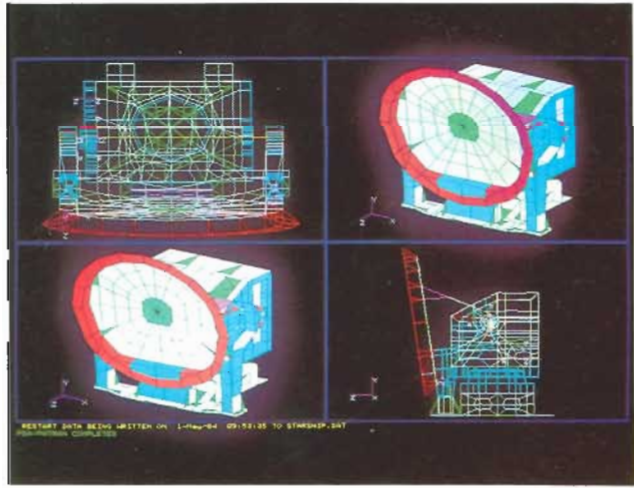


HP Series 500 Graphics Processor



A Hardware Summary*

* Data subject to change without notice.



Introduction

The HP 97060A Graphics Processor provides the high-performance, high-resolution color graphics capability needed for engineering applications such as mechanical drawing and electrical layout. Designed for the HP 9000 Series 500 32-bit computer system, it features a high-level instruction set which offers easy access to a graphics display system.

The Graphics Processor can interface to an HP 13279B Color Monitor or other compatible RS-343 monitors. By interfacing the HP Series 500 computer with the 16-bit parallel interface, vector generation speeds of up to 16M pixels per second are obtained. And with the graphics processor's built-in HP-IB interface you can communicate with the HP 9111A Graphics Tablet and improve the total performance of the HP 9000 system.

Some of the key features of the HP Series 500 Graphics Processor include:

- 256 colors from a palette of 16.7 million
- 1024 x 1024 memory resolution
- Extensive hardware instruction set including polygon-fill and local graphics input control
- Vector drawing rates of up to 1M pixels/sec; FLASH-fill at up to 16M pixels/sec
- Extensive built-in self-tests and diagnostics
- Hardware pan and integer zoom
- User selectable 33 Hz or 60 Hz refresh rate
- Supports RS-343 compatible monitors

System Architecture

The central part of the HP 97060T Graphics System is the graphics processor. It provides the high-performance, high-resolution color graphics capability and contains display memory, a color look-up table, a display memory controller, the drawing processor, and the interface to the HP Series 500 computer. (See Figure 1.)

Display Memory

The display memory consists of 8 planes each with 1024 x 1024 bits; these planes form a bit map of the displayed image. The memory planes, in conjunction with the user-programmable color look-up table, allow up to 256 colors to be displayed simultaneously from a palette of over 16 million colors. In monochrome applications, 256 shades of gray can be selected from a palette of 256.

Display Memory Controller

The display memory controller addresses the display memory and thus determines the displayed image format. It can easily be configured to display 1024 x 768 pixels at a 33 Hz refresh rate, or 736 x 552 pixels at a 60 Hz refresh rate. An integer zoom with a range of 1 to

16X is provided, as well as panning by pixel both vertically and horizontally.

Drawing Processor

The drawing processor provides the capability of drawing graphics primitives into the display memory at high speed with minimal involvement from the HP Series 500 computer's CPU. The drawing processor can draw vectors, characters, and filled polygons at the rate of 1 pixel every 220 nanoseconds. The average drawing speed is 1 million pixels per second.

Vectors can be drawn solid or with dashed patterns, and areas can be filled solid or in a variety of shading patterns. The read-mask and write-mask allow individual memory planes to be selectively filled and displayed. Hardware clipping at the memory edges prevents wraparound of displayed information.

In addition to the polygon and random area fill capability, a special FLASH-fill mode is provided. This allows rectangular regions of the screen to be filled or cleared at speeds of up to 16 million pixels per second.

