HP 9000 Series 500 Computers Models 520, 530, 540, 550 Hardware Technical Data

HEWLETT PACKARD

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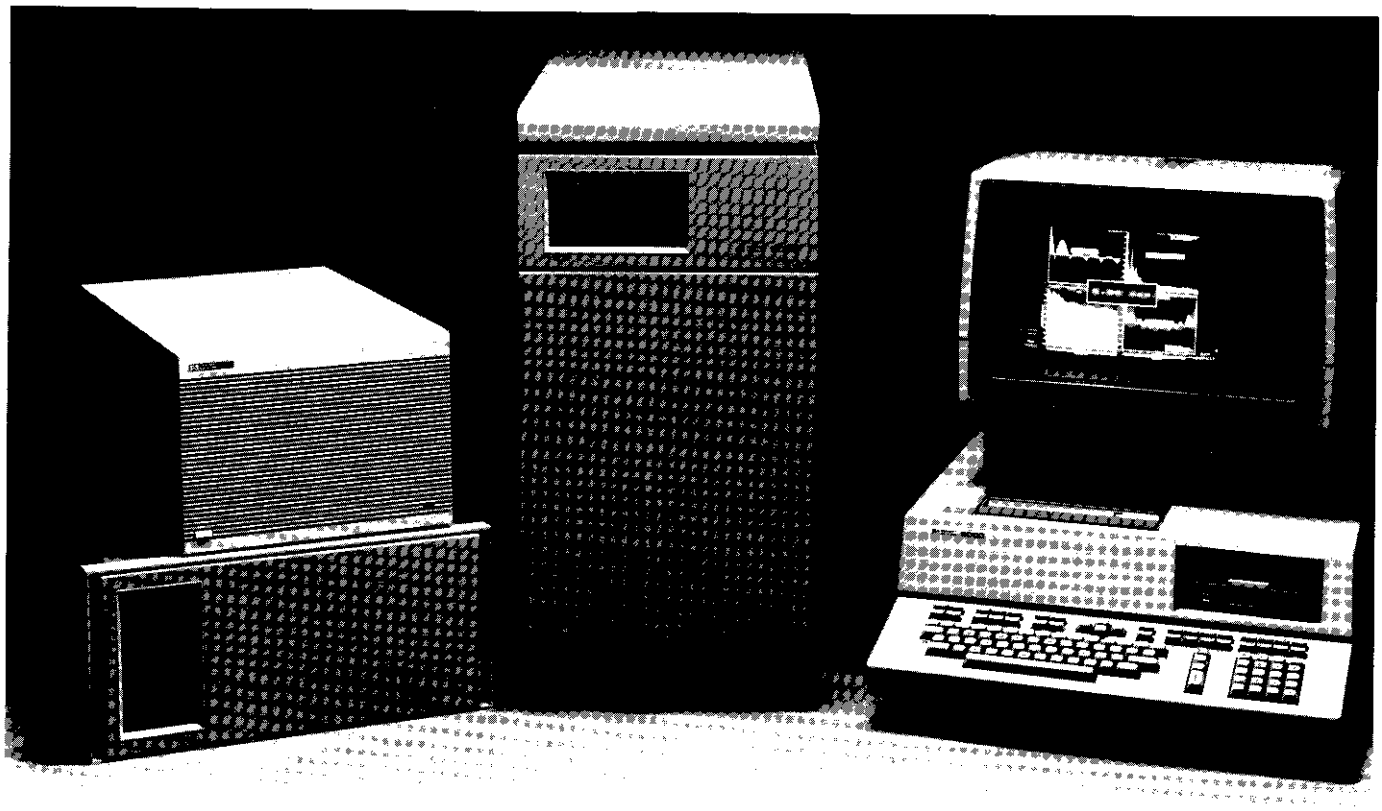

Introduction

The HP 9000 Series 500 is a family of powerful 32-bit computers for scientific and engineering applications offering a variety of configurations – from integrated or modular workstations to multi-user systems. With the Series 500, Hewlett-Packard displays a major breakthrough in microprocessor technology by packaging a complete 32-bit processor in a single integrated circuit. This technology gives the Series 500 a significant price/performance improvement over traditional computer systems and eliminates the need for a 32-bit technical computer to operate in a temperature controlled environment. The result is a viable solution for personal, 32-bit engineering computation.

