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## HP VISUALIZE fx4



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### Background information on the HP VISUALIZE fx4 graphics technology

The HP VISUALIZE fx4 is an Accelerated Graphics Port (AGP)-based OpenGL graphics subsystem offering a quantum leap forward in performance and an industry-leading feature set. It has been designed specifically for the Pentium II-based HP Kayak XW PC Workstations.

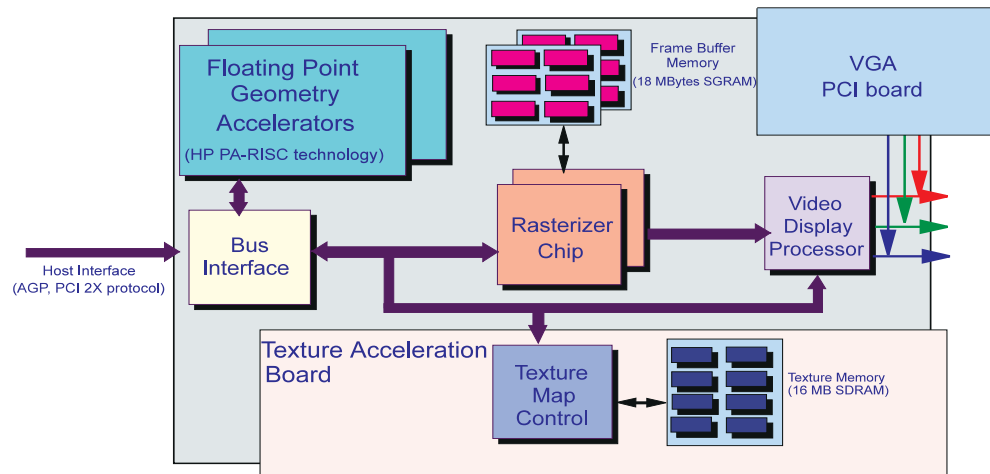
The HP VISUALIZE fx4 uses two powerful geometry accelerators based on HP PA-RISC technology, each containing two floating point units. It supports a wide range of screen resolutions—from 640x480 VGA to 1600x1200 in 24-bit true color. Refresh rates from 60 to 85 Hz are designed to work with a wide range of monitors. In addition, the HP VISUALIZE fx4 supports stereo graphics at both 1024x768 and 1280x1024 resolutions, with refresh rates up to 120 Hz (60 Hz per eye).

Display features include:

- Fast double-buffering, which enhances visual design and optimizes interactivity for simulation work.
- Support for Overlay planes and Windows ID, to enable CAD applications to manipulate complex models which are spread over multiple windows and viewports without diminishing performance.
- HP Color Recovery technology to improve display quality by allowing dithered 8-bit images to be displayed in over four million colors.

**VISUALIZE**  
Graphics Technology

The following illustration shows the board layout of the HP VISUALIZE fx4.



The HP VISUALIZE fx4 is a two-board solution:

- The main board fits into the PC workstation's AGP slot.
- The VGA graphics board occupies the PCI slot next to the AGP interface.

The optional texture acceleration board provides texture acceleration and texture memory. It is preinstalled in certain models of the HP Kayak XW PC Workstation.

The following sections describe the components of the HP VISUALIZE fx4 in detail.

## Geometry Accelerators

The HP VISUALIZE fx4 has two geometry accelerator chips (each containing two floating point units), which accelerate 3D graphics. These accelerators support the complete OpenGL geometry pipeline, including:

- Material properties
- Transformations
- Lighting and shading
- View and model clipping
- Compound primitives
- Texture coordinate generation
- Environment mapping

The floating point units in the geometry accelerators are based on HP PA-RISC workstation processor technology and offer levels of performance only previously found in Unix workstations. The geometry accelerators free the system CPU from performing graphics calculations, leaving more processing power available for application work.