Instruction Set

The HP 97060T Graphics Display System communicates with the HP Series 500 computer using a simple, byte-oriented protocol. This command structure was chosen to minimize the number of bytes which must be transferred from the HP Series 500 computer to perform time-critical tasks. Table 1 shows the display controller instruction set.

ARC, FFIL, POLF, and BLINK are among those instructions that offer significant performance enhancements. An arc or circle can be drawn at high speed through the ARC instruction. Rectangle fill, FFIL, and polygon fill, POLYF, offer fill speeds of 16 million and 1 million pixels per second, respectively. BLINK instructions use one of the bit planes to allow blinking between any two displayable colors.

PIXBLT™ is an especially powerful hardware instruction. A rectangular block of pixels, once drawn, can be oriented and translated to any place on the bit plane with the PIXBLT command. Other powerful instructions include COMPDR, which draws vectors in complement mode to facilitate rubber banding of vectors, and BLANK, which is a fast display blanking instruction.

Character Fonts

A cross-hair cursor is provided and a set of 122 characters (8 x 16 pixels) are resident in ROM for increased performance.

PIXBLT™ is a trademark of Metheus Corporation.

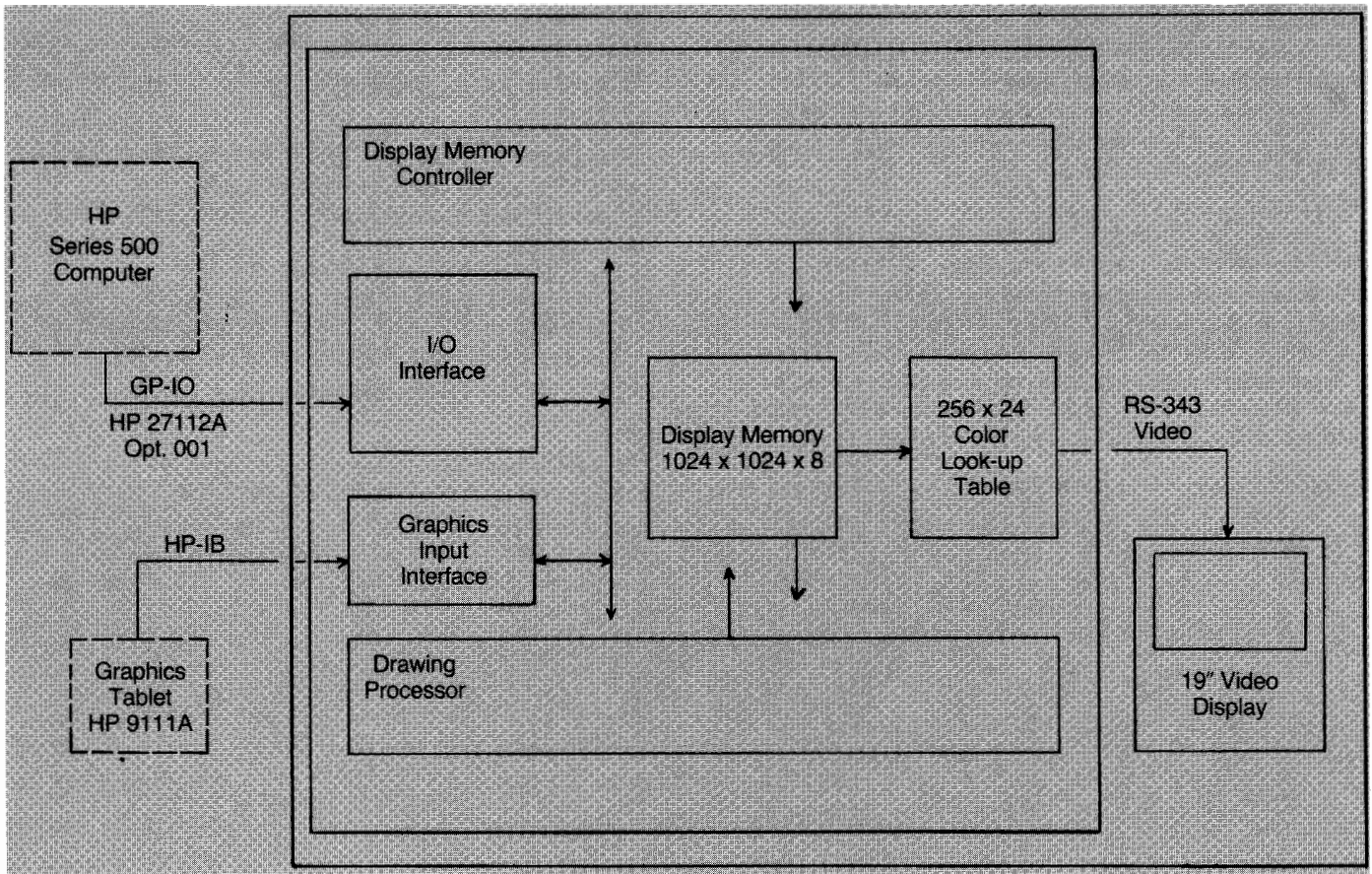


Figure 1. Graphics System Block Diagram

Table 1. Graphics Processor Instruction Set*



Initialization

INIT – reset and initialize.

Display Pointer Move

- MOVP1 x,y – move pointer 1 to x,y.
- MOVP2 x,y – move pointer 2 to x,y.
- RMOVP1 dx,dy – relative move pointer 1 to dx,dy.
- RMOVP2 dx,dy – relative move pointer 2 by dx,dy.
- POLYS – begin polygon define.
- POLYV x,y – add polygon vertex.

Drawing Commands

- DRAW – vector draw.
- COMPDR – vector draw pixel complement.
- CHAR – draw character at P1.