The Series 500 offers tremendous flexibility in configuring systems to solve a wide range of problems. The Model 550 is a powerful multi-user system in a compact size (13 inches wide x 9 inches high x 21 inches deep) designed for ease of use. As part of the HP "Design Plus Family", its standard size is compatible with a growing set of HP peripherals and furniture. It can be stacked in a taboret, a handy cabinet on wheels that easily rolls under a desk, or it can be used stand-alone, placed in a mini-rack or on a CAD worktable. The Model 520 is an integrated workstation with keyboard, printer, mass storage and graphics display all mounted in a desktop configuration. Or you have your choice of either a rack-mountable box (Model 530) or a mini-cabinet (Model 540) that permits selection of only those peripherals you need.

The Model 520 lets you choose between a UNIX† operating system (HP-UX) or HP's BASIC Language System. The HP BASIC system is single-user only while the HP-UX system offers single- or multi-user versions. The Model 530, 540 and 550 offer only the HP-UX system.

* *Data subject to change.*

† *UNIX is a trademark of AT&T Bell Laboratories, Inc.*

System Architecture

There are four main components in the Series 500 processor: the Central Processing Unit (CPU) chip, a 128 Kbit Random Access Memory (RAM) chip, a 256 Kbit Dynamic RAM (DRAM) chip, and an I/O Processor (I/OP) chip. These four components communicate via a common Memory-Processor Bus (MPB) and are the result of an advanced photolithography process that can achieve 1.5 micron devices with 1 micron spacings. This NMOS process was designed specifically to produce the high performance integrated circuits for the Series 500.

The chip set has self-test logic which automatically tests 99% of its devices at power-up.

The CPU, I/O Processor and RAM Boards are installed in a card cage called the Memory/Processor Module (M/PM). The cards are interconnected within the Module by a 36 Mbyte/sec. Memory Processor Bus.

Central Processor Unit

The Series 500 CPU features the following:

- A 32-bit, single-chip microprocessor comprised of 450,000 transistors based on a stack architecture.
- Three floating point math chips to provide superior performance.
- A direct address range of 500 Mbytes.
- An instruction set consisting of 230 operation codes implemented in a 9 K x 38-bit ROM control store. The set provides operations for stack manipulation, code/data segmentation, shared code in memory and I/O processing.
- An 18 MHz clock rate and a 55 nsec. micro-instruction cycle time.
- In conjunction with the memory controllers, a scheme of overlapped memory cycles ("pipelining") is implemented in the hardware. The result is a memory cycle time of 110 nsec.
- Series 500 typical execution times:

Load register from memory	550 nanoseconds
64 bit floating point multiply	1.28 microseconds
32 bit integer multiply	2.92 microseconds
64 bit floating point add	1.17 microseconds

The unique architecture of the HP 9000 Series 500 family allows multiple processors to work simultaneously – each sharing the workload by taking on the next available task. You can add up to two additional CPUs to the standard Series 500 for a total of three. Adding these CPUs is simply a matter of plugging in another CPU Finstrate board (done by an HP Customer Engineer). It does not require any operating system or software changes. And you can tune your task distribution to take full advantage of multiple CPUs.

Memory

The Series 500 Random Access Memory offers the following set of features:

- Each RAM Board has a Memory Controller (MC) chip that interfaces the RAM chips to the Memory Processor Bus and performs error detection/correction.
- Each memory address contains 32 bits for data and 7 bits to store a Hamming code which gives each Memory Controller the ability to locally detect and correct all single-bit errors and detect all double-bit errors and most multi-bit errors.
- The Series 500 memory utilizes overlapped memory cycles. With current technology, all models of the Series 500 can have up to 10 Mbytes of RAM.

During power-up of the Series 500, the system tests all of its memory by reading and writing various data patterns into each memory location. During this process, if any double-bit errors occur or if too many single-bit errors are detected, a block of memory containing the defective locations is mapped out by the Memory Controller with no loss of system integrity.

In addition to its power-up memory test, the Series 500 will correct any single-bit errors that occur during subsequent memory accesses. Double-bit or multi-bit errors are also detected.

I/O Processors

The I/O Processor (I/OP) is a microprogram-controlled interface between the Series 500's Memory Processor Bus and 8 I/O interface channels. The I/OP can handle direct CPU I/O, generate CPU interrupts and conduct simultaneous, independent Direct Memory Access transactions on all 8 I/O channels.