The geometry accelerators operate at 600 million floating point operations per second, giving the system a total of 2400 megaflops. This high-speed floating point capability means that the HP VISUALIZE fx4 can render, for example, up to 3.4 million shaded triangles per second.

The geometry accelerators create lit, shaded primitives that are then forwarded to two powerful rasterizer chips.

## Rasterizer Chips

These chips rasterize geometric data to set up display information. The units have a 192-bit path to frame buffer memory, and fully support many 3D rasterization features, including:

- Color interpolation, for shaded primitives
- Depth buffering, for hidden surface removal
- Fog, for visual simulation and depth cueing
- Alpha test and blend, for transparency effects
- Polygon and line stipple, for patterned surfaces and edges
- Stencil buffers, for detail polygons, capping, interference checking, and polygon edging
- Antialiasing, for smooth lines without interfering with motion artifacts
- Visibility checking, which allows applications to determine whether subassemblies are visible before rasterizing them. DirectModel (an Application Programming Interface designed to support very large model applications with superior display performance) is accelerated by this feature.



## Memory Architecture

The HP VISUALIZE fx4 uses a “stacked” frame buffer architecture which ensures that even multiple windows are accelerated because every pixel on the screen has its own memory.

Specifically, the HP VISUALIZE fx4 uses 90 bits to represent each screen pixel, consisting of:

- Two 24-plane color buffers
- One 24-bit depth buffer
- Four bits of stencil
- An 8-bit overlay
- One clipping plane
- Five window ID planes.

A total of 18MB of video memory is provided to support this architecture.

The frame buffer memory is Synchronous Graphics RAM, or SGRAM, which supports extremely high clock rates, enabling both faster rasterization of graphics primitives and higher refresh rates. SGRAM also has features such as accelerated block writes, screen clears, and screen-to-screen block moves.

## Texture Acceleration Board

This optional accessory board provides accelerated texture mapping support for the HP VISUALIZE fx4, plus 16MB of Synchronous DRAM (SDRAM) to buffer texture maps. It supports all standard OpenGL texture types and operations, and can handle 2D textures up to 4096x4096 pixels in size.

The HP VISUALIZE fx4 also supports a unique virtual caching mechanism which relieves applications of the need to manage texture memory. This caching mechanism allows texture data exceeding 16MB to be offloaded to system memory. The HP VISUALIZE fx4 is therefore able to handle texture maps in excess of 16MB. The display performance of such large texture maps is sustained at high levels due to the HP VISUALIZE fx4's 66Mhz implementation of the AGP standard.

In addition to standard features, the HP VISUALIZE fx4 supports many extensions to OpenGL, including accurate specular highlights, 3D texture volumes, shadow textures, and edge and border clamp modes. All these features give outstanding accuracy and performance when handling complex texture maps. With a filtered fill rate of up to 70 million pixels per second, the HP VISUALIZE fx4 can interactively animate highly complex scenes. The texture memory can also be used as offscreen memory to accelerate applications which must save and restore portions of the frame buffer or depth buffer while manipulating objects.

## Video Display Processor (RAMDAC)

Graphics data is assimilated in the Video Display Processor, which provides features such as:

- Multiple colormap support, enabling separate color maps for Windows.
- Gamma-corrected 3D graphics.
- Overlay planes.
- Stereo synchronization signals which work with industry-standard stereo glasses and head-mounted displays to allow an independent, full-color image to be presented to each eye, resulting in true 3-dimensional images.
- An accelerated mouse cursor that doesn't lag behind even when complicated 3D graphics are being displayed.
- Intelligent synchronization of buffer swaps, eliminating unwanted "tearing" of graphics while allowing extremely high frame rates for non full-screen windows.

To improve the display quality of 8-bit colors as well as higher color depths at maximum screen resolution, the Video Display Processor supports HP Color Recovery dithering. This special image processing facility allows 8-bit dithered versions of 24-bit true color images to be displayed in over four million colors.