- ARC n – draw arc or circle using center P1 and initial point P2; arc length or circle circumference is n pixels.
- RECT1 – rectangle outline.
- RECT2 – fill rectangle defined by P1 and P2.
- FFILL – FLASH-fill of rectangle defined by P1 and P2.
- CLEAR – clear image memory (also clear or set individual planes).
- POLYO – polygon outline.
- POLYE – polygon fill.
- AFILL1 – random area “seed” fill.
- AFILL2 – random area fill – boundary specified.
- RLFILL n – runlength fill from P1.

Drawing Control Commands

- COLOR d – set drawing color.
- WRMASK d – write selected planes only.
- RDMASK d – display selected planes only.
- PATTRN d – select drawing pattern and mode.
- SETC d – select character size, rotation and mirror.

Display Control Commands

- BLANK – blank screen allows 4X drawing speed.
- Zoom d – select horizontal and vertical zoom factors.
- PPAN x,y – pan to origin at x,y.
- CMAP a,d – load color map address a with data.
- BLINK – clock most significant plane on and off

Data Transfer Commands

- GRAFIN – local cursor control by graphics tablet.
- WRR d . . . – block write rectangle defined by P1 and P2.
- RDR – block read rectangle defined by P1 and P2.
- PIXBLT w,h,f – block pixel move from P1 to P2 of rectangle of width w, height h and direction f.
- RPIXEL – read pixel at P1.
- WPIXEL – write pixel at P1.

Cursor Commands

- CURS – enable cursor display at P1.

Utility Commands

- CRCRD – read signature analyzer value.
- SYNCH – wait for vertical retrace (for animation).
- CFGRD – read configuration.

* Note that not all instructions are supported under DGL graphics library or BASIC graphics library.

I/O Interface

A 16-bit parallel interface to the HP Series 500 was chosen to allow maximum performance. An IEEE-488-1978 interface is also provided for a graphics input device to allow local cursor movement without any interaction from the HP Series 500's CPU.

