

# WHITE PAPER

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## Compaq Professional Workstation AP500 Key Technologies White Paper

*The purpose of this paper is to provide an overview of the Key Technologies incorporated into the Compaq Professional Workstation AP500. This paper concentrates on covering those features and technologies that have unique customer benefits. The objective is to provide the technical information and benefits of these features, so that geographic regions can market them successfully.*

*For more information about our graphics offering refer to:  
<http://www.compaq.com/products/workstations/graphics>*

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## Compaq Professional Workstation AP500 Key Technologies White Paper

August 1998

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## NEW COMPAQ PROFESSIONAL WORKSTATION AP500

The Compaq Professional Workstation AP500 is a powerful, industry standard workstation specifically designed for professionals using a broad range of workstation applications. Common applications for this product include mainstream CAD/CAE (AutoCAD, Mechanical Desktop, Solidworks, Pro/ENGINEER), mainstream digital content creation (PhotoShop, 3D StudioMXA), select EDA (Concept, Board Station), financial trading (Dow Jones Market, PTW), network management (Compaq Insight Manager, BMC Patrol), and software development (Microsoft® Visual Studio).

Compaq Professional Workstations are backed by strong partnerships with leading ISVs to provide highly integrated and optimized solutions, which can be confidently deployed in the most demanding, business critical environments. The Compaq Professional Workstation AP500 combines powerful industry standard components, strong partnerships with leading ISVs, and traditional Compaq quality and reliability, giving users the time-to-market advantage they need to succeed.

The Compaq Professional Workstation AP500 features a highly expandable tower form factor with tool-less entry for easy service and upgrades. The tower form factor, measuring 19.75 x 10 x 23.5 in/50.165 x 25.40 x 59.69 cm (HxWxD) is optimized for placement on the floor and is rack mountable with an optional rack mount kit.

## INTEL® PENTIUM® II

The Compaq Professional Workstation AP500 uses the newest Intel Pentium II 400-MHz and 450-MHz processors, which incorporate MMX technology and 100-MHz Front Side Bus. The Front Side Bus is the processor-to-memory bus. Pentium II processors preceding the 350-MHz clock speed and Pentium Pro processors supported 66-MHz Front Side Bus. Pentium II processors with 350-MHz or higher clock speeds have now increased to 100-MHz Front Side Bus, which provides greater processor-to-memory bandwidth and faster performance. The Compaq Professional Workstation AP500, with the Pentium II processor, supports up to 1 GB of maximum memory (using four 256-MB DIMMs). Like previous Pentium II processors, the new processor ships as a single module that contains the CPU chip, the cache tag, and the L2 cache packaged in a Single Edge Connect Cartridge (SECC).

The Intel Pentium II processor features 512 KB of integrated non-blocking L2 cache and a dedicated 64-bit cache bus, which improves performance by reducing average memory access time. The Pentium II processor's L2 cache scales with the processor core frequency. Higher core frequencies will require a 100-MHz Front Side Bus (FSB), which in turn will require a new chipset, memory, and system board. The faster system bus and memory will significantly increase overall PC performance.

### **CUSTOMER BENEFITS**

- **Major leaps in processor power.** The new Pentium II 400-MHz and 450-MHz processors provide a significant increase in processing power over previous Intel processors. The Pentium II 450-MHz processors deliver up to a 28% performance boost over the Pentium II 350-MHz processors in certain integer or multimedia benchmarks.
- **Improved overall system performance.** The 100-MHz FSB improves the overall performance of the workstation by enhancing the speed at which data is transferred between the processor and other parts of the system.
- **Improved value.** The new Pentium II processors deliver a great value by delivering higher performance at an affordable price.

### **MMX**

Similar to the previous Pentium II processors, the new Pentium II 400-MHz and 450-MHz processors have MMX technology. MMX (MultiMedia Extensions) is the name for the 57 multimedia instructions Intel has added to its processors. These multimedia extension instructions significantly improve performance on CPU-intensive multimedia applications.

For additional information on MMX, please access the Intel web site at <http://developer.intel.com/drg/mmx/Support/faq.htm>.

## **COMPAQ SYSTEM ARCHITECTURE**

### **Intel 440BX Chipset**

The AP500 uses the Intel 440BX chipset. The Intel 440BX chipset was designed as a follow on to the 440LX, which had replaced the previous generation of 440FX chipsets used with Pentium Pro and early Pentium II processors. Chipsets include technologies that allow processors, memory, I/O, graphics, and other devices to communicate and work together in a computer.

The 440LX was Intel's first chipset designed specifically for more advanced Pentium II systems, providing built-in support for SDRAM, Ultra ATA hard drives, and Accelerated Graphics Port (AGP) technology. (More information on AGP later in this paper.) The Intel 440BX chipset also supports these features, as well as a 100-MHz FSB. As mentioned earlier, the benefits of the 100-MHz FSB are greater processor-to-memory bandwidth and faster performance.

