-load system CPU
  - Improved 3D drawing engine supports:
    - Bilinear texture filtering
    - Fogging.
    - Alpha blending
    - Anti-aliasing
    - Specular highlighting
-

### 3 Interface Cards

#### Graphics Cards

- High-performance VGA
- Integrated front-end and back-end scalers
- Fully Direct Draw, Direct 3D, Mini Client Drivers (MCD), and OpenGL<sup>®</sup> compliant
- 143 MHz SGRAM (LVTTL) memory configurations (up to 16 MB maximum)
- Support for memory upgrade via 144-pin SO\_DIMM memory modules (SGRAM)
- Serial EEPROM video BIOS interface (32 KB)
- ITU-656 and VMI-like host port provides interface to low-cost decoders/ CODECs
- 12-bit digital RGB port (MAFC) provides support for video encoders and panel link interfaces

The diagram below shows the Matrox Millennium G250 graphics card.



#### Available Video Resolutions

The number of colors supported is limited by the graphics device and the video memory. The resolution/color/refresh-rate combination is limited by a combination of the display driver, the graphics device, and the video memory. If the resolution/refresh-rate combination is set higher than the display can support, you risk damaging the display.



The tables below summarize the video resolutions and refresh rates that are supported.

<b>Resolution 2D/3D</b>	<b>8-bit 256 colors</b>	<b>16-bit 64k colors</b>	<b>24-bit 16.7 million colors</b>	<b>32-bit 16.7 million colors</b>
640x480	200 Hz	200 Hz	200 Hz	200 Hz
800x600	180 Hz	180 Hz	180 Hz	180 Hz
1024x768	140 Hz	140 Hz	140 Hz	140 Hz
1152x864	120 Hz	120 Hz	120 Hz	120 Hz
1280x1024	100 Hz	100 Hz	100 Hz	90 Hz
1600x1200	90 Hz	90 Hz	85 Hz	65 Hz
1800x1440	80 Hz	80 Hz	75 Hz	650 Hz
1920x1440	76 Hz	76 Hz	70 Hz	-
2048x1536	70 Hz	70 Hz	65 Hz	-

<b>Maximum Refresh Rates<sup>1</sup></b>			
<b>Resolution</b>	<b>8 bpp / 16 bpp</b>	<b>24 bpp</b>	<b>32 bpp</b>
640x480	200 Hz	200 Hz	200 Hz
800x600	180 Hz	180 Hz	180 Hz
1024x768	140 Hz	140 Hz	140 Hz
1152x864	120Hz	120Hz	120Hz
1280x1024	100 Hz	100 Hz	90 Hz
1600x1200	90 Hz	85 Hz	65 Hz
1920x1080	80Hz	80Hz	60Hz
1920x1200	76 Hz	70 Hz	-
1800x1440	70 Hz <sup>2</sup>	65 Hz	-

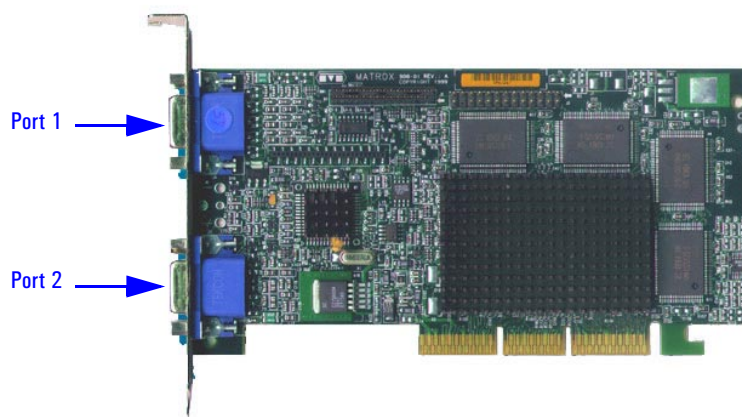
1. Your display may not support the maximum refresh rates shown here. Refer to the User's Guide supplied with your display for details of the refresh rates supported by your display.
2. Limitation due to 250 MHz RAMDAC.

#### Matrox Millennium G400 Graphics Card

The Matrox Millennium G400 Dual AGP 2X/4X graphics card has 16MB of installed video memory (non-upgradeable), and can be characterized as follows:

- Powered by the Matrox MGA-G400 chip
- Full AGP 2X/AGP 4X support (up to 1GB/s bandwidth)
- Integrated 300MHz RAMDAC with Ultra Sharp technology for highly saturated and separated colors
- Matrox DualHead Display technology with PowerDesk desktop manager:
  - Easy multiple resolutions support
  - Simple dialog box
  - Effortless multiple-window management
- DDC2B support for Plug & Play detection of monitor
- 256-bit dual bus architecture; true 128-bit external bus to video memory
- Vibrant color quality - true 32-bit ARGB
- Supports 32-bit Z buffering for exceptional rendering precision
- 32-bit internal precision specially enhanced for multi-texturing using 32-bit text sources
- 16/10 monitor support
- Support for true 32-bit color (16.7 million colors) at resolutions of up to 2048 x 1536
- Bilinear, trilinear, and anisotropic filtering
- Floating-point 3D setup engine
- DirectX 6 and OpenGL<sup>®</sup> compliant

The diagram below shows the Matrox Millennium G400 graphics card.




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**NOTE**

If only one monitor is used, then Port 1 must be used.

In the case where a second monitor is installed, it is detected by the driver during the operating system boot (not after).

If only one monitor is detected, then only the mono head settings will be available in the Driver Configuration screens.

---

### Available Video Resolutions

The number of colors supported is limited by the graphics device and the video memory. The resolution/color/refresh-rate combination is limited by a combination of the display driver, the graphics device, and the video memory. If the resolution/refresh-rate combination is set higher than the display can support, you risk damaging the display.

The tables below summarize the 2D and 3D video resolutions that are supported, and the refresh rates.

Color palette	Max. 2D display area	Max. 3D display area	Double-buffered + 16-bit Z	Double-buffered + 16-bit Z
8-bit	2048 x 1536			
15- or 16-bit	2048 x 1536	2048 x 1536	1880 x 1440	1600 x 1200
124-bit	2048 x 1536	-	-	-
32-bit	2048 x 1536	1600 x 1200	1280 x 1024	1280 x 1024

---

### 3 Interface Cards

#### Graphics Cards

Maximum Refresh Rates		
Resolution (4:3 aspect ratio)	Main Display (8-/16-/24-/32-bit)	Second Display (16-/32-bit)
640x480	200 Hz	200 Hz
800x600	200Hz	180 Hz
1024x768	160 Hz	115 Hz
1152x864	140 Hz	95 Hz
1280x1024	120 Hz	75 Hz
1600x1200	100 Hz	43 Hz
1600x1280	90 Hz	43 Hz
1800x1440	80Hz	-
1920x1440	75 Hz	-
2048x1536	70Hz	-
Resolution (16:9 aspect ratio)	Main Display (8-/16-/24-/32-bit)	Second Display (16-/32-bit)
1600x1024	120 Hz	43
1920x1035	100 Hz	-
1920x1080	100 Hz	-
1920x1200	90 Hz	-

### 3Dlabs Oxygen GVX1

There is a total of 32 MB of video Synchronous Graphics RAM (SGRAM) memory installed on the graphics card.

#### Features

- OpenGL-based geometry and lighting acceleration entirely in the hardware, freeing the processor for other applications
- OpenGL specific extensions that doubles the performance under AutoCad
- Innovative virtual textures technology, using on-board graphics memory to cache large textures
- Multi-screen support (with additional PCI cards)
- Supports 16: 10 wide-format monitors
- PowerThreads™ SSE OpenGL drivers fully tested with all leading professional graphics applications

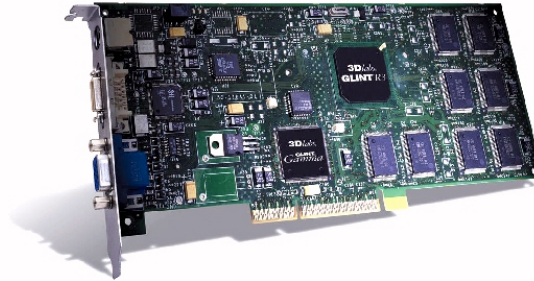
#### Specifications

- Full AGP 1X support
- Professional 3D rendering features that include:
  - Perspectively correct bilinear and trilinear filtering
  - Perspectively correct per-pixel MIP mapping
  - Single pass dual bilinear mip-mapped textures
  - Flat and Gouraud shading
  - Source and destination Alpha blending for transparency
  - High-quality anti-aliasing
  - Fog and depth-cueing
  - Overlay and stencil buffers
  - 32-bit Z-buffering
  - GID clipping
- GLINT R3 Rasterization processor for:
  - Virtual texture memory management unit
  - Up to 256 MB virtual texture address space
  - Integrated 300MHz RAMDAC
  - High-speed 128-bit memory interface
  - 2D/3D raster engine
  - Integrated SVGA controller

### 3 Interface Cards

#### Graphics Cards

The diagram below shows the 3Dlabs Oxygen GVX1 graphics card.



#### Video Memory

The video memory, also known as SGRAM, is a local block of RAM for holding major data structures: Frame Buffer (double buffer), Z-Buffer and T-Buffer (Texture Buffer). The Frame Buffer holds one frame steady on the screen while the next one is being processed, while the Z-buffer stores depth information for each pixel.

#### Available Video Resolutions

The number of colors supported is limited by the graphics device and the video memory. The resolution/color/refresh-rate combination is limited by a combination of the display driver, the graphics device, and the video memory. If the resolution/refresh-rate combination is set higher than the display can support, you risk damaging the display. The table below summarizes the 3D video resolutions and refresh rates that are supported.

Display resolution	Color depth	Refresh rates
640 x 480	8-bit, 16-bit, True color	100, 85, 75, 60 Hz
800 x 600	8-bit, 16-bit, True color	100, 85, 75, 60 Hz
1024 x 768	8-bit, 16-bit, True color	100, 85, 75, 60 Hz
1152 x 864	8-bit, 16-bit, True color	100, 85, 75, 60 Hz
1280 x 960	8-bit, 16-bit, True color	100, 85, 75, 60 Hz
1280 x 1024	8-bit, 16-bit, True color	100, 85, 75, 60 Hz
1600 x 1200	8-bit, 16-bit, True color	100, 85, 75, 60 Hz
1920 x 1080	8-bit, 16-bit, True color	100, 85, 75, 60 Hz
1920 x 1200	8-bit, 16-bit, True color	76 Hz
2048 x 1536	8-bit, 16-bit, True color	60 Hz

### ELSA Synergy II Graphics Card

The ELSA Synergy™ II graphics card has 32 MB of Synchronous Graphics RAM (SGRAM) installed video memory.