The modular design of the I/OP permits multiple I/OPs to reside on the Memory Processor Bus and function independently. To utilize the additional I/O channels of a second or third I/OP, an HP 97098A I/O Expander must be cabled to each I/OP.

Features

- Each I/OP supports 8 channels of I/O with Direct Memory Access capability on every channel.
- Up to three I/OPs and their associated 97098A I/O Expanders are supported on Models 520, 530 and 540; up to two with the Model 550.
- Nominal I/OP bandwidth = 900 Kbytes/sec. (multi-plexed across several channels).

Specifications

Model 520

The Series 500 Model 520 is a highly integrated, 32-bit engineering computer that features a keyboard, a choice of mass storage devices (removable media), three different CRT displays and up to 10 Mbytes of RAM in a single workstation package.

System Components

Component	Base Systems			Bundled Systems	
	9020A	9020B	9020C	9020AS	9020AT
CRT	Standard Color	Monochrome (green)	High Performance Color	Standard Color	Standard Color
Keyboard	ASCII is standard, others are available				
RAM (std.)	512 Kbyte			1 Mbyte	1.5 Mbyte
RAM (opt.)	Up to 10 Mbytes in 2 Mbyte increments or up to 5 Mbytes in 512 Kbyte increments				
Mass Storage	5¼" Flexible Disc Standard, 10 Mbyte Fixed Disc Optional			5¼" Flexible Disc *and* 10 Mbyte Fixed Disc	5¼" Flexible Disc Standard, 10 Mbyte Fixed Disc Optional
Thermal Printer	Optional			Standard	
CPU Options	Single is standard, up to 2 additional CPUs are allowed				
I/O Options	Single is standard, up to 2 additional I/O Processors with I/O Expanders allowed				
System Software	BASIC (single-user is standard) HP-UX (single-user is standard, multi-user is optional)			HP BASIC	HP-UX (single-user only) with FORTRAN, C and Pascal compilers, and Graphics

Physical Specifications

Width . . . . . 21.75 in. (55.2 cm)
Depth . . . . . 29 in. (73.6 cm)
Height . . . . . 24.5 in. (62.2 cm)
Net Weight:
9020A/R . . . . . 137 lbs. (62.1 kg)
9020B/S . . . . . 121 lbs. (55 kg)
9020C/T . . . . . 163 lbs. (74 kg)
Shipping Weight:
9020A/R . . . . . 168 lbs. (76.2 kg)
9020B/S . . . . . 152 lbs. (69 kg)
9020C/T . . . . . 194 lbs. (88 kg)
Temperature:
Operating . . . . . 10° to 40°C (w/disc media)
Storage . . . . . −40° to 75°C (flexible disc media excluded)
Slew Rate* . . . . . 10°C per hour
Humidity . . . . . 20 − 80% RH non-condensing (max. wet bulb, 25.5°), machine operating
Altitude . . . . . 15,000 ft. (570 mbars barometric pressure), machine operating
Voltage Ranges . . . . . 90 − 125 Vac or 189 − 250 Vac
Line Frequency Range . . . . . 48 − 66 Hz
Current Requirements† . . . . . 12.0 A at 108 Vac
8.0 A at 198 Vac
15.0 A at 90 Vac (Japan)
Power Dissipation . . . . . 850 Watts (2900 BTU/hr.)

* *Specification refers only to 10 MByte Internal Fixed Disc.*
† *If the Model 520 includes the High-Performance Color Display, the display will draw a maximum additional 6 A at 88 Vac or 3 A at 198 Vac.*