The 440BX supports the 100-MHz FSB, an upgraded infrastructure designed to support clock speeds of 350 MHz and above in the more advanced Pentium II processors. This additional 100-MHz FSB support is the key difference between the BX and the LX chipsets.

The following table shows how the BX chipsets compare to the LX technology.

Key Features Supported by Intel Pentium II Chipsets		
Feature	440LX Chipset (440LX/PIIX-4)	440BX Chipset (443BX/PIIX-4)
Processor FSB	66 MHz	66 MHz or 100 MHz
Memory – Max/type	512 MB SDRAM ECC supported	1 GB SDRAM ECC supported
IDE	UltraDMA/33	UltraDMA/33
AGP	Yes	Yes
USB	2 ports	2 ports
ACPI	Yes	Yes

**CUSTOMER BENEFITS**

- **Performance.** Support for up to 1 GB of SDRAM provides support for memory-intensive applications and data files. This increases system performance.
- **Speed.** Clock speeds of 350 MHz and above are possible with support for the 100-MHz Front Side Bus.
- **Support for better, faster graphics.** Brings built-in support for Accelerated Graphics Port (AGP) technology.
- **ACPI-ready.** ACPI defines a hardware interface that allows a standard way to integrate power management features throughout the workstation system. Since the workstation ships standard with the ACPI hardware, you will be able to utilize ACPI features once future ACPI-enabled Microsoft operating systems become available.

**Q. Does the Compaq Professional Workstation AP500 use the Highly Parallel System Architecture?**

**A.** No. The Compaq Professional Workstation AP500 does not use the Highly Parallel System Architecture.

**Q. Why is Compaq not using the Highly Parallel System Architecture for this product?**

**A.** In keeping with our strategy of optimizing our product lines to meet the needs of specific target markets, we use the Compaq Highly Parallel System Architecture in our high-performance line of products, since the applications targeted for this line are most apt to benefit from the technology. The Compaq Professional Workstation AP500 is targeted at price/performance-conscious users in the workstation market who must balance their desire for performance with a desire for value.

## MEMORY

The Compaq Professional Workstation AP500 uses 100-MHz Registered ECC Synchronous DRAM (SDRAM) and supports up to 1 GB of memory. SDRAM is designed to accommodate higher processor speeds and provides faster memory operation with burst data rates of up to four times that of standard page-mode DRAMs. The new burst mode addresses an entire block of data rather than one piece at a time. Most importantly, SDRAM is synchronized with the CPU system clock to allow continuous data flow. Estimated performance increases are 2% for cached systems and 10% for non-cached systems.

100-MHz SDRAM is required to work with the 100-MHz Front Side Bus (FSB), which is an integral part of high-speed systems. 100-MHz SDRAM is designed to accommodate higher microprocessor speeds and to provide faster memory operation.

## CUSTOMER BENEFITS

There are clear benefits to SDRAM compared to the previous memory technology, EDO (extended data output) DRAM. Some key benefits are:

- **Increased performance.** Customers will experience greater CPU responsiveness with SDRAM technology. The 100-MHz SDRAM will support high-speed Pentium II 400-MHz and 450-MHz technologies that EDO DRAM cannot support.
- **Faster bus speeds.** SDRAM can run up to 100 MHz, while the maximum bus speed that EDO DRAM can run is 66 MHz.
- **Perfect match for demanding applications.** As graphics and software programs become more and more complex, SDRAM is better suited to handle these advances compared to EDO SDRAM because of its higher bus speed.

**Q. Compaq Professional Workstation AP500 uses registered memory. What is the difference between registered and unregistered memory?**

**A.** Registered memory is buffered memory. Buffered DIMMs use buffer logic chips on their control lines to reduce loading on the system board. This buffering action increases the maximum size of DIMM module sockets on the system board. Unbuffered DIMMs do not use any buffer logic chips, thus achieving slightly faster operation due to the elimination of the propagation delay of the logic buffer. The increase in speed comes at the tradeoff of reducing the maximum size of DIMM modules on the system board, which results in smaller memory capacity.

**Q. Can I use older memory from my installed base of Compaq Professional Workstation systems in the new AP500 machine?**

**A.** The Compaq Professional Workstation AP500 uses the same memory as the Compaq Professional Workstation AP400; however, the AP500 memory is not interchangeable with the AP200, 5000, 5100, 6000, or 8000 products. The AP200 uses unregistered DIMMs, and the remaining products use 66-MHz EDO memory.

## ULTRA ATA

Ultra ATA is a definition for an ATA data transfer protocol. The Ultra ATA protocol is included in the ATA-4 specification, an industry-wide specification designed to provide firm guidelines to hardware developers and manufacturers. The development of the transfer protocol "Ultra ATA" hard drives (also known as UDMA, UATA, Ultra DMA, Ultra DMA-33) has increased the burst data transfer rate to 33.3 MB/s compared to Fast ATA, effectively doubling the transfer rate vs. Fast ATA. Due to faster transfer rates, Ultra ATA technology processes data twice as fast. This causes a reduction of 250 ms to 125 ms in time to empty the buffer. These savings in time allow the time to empty the buffer (400 ms) to equal the buffer fill time, thus eliminating the bottlenecks experienced with Fast ATA.