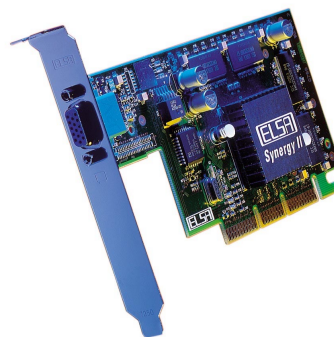
#### Features

- Fastest 128-bit 2D performance
- 3D hardware texture acceleration
- Resolution support up to 1920 x 1200 at 96 Hz
- Multi-screen support (up to 4 with additional PCI cards)
- Supports 16: 10 wide-format monitors
- Software tools: ELSA POWERdraft, ELSA MAXtreme, ELSA Views3D
- OpenGL® extensions for AutoCAD 2000 that doubles performance
- PowerThreads™ SSE OpenGL drivers fully tested with all leading professional graphics applications

#### Specifications

- Full AGP 2X/AGP 4X support
- RIVA TNT2 (NVIDIA) graphics processors
- VESA 3 (flash ROM)
- Integrated 300 MHz RAMDAC
- 3D standards: Hardware accelerated OpenGL®, DirectX3, DirectX5/6
- Standards: VESA DPMS, DDC2B, Plug & Play

The diagram below shows the ELSA Synergy™ II graphics card.



### 3 Interface Cards

#### Graphics Cards

#### Video Memory

The video memory, also known as SGRAM, is a local block of RAM for holding major data structures: Frame Buffer (double buffer), Z-Buffer and T-Buffer (Texture Buffer). The Frame Buffer holds one frame steady on the screen while the next one is being processed, while the Z-buffer stores depth information for each pixel.

#### Available Video Resolutions

The number of colors supported is limited by the graphics device and the video memory. The resolution/color/refresh-rate combination is limited by a combination of the display driver, the graphics device, and the video memory. If the resolution/refresh-rate combination is set higher than the display can support, you risk damaging the display.

The table below summarizes the 3D video resolutions and refresh rates that are supported.

Display resolution	Color depth	Refresh rates
640 x 480	8-bit, 16-bit, True color	200, 100, 85, 75, 60 Hz
800 x 600	8-bit, 16-bit, True color	200, 100, 85, 75, 60 Hz
1024 x 768	8-bit, 16-bit, True color	200, 100, 85, 75, 60 Hz
1152 x 864	8-bit, 16-bit, True color	200, 100, 85, 75, 60 Hz
1280 x 960	8-bit, 16-bit, True color	100, 85, 75, 60 Hz
1280 x 1024	8-bit, 16-bit, True color	100, 85, 75, 60 Hz
1600 x 1200	8-bit, 16-bit, True color	100, 85, 75, 60 Hz
1920 x 1080	8-bit, 16-bit, True color	100, 85, 75, 60 Hz
1920 x 1200	8-bit, 16-bit, True color	up to 96 Hz

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**NOTE**

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200 Hz accepted if supported by the monitor.



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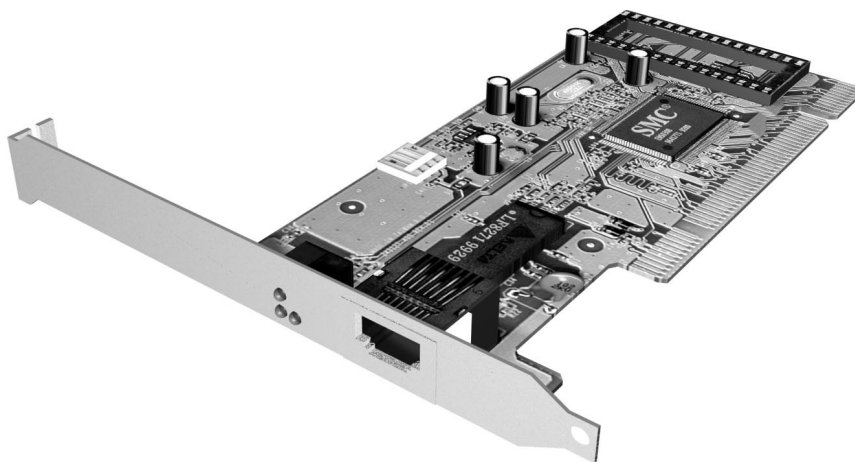
## Network Cards

Most *HP Kayak XM600 PC Workstation* models are supplied with an HP 10/100 TX LAN card.

A description of this card and the features of other supported LAN cards is provided in this section.

### HP 10/100 TX PCI LAN Interface

The 10/100 TX LAN Interface is a 32-bit PCI 2.2 card that supports 10 Mbits per second (10 BaseT) and 100 Mbits per second (100 TX) transfer speeds, and both half and full duplex operation.



### 3 Interface Cards

#### Network Cards

#### HP 10/100 TX PCI LAN Interface Features

Feature:	Description:
<i>RJ45 Connector</i>	Connection to Ethernet 10/100 TX autonegotiation
<i>BootROM</i>	Protocols: <ul style="list-style-type: none"><li>• PXE 2.0,</li><li>• On-board socket support up to 128 Kb.</li></ul>
<i>Remote Power On (RPO)</i>	Full remote power on using Magic Packet for Microsoft Windows 95, Windows 98, Windows NT4 in APM mode.
<i>Remote Wake Up (RWU)</i>	Enable and Wake Up from Suspend state using Magic Packet and Pattern Matching for Microsoft Win98SE and Win2000 in ACPI mode.  This feature enables a host computer to remotely (over the network) power on computers and wake computers up from energy-saving Sleep mode. For these features to work, use the Setup program to configure the BIOS.
<i>Power Management</i>	<ul style="list-style-type: none"><li>• OnNow 1.0,</li><li>• Advanced Power Management 1.2,</li><li>• PCI Power Management 1.1,</li><li>• WfM 2.0 compliant, ACPI.</li></ul>
<i>Manageability</i>	<ul style="list-style-type: none"><li>• Desktop Management Interface (DMI) 2.0 Dynamic driver,</li><li>• DMI 2.0 SNMP mapper,</li><li>• PXE 2.0 Flashable BootROM (optional on socket).</li></ul>
<i>Diagnostic</i>	<ul style="list-style-type: none"><li>• Mac address DOS report tool,</li><li>• User Diag for DOS.</li></ul>

#### HP 10/100 TX PCI LAN Interface LED Descriptions

LED	Description	Flashing	Steady	Off
<i>10 LNK</i>	Link integrity	Reversed polarity	Good 10 Base-T connection between NIC and hub.	No connection between NIC and hub
<i>100 LNK</i>	Link integrity	Reversed polarity	Good 100 TX connection between NIC and hub.	No connection between NIC and hub
<i>ACT</i>	<b>Yellow:</b> Port traffic for either speed	Network traffic present	Heavy network traffic	No traffic

## Supported LAN Cards

The following LAN cards are supported on the *HP Kayak XM600 PC Workstation*.

## 3COM NIC (Network Interconnect) LAN Card

### 3COM NIC LAN Card Features

Feature	Description
<i>Interface</i>	32-bit 10/100 BT full duplex RJ LAN Port.
<i>LED</i>	Three LEDs: <ul style="list-style-type: none"> <li>• activity,</li> <li>• 10 MB/s speed,</li> <li>• 100 MB/s speed.</li> </ul>
<i>Labels</i>	PCI 2.2 Specification, PC 99, Intel WfM 2.0.
<i>Power Management</i> <sup>1</sup>	<ul style="list-style-type: none"> <li>• RPO and RWU for APM Windows 95 and Windows 98,</li> <li>• RWU for ACPI Windows 98 and Windows 2000,</li> <li>• RPO for Windows NT 4,</li> <li>• OnNow 1.0, APM 1.2,</li> <li>• PCI power management. 1.1,</li> <li>• WOL, PCI VccAux 3.3 V.</li> </ul>
<i>Manageability</i>	DMI 2.0 Component Code.
<i>Diagnostic</i>	<ul style="list-style-type: none"> <li>• Mac address DOS report tool,</li> <li>• User Diag for DOS, Windows NT 4, Windows 95 and Windows 98.</li> </ul>
<i>Drivers</i>	Major OSes, Minor OSes.
<i>Boot ROM</i>	Multiboot BootROM (BIOS or socket).
<i>Remote Wake Up (RWU)</i>	This feature enables a host computer to remotely (over the network) power on computers and wake computers up from energy-saving Sleep mode. For these features to work, use the Setup program to configure the BIOS.

### 3 Interface Cards

#### Network Cards

#### 3COM LAN Card LED Descriptions

LED	Description	Flashing	Steady	Off
<i>10 LNK</i>	<b>GREEN:</b> Link integrity	Reversed polarity	Good 10 Base-T connection between NIC and hub.	No connection between NIC and hub
<i>100 LNK</i>	<b>GREEN:</b> Link integrity	Reversed polarity	Good 100 TX connection between NIC and hub.	No connection between NIC and hub
<i>ACT</i>	<b>Yellow:</b> Port traffic for either speed	Network traffic present	Heavy network traffic	No traffic

## INTEL NIC (Network Interconnect) LAN Card

### INTEL NIC LAN Card Features

Feature	Description
<i>Interface</i>	IEEE802.3 100 Base-TX, IEEE802.3 10 Base-T, 32-bit 10/100 BT full duplex RJ LAN Port.
<i>LED</i>	Two LEDs: <ul style="list-style-type: none"> <li>• one for act/lnk (activity and link),</li> <li>• one for 10 MB operation (on = 100 MB, off = 10MB).</li> </ul>
<i>Labels</i>	PCI 2.2 Specification, PC 99.
<i>Power Management</i>	<ul style="list-style-type: none"> <li>• Wfm 2.0 compliant,</li> <li>• RPO and RWU for APM Windows 95 and Windows 98,</li> <li>• OnNow 1.0, APM 1.2,</li> <li>• PCI power management 1.1,</li> <li>• VccAux s3.3 V support via PCI bus 2.2,</li> <li>• VccAux 5 V support via 3-pin WOL.</li> </ul>
<i>Manageability</i>	DMI 2.0 and DMI 2.0 SNMP mapper.
<i>Diagnostic</i>	<ul style="list-style-type: none"> <li>• Windows and DOS based,</li> <li>• Mac address DOS report tool,</li> <li>• User Diag for DOS, Windows NT 4, Windows 95 and Windows 98.</li> </ul>
<i>Drivers</i>	Major OSes, Minor OSes.
<i>Boot ROM</i>	Onboard flash ROM.
<i>Remote Wake Up (RWU)</i>	This feature enables a host computer to remotely (over the network) power on computers and wake computers up from energy-saving Sleep mode. For these features to work, use the Setup program to configure the BIOS.