CRT Display Specifications

	Standard Color	High-performance Monochromatic	High-performance Color
Screen size (diagonal)	12.2 in.(310mm)	12.2 in. (310mm)	13 in. (330mm)
Screen brightness	50 Hz = 27 ft.-Lamberts 60 Hz = 31 ft.-Lamberts	To 30 ft.-Lamberts	To 30 ft.-Lamberts
X-ray emission	<0.5 mR/hr.	<0.5 mR/hr.	<0.5 mR/hr.
Refresh rate	50 or 60 Hz	60 Hz	60 Hz
Maximum altitude	15,000 ft.	15,000 ft.	15,000 ft.
Screen capacity	26 lines x 80 characters	26 lines x 80 characters	26 lines x 80 characters
Dot spacing	.017 in. (.428mm)	.013 in. (.328mm)	.013 in. (.343mm)
Character matrix	7 x 9 character in a 9 x 12 cell	7 x 9 character font in a 9 x 12 cell	7 x 9 character font in a 9 x 12 cell
Graphics			
No. of colors	16 displayed from 4,096	Monochrome	8 pure, 4,913
Raster size	8.5 in. x 6.4 in. (216 x 162.5mm)	7.24 in. x 5.86 in. (184 x 149mm)	7.55 in. x 6.14 in. (192 x 156mm)
Array size	512 x 390 dots	560 x 455 dots	560 x 455 dots
Dot resolution	.017 in. (.42mm)	.013 in. (.33mm)	.013 in. (.34mm)
Linearity	<3.0% full screen	1.5% full screen	<2% full screen
Cursor			
Plotting mode	Full screen or small crosshair	Full screen, small crosshair or blinking underline	Full screen or small crosshair
Letter mode	None	Blinking underline	Blinking underline
Character editing	Overstrike	Overstrike	Overstrike
Light Pen			
Min. intensity for pick of single pixel	N/A	10 ft.-Lamberts (white, blue, or green)	10 ft.-Lamberts (white, blue, or green)
Convergence	0.7mm, user adjustable	0.7mm, user adjustable	0.7mm, user adjustable

Internal Thermal Graphics Printer Specifications

The Series 500 Model 520 internal printer offers the following features:

- True overprinting.
- Printing enhancements such as inverse (white characters on black), underline, overline and 150% tall in any combination.
- Capability to dump graphics from CRT (pixel-by-pixel). BASIC only.
- Seven user-definable characters.
- Standard character sets are: US ASCII and Line Drawing, HP Roman Extension or Katakana.
- Programmable vertical pitch, lines per page and top/bottom margin.

Line width . . . . . 80 columns
Print speed . . . . . Up to 450 lines/min.
Character sets . . . . . Roman Extension or Katakana
Graphics resolution . . . . . 560 dots/line, 77 dots/in. (vert. and horiz.)
Plot speed:
Nominal plot . . . . . .49 in./sec. (12.5mm/sec.)
Plot all pixels on . . . . . .15 in./sec. (3.8mm/sec.)
Character matrix . . . . . 5 x 7 dots (7 x 12 field)
Paper dimensions . . . . . 8.27 in. x 197 ft. (210mm x 60m)
8.5 in. x 200 ft. (216mm x 61m)
Paper types . . . . . Black or blue print, perforated, fan fold, 330 sheets per pkg.

Note: *The Series 500 Model 520 printer is designed to print approximately 50,000 ft. of paper prior to print head replacement. The actual print head life will vary, however, with usage. If you expect to do a lot of printing, we recommend that you consider purchasing a heavy duty printer such as one of the HP impact printers.*

Internal Flexible Disc Specifications

Capacity . . . . . 270,336 bytes user available (formatted), less file directory allocation
Media . . . . . 5.25 in. (133mm) double-sided/double density disc
Average media life . . . . . More than 2.5 million revolutions (140 hrs. rotating)‡, stops when not accessed
Tracks per disc . . . . . 70 total, 35 per side, 66 user available
Sectors per track 16
Bytes per sector 256
Average access time . . . . . 300 msec.
Max. access time . . . . . 425 msec. (assumes no data errors)
Average throughput . . . . . 16 Kbytes/sec. (interleave factor of 1)

‡ *The internal disc drive is intended for program and data storage with a duty cycle of less than 25%. Greater duty cycles may reduce media life.*

Internal Fixed Disc Specifications

Capacity . . . . . 9.896 Mbytes (formatted), less directory file allocations
No. of platters 2
No. of tracks . . . . . 1224 (306 cylinders x 4 heads); 1208 user available
Sectors per track 32
Bytes per sector 256
Average access time . . . . . 85 msec.
Max. access time . . . . . 205 msec. (assumes no errors detected)
Average throughput . . . . . 115 Kbytes/sec. (interleave factor of 4)

Model 520 Keyboard Options

The following keyboards and character sets are available for the Series 500:

ASCII (standard)	Spanish	Katakana
French	German	Swedish/Finnish

Real Time Clock

The Series 500 Real Time Clock offers the following set of features:

- Accuracy to within 45 ppm over the range 0°C – 45°C. Note: 45 ppm is approximately 2 min./month.
- A "keep alive" time of 30 days (nominal) and 10 days (worst case).
- Provides date and time of day.