### *CUSTOMER BENEFITS*

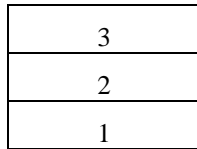
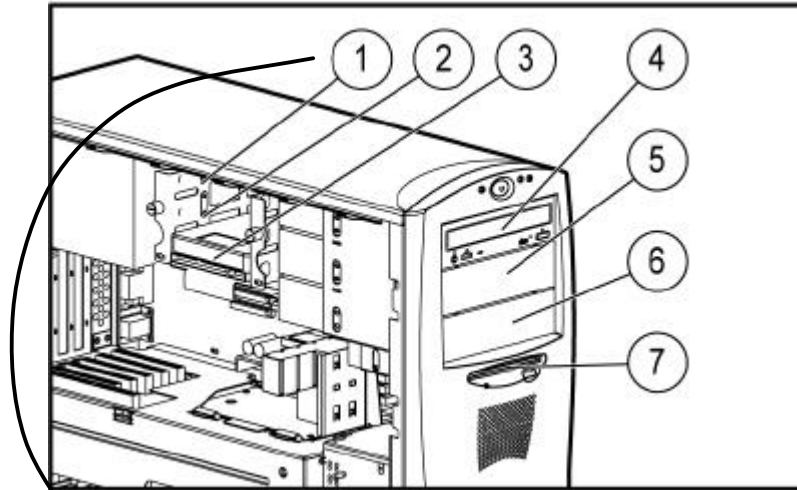
- **Extends the data transfer rate.** Provides improvement over Fast ATA speed of 16.6 MB per second to 33.3 MB per second.
- **Provides improved signal integrity through CRC (Cyclical Redundancy Check).** Checks to verify the integrity of the data transferred by validating all data transferred across the cable.
- **Fully backward compatible.** Uses the same electrical connection as Fast ATA and can run in standard EIDE mode with old ATA chipsets. Ultra ATA devices can also operate on an ATA bus with non-Ultra ATA devices.

**Q. Why does the Compaq Professional Workstation AP500 use Ultra ATA drives as well as Wide Ultra SCSI drives?**

**A.** The Compaq Professional Workstation AP500 will attract different users. Some may need the higher speed 40-MB per second data transfer rate of Wide-Ultra SCSI drives for extra performance. For those who find the 33.3-MB per second data transfer rate satisfactory, Ultra ATA drives provide excellent price/performance with almost no difference when using business productivity applications.

## WIDE-ULTRA SCSI HARD DRIVES

Standard SCSI hard drive configurations for the Compaq Professional Workstation AP500 include a one-inch 4.3-GB 7200 rpm or 10,000 rpm hard drive, depending on the model. The standard hard drive occupies a bay in the removable drive cage. The AP500 is expandable for customers with additional storage requirements. It supports up to five one-inch hard drives or up to four 1.6-inch hard drives. For those customers who require even more storage, the integrated Wide-Ultra SCSI controller (with an external Wide-Ultra SCSI connector) supports external SCSI devices. The following table describes the available SCSI hard drive configurations.



Bay	Bay Width	Bay Height	Device configuration
1	3.5 inch	Third	Part of the removable hard drive cage. Supports a 1.0-inch hard drive or a 1.6-inch hard drive.
2	3.5 inch	Third	Part of the removable hard drive cage. Supports a 1.0-inch hard drive. Bay 2 is not available when a 1.6-inch hard drive is installed in either bay 1 or 3.
3	3.5 inch	Third	Part of the removable hard drive cage. Supports a 1.0-inch hard drive or a 1.6-inch hard drive.
4	5.25 inch	Half	Supports 1.6-inch CD-ROM only
5	5.25 inch	Half	Supports 1.0-inch or a 1.6-inch storage device. If installing 10,000 rpm hard drives, the optional 10K Drive/Cooling Kit (part number 329294-B21) is required.
6	5.25 inch	Half	Supports 1.0-inch or a 1.6-inch storage device. If installing 10,000 rpm hard drives, the optional 10K Drive/Cooling Kit (part number 329294-B21) is required.
7	3.5 inch	Third	Supports a 1.0-inch storage device. A 3.5-inch diskette drive is standard.



## ACCELERATED GRAPHICS PORT (AGP)

Today's three-dimensional graphic applications consume large amounts of memory bandwidth. Consequently, the proliferation of 3D applications is increasing the need for high-speed access to larger amounts of graphics memory. AGP is an industry standard solution to improve the bandwidth between the graphics accelerator and the system memory so that a portion of the 3D rendering data structures can be shifted into main memory. The higher bandwidth of AGP (compared to PCI) also improves sharing rendering tasks between the system processor and the graphics accelerator.