### INTEL NIC LAN Card LED Descriptions

LED	On	Flashing	Off
<i>ACT/LNK</i>	Adapter and hub are receiving power. Cable connection is good.	Receiving or sending packets	Adapter and hub are not receiving power. Cable connection could be faulty or there is a driver configuration problem.
<i>100 TX</i>	Operating at 100 Mbps	N/A	Operating at 10 Mbps

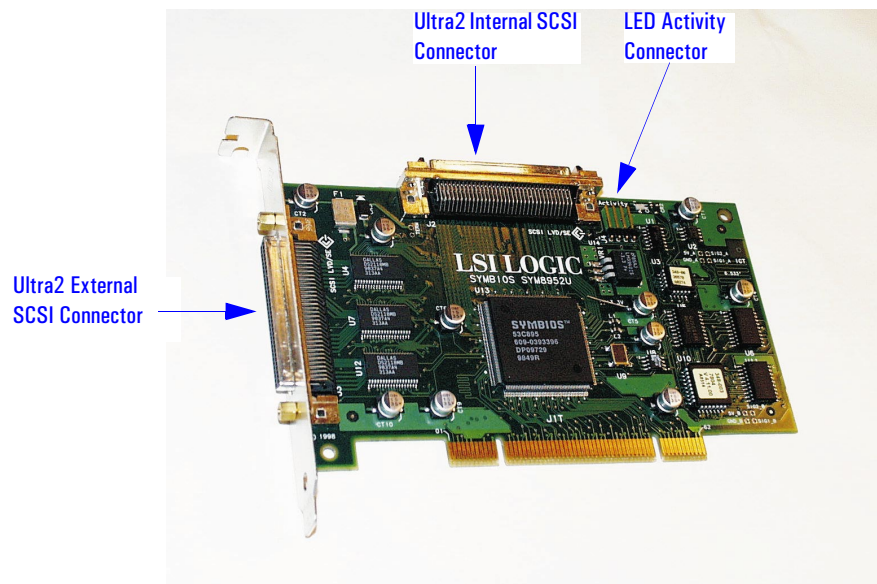
### 3 Interface Cards

#### SCSI Adapter Card

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## SCSI Adapter Card

Some *HP Kayak XM600 PC Workstation* models are supplied with an Ultra2 SCSI PCI Adapter card. Up to a total of 15 devices (internal and external) can be supported by this controller via 16-bit Wide SCSI 68-pin high-density connectors. The Ultra2 SCSI PCI Adapter card also provides twice the performance and greater flexibility with increased cable lengths.



The functionality and performance of the Ultra2 SCSI PCI Adapter card comes from the on-board LSI Logic SYM53C895 PCI-Ultra2 single chip controller.

The ability to automatically switch from a single-ended (SE) operation for legacy Fast/Ultra devices to universal low voltage differential (LVD) operation when Ultra2 devices are connected is also provided by this controller.

## Hardware Features

Feature	Description
PCI Bus Interface	<ul style="list-style-type: none"> <li>Complies with PCI 2.1 Specification.</li> <li>PCI is 32-bits, 33 MHz.</li> <li>Bus Mastering.</li> <li>Universal PCI signalling: operates on 3.3 V or 5 V buses.</li> </ul>
SCSI Bus	<ul style="list-style-type: none"> <li>16-bit Wide SCSI bus.</li> <li>LVD SCSI bus.</li> </ul>
Supported SCSI Rates	<ul style="list-style-type: none"> <li>80 MB/s (Synchronous) — Ultra2 SCSI.</li> <li>40 MB/s (Synchronous) — Ultra SCSI.</li> <li>20 MB/s (Synchronous) — Fast SCSI.</li> <li>Asynchronous.</li> </ul>
Number of SCSI Devices	<ul style="list-style-type: none"> <li>15 on one SCSI channel.</li> </ul>
SCSI Connectors	<ul style="list-style-type: none"> <li>One internal 68-pin high-density Wide SCSI connector.</li> <li>One external 68-pin high-density Wide SCSI connector.</li> <li>One 4-pin LED Activity connector on the system board.</li> </ul>
BIOS	<ul style="list-style-type: none"> <li>On-board, upgradeable BIOS in Flash ROM.</li> </ul>
Serial EEPROM	<ul style="list-style-type: none"> <li>On-board serial EEPROM for SCSI bus configuration storage.</li> </ul>
Operating Systems	<ul style="list-style-type: none"> <li>Windows 9x, Windows NT4, Windows 2000, Solaris.</li> </ul>

## Performance

- DMA bus mastering for low overhead with 32-bit burst data transfers at PCI data transfer rates.
- Zero wait state PCI transfers.
- Up to 128-word PCI burst size to maximize PCI data transfer rate.

## Ultra2 SCSI PCI Adapter Card Installation

The Ultra2 SCSI PCI Adapter card can be installed in any PCI slot. It includes an internal SCSI cable (three-device position — three hard disk drives are supported inside the XM600 Minitower models).

### 3 Interface Cards

#### SCSI Adapter Card

### Connectivity

Enables both internal and external connection.

#### Internal Connection

The internal connector is a Wide SCSI 68-pin high-density connector. The internal ribbon cable has to be connected to this connector.

#### External Connection

The external connector is located on the PCI bracket. It is a shielded Wide SCSI 68-pin high-density connector. Any cable connected to this connector must be shielded.

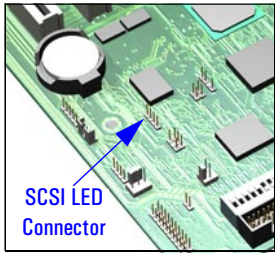
- When running in LVD mode, the external cable should not exceed 12 m.
- When running in SE mode, the external cable should not exceed 1,5 m.

### Cables

#### Internal SCSI cable

The internal SCSI cable is supplied with an embedded multi-mode terminator at one end of it.

#### LED Activity cable



The LED cable supplies SCSI LED activity to the front panel hard disk LED. For this to work, the SCSI LED cable must be connected to the LED Activity connector on the Ultra2 SCSI PCI Adapter card (refer to graphic on [page 86](#)) and the SCSI LED connector on the system board.

The connectors on both ends of the cable are identical, hence they can be connected to either connector.

### SCSI Controller

The SCSI controller characteristics are as follows:

- PCI 32-bit 33MHz chip.
- SCSI Multimode LVD/SE.

### SCSI Bus

- LVDlink™ transceivers meet all of the SPI-2 standard requirements.
- Uses LSI Logic TolerANT® active negation technology for improved single-ended SCSI signal integrity.
- Pre-fetches up to 8 words of SCSI SCRIPTS® instructions to save PCI bus overhead.
- Supports SCSI SCRIPTS Load and Store instructions for more efficient moving of data between memory and chip register space.
- Includes 4 KB of internal RAM for SCRIPTS instruction storage to reduce or eliminate instruction fetches over the PCI bus.
- Improved support for large block transfers at Ultra2 SCSI speeds.



- Provides data reliability and cable distance of differential SCSI without cost of external differential transceivers.
- Improves connectivity (up to 15 LVD Ultra 2 SCSI devices) and cable lengths (up to 12 meters with Ultra 2 SCSI). Longer cables may be possible in point-to-point connections.
- Supports SCAM (SCSI Configured Automatically) Level 1 functionality.

### PCI connector

- One 32-bit universal connector (supports both 5 V and 3,3 V signaling).
- Configured as a 7,5 W board (PRSN1 and PRSN2 grounded).
- The SCSI Adapter Card sink current on the 5 V power supplies lines. The 3,3 V is supplied by an on-board regulator.

### PCI Bus

- Complies with PCI Specification 2.1.
- Supports 32-bit, 33 MHz PCI Bus.
- Supports PCI write and invalidate, read line and read multiple commands.
- Functions as full 32-bit PCI DMA Bus Master.
- Operates on 3.3 V or 5 V PCI buses.

### Terminators

- Three multi-mode SE/LVD active, auto-terminating terminators
- Auto-termination: terminators are active when one of the tow connectors is used. If both connectors are used at the same time, terminators will automatically switch to high impedance mode.
- The terminator will automatically detect the bus type (LVD or SE) and switch to the right mode.

### Flash memory

The flash memory stores the SCSI BIOS. Refer to [page 104](#) for information about the LSI Logic SCSI Configuration Utility.

### 3 Interface Cards

SCSI Adapter Card

## Mass Storage Devices

This chapter describes the mass storage devices that are supplied with the PC Workstation. For the position of the different mass storage devices, refer to the diagram on [page 13](#) for the Desktop package and [page 14](#) for the Minitower package. This chapter also summarizes the pin connections on internal and external connectors.

HP product numbers and replacement part numbers for mass storage devices are listed in the Service Handbook Chapters, which can be accessed from the HP World Wide Web site at the following address:

<http://www.hp.com/go/kayaksupport>.

Information about available accessories can be obtained from

<http://www.hp.com/go/pcaccessories>

### Flexible Disk Drives

A 3.5-inch, 1.44 MB flexible disk drive is supplied in the front-access shelf.

### Hard Disk Drives

The following table lists the 3.5-inch (1-inch high) hard disk drives (which are subject to change) that may be supplied with the *HP Kayak XM600 Desktop and Minitower PC Workstations* (type and quantity depends on model) on internal shelves, connected to the SCSI or IDE controller.

	<b>Quantum Atlas IV SCSI (7.2 krpm)</b>	<b>Quantum Eagle IDE (5.4 krpm)</b>	<b>Seagate Durango II IDE (7.2 krpm)</b>
Capacity	9.1 GB	10 GB	15 GB
Interface	Ultra2 Wide SCSI	Ultra IDE ATA/66	UltraIDE ATA/66
External peak transfer rate	160 MB/s	66 MB/s	66 MB/s
Average seek time (read)	6.9 ms	9.5 ms	7.6 ms
Internal formatted transfer rate (MB/s)	21 Mb/s	123.1 Mb/s min. to 217.5 Mb/s max.	43
Number of discs/heads	2/4	1/2	2/4
Buffer size	2 MB	512 KBytes	512 KBytes

### CD-ROM Drives

**IDE 48X CD-ROM Drive** Some models<sup>1</sup> have a 48X IDE CD-ROM 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, Yellow, Green and Orange Book.