The HP VISUALIZE fx4 can support double buffering even at the maximum screen resolution of 1600x1200. By using 12-bit colors internally and applying HP Color Recovery dithering, the 12-bit colors are displayed with the same quality as 24-bit true colors. HP Color Recovery thereby combines 1600x1200 resolution with double buffering and true color display.

**Table 1: Supported screen formats and resolutions**

Resolution	256 color (8-bit) Double buffered	True color (24-bit) Double buffered	Stereo vision Double buffered	Refresh rates (Hz)
640 x 480	✓	✓		60, 75, 85
800 x 600	✓	✓		60, 75, 85
1024 x 768	✓	✓	✓	60, 75, 85
1280 x 1024	✓	✓	✓	60, 75, 85
1600 x 1200	✓	a		60, 75

a. Double-buffering supported with HP Color Recovery dithering.

## OpenGL Support

The HP VISUALIZE fx4 is fully compliant with the OpenGL Version 1.1 Application Programming Interface (API). Hewlett-Packard has added support for a number of OpenGL extensions to provide application programmers with maximum flexibility in accessing VISUALIZE graphical data. These extensions include:

- Visibility testing
- Enhanced alpha blend modes
- 3D volume textures
- Shadow maps
- Enhanced texture clamping modes
- Correct texture lighting.

## 2D Support

In addition to high-end 3D features, the HP VISUALIZE fx4 supports a large number of 2D features. These include line drawing, area filling, block moving, and text display, as well as offscreen memory and a host-addressable frame buffer.

## Software

The HP VISUALIZE fx4 provides an easy-to-use control panel to access all the important features, including an options tab that allows you to quickly customize the graphics subsystem for various applications. A variety of utilities demonstrating the capabilities and features of the HP VISUALIZE fx4 are also included. This software not only has the “Designed For Windows NT” logo (which is a guarantee that it passes a large number of compatibility tests), but also passes Hewlett-Packard’s own extensive internal test suite. Hewlett-Packard maintains relationships with numerous Independent Software Vendors to ensure the smooth and optimal performance of their applications with the HP VISUALIZE fx4.

**Table 2: HP VISUALIZE fx4 - Features**

<b>Video Graphics</b>	<p>World class geometry engine using dedicated floating-point processors based on PA-RISC technology</p> <p><b>18MB SGRAM video memory:</b></p> <ul style="list-style-type: none"> <li>- 24-bit true color, double buffered</li> <li>- 24-bit Z buffer</li> <li>- 8-bit overlay</li> <li>- 4-bit stencil and Windows ID</li> </ul> <p>Resolution up to 1600 x 1200 in 24-bit true color (single buffered); 1280 x 1024 in 24-bit true color (double-buffered)</p> <p><b>OpenGL hardware features:</b></p> <ul style="list-style-type: none"> <li>- Gouraud shading</li> <li>- Alpha blending for transparency</li> <li>- Anti-aliasing</li> <li>- Fog</li> </ul> <p><b>Optional hardware texture acceleration:</b></p> <ul style="list-style-type: none"> <li>- Dedicated texture mapping processor</li> <li>- 16MB SDRAM dedicated texture memory</li> <li>- Point-sampled bilinear and trilinear MIP mapping</li> <li>- 3D textures</li> <li>- Shadow textures</li> </ul> <p>HP Color Recovery dithering  HP DirectModel acceleration with occlusion culling  Stereo vision support  VGA support with PCI daughter card  Over 3.4M triangles per second (25-pixel, smooth shaded)  Over 6.3M 3D vectors per second (10-pixel, anti-aliased)</p>
<b>Available graphics drivers</b>	<p>Windows NT Workstation 4.0 (preloaded)  OpenGL 1.1 installable client driver with broad support of OpenGL extension (preloaded)  Heidi driver for Kinetix 3D studio MAX (available from Web)</p>

## For More Information

For the latest details about the HP Kayak PC Workstations, visit Hewlett-Packard's PC Workstation Web site:

**[www.hp.com/go/kayak](http://www.hp.com/go/kayak)**

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