AGP improves system performance by establishing pipelined access to the system's main memory and effectively reducing latency. AGP also transfers data up to four times faster than PCI, utilizing the bandwidth of a 100-MHz system memory bus more efficiently. The maximum data transfer rate of AGP is 533 MB/s, compared to 133 MB/s for PCI.

### CUSTOMER BENEFITS

Some specific applications that can benefit from AGP include:

- Video applications, like conferencing or DVD playback, where a steady stream of images must be sent from system memory to the graphics frame-buffer for display.
- Graphics command lists, such as lengthy data sets defining vertices for 3D objects.
- Texture memory for 3D rendering, where textures are overlaid on 3D objects for realistic effects. To improve realism, texture sizes will grow to 32 MB and beyond in 1999.

*Note: 3D texture data is the most immediate and important target opportunity for AGP. By shifting texture data to system memory, bandwidth load and memory size can be balanced between system and local graphics frame-buffer memory. The bandwidth and space required for textures are split between the heavily loaded frame-buffer and the (comparatively) lightly loaded system memory. Since texture data is not persistent (unlike display buffers), system memory used for texture data is returned to the free memory heap when a 3D application concludes.*

To gain the full benefit of AGP performance, the system must have the following features:

- Pentium II class microprocessors
  - Note: While AGP could be adapted to Pentium-class processors, the floating point and processing power of the Pentium II class products are a better fit.*
- AGP Sideband and Pipeline functions in the core logic, which improve data transfer efficiency
- 100-MHz system memory architecture to meet system processor and AGP bandwidth demands
- Microsoft Windows® 95 OSR2.1, Windows 98, or Windows NT® 5.0 operating systems to provide necessary memory management services

*Note: Windows NT 4.0 can operate AGP subsystems as PCI 66MHz-type devices only.*

AGP promises to enable photo-realistic 3D rendering and other high-performance 3D graphics capabilities. The cutting edge graphics performance of AGP will benefit 3D content providers by enabling a much wider market for their products.

## GRAPHICS

Two graphics solutions are available for the Compaq Professional Workstation AP500. Both are AGP controllers, which take advantage of main memory for texture mapping operations. All controllers have been tested to ensure optimum compatibility and reliability.

- For 2D and entry 3D applications, the Compaq Professional Workstation AP500 includes the ELSA GLoria Synergy+ (AGP). The ELSA GLoria Synergy+ (AGP) comes standard with 4 MB of SGRAM and is upgradeable to 8 MB. It provides fast 2D windowing and is a great low-cost 3D solution for CAD and DCC applications. For multiple display requirements, additional ELSA GLoria Synergy+ (PCI) controllers may be added.
- For mid-range 3D applications, the Compaq PowerStorm 300 (AGP) provides a competitive high-performance solution. The Compaq PowerStorm 300 (AGP) is a 3D graphics solution for users working in demanding, true color environments. Standard on certain models of the Compaq Professional Workstation AP500, the Compaq PowerStorm 300 (AGP) has 15 MB of 3D-RAM frame buffer memory and 16 MB of texture memory. Dual display capability is achieved using an additional Compaq PowerStorm 300 (PCI) controller.

### Compaq Graphics Driver Compatibility

All controllers are high-performance graphics solutions, optimized for Microsoft Windows NT applications that require up to 16.7 million color processing and high resolutions. The drivers for each are developed by their respective manufacturers and have been thoroughly tested by Compaq to ensure compatibility with existing applications.

### ELSA GLoria Synergy+ (AGP) Graphics Controller

The ELSA GLoria Synergy+ (AGP) graphics controller in the Compaq Professional Workstation AP500 is a low-cost, high-performance leader in the 2D/entry 3D segment. Users requiring fast windowing and menu level performance, as well as robust 3D rendering capabilities, use 2D/3D graphics.

Requirements for the 2D/3D graphics segment include exceptional 2D/3D-vector performance, 3D shading and lighting, and texture mapping support. These features, used by mainstream OpenGL- and Heidi-based applications, typically offer great price and performance without sacrificing required functionality. This combination is important for mainstream CAD applications, such as AutoCAD, Microstation, and SolidWorks, which have recently integrated 3D techniques into their environment. It is also useful in DCC where 2D and 3D animation applications are used in the same environment. Financial analysis and trading environments can benefit from the 2D performance provided by these solutions. Graphics controllers in this segment also provide investment protection as financial analysis application developers add 3D modeling to their environment in FY98.

The ELSA GLoria Synergy+ (AGP) graphics controller is based on the Permedia-2A graphics engine from 3Dlabs. It provides the 2D performance of a Matrox Millennium II while adding a robust 3D environment that rivals the performance of previous GLINT Delta/TX controllers, such as the GLoria-L. The GLoria Synergy+ is the perfect low-cost solution for mainstream CAD, web authoring, pre-print, and 2D/3D animation applications that do not require greater than 1024x768 resolution for true-color rendering. The GLoria Synergy+, as an AGP device, can also take advantage of main memory for texture mapping operations. This is a feature that will be supported in Windows NT 5.0 from Microsoft.