Models 530, 540 and 550

The Models 530 and 540 use the same Memory Processor Module as the Model 520 but they are packaged in either an HP System II rack-mount enclosure or in a stand-alone mini-cabinet. The Model 550 is housed in a small package, 325 mm wide. Modular packaging is useful for workstations and multi-user applications that have specific peripheral requirements.

System Components

	Base Systems 9030A | 9040A | 9050A	Bundled Systems 9040AT	9040AM	9050AT	9050AM
RAM (Std.)	512 Kbyte	1.5 Mbyte			
RAM (Opt.)	Up to 10 Mbytes in 2 Mbyte increments or up to 5 Mbytes in 512 Kbyte increments				
Service/ Diagnostic Panel	Standard				
CPU Options	Single is standard; up to two additional CPUs are allowed.				
I/O Options	Models 9030/9040 – Up to two additional I/O Processors (IOP) allowed. Model 9050 – Up to one additional I/O Processor. Each IOP adds eight DMA-capable I/O slots.				
System Software	Optional (HP-UX)	HP-UX plus additional software options and compilers (single-user)	HP-UX plus additional software options and compilers (multi-user)	HP-UX plus additional software options and compilers (single-user)	HP-UX plus additional software options and compilers (multi-user)

Physical Specifications

	Model 9030 System II Enclosure*	Model 9040A Stand-alone Mini-cabinet	Model 9050 Standard 325 mm Width
Width	17 in. (43.2 cm)†	14 in. (35.6 cm)	12.8 in. (32.5 cm)
Depth	23.0 in. (58.4 cm)	28.0 in. (71.1 cm)	20.9 in. (53.0 cm)
Height	8.75 in. (22.2 cm)	28.0 in. (71.1 cm)	9.2 in. (23.4 cm)
Shipping weight (typical)	65 lbs. (29.4 kg.)	141 lbs. (51.6 kg.)	40 – 60 lbs. (18 – 27 kg.)

* *Industry standard EIA mounting.*

† *Add 2 in. (7.6 cm) for rack-mount "ears".*

Temperature
Operating . . . . . 0° to 55°C
Storage . . . . . –40° to 75°C
Humidity . . . . . 95% RH at 40°C, machine operating
Altitude . . . . . 15,000 ft. (570 mbars barometric pressure), machine operating

Frequency range . . . . . 48 – 66 Hz
Vibration (peak-to-peak amplitude deflection) . . . . . .125 in. at 5 to 10 Hz
.060 in. at 10 to 25 Hz
.015 in. at 25 to 55 Hz

	Model 9040/9030	Model 9050
Current requirements/ Voltage ranges	90 – 125 Vac, 11A 198 – 250 Vac, 5.5A	90 – 108 Vac, 9A 108 – 125 Vac, 7.6A 198 – 250 Vac, 4.3A
Maximum power dissipation	650 Watts (2200 Btu/hr.)	580 Watts (220 Btu/hr.)

Series 500 I/O

The Series 500 I/OP communicates to external devices through a specially designed I/O channel and interface cards. This combination of I/O Processors, I/O channel and interface cards conforms to the HP channel I/O (HP-CIO) standard.

These interface cards can receive and transmit data in multiple-word "bursts." The I/OP also communicates with the Series 500 CPU in this fashion. These "bursts" permit communication overhead to be spread over a number of data words thereby increasing the capacity of the system to handle half-word or byte-oriented I/O transactions.

HP-IB (HP 27110A)

The HP-IB Interface Card for the Series 500 allows connection of up to 14 HP-IB compatible devices. These devices include flexible and hard discs, printers, plotters, magnetic tape drives, tablets and an extensive list of instruments.

Features

- IEEE-488-1978 compatible.
- Supports DMA with two modes of performance: High Speed Mode for operation with fixed discs or other high speed peripherals and Medium Speed for instruments and slower peripherals.
- Supports up to 7 high-speed devices or 14 standard-speed devices.
- Selectable HP-IB controller or slave capabilities and parallel poll capabilities.
- Built-in hardware self-test.

Operation

Eight bidirectional data bus lines carry coded messages in bit-parallel, byte-serial form to/from other devices on the bus with each byte transferred from one "talker" to one or more "listeners." Data is exchanged asynchronously using interface messages to set up, maintain and terminate an orderly flow of device-dependent messages. Three data transfer control lines control the transfer of each byte of coded data on the eight lines. Five general interface management lines ensure the orderly flow of information.