Some of the 48X IDE CD-ROM features include:

- Application Disk 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

	Description
Data capacity	650 MB
Data transfer rate	Sustained transfer rate (1X = 150 KB/s); Outerside: 7,200 KB/s 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
Buffer memory size	128 Kbytes
Access time	Average Stroke (1 / 3) 110 ms Full Stroke 180 ms
Rotational speed	2,048 bytes (Mode-1) 2,336 bytes (Mode-2)
Interface	ATAPI
Power requirements	5V, 1.2A 12V, 0.8A

---

1. Refer to the HP Kayak PC Workstations Service Handbook to find out which models are installed with the 48X IDE CD-ROM.

**8X Video IDE DVD-ROM Drive**

Some models<sup>1</sup> have a DVD-ROM (Read Only) drive. 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, Yellow, Orange and Green Books.

	Description
Data capacity	650 MB
Data transfer rate	Sustained transfer rate (1X = 150 KB/s); Outerside: 7,200 KB/s 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
Buffer memory size	128 Kbytes
Access time	Average Stroke (1 / 3) 110 ms Full Stroke 180 ms
Rotational speed	2,048 bytes (Mode-1) 2,336 bytes (Mode-2)
Interface	ATAPI
Power requirements	5V, 1.2A 12V, 0.8A

---

1. Refer to the HP Kayak PC Workstations Service Handbook to find out which models are installed with the DVD-ROM drive.

### 4X IDE CD-Writer Plus Drive

Some models<sup>1</sup> have a CD-RW (ReWritable) 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, and can record both write-once (CD-R) and CD-RW optical media. It conforms to optical and mechanical standards as specified in the Red, Yellow, Orange and Green Books.

	Description
Data capacity	650 MB or up to 74 minutes of audio per disc 547MB in CD-UDF data format
Performance	Seek time (1/3 stroke: < 150 ms (CD-ROM)) Data transfer rate: Read: Up to 24X (1X = 150 KB/s) Write: 4X (CD-R); 2X (CD-RW)
Minimum burst transfer rate	2.5Mbytes/sec.
Spin-up time (2X)	2 seconds max. (from spin down state until disc ready)
Initialization time (2X)	5 seconds max. (from new disc inserted until disc ready)
HP fast format time (CD-RW)	5 minutes max.
Disc finalization time (2X)	2 minutes typical
Corrected error rate	Audio, Mode 2, Mode 2 Form 2: < 1 frame in 10 <sup>9</sup> bits read Mode 1, Mode 2 Form 1: < 1 frame in 10 <sup>12</sup> bits read
Buffering	1MByte ( > 6 sec at 1X speed). If buffered data drops to less than one sector, the recording stops.
Write methods	- Track at once - Disc at once - Incremental (packet) - Multisession
Write verification	Automatic Power Control to dynamically adjust laser writer power
Format and EEC standard	Red, Yellow, Orange, Green books
MTBF	150,000 hours
Interface	ATAPI

1. Refer to the HP Kayak PC Workstations Service Handbook to find out which models are installed with the HP CD-RW drive.

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## HP BIOS

This chapter summarizes the *Setup* program and BIOS of the *HP Kayak XM600 PC Workstation*. The POST routines are described in the next chapter.

The BIOS is based on the core Phoenix BIOS, which includes 4 M/bits of flash memory, support for PCI 2.2 Specification, suspend to RAM, and RIMM or DIMM memory modules.

The BIOS includes a Boot ROM for the 3COM 3C905C LAN card. In future BIOS releases, a Boot ROM for HP LAN cards will also be included.

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 subsequent chapter, gives 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 *qXX.YM.mm*, where:

- *q* is an optional letter indicating non-production status (removed at release).
- *XX* is a two-letter code indicating the system.
- *Y* is a one-digit code indicating the HP entity.
- *M* is the major BIOS version.
- *mm* is the minor BIOS version.

An example of a released version would look similar to the following the example: IC.11.02.

The procedure for updating the System ROM firmware is described on [page 101](#).

## Using the HP Setup Program

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

Alternatively, press **Esc** to view the summary configuration screen. By default, this remains on the screen for 15 seconds, but pressing any key will ignore this delay. It is not possible to hold the summary configuration screen indefinitely on the screen.

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.

The following screens are examples of a BIOS configuration.

### Main Screen

The Main Screen presents a list of fields. To change a value press either the **F7** or **F8** keys.

PhoenixBIOS Setup Utility											
Main		Advanced		Security		Boot		Power		Exit	
										Item-Specific Help	
BIOS Version:				1C.11.02							
PnP OS				[No]							
Reset Configuration Data:				[No]							
System Time:				[14:42:33]							
System Date:				[02/08/2000]							
Key Click:				[Disabled]							
Keyboard auto-repeat rate speed:				[21.8 per Second]							
Delay before auto-repeat:				[0.50 Second]							
Numlock at Power-on:				[On]							
F1	Help	↑	↓	Select Item	F7/F8	Change Values			F9	Setup Defaults	
ESC	Exit	←	→	Select Menu	Enter	Select > Sub-Menu			F10	Previous Values	



## Advanced Screen

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

The Advanced screen is to be used by advanced users who wish to carry out special system configurations.

Main	Advanced	Security	Boot	Power	Exit
	>> Processors, Memory and Cache >> Floppy Disk Drives >> IDE Devices >> Integrated USB Interface >> Integrated I/O Ports >> Integrated Audio Device >> AGP Configuration (Video) >> PCI Device, slot #1 >> PCI Device, slot #2 >> PCI Device, slot #3 >> PCI Device, slot #4 >> PCI Device, slot #5				Item-Specific Help

## Processors, Memory and Cache

Advanced		
Processors, Memory and Cache		Item-Specific Help
Processor Type	Pentium III®	
CPU Speed	500 MHz	
Processor Serial Number	[Disabled]	
Memory Caching	[Enabled]	
Memory Error Checking <sup>1</sup>	[Disabled]	

<sup>1</sup>. Only if ECC modules are detected.

## Floppy Disk Drives

Advanced		
Floppy Disk Drives		Item-Specific Help
Floppy Disk Controller	[Enabled]	
Floppy Disk Drive A	[1.44, 3½"]	
Floppy Disk Drive B	[Not installed]	

## 5 HP BIOS

### IDE Devices

Advanced			
IDE Devices			Item-Specific Help
>>	IDE Primary Master Device	[None]	
>>	IDE Primary Slave Device	[None]	
>>	IDE Secondary Master Device	[None]	
>>	IDE Secondary Slave Device	[None]	
>>	Large Disk Access Method	[NT/DOS]	
>>	Integrated IDE Controller	[Both Enabled]	

### IDE Primary Master Device

Advanced			
IDE Primary Master Device (HD 2564)			Item-Specific Help
Type			
Multisector transfer			
LBA Mode Control			
32 bit I/O			
Transfer Mode			
ULTRA DMA Mode			

### Integrated USB Interface

Advanced			
Integrated USB Interface			Item-Specific Help
USB Controller	[Auto]		
Legacy Keyboard Emulation	[Disabled]		
LBA Mode Control			

### Integrated Audio Device

Advanced			
Integrated Audio Device			Item-Specific Help
Integrated Audio	[Enabled]		

### Integrated I/O Ports

Advanced			
Integrated I/O Ports			Item-Specific Help
Parallel Port	[Auto]		
Parallel Port Mode	[ECP]		
Serial Port A	[Auto]		
Serial Port B	[Auto]		

**AGP Configuration (Video)**

Advanced		
AGP Configuration (Video)		Item-Specific Help
Graphic Aperture	[64 MB	

**PCI Device, Slot #1**

Advanced		Item-Specific Help
PCI Device, Slot 1 <sup>1</sup>		
Option ROM Scan	[Auto]	
Bus Master	[ECP]	
Bus Latency Timer	[Auto]	

1. PCI Slot #x have the same options as above. PCI Device, Slot 1 is only used as an example.

**Security Screen**

Sub-menus are presented for changing the characteristics and values of the System Administrator Password, User Password, Power-on Password, boot device security and Hardware Protection.

Main	Advanced	Security	Boot	Power	Exit
					Item-Specific Help
Administrator Password		Clear			
Set Administrator Password		[Enter]			
Clear Both Passwords		[Enter]			
User Password		Clear			
Set User Password		[Enter]			
Clear User Password		[Enter]			
Power-on Password		[Disabled]			
Start from Floppy		[Enabled]			
Start from CD-ROM		[Enabled]			
Start from HDD		[Enabled]			
> > Hardware Protection					

**Hardware Protection**

Security			Item-Specific Help
Hardware Protection			
Write on Floppy Disks	[Unlocked]		
Secured Setup Configuration	[No]		
Hard Disk Boot Sector	[Normal]		

## 5 HP BIOS

### Boot Screen

This screen allows you to select the order of the devices in which you want the BIOS to attempt to boot the operating system:

- Hard disk drives
- Removable devices.

The operating system assigns drive letters to these devices in the order you specify. During POST, if the BIOS is unsuccessful at booting from one device, it will then attempt to boot from the next device on the *Boot Device Priority* list until an operating system is found.

Main	Advanced	Security	Boot	Power	Exit
Quickboot Mode [Enabled]					Item-Specific Help
Display Option ROM Messages [Enabled]					.
Primary Video Adapter [AGP]					
> Boot Device Priority					
> Hard Disk Drives					
> Removable Devices					

### Power Screen

This screen allows you to set the standby delay and suspend delay. Standby mode slows down the processor, while the suspend mode saves a maximum of energy. Both these options are only available with Windows 95 RTM. For other operating systems, Windows 95 SR 2.5, Windows 98 and Windows 2000, use the control panel for similar options.

Modem ring enables or disables the system to return to full speed when an IRQ is generated. Network interface enables or disables the system to return to full speed when a specific command is received by the network interface.

Main	Advanced	Security	Boot	Power	Exit
Standby Delay [None]					Item-Specific Help
Suspend Delay [None]					.
Suspend Wakeup					
Modem Ring [Enabled]					
Network Interface [Enabled]					

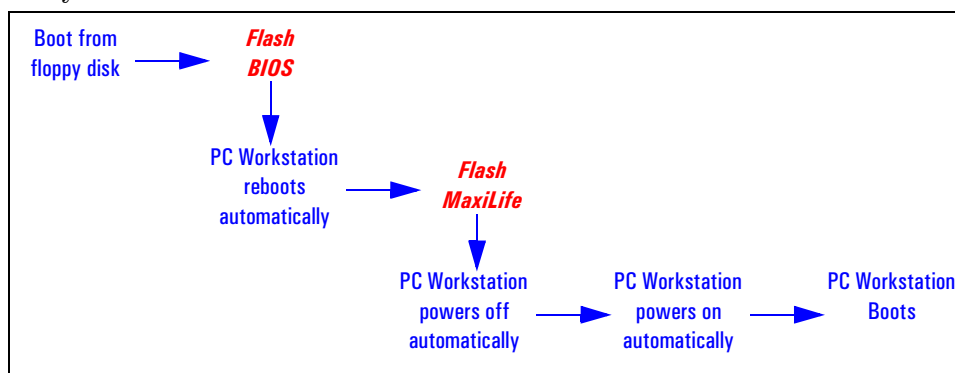
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## Updating the System BIOS

The latest system BIOS (standard flash operation) can be downloaded from HP's Support Web site at: [www.hp.com/go/kayaksupport](http://www.hp.com/go/kayaksupport). Then select HP Kayak XM600 PC Workstation.