**Color and Resolution Support**

<b>Maximum Color Depth Single-Buffer Mode</b>			
<b>Resolution</b>	<b>4-MB SGRAM</b>	<b>8-MB SGRAM</b>	<b>Max Refresh Rate</b>
1920 x 1200	256	32,768	75 Hz
1920 x 1080	256	32,768	80 Hz
1600 x 1280	32,768	32,768	75/85 Hz
1600 x 1200	32,768	32,768	85 Hz
1600 x 1000	32,768	32,768	100 Hz
1536 x 1152	32,768	32,768	85 Hz
1280 x 1024	32,768	16.7 million*	100/80 Hz
1152 x 864	16.7 million	16.7 million	100 Hz
1024 x 768	16.7 million	16.7 million	100 Hz
800 x 600	16.7 million	16.7 million	100 Hz
640 x 480	16.7 million	16.7 million	100 Hz

\* 1280 x 1024 can run in a double-buffered visual if it is reduced to 32,768 colors.

**Features and Technical Specifications**

The following features are included in the ELSA GLria Synergy+ (AGP):

- Provides 2D windowing performance equivalent to the Matrox Millennium II
- A low-cost solution for professional 3D applications, such as AutoCAD, Microstation, SolidWorks, and 3D StudioMAX
- Supports a wide range of resolutions and color depths for flexibility and performance in a variety of 3D graphics environments
- Supports up to 4 displays using additional GLoria Synergy (PCI) controllers
- Uses 3Dlabs Permedia-2A processor for highly integrated 2D and robust 3D rendering requirements
- Comes standard with 4 MB of SGRAM, upgradeable to a maximum of 8 MB
- Supports up to 1920x1200 resolution at 16 bpp (requires 4-MB upgrade)
- Provides a 16-bit double buffered environment at 1024x768 resolution (16-bit/single buffer at 1280x1024 including a 16-bit Z-buffer)
- Optimized graphics drivers for OpenGL and Heidi under Windows NT 4.0 and 3.51, display list drivers for AutoCAD, and Direct3D driver for Windows 95

Features	Technical Specifications
Controller	3Dlabs Permedia-2A
Bus Type	AGP
RAMDAC	Integrated 250 MHz
Memory Type	SGRAM
Memory Amount	4 MB standard (4-MB optional upgrade)
Memory Speed	8 ns
Data Path	64-bit
Controller Clock Speed	90 MHz
Max Vertical Refresh Rate	219 Hz
Max Horizontal Scan Rate	281 kHz
Max Pixel Clock	250 MHz at 8 bpp and 16 bpp/5:5:5 145 MHz at 32 bpp/8:8:8
Video Features: Interface	VGA

Features	Technical Specifications
3D Graphics Features: <ul style="list-style-type: none"> <li>• Integrated geometry pipeline setup processor</li> <li>• True-color 3D graphics</li> <li>• Polygon based with Z-buffer</li> <li>• Texture decompression</li> <li>• Full scene anti-aliasing</li> <li>• Enhanced GUI</li> </ul> Acceleration: <ul style="list-style-type: none"> <li>• Ultra-fast BLT engine and 2D rasterizer</li> <li>• Stretch BLTs, monochrome/color expansion and logic ops</li> <li>• Fast on-chip SVGA</li> <li>• Autodesk Display list driver</li> <li>• Heidi drivers support for 3D Studio MAX</li> </ul>	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
Operating Systems	Windows 95, Windows 98 Windows NT 3.51/4.0

**Compaq PowerStorm 300 (AGP) Graphics Controller**

Standard on certain models of the Compaq Professional Workstation AP500 is the Compaq PowerStorm 300 (AGP) graphics controller. The Compaq PowerStorm 300 provides a high-performance, mid-range, 3-dimensional graphics solution at a very competitive price.

Professionals that use more demanding workstation applications require the performance of mid-range 3D graphics solutions. CAD and CAE applications, such as Pro/E, take advantage of this graphics controller to provide a high-performance rendering solution for solids modeling and visual data analysis. The PowerStorm 300 also provides superior performance and visual quality for DCC applications, such as 3D StudioMAX. System performance is key for these applications where the graphics controller must not be perceived as a bottleneck.

The PowerStorm 300 is an optimized, high-performance solution for mid-range 3D graphics requirements in these segments. Based on the next-generation REALimage 2000 architecture from Evans and Sutherland, it provides the fastest 3D-application performance in its class. The PowerStorm 300 is the graphics controller to use when up against other non-geometry accelerated solutions, such as the Intergraph 3400T (VX113T).