Supported HP-IB functions as detailed in IEEE Standard 488-1978 are: C1-C5, SR1, RL1, PP1, DC1, DT1, SH1, AH1, T5, TE5, L3, LE3.

Cable Specifications

Maximum cable length for Standard Mode operation is 2m (6.5 ft.) per device connected, with a 20m (65 ft.) total length. The maximum number of devices is accommodated by interconnections using shorter-than-maximum cable length.

Maximum cable length for High Speed operations is 1m (3.2 ft.) per device connected with a 15m (48.8 ft.) total length.

Internal HP-IB (Model 550)

The Series 500 Model 550 features a built-in, standard speed HP-IB interface. It is recommended for general purpose HP-IB applications at transfer rates of 300 Kbytes/sec. Although it can be used to control the root disc, it is not recommended because of loss of performance. The feature set supported is IEEE-1978 compatible.

General Purpose I/O (HP 27112A)

The 27112A General Purpose I/O Interface is designed to provide multi-purpose 8- or 16-bit parallel communication with Direct Memory Access between external devices and the Series 500 using the standard architecture.

Features

- Choice of programmable operating modes (clocked or transparent) for ease of use with instrumentation.
- Supports +5V on all input and output signals, plus an optional +12V level on output signals.
- Programmed data detection for either positive true or ground true levels.
- Independent 16-bit input and output lines and storage registers.
- Two control and two status lines.

Operation

The GP-IO Interface supports either 8- or 16-bit transfers without byte packing on the 8-bit transfers. All data is latched in a 16-bit input or output data register.

This interface supports two modes of operation: Clocked and Transparent. With the Clocked mode, data may be latched externally with a rising or falling clock pulse, or internally with a Series 500 BASIC READ command. The Transparent mode is useful for communicating with one or several asynchronous external devices. While in this mode, all data is read and sent programmatically and independent of hardware handshakes.

In addition, all input, output, status and control lines can be configured independently to detect a true condition on a high or low voltage level. Included in this set of signals are two control and two status lines which are latched and available to the user for unique communication requirements.

Line Characteristics

PDIR		Peripheral Data
DIN	(0 – 15)	Data Input
DOUT	(0 – 15)	Data Output
STS	(0 – 1)	Status Input
CTL	(0 – 1)	Control Output
PFLAG		Peripheral Flag
PCNTL		Peripheral Control
PEND		Peripheral End
PRESET		Peripheral Reset

Asynchronous Serial (HP 27128A)

The 27128A is a single-channel, asynchronous serial interface suitable for interfacing to RS-232C peripherals and terminal emulation. An on-board microprocessor and buffering offer a wide range of protocol, timing and editing features to simplify application programming and reduce central processing overhead.

Features

- Switch selectable and software programmable baud rate; up to 19200 bits per second.
- EIA RS-232C, CCITT V.24, and CCITT V.28 compatibility.
- Asynchronous transmission in simplex, full duplex and echoplex mode. Note: modem support for full duplex and echoplex.

- Programmable format control and built-in framing error, overrun error and parity checking.
- Break detection, support for X-ON/X-OFF and terminal emulation mode.

Operation

The serial interface permits the following baud rates to be configured by program control or by a switch that selects the rate to be configured at power-up: 50, 75, 110, 134.5, 150, 300, 600, 900, 1200, 1800, 2400, 3600, 4800, 7200, 9600, 19200.

Note: *Not all data recognition features are supported for continuous data transfer at 19200 baud.*

The following formats and protocols are also programmable:

- Parity: none, odd, even, "0" or "1".
- Number of bits per character: 5, 6, 7, or 8 plus parity.
- Number of stop bits: 1, 1.5, or 2.
- Handshaking: ENQ/ACK and X-ON/X-OFF

The on-board microprocessor and buffering of the 27128A offer efficient, high-performance terminal handling. The 27128A card has enough buffer space to store up to 485 characters on input and 500 on output. The on-board processor allows the user to edit the buffer with delete character and delete line commands. These features significantly reduce the time spent by the CPU to handle data entry from terminals.

In addition, the 27128A offers numerous features for satisfying more specialized data communication and serial interfacing requirements. The features listed below are currently accessible to user programs through the Series 500 BASIC Language System only. Many of these features are also accessible through HP-UX's Asynchronous Communication software and BASIC's Asynchronous Terminal Emulator. These two packages are designed to help develop readily configured, asynchronous data communication solutions.