Self-Test

Reliability and serviceability are the major objectives in the design of the graphics processor. All electronics, except for the I/O and power supply, are contained on a single printed circuit board, thus eliminating many mechanical connections. Diagnostic capability is provided by an on-board signature analyzer and built-in diagnostic microcode which can accurately determine whether the system is fully functional or in need of repair.

Video Output

RS-343 compatible red, green, and blue video outputs with composite video sync on the green channel are provided. See the HP 13279B 19" Color Monitor Data Sheet (HP Publication Number 5953-5862) for more information on the monitor.

Specifications

Image Memory	1024 pixels horizontal by 1024 pixels vertical
Display Memory Bits per Pixel	8
Display Resolution	1024 pixels horizontal by 768 pixels vertical at 33 Hz refresh rate (interlaced); 736 pixels horizontal by 552 pixels vertical at 60 Hz refresh rate (non-interlaced)
Pan	Pan by pixel, except horizontal pan by 16 pixels at 1X zoom
Zoom	Integer zoom from 1X to 16X
Color Map	Eight plane: 256 24-bit words allowing 256 displayable colors; 2 ²⁴ color palette
Video Timing	RS-343 compatible; 33 Hz vertical frame rate, horizontal rate 28.35 KHz, interlaced 2:1; 60 Hz vertical frame rate, horizontal rate 35.5 KHz, non-interlaced; video bandwidth 36 MHz for both modes
Video Output	BNC connectors with greater than 1 volt peak-to-peak output into 75 ohms
I/O Interface	16-bit parallel HP channel I/O interface to HP Series 500; HP-IB (IEEE-488-1978) interface for local input device
Dimensions	43.2cm x 13.3cm x 53.3cm (17" W x 5.25" H x 21" D)
Weight	13.6 Kg (30 pounds)
Power Requirements	100, 120, 220, 240 Vac \pm 10%, 47 - 63 Hz, 200 Watts
Operating Temperature	0° to 55°C
Operating Relative Humidity	5% to 95% (non-condensing)

Ordering Information

To order complete system including:

- 19" color monitor with long persistence phosphor
- 16-bit interface and cable

- Graphics processor
Order HP part number 97060T.

To order individual parts:

- 19" color monitor with long persistence phosphor
Order HP Part Number 13279B Option 065.
- 16-bit parallel interface card and cable
Order HP Part Number 27112A Option 001.
- Graphics processor
Order HP Part Number 97060A.

Purchase Plans

Contact one of the Hewlett-Packard Sales and Service offices for specific prices and plans.

Service

Hewlett-Packard maintains well-trained and well-equipped service departments at more than 170 offices worldwide to professionally handle our customers' maintenance and service requirements. Contact one of the HP Sales and Service offices for specific prices and plans on servicing your Graphics Processor.

Maintenance Services

Maintenance agreements are available for all HP computer system products to provide priority service response and a fixed, affordable annual cost regardless of the amount of service actually required. If a maintenance agreement is not required, Hewlett-Packard also offers service at a Standard Repair Charge (STREP) that allows you to know the actual cost of repair before it is made. If neither a maintenance agreement nor STREP is the best solution, HP offers service on a time-and-materials basis.

Contact one of the HP worldwide Sales and Service offices for more details on these maintenance plans.

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Hewlett-Packard will, at its option, repair or replace equipment which proves to be defective during the warranty period. This warranty includes labor, parts and surface travel costs, if any. Equipment returned to Hewlett-Packard for repair must be shipped freight prepaid. Repairs necessitated by misuse of the equipment, or by hardware, software or interfacing not provided by Hewlett-Packard are not covered by this warranty.

HP warrants that its software and firmware designated by HP for use with a CPU will execute its programming instructions when properly installed on that CPU. HP does not warrant that the operation of the CPU, software or firmware will be uninterrupted or error free.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. HEWLETT-PACKARD SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES.

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