**Color and Resolution Support**

<b>Maximum Color Depth Single-Buffer Mode</b>			
<b>Resolution</b>	<b>3D Acceleration with Double Buffering, Colors Supported</b>	<b>Texture Memory</b>	<b>Max Refresh Rate</b>
640 x 480	16.7 million	16 MB	85 Hz
800 x 600	16.7 million	16 MB	85 Hz
1024 x 768	16.7 million	16 MB	85 Hz
1280 x 1024	16.7 million	16 MB	85 Hz

**Features and Technical Specifications**

The following features are included in the Compaq PowerStorm 300:

- Optimized solution at 1280 x 1024, true-color double buffered for demanding solids modeling, animation, and visualization applications
- Next-generation high-performance rendering engine based on the Evans and Sutherland REALimage 2000 architecture
- 15-MB 3D-RAM for frame buffer and Z-buffer, 16-MB CDRAM (cache DRAM) for fast texture buffering
- Dual display support using an additional PCI controller

<b>Features</b>	<b>Technical Specifications</b>
Controller	Evans and Sutherland REALimage 2100
Bus Type	AGP
RAMDAC	IBM 640
Memory Type	3D RAM and CDRAM
Memory Amount	15-MB 3D RAM, 16-MB CDRAM
Memory Speed	10-ns 3D RAM, 15-ns CDRAM
Data Path	64-bit
Controller Clock Speed	100 MHz
Max Vertical Refresh Rate	120 Hz
Max Pixel Clock	220 MHz

Features	Technical Specifications
Hardware Accelerated 3D: <ul style="list-style-type: none"> <li>• 24-bit Z-buffering</li> <li>• Gouraud Shading</li> <li>• Stencils</li> <li>• Texture Mapping (bilinear and trilinear)</li> </ul>	Yes Yes Yes Yes
Performance: <ul style="list-style-type: none"> <li>• Random 10-Pixel Solid Lines</li> <li>• Filled 25-Pixel Triangles</li> </ul>	4 million/s 4 million/s
Pixel Fill Rates: <ul style="list-style-type: none"> <li>• Bilinear</li> <li>• Trilinear</li> </ul>	90 million/s 45 million/s
Operating Systems	Windows NT 3.51/4.0

## CHASSIS FEATURES

The Compaq Professional Workstation AP500 chassis has been designed for ease of service and expandability. The unit is opened using thumbscrews (no tools are required) and a single side panel. After the side panel is removed, most of the components are visible. The Compaq Professional Workstation AP500 uses an expansion board assembly, which holds the PCI and ISA expansion slots and is removable. The system board is attached to a tray and slides out for easy removal or replacement. The internal drive cage is also removable and makes adding additional hard drives easier.

The Compaq Professional Workstation AP500's chassis is very expandable. It has a total of six expansion slots: three PCI, one ISA, one shared PCI/ISA, and one AGP (populated by graphics controller). There are also seven drive bays: three internal 3.5" (one populated by hard drive), three 5.25" user-accessible drive bays (one populated by the CD-ROM drive), and one 3.5" diskette drive.

## INTEGRATED NETWORK INTERFACE CONTROLLER (NIC)

With the new Compaq Fast Ethernet Embedded NIC NC3121 (10/100 Mbps), Compaq dramatically simplifies the network management task and lowers the total cost of ownership in today's businesses. The product's Wake-on-LAN (WOL) feature enables remote system power-up and maintenance during non-working hours, making it easy to perform routine updates, audits, and other management operations without interrupting end users. Moreover, because the new NIC operates at both 10 and 100 Mb/s, it is an ideal solution for environments that are migrating towards Fast Ethernet.

For maximum flexibility in designing your business' network, the NC3121 NIC conforms to the full range of today's industry standards, including PC97. It is compatible with both Compaq and Intel Fast Ethernet drivers, allowing MIS departments to standardize on one set of drivers. The SNMP-compliant NC3121 can be remotely monitored with Compaq's Insight Manager, Compaq's CNMS network management software, HP Openview, or any other SNMP compliant management solution.

Performance and connectivity are further enhanced by the NC3121's 10/100 autosensing, auto-negotiating feature, which enables the NIC to automatically negotiate between 10 and 100 Mb/s and achieve the highest common speed on the network. Full duplex support allows the controller to transmit and receive data simultaneously for data rates up to 20 Mb/s for Ethernet and 200 Mb/s for Fast Ethernet, and 6-KB buffer memory produces low CPU utilization at high throughputs.

Features	Technical Specifications
Compliance	IEEE 802.2, 802.3, and 802.3u
Data Transfer	32-bit bus-master PCI, 10 or 100 Mb/s, autonegotiating
Connector	RJ-45
Buffer Memory	6 KB
Communication Processor	Intel 82558 chipset
Operating System Support	Windows 95 and Windows NT, ODI 16-bit and ODI 32-bit (Novell NetWare), NDIS 2.0 (most operating systems), and SCO UNIX

- Q. What is the purpose of Intel driver compatibility?**
- A. Because the NC3121 NIC is compatible with both Compaq and Intel drivers, MIS departments can standardize on one set of drivers while using both Compaq and Intel NICs.
- Q. What is the relationship between Intel and Compaq with regard to Compaq NICs?**
- A. The relationship between Compaq and Intel allows the two companies to speed the deployment and evolution of new networking technologies. With technology licensing and cooperative engineering and product development, the two companies can generate more affordable, efficient, and interoperable networks.
- Q. Is this NIC standards-based?**
- A. Yes. The NIC works with any standards-based system. It is PC 97 compliant, Windows 98 compatible, and fully compliant with IEEE 802.2, 802.3, and 802.3u. The product also complies with "Blue Angel" standards to make it compatible with the latest German environmental requirements.