Instructions on updating the BIOS are supplied with the downloaded BIOS files and a BIOS flash utility (flash.txt).

The BIOS update not only flashes the BIOS, but also updates MaxiLife. How the System BIOS flash is carried out is shown below.



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.

---

## Restoring BIOS Default Settings

Suspected hardware errors may be caused by BIOS and configuration issues. If the BIOS settings are suspected to be wrong, do the following steps to restore the BIOS to its default setting:

- 1 Press **[F2]** while the initial “Kayak” logo is displayed immediately after restarting the PC Workstation to access the *Setup* program.
  - 2 Press **[F9]** to load the default settings from the *Setup* program.
  - 3 Set the “Reset Configuration Data” to Yes in the Main menu.
- It is recommended that before you make any modifications to the BIOS you take note of the system setup.

---

## Clearing the CMOS

- 1 Turn off the PC Workstation, disconnect the power cord and data cables, then remove the cover.
- 2 Set the system board switch 8 to the ON position to clear the CMOS memory.
- 3 Replace the cover, and only reconnect the power cord.
- 4 Reboot the PC Workstation. A message similar to the following will be displayed:

**"Configuration has been cleared, set switch Clear to the ON position before rebooting."**

- 5 Turn off the PC Workstation, disconnect the power cord, and remove the cover.
- 6 Set the system board switch 8 to the OFF position to retain the configuration.
- 7 Replace the cover, and reconnect the power cord and data cables.
- 8 Switch on the PC Workstation. Run the *Setup* program by pressing **[F2]**. Then press **[F9]**, the CMOS default values will be automatically downloaded and saved.
- 9 Press **[Esc]** to save the configuration and exit from the *Setup* program.

---

## Recovering the BIOS (Crisis Mode)

If for some reason the BIOS is corrupted and the standard flash cannot be used, use the BIOS Recovery Mode (exceptional BIOS recovery operation) to restore the BIOS. To do this:

- 1 Obtain a bootable DOS floppy disk.
- 2 Copy the BIOS files on to the floppy disk.  
How to download the system BIOS is described on [page 101](#).
- 3 Create (or edit) the file, AUTOEXEC.BAT  
This should contain a single line of text:  
`"phlash /c /mode=3 /s IC1105US.FUL"`  
(rename the BIOS filename with the one on the floppy disk).
- 4 Shut down the PC Workstation.
- 5 Power off the PC Workstation and remove the power cord.
- 6 Remove the cover.
- 7 Set switch 7 to the ON position.
- 8 Insert the floppy disk into the floppy disk drive.
- 9 Reconnect the power cord and switch on the PC Workstation.
- 10 The PC Workstation boots from the floppy disk, then flashes the BIOS.  
However, it should be noted, that during the flash process, the screen remains blank.
- 11 The recovery process is finished when there is one very long beep.
- 12 Power off the PC Workstation. Remove the floppy disk from the drive.  
Remove the power cord.
- 13 Set switch 7 back to the OFF position.
- 14 Replace the cover, reconnect the power cord, then reboot the PC Workstation.

## LSI Logic SCSI Configuration Utility

The LSI 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.

Settings for the Host Adapter and All Devices	Default Settings	Description
SCAM Support	Off	LSI Logic BIOS version 4.x and above supports SCSI Plug and Play protocol called SCAM (SCSI Configured Automatically).
Parity Checking	On	LSI Logic PCI to SCSI host adapters always generate parity, but some SCSI devices do not. For this reason, parity checking can be disabled (Off). <sup>1</sup>
Host Adapter SCSI ID	7	It is not recommended to change the host adapter ID from the default value of 7, as this gives it the highest priority on the SCSI bus.
Scan Order	Low to High (0-Max)	Informs the host adapter BIOS and device drivers to scan the SCSI bus from low (0 to max) SCSI ID, or from high to low (max to 0) SCSI ID. If there is more than one device on a SCSI bus, changing the device order changes the drive letters which are assigned to them by the system. This will change the boot order.
Removable Media Support	None	Only used when removable disks are installed.
CHS Mapping	SCSI Plug and Play Mapping	Defines the cylinder head sector (CHS) values that are mapped onto an unpartitioned disk.
Spinup Delay (secs.)	2	
Secondary Cluster Server	No	
Termination	Auto	

<sup>1</sup>. When disabling parity checking, you may have to disable disconnects for certain devices as parity checking for the re-selection phase is not disabled. If a device does not generate parity, and it disconnects, the I/O never completes because the re-selection never completes.



Settings for Individual SCSI Devices	Default Settings	Description
Synchronous Transfer Rate (MB/s)	80	Sets the transfer rate for the device. The available choices are: Off, 10 MB/sec, 20 MB/sec, 40 MB/sec, or 80 MB/sec.
Data Width	16	Sets the maximum SCSI data width at which a 16-bit host adapter negotiates. The host adapter and SCSI device must agree on a width at which they can both operate. For example, for a 16-bit device on a 8-bit wide cable (bus), the width at which they can both operate is 8-bits. Similarly, for an 8-bit device on a 16-bit wide cable (bus), the width at which they can both operate is 8-bits.
Disconnect	On	Enables or disables disconnects for the device. To optimize SCSI bus performance, this option should be set to On when two or more SCSI devices are connected to the host adapter. Set the option to Off to achieve a slightly better performance when only one SCSI device is connected to the SCSI bus.
Read Write I/O Timeout (seconds)	10	Enters a read write time-out value in seconds for the device.
Scan for Devices at Boot Time	Yes	Specifies whether the device is scanned for at boot time.
Scan for SCSI LUNs	Yes	More advanced SCSI devices can have several logical units (LUNs). This option lets you specify whether SCSI LUNs are scanned for at boot time.
Queue Tags	On	Specifies whether queue tags are enabled or disabled. In a multi-tasking environment this option must be set to Yes. It should only be disabled for troubleshooting.
Initial Boot Device	No	This setting cannot be modified.

### Starting the LSI Logic SCSI Configuration Utility

You access the LSI Logic 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 LSI Logic SCSI Configuration utility appears.

---

## 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 on [page 101](#).

### System Memory Map

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

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
000E 0000-000F FFFF	128 KB BIOS (Flash/Shadow)
0001 0000-000F FFFF	Memory (1 MB to 16 MB)
0010 0000-001F FFFF	Memory (16 MB to 32 MB)
0020 0000-003F FFFF	Memory (32 MB to 64 MB)
0040 0000-007F FFFF	Memory (64 MB to 128 MB)
0080 0000-7FFF FFFF	Memory (128 MB to 2 GB)
FECO 0000	I/O APIC
FEE0 0000	Local APIC (each CPU)
FFFE 0000-FFFF FFFF	128 KB BIOS (Flash)

## HP I/O Port Map (I/O Addresses Used by the System<sup>1</sup>)

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).

Default Values for I/O Address Ports	Function
0000 - 000F	DMA controller 1
0020 - 0021	Master interrupt controller (8259)
002E - 002F	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
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
00F0 - 00FF	Co-processor error
0170 - 0177	Free (IDE secondary channel)
01F0 - 01F7	IDE primary channel
0278 - 027F	LPT 2
02E8 - 02EF	Serial port 4 (COM4)
02F8 - 02FF	Serial port 2 (COM2)
0372 - 0377	Free (IDE secondary channel, secondary floppy disk drive)
0378 - 037A	LPT1
03B0 - 03DF	VGA
03E8 - 03EF	COM3
03F0 - 03F5	Floppy disk drive controller
03F6	IDE primary channel
03F7	Floppy disk drive controller

1.If configured.

## 5 HP BIOS

### BIOS Addresses

Default Values for I/O Address Ports	Function
03F8 - 03FF	COM1
04D0 - 04D1	Interrupt edge/level control
0678 - 067B	LPT2 ECP
0778 - 077B	LPT1 ECP
0CF8 - 0CFF	PCI configuration space
C000 -	Power Management I/O space and ACPI Registers
C100 -	MBus I/O 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.

DMA controller	
Channel	Function
DMA 0	Free
DMA 1	Free if not used for parallel port in <i>Setup</i>
DMA 2	Floppy disk drive controller
DMA 3	Free if not used for parallel port in <i>Setup</i>
DMA 4	Used to cascade DMA channels 0-3
DMA 5	Free
DMA 6	Free
DMA 7	Free

## Interrupt Controllers

The system has an Interrupt controller which is equivalent in function to that of two 82C59 interrupt controllers. The following table shows how the 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).

I/O APIC Input	IRQ	Interrupt Request Description
INTIN0	ICH	
INTIN1	IRQ1	Super I/O Keyboard Controller
INTIN2	IRQ0	ICH System Timer
INTIN3	IRQ3	Super I/O - Used by serial port if enabled
INTIN4	IRQ4	Super I/O - Used by serial port if enabled
INTIN5	IRQ5	Free if not used for parallel port or audio
INTIN6	IRQ6	Super I/O - Floppy Disk Controller
INTIN7	IRQ7	Super I/O - LPT1
INTIN8	IRQ8	ICH - RTC
INTIN9	IRQ9	Available for PCI devices
INTIN10	IRQ10	Available for PCI devices
INTIN11	IRQ11	Available for PCI devices
INTIN12	IRQ12	Super I/O - Mouse
INTIN13	IRQ13	Co-processor
INTIN14	IRQ14	ICH - Integrated IDE Controller (primary)
INTIN15	IRQ15	ICH - Integrated IDE Controller (secondary).
INTIN16	PCINTA	
INTIN17	PCINTB	
INTIN18	PCINTC	
INTIN19	PCINTD	
INTIN20	TFPC IRQ	
INTIN21	SCI IRQ	
INTIN22	not connected	
INTIN23	ICH SMI (not used)	

There are three major interrupt modes available:

*PIC mode:* This “Legacy” mode uses only the interrupt controllers. Therefore, only one processor can be supported in this mode. This mode can be selected upon installation of Windows NT.

*Virtual wire mode:* This mode is implemented using the 82C59 interrupt and the I/O APIC controller and is used during boot time. The virtual wire mode allows the transition to the “symmetric I/O mode”. In the virtual wire mode, only one processor executes operations.