The 27128A offers four alternatives for signaling the Series 500 when an incoming record is complete and ready for processing.

- User-specifed single text terminators. The user can specify up to eight characters and, with the quoting mode, specify a terminator which should be inserted in the text buffer without terminating the record.
- A user-specifed double text terminator.
- Activation of an interrupt mode which will signal the Series 500 when new data is available.
- Expiration of a character counter.

Additional character recognition capabilities allow the following features:

- automatic and conditional appendage of separators on transmitted text,
- programmable prompt sequence detection and
- signal character checking.

The 27128A can ease real-time programming requirements with the following:

- break detection and generation,
- a no-activity and lost receiver disconnect timer, and a host ENQ/ACK timer.

Asynchronous 8-Channel Multiplex (HP 27130A)

The 27130A Asynchronous Multiplexer is an economical solution for interfacing up to eight RS-232C or RS-423A compatible devices to the Series 500 with a single hardware interface. The 27130A can easily be configured to support a wide range of terminals, printers and other asynchronous devices.

Features

- CCITT V.10/28, EIA RS-232C compatible.
- Supports simplex, echoplex or full-duplex mode (asynchronous transmission only).
- Selection of data transmission attributes can be performed independently on each channel.
- Local intelligence reduces time consumed by the CPU during I/O transactions by offering edit functions, special character recognition and handshake protocol control.
- Parity, overrun and framing errors are sensed locally to detect transmission errors.
- X-ON/X-OFF (both directions) and ENQ/ACK (one direction, host sending ENQ) handshaking.

Operation

Programmable attributes:

Baud rates	110, 134.5, 150, 300, 600, 1200, 2400, 4800, 9600 or 19200
Parity	Odd, even or none
Stop bits	1 or 2
Character size	5, 6, 7 or 8 bits
Handshakes	ENQ/ACK and X-ON/X-OFF

Note: *Not all data recognition features are supported for continuous data transfer at 19200 baud.*

The 27130A uses microprogrammed capabilities to offer efficient, high performance device handling. The interface buffers each channel with two 512 byte memories for transmission and receiving. The intelligence of the interface permits users to edit these memories and use character recognition to insert or strip characters, which results in a streamlined peripheral interface.

I/O Expander (HP 97098A)

The HP 97098A I/O Expander is an external card cage supported by the Series 500. It provides user access to the second and third I/O Processors for additional I/O interface card capacity. With the 97098A, you can access an additional eight channels with Direct Memory Access capability on each channel. Thus, two 97098A I/O Expanders will increase the capacity to 20 user-available I/O slots on the Model 520, and 23 on the Models 530 and 540, and 15 on Model 550 (with one additional 97098A).

Specifications

No. of I/O slots	8
Line requirements	90 – 132 Vac, 2.5 A max. or 198 – 250 Vac, 2.5 A max.
Max. power dissipation	180 watts
Input frequency	47 – 66 Hz
Dimensions:	
Height	7.4 in. (18.7 cm)
Width	16.75 in. (42.5 cm)
Length	19.85 in. (50.4 cm)
Cable length	6 ft. (1.82m)

Note: *There must be an additional I/OP for each Expander. Limit = 2 I/OPs.*

LAN 9000 Local Area Network (HP 2285A)

LAN 9000 is a bundled software and hardware product that provides high performance local area networking of HP 9000 Series 500 computers running the HP-UX Operating System. Its implementation is Ethernet* Version 1.0 and it is essentially transparent to its users. In addition to its multi-user, multi-service and multi-connection capabilities, it provides:

Remote File Access – access to directories, data files, special files and peripherals across the network.

Network File Transfer – transfer of files within the network.

Remote Process Management – starting or stopping processes on systems throughout the network.

Interprocess Communication – communication between simultaneously running processes. LAN 9000 can link processes local to one machine or remotely across the network while maintaining the same user interface.

** Ethernet is a registered trademark of Xerox Corporation.*

Features

- Coax cable with baseband signalling.
- 10 Mbps data signalling rate.
- Minimum separation between nodes is 2.5m.
- Nodes can be up to 50m from the coax cable.
- Masterless protocol, Carrier-Sense Multiple Access with Collision Detection (CSMA/CD).
- Up to 500m segment coax length and up to 100 nodes per segment