## 32X MAXIMUM CD-ROM

The Compaq Professional Workstation AP500 features a 5.25", half-height tray-load 32X Maximum CD-ROM Drive using the new Constant Angular Velocity (CAV) technology. Previous CD-ROM technology used Constant Linear Velocity (CLV) technology, which allowed the disc to rotate at a faster rate while reading the inner tracks and a slower rate when reading the outer tracks. Conversely, CAV technology spins the disc at a fixed rate and the data transfer rate increases as it moves toward the outer tracks. This is the same technology that is used for hard drives where it has demonstrated excellent performance in high data transfer and fast access times. Using this technology enables reliable CD-ROM speeds above 8X. The 32X CAV CD-ROM dramatically increases the access time performance of the CD-ROM in the Compaq Professional Workstation AP500.

Features	Technical Specifications
Access Time	Random = <100 ms Full Stroke = <150 ms
Variable Transfer Rate	2100 - 4800 KB/s

## PREMIERSOUND™ AUDIO

The Compaq Professional Workstation AP500 PremierSound audio system is a solution optimized for workstations. The signature performance characteristics of a PremierSound audio system are exceptional sound output and clarity from a completely integrated, "no desktop clutter," audio solution.

The PremierSound audio system is comprised of several subsystems, each individually optimized to work as a complete solution. The end result of the interaction between the subsystems is a well balanced, "no desktop clutter," audio system capable of delivering clean, undistorted output at a level needed to support an office environment.

### CUSTOMER BENEFITS

- **"No desktop clutter."** Compaq PremierSound is integrated in the AP500. This provides more free space on desktops.
- **High-performance loudspeaker with long excursion.** Provides crisp, clean, wide-bandwidth audio from a small-integrated solution. The voice clarity and low frequency output of the speaker is dramatically better than current integrated computer office products.
- **Low distortion.** PremierSound utilizes an audio power amplifier that delivers a clean, undistorted signal. This amplifier is conservatively rated at 5 watts RMS and is designed to take full advantage of the loudspeaker's output capability by providing a large, low distortion, audio output signal.
- **Five stages of fixed equalization.** The five stages of fixed equalization incorporated in the electronics are used to "shape" the system frequency response in various listening positions. The system frequency response is manipulated to provide smooth, natural voice reproduction and high-quality CD playback.

- **Electrical system gain staging.** Gain staging is a key process in transforming the individual piece parts into a unified audio system. Gain staging allows Compaq to compensate for the different input levels that are generated by a number of different audio sources, such as CD-ROM, wavetable, and line in.

The end result of the interaction between the subsystems is a well balanced, “no desktop clutter,” audio system capable of delivering clean, undistorted output at a level needed to support an office environment.

## UNIVERSAL SERIAL BUS (USB)

The Compaq Professional Workstation AP500 includes two Universal Serial Bus (USB) ports.

USB is a peripheral bus standard developed by a group of PC and telecom industry leaders including Compaq, DEC, IBM, Intel, Microsoft, NEC and NORTEL. USB enables hot plug and play of computer peripherals outside of the workstation eliminating the need to install boards into expansion slots and then having to reconfigure the system. Workstations equipped with USB allow peripheral devices to be automatically configured as soon as they are physically attached, without the need to reboot or run setup. USB also allows up to 127 devices to run simultaneously with peripherals such as monitors and keyboards acting as additional plug-in sites or hubs.

USB peripherals include telephones, modems, keyboards, mice, CD-ROM drives, joysticks, tape and diskette drives, scanners, and printers. USB has a 12 Mbits/s data rate, compared to 115.2 Kb/s for serial ports and 2 Mb/s for enhanced parallel ports. This improved transfer rate will accommodate a new generation of peripherals, including MPEG-2 (compressed data) video-based products and digitizers.

Drawing its intelligence from the host workstation, USB detects when devices are added and removed. USB automatically determines what host resource each peripheral needs, including driver software and bus bandwidth, and makes those resources available without user intervention.

Currently, there are different ways to implement USB. The Compaq Professional Workstation AP500 implements the OpenHCI USB interface. OpenHCI reduces CPU overhead for USB devices compared to other implementations and is fully compatible with UniversalHCI.

Currently, Windows NT Workstation 4.0 does not support USB, but future versions are expected to include USB drivers that will allow the workstation to recognize USB peripherals.

## MONITORS

The recommended monitors for the Professional Workstation AP500 are the Compaq P75 (17-inch), V90 (19-inch), P110 (21-inch), and P1610 (24-inch), and the Compaq TFT500 and TFT450 Flat Panel Monitors.