*Symmetric I/O mode:* This mode is implemented using the I/O APIC controller and allows for multiple processor operations.

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**NOTE**

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In “PIC mode” and “virtual wire mode”, the PCI interrupts are routed to the INT line. In the “symmetric I/O mode”, the PCI interrupts are routed to the I/O APIC controllers and forwarded over an APIC bus to the processors.

### 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 [page 70](#) for a table of the PCI device interrupts.

---

## 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.

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### MaxiLife Test Sequence and Error Messages

---

#### NOTE

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Both Desktop and Minitower models contain the MaxiLife firmware. However, on the *HP Kayak XM600 Minitower PC Workstation*, error messages are displayed on the MaxiLife LCD status panel. All LCD status panel messages shown in this refer to the Minitower platform only.

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

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

If any errors are detected during the startup 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 from working correctly).

Errors that are not so critical will be detected both during pre-boot diagnostics and POST where the BIOS boot process will abort after beeping. Some errors are only detected during POST sequence, and produce the same abort process.

Finally, while the PC 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 as soon as the problem is fixed (for example, the fan cable has been reconnected).

The different diagnostics are described below.

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## 6 Tests and Error Messages

### MaxiLife Test Sequence and Error Messages

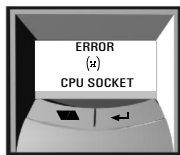
#### Basic Pre-boot Diagnostics

The first diagnostic (called basic pre-boot diagnostics) is run to check the presence of the processor(s) or terminators, power supply, CPU Board PLL and memory. Simply by having a power cord connected to the PC Workstation activates the Basic Pre-boot Diagnostics.

The pre-boot diagnostic tests are run in order of priority with respect to their importance to computer functions.

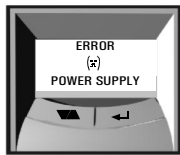
On the *HP Kayak XM 600 Minitower PC Workstation*, the first detected error displays a message on the LCD status panel. If this happens, one of the following screens could appear.

Presence of processor, or  
processor terminator



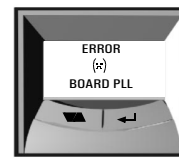
Missing or incorrectly  
installed processor or  
processor terminator

Control of Some Voltages:  
12V, 3.3V, 1.8V, 2.5V



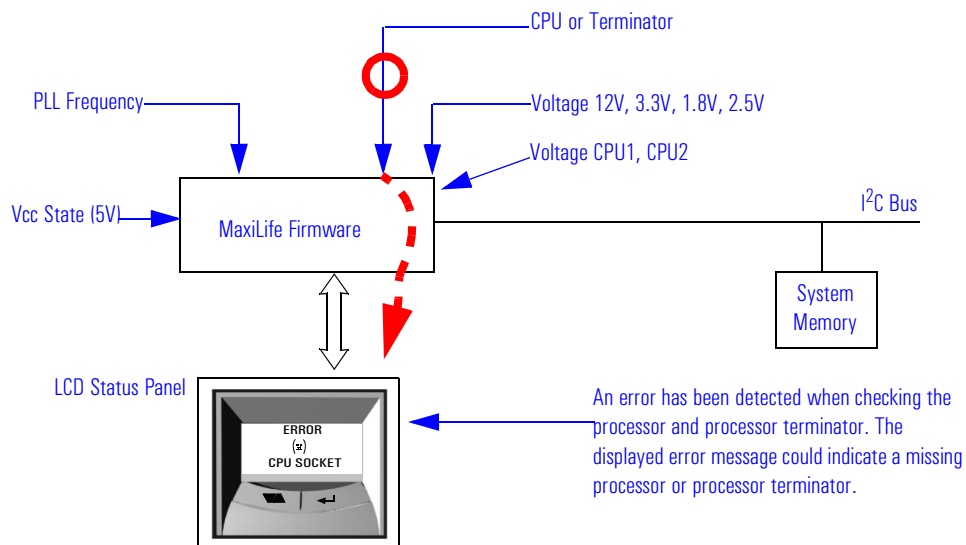
If a CPU Power Supply error is displayed, a cause could be with  
the power supply cabling or circuits.

Control of the CPU Board



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

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





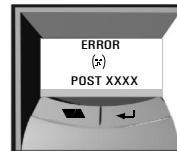
The following table shows the test sequence carried out, the type of error message, and the action to take.

Test	Error Code	Action to Take
Presence of either a processor or processor terminator	CPU SOCKET	Check that the processor(s), processor terminator are correctly installed.
Control of some voltages: 12V, 3.3V, 1.8V, 2.5V	POWER SUPPLY	Check the power supply cable and connectors, and processor.
Check the system board clock generators (PLL).	BOARD PLL	<ol style="list-style-type: none"> <li>1 Check that the system board is connected</li> <li>2 Replace the system board (PLL clock generator).</li> </ol>

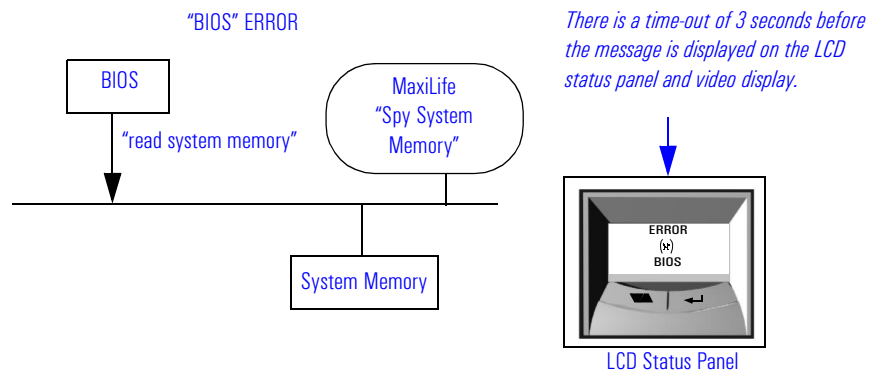
### Post Test Sequence and Post Error

In this phase, MaxiLife waits for any error messages that the BIOS may issue. If such an error occurs, then an error code is displayed on the monitor screen.

On the *HP Kayak XM 600 Minitower PC Workstation*, 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 monitor screen. If the POST issues several error codes, only the last one is visible on the LCD status panel.

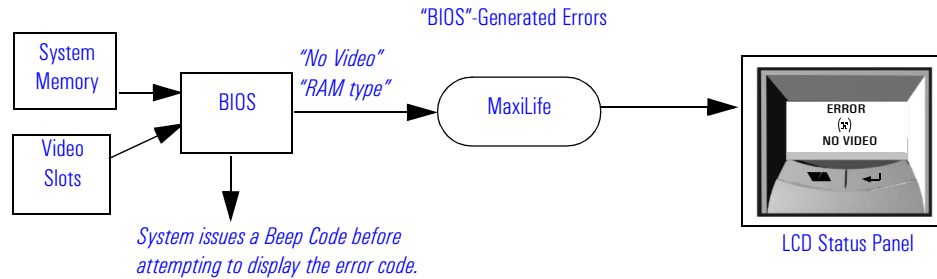


The following diagrams show the different BIOS-generated errors.



## 6 Tests and Error Messages

### MaxiLife Test Sequence and Error Messages



Test	Error Code	Action to Take
Presence of continuity modules in the RIMM sockets	RIMM CONTINUITY	Check that the RDRAM continuity modules are installed
Presence of RDRAM modules	NO RIMM	Install RDRAM modules in the RIMM sockets
Compatibility speed rating of installed RDRAM modules	RIMM SPEED	Check that the installed RDRAM modules have the same speed ratings
Presence of installed SDRAM modules	NO DIMM	Check that the SDRAM modules are correctly installed in the DIMM sockets
Presence of memory modules	MEMORY ERROR	Check that the memory modules are correctly installed
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.
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.

### Operating System Boot Phase

If no error message has been displayed at this stage of the system startup by the BIOS, the operating system is launched.

On the *HP Kayak XM 600 Minitower PC Workstation*, the LCD status panel will display the system platform and a "smiling icon."

## Run-Time Errors

During the normal usage of the PC Workstation (and at boot), MaxiLife continually monitors vital system parameters. These include: temperature errors, fan malfunctions, power voltage drops, board PLL problems and CPU problems.

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

Test	Error Code	Action to Take
During normal usage of the PC, HP MaxiLife continually checks vital system parameters. If an error occurs, a message appears on the LCD panel.	FAN CPU	Rear fan, system board, <sup>1</sup> fan cable.
	FAN PCI	PCI fan, PCI cards, system board, fan cable.
	TEMP. CPU	Rear fan, airflow guide, “Airflow Separator” <sup>2</sup> , system board.
	TEMP PCI	PCI fan, airflow guide, “Airflow Separator”, system board, PCI cards.
	TEMP DISK	Rear fan, airflow guide, “Airflow Separator”, disk temperature, sensor, system board.
	POWER ERRORS	Power supply unit, system board.
	BOARD PLL	Processor(s), system board
	POWER 12V ERROR	Power supply unit has failed. Try the following: 1 Replace the power supply unit with a known working one 2 If the problem persists, replace the system board
	VCC CPU 1 ERROR	
	VCC CPU 2 ERROR	
	POWER 1.5V ERROR	
	POWER 1.8V ERROR	
	POWER 2.5V ERROR	
	POWER 3.3V ERROR	
	POWER 5V ERROR	

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

<sup>2</sup>A retaining bar holds the airflow guide in place, dividing inside the chassis into two separate areas (processor and PCI slots) for better cooling.

## 6 Tests and Error Messages

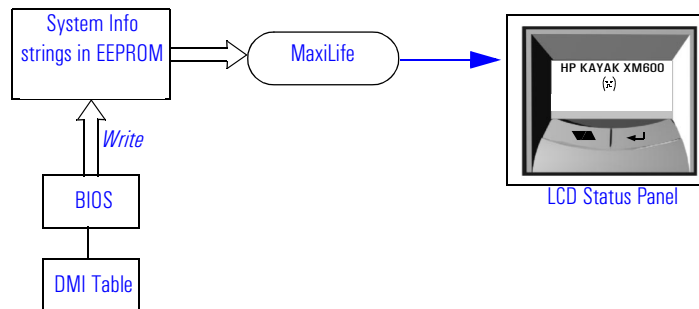
### MaxiLife Test Sequence and Error Messages

#### Main Menu (Minitower models only)

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

##### System Info

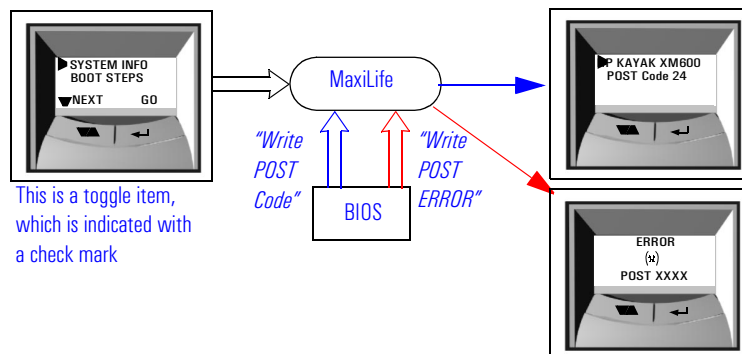
Obtains information from the BIOS and the system's Serial EEPROM from a previously successful boot. This information includes: product name, BIOS version, serial number, number of processors and speed, size of memory for each socket. The following diagram shows how the System Info obtains its information.