	<b>P75</b>	<b>V75</b>	<b>V90</b>	<b>P110</b>	<b>P1610</b>
<b>Viewable image</b>	16.0 inches	16.0 inches	18.0 inches	21.0 inches	24.0 inches
<b>Screen type</b>	.25 mm stripe pitch	.26 mm dot pitch	.26 mm dot pitch	.25 to .27 mm variable aperture grille pitch	.25 to .28 mm variable aperture grille pitch
<b>Top Resolution</b>	1280 x 1024	1280 x 1024	1600 x 1200	1600 x 1200	1920 x 1200
<b>Refresh rate at top resolution</b>	75 Hz	75 Hz	75 Hz	85 Hz	76 Hz
<b>TCO 95 Compliant</b>	Yes	Yes	Yes	Yes	Yes
<b>Plug and Play</b>	Yes	Yes	Yes	Yes	Yes
<b>Microsoft 97 compliant</b>	Yes	Yes	Yes	Yes	Yes

	<b>TFT450</b>	<b>TFT500</b>
<b>Viewable image</b>	14.5 inches	15.0 inches
<b>Screen type</b>	Thin Film Transistor (TFT)	Thin Film Transistor (TFT)
<b>Plug and Play</b>	Yes	Yes
<b>Microsoft PC97</b>	Yes	Yes
<b>Horizontal viewing angle</b>	120 °	120°
<b>Vertical viewing angle</b>	105°	80°

For a more complete overview of Compaq monitors, please refer to the monitor area on Compaq's web site: <http://www.compaq.com/products/monitors>.

## WORKSTATION SOFTWARE PLATFORM

### Microsoft Operating System Compatibility

The Compaq Professional Workstation AP500 is designed to comply with the requirements of the PC97 Hardware Design Guide. In support of this initiative, the AP500 meets the hardware compatibility requirements for the Windows NT Workstation operating system and has been verified, tested, and certified as "Designed for Windows NT" in Microsoft's logo program.

### Intelligent Manageability

Intelligent Manageability is the Compaq management solution that gives customer's day one ROI by making Compaq Workstations more manageable from a single point on the network. The Compaq Workstation family can be integrated into a broad range of LAN and enterprise management applications. Workstation products are easy to troubleshoot because the hardware has built-in instrumentation to detect potential failures and allow for rapid recovery if problems occur. Fundamental benefits include the ability to protect data and minimize end-user downtime, thus increasing the productivity of both the end-user and the IT organization. End-users can feel more secure knowing that systems and data are protected while the IT organization benefits from smoother and faster service call resolution. This is a key benefit for organizations with limited technical support resources.

Most fault management features (local and remote) require that the Compaq Management Agent be running on the Workstation. This agent is available for Windows NT Workstation and comes pre-installed and pre-configured on the Professional Workstation AP500. The Compaq Management Agent is available on the Software Support CD and the Compaq Web site ([www.compaq.com](http://www.compaq.com)).

Key Intelligent Manageability features for the Professional Workstation AP500 include:

### Initial Configuration and Deployment

- Remote System Installation (Remote Boot Capability)
- Replicated Setup
- Support Software CD and WWW Site
- Compaq SmartStart for Workstations

### Asset Tracking and Security

- AssetControl
- System, monitor, hard drive, memory, serial number, model, and manufacturer
- ROM and system board revision level
- DMI 2.0 Support
- Memory Change Alert
- Ownership Tag
- Standard security features include power-on password, setup password, and media and port input/output control

**Software Updating and Management**

- Compaq Info Messenger
- Compaq SmartStart for Workstations
- Remote Security Management
- Remote ROM Flash
- Remote Wakeup/Remote Shutdown
- Support Software CD and Compaq Web site

**Fault Notification and Recovery**

- ECC Memory, Fault Prediction, and Pre-failure Warranty
- SMART Drives, Proactive Backup, and Pre-failure Warranty
- Surge Tolerant Power Supply
- Thermal Sensor
- Ultra ATA Integrity Monitoring
- Diagnostics for Windows

**Other Features**

- ACPI-ready Hardware
- Dual-State Power Button

**Support Software CD and the Compaq Web Site**

The Compaq Support Software CD and Compaq's Web site ([www.compaq.com](http://www.compaq.com)) provide software updates, device drivers, tools, and other value adds that allow customers to achieve optimum performance and the best manageable workstation. Through both of these mediums, a customer can easily customize the software that comes pre-installed on each Professional Workstation AP500. These instruments, which are updated monthly, provide easy installation of the most current device drivers and other value-added software. The Support Software CD is available by subscription.

**SmartStart for Workstations**

All Compaq Professional Workstations ship standard with SmartStart for Workstations. SmartStart for Workstations enables re-installation of the operating system, drivers, and management agents in the event that the customer experiences hard drive failure or chooses to perform a custom installation of the systems software and operating system.

For more information about the software platform, please refer to the Compaq Professional Workstation Software area on the Workstation web site:

<http://www.compaq.com/products/workstations/software-platform/index.html>.