##### Boot Steps

Shows the Power-On-Self-Test (POST) codes during the system startup. 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 startup, 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.



## 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.

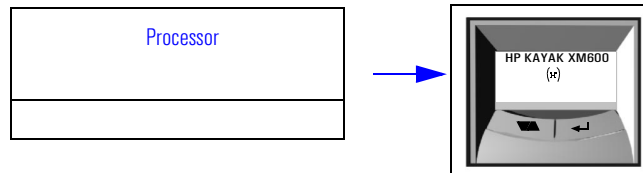
It is possible to cancel the diagnostic process and return to the previous state by pressing the LCD key labelled "Back". When "OK" is selected, the main power supply is started but the PC Workstation is not allowed to do a normal boot. The purpose of this is to allow only those devices that can be tested 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.

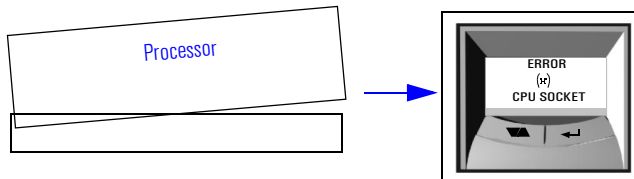
At the end of the test, you can exit the diagnostic mode by pressing the ⬅ LCD button.

## Typical Diag Error Messages

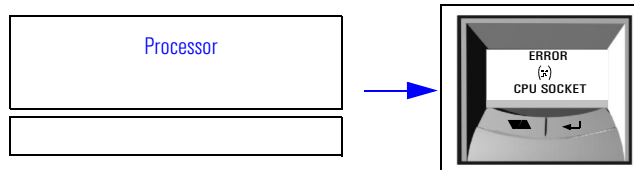
*When the Processor is correctly installed, the "smiling icon" is shown on the LCD status panel.*



*If the Processor has only been partly inserted in the processor slot, then the displayed message will indicate a CPU socket error.*



*The Processor has not been inserted correctly in the processor slot. The displayed message will indicate a CPU socket error.*



## For More Information About MaxiLife

Refer to the online *Troubleshooting Guide* for more information about this diagnostics utility at the HP World Wide Web site:

<http://www.hp.com/go/kayaksupport>.

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## Order in Which POST 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 PC Workstation's logo when the PC 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 screen switches to text mode, and a detailed error message is 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 [page 126](#) for a brief summary).

Devices such as memory and newly installed hard disks, are configured automatically. The user is not requested to confirm the change.

During the POST, the BIOS and other ROM data are 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

The following example explains the different coding messages that appear in the lower left corner of the screen when the POST detects an error during startup. For example, if the error 0101 - 52 is displayed.

0101 - Post Error Code failure. This error code is accompanied by a short message. A table listing the error codes, causes and symptoms is shown on [page 127](#).

52 - Post Checkpoint Code. This checkpoint code indicates that a test has failed at this stage of the POST.

The following table lists the POST checkpoint codes written at the start of each test and their associated beeps. Refer to [page 130](#) for more details about Beep codes during boot.

Checkpoint Code	Beeps	POST Routine Description
02h		Verify Real Mode
03h		Disable Non-Maskable Interrupt (NMI)
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	1-2-2-3	BIOS ROM checksum
17h		Initialize cache before memory autosize
18h		8254 timer initialization
1Ah		8237 DMA controller initialization
1Ch		Reset Programmable Interrupt Controller
20h	1-3-1-1	Test DRAM refresh
22h	1-3-1-3	Test 8742 keyboard controller
24h		Set ES segment register to 4 GB
26h		Enable A20 line

## 6 Tests and Error Messages

### Order in Which POST Tests Are Performed

Checkpoint Code	Beeps	POST Routine Description
28h	1-3-3-1	Autosize DRAM
29h		Initialize POST Memory Manager
2Ah		Clear 512 KB base RAM
2Ch	1-3-4-1	RAM failure on address line <sup>1</sup>
2Eh	1-3-4-3	RAM failure on data bits <i>xxxx</i> <sup>1</sup> of low byte of memory bus
2Fh		Enable cache before system BIOS shadow
30h	1-4-1-1	RAM failure on data bits <i>xxxx</i> <sup>1</sup> of high byte of memory bus
32h		Test CPU bus-clock frequency
33h		Initialize POST Dispatch Manager
36h		Warm start shut down
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	2-1-2-3	Check ROM copyright notice
48h		Check video configuration against CMOS
49h		Initialize PCI bus and devices
4Ah		Initialize all video adapters in system
4Bh		Display QuietBoot screen (optional)
4Ch		Shadow video BIOS ROM
4Eh		Display BIOS copyright notice
50h		Display CPU type and speed
51h		Initialize EISA board



Checkpoint Code	Beeeps	POST Routine Description
52h		Test keyboard
54h		Set key click if enabled
56h		Enable keyboard
58h	2-2-3-1	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
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

## 6 Tests and Error Messages

### Order in Which POST Tests Are Performed

Checkpoint Code	Beeps	POST Routine Description
82h		Detect and install external RS 232 ports
83h		Configure non-MCD IDE controllers
84h		Detect and install external parallel ports
85h		Initialize PC-compatible PnP ISA devices
86h		Re-initialize onboard I/O ports
87h		Configure System Board 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
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		Fix up Multi Processor table
98h	1-2	Search for option ROMs. One long, two short beeps on checksum failure.
99h		Check for SMART drive
9Ah		Shadow option ROMs
9Ch		Set up Power Management
9Dh		Initialize security engine (optional)
9Eh		Enable hardware interrupts

Checkpoint Code	Beeps	POST Routine Description
9Fh		Determine number of ATA and SCSI drives
A0h		Set time of day
A2h		Check key lock
A4h		Initialize typematic rate
A8h		Erase F2 prompt
AAh		Scan for F2 key stroke
ACh		Enter SETUP
A Eh		Clear Boot flag
B0h		Check for errors
B2h		POST done - prepare to boot operating system
B5H		Terminate QuietBoot (optional)
B6h		Check password (optional)
B7h		ACPI tables initialized
B8h		Clear global descriptor table
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

## 6 Tests and Error Messages

### Order in Which POST Tests Are Performed

Checkpoint Code	Beeps	POST Routine Description
C4h		Initialize system error handling
C5h		PnPnd dual CMOS (optional)
C6h		Initialize notebook docking (optional)
C7h		Initialize notebook docking late
C8h		Force check (optional)
C9h		Extended checksum (optional)
D2h		Unknown Interrupt
<b>The following are for boot block in Flash ROM</b>		
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

Checkpoint Code	Beeps	POST Routine Description
F1h		Initialize Run Time Clock
F2h		Initialize video
F3h		Initialize System Management Mode
F4h	1	Output one beep before boot
F5h		Boot to Mini DOS
F6h		Clear Huge Segment
F7h		Boot to Full DOS

1. If the BIOS detects error 2C, 2E, or 30 (base 512K RAM error), it displays an additional word-bitmap (xxxx) indicating the address line or bits that failed. For example:  
 "2C 0002" means 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.  
 The BIOS also sends the bitmap to the port-80 LED display. It first displays the checkpoint code, followed by a delay, the high-order byte, another delay, and then the low-order byte of the error. It repeats this sequence continuously.

## Error Message Summary

In the event of an error generated in POST (Power-On-Self-Test) during the boot process, there are two beeps, then the Error Setup Manager gives access to one or more detected errors. Each EMU error is displayed as a 4-digit code with an associated text message on the monitor screen and the MaxiLife LCD panel.

### NOTE

If the monitor is not available, a short error message is also displayed on the MaxiLife LCD panel.

Further details can be accessed by pressing ENTER. A detailed description of the reason for the failure and how to solve the problem is displayed. The following examples give the different types of error categories.

**Category #1:** If an error can be bypassed with <F1> or solved through Setup, the POST should prompt:

ERROR

**0070** CPU Terminator Card Error

**Press <Enter> to view more information about error**

<F1= Continue> , <F2= Setup>

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

WARNING<sup>1</sup>

**00100** Keyboard Error

<sup>1.</sup> After a time-out period of five seconds without any intervention, the system resumes to boot.

**Category #3:** If the error is serious, the POST should prompt:

**00xx** The BIOS has detected a serious problem that prevents your PC from booting

**Press <Enter> to view more information about error**

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	PC configuration lost (both SE2P and CMOS lost)	Incorrect PC 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
0040h	Serial number corrupted (bad checksum or null #)	Invalid PC 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
0070h	CPU Termination Card missing from Processor 2 socket in a mono-processor system	CPU Terminator Card 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
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
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
0306h	General failure on floppy controller	Flexible Disk Drive Error
0307h	Conflict on floppy disk controller	Flexible Disk Drive Error

## 6 Tests and Error Messages

### Error Message Summary

Code #	Cause / Symptom	Short message (US)
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
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
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.

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.

## 6 Tests and Error Messages

### Error Message Summary

#### Beep Codes During Boot

If an error occurs during the POST, which prevents the PC Workstation from starting, 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	Recommended Action
— — — — —	1-2-2-3	16h	BIOS ROM check-sum failure	Inform HP support/HP reseller that system board is defective.
— — — — —	1-3-1-1	20h	DRAM refresh test failure <sup>1</sup>	Check the memory is correctly installed. If the error still occurs, replace the module.
— — — — —	1-3-1-3	22h	8042 Keyboard controller test failure	Inform HP support/HP reseller that system board is defective.
— — — — —	1-3-3-1	28h	Initialization of RDRAM has failed.	Verify that memory or continuity modules are installed.
— — — — —	1-3-4-1	2Ch	RAM failure on address line <sup>1</sup> ....	Check the memory is correctly installed. If the error still occurs, replace the module.
— — — — —	1-3-4-3	2Eh	RAM failure on data bits ....of low byte of memory bus <sup>1</sup>	Check the memory is correctly installed. If the error still occurs, replace the module.
— — — — —	1-4-1-1	30h	RAM failure on data bits ....of high byte of memory bus <sup>1</sup>	Check the memory is correctly installed. If the error still occurs, replace the module.
— — — — —	2-1-2-3	46h	ROM copyright notice check failure	Inform HP support/HP reseller that system board is defective.
— — — — —	2-2-3-1	58h	Unexpected interrupts test failure	Inform HP support/HP reseller that system board is defective.
— —	1-2	98h	Video configuration failure or option ROMs check-sum failure	This can be caused by problems with the ROM on integrated video, an add-on video board or the ROM on a SCSI card. Inform reseller for the affected component.

<sup>1</sup>. Non-HP memory modules are not supported. Only HP memory modules should be used.

## Connectors and Sockets

### IDE Drive Connectors

IDE Connectors			
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	HDO	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	DTENO#
17	Ground	18	DIR#
19	Ground	20	STP#
21	Ground	22	WRDATA#
23	Ground	24	WREN#
25	Ground	26	TRKO#
27	Ground	28	WRPRDT#
29	Ground	30	RDDATA#
31	Ground	32	HDSEL1#
33	Ground	34	DSKCHG#

### Battery Pinouts

Battery Connections	
Pin	Signal
1	GROUND
2	VBAT1
3	VBAT2

Battery Connections	
Pin	Signal
1	VBAT1
2	GROUND

### Additional SCSI LED Connector

Additional SCSI LED Connector (4-pin)	
Pin	Signal
1	Not used
2	LED Out
3	LED Out
4	Not used

### Power Supply Connector (20-pin) and Aux Power Connector

Power Supply Connector for System Board (20-pin)			
Pin	Signal	Pin	Signal
11	3V3_MAINSENSE	1	3V3_2
12	12V_NEG	2	3V3_3
13	GROUND_1	3	GROUND2
14	_PSON	4	5V_1
15	GROUND3	5	GROUND4
16	GROUND5	6	5V_2
17	GROUND6	7	GROUND7
18	5V_NEG	8	PWOK
19	5V_3	9	5VSB
20	5V_4	10	12V

Aux. Power Connector	
Pin	Signal
1	GROUND1
2	GROUND2
3	GROUND3
4	3V3_1
5	3V3_2
6	5V

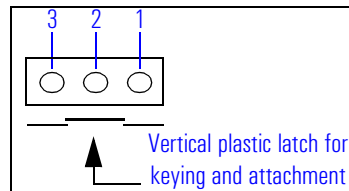
### Wake On LAN Connector

Wake On LAN (WOL)	
Pin	Signal
1	5V STDBY
2	Ground
3	LAN_WAKE

### Rear Fan Connector

Fan Connector	
Pin	Signal
1	Ground
2	12V Power
3	Sense

### PCI Fan Connector (MT only)



Fan Connector	
Pin	Signal
1	Sense
2	+ 12 V Power (or less, depending on desired fan speed)
3	Ground

### Internal Audio Connectors

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

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

Internal Speaker	
Pin	Signal
1	SPK1
2	Tst1
3	Tst2
4	SPK2

### Status Panel and Intrusion

Status Panel			
Pin	Signal	Pin	Signal
1	B1_LCD1	2	B1_LCD2
3	Ground	4	PWR_LED_A
5	HDD_LED_K	6	BACKLIGHT
7	ON_OFF	8	RED-LED_A
9	GROUND2	10	HDD_LED_A
11	_RESET	12	SDA
13	VSTDBY_3V	14	SCL

Intrusion	
Pin	Signal
4	CLOSE
3	COMMON
1	OPEN

### Hard Disk Drive Temperature Connector

HDD Temperature	
Pin	Signal
1	3V3
2	SENSE
4	Ground

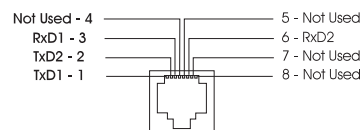
### VGA DB15 Connector

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	V <sub>CC</sub> supply (optional)
10	Digital ground	Digital ground
11	Monitor ID 0	Monitor ID 0
12	Monitor ID 1	Data:SDA
13	HSYNC	HSYNC
14	VSNC	VSNC
15	n/c	Clock:SCL

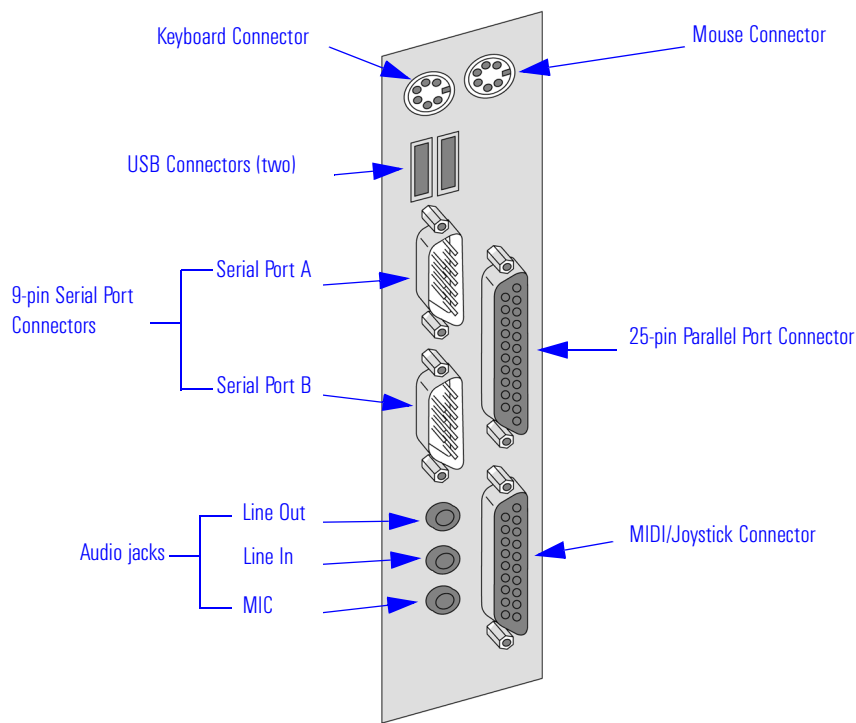
### LCD Panel

LCD Panel			
Pin	Signal	Pin	Signal
1	SCL_5V	2	VSTDBY 5V
3	SDA_5V	4	BT_LCD 1
5	not connected	6	BT_LCD 2
7	RX_BB	8	TX_BB
9	Ground	10	Ground

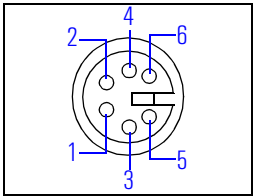
### Ethernet UTP Connector



Rear Panel Socket Pin Layouts



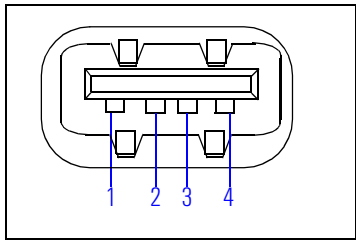
Keyboard (bottom) and Mouse (top) Connectors



Keyboard and Mouse Connectors			
Pin	Signal	Pin	Signal
1	Data	2	Not Used
3	Ground	4	+ 5 V dc
5	Clock	6	Not Used

USB Stacked  
Connector

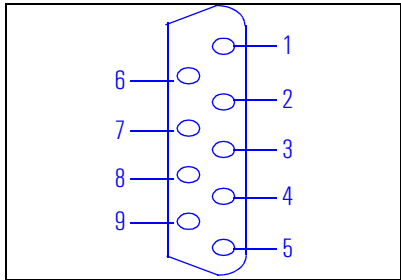
The USB graphic and pinout table for a USB connector. However, the information is also valid for a USB Stacked Connector.



USB Connector	
Pin	Signal
1	VBus
2	D-
3	D+
4	GND
Shell	Shield

Serial Port A  
(top - MT, Left - DT)  
and Serial Port B  
(bottom - MT, Right - DT)  
Connectors

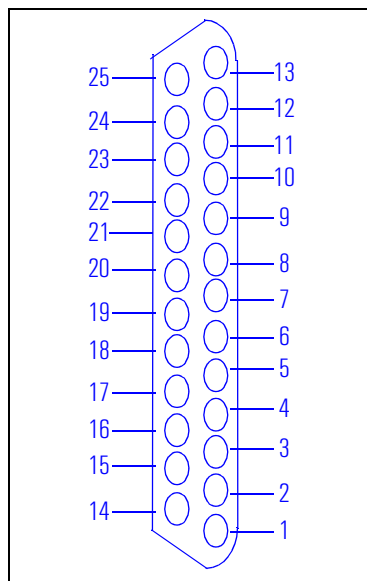
Even though the graphic and pinout table below are for one connector, the information is valid for both the Serial Port A and Serial Port B Connectors.



9-pin Serial Port Connector			
Pin	Signal	Pin	Signal
		1	(DCD) CF
6	(DSR) CC	2	(RD) BB
7	(RTS) CA	3	(TD) BA
8	(CTS) CB	4	(DTR) CD
9	(R) CE	5	(GND) AB

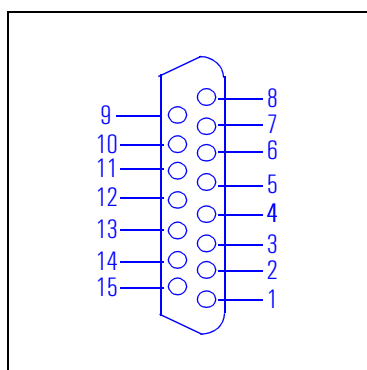


## 25-pin Parallel Connector



25-pin Parallel Connector			
Pin	Signal	Pin	Signal
		13	SLCT
25	Ground	12	PE
24	Ground	11	BUSY
23	Ground	10	ACK
22	Ground	9	D7
21	Ground	8	D6
20	Ground	7	D5
19	Ground	6	D4
18	Ground	5	D3
17	SLIN	4	D2
16	INIT	3	D1
15	ERROR	2	D0
14	AUTO-FD	1	Strobe

## MIDI/Joystick Connector



MIDI/Joystick Connector			
Pin	Signal	Pin	Signal
		8	+5 V
9	+5 V	7	A-2
10	B-1	6	A-Y
11	B-X	5	Ground
12	MIDI-OUT	4	Ground
13	B-Y	3	A-X
14	B-2	2	A-1
15	MIDI-IN	1	+5 V

## External Audio Jacks

On the PC Workstation there is a Line In jack, Line Out jack and Mic In jack located on the rear panel. These external jacks are standard connectors.

## 7 Connectors and Sockets

### Rear Panel Socket Pin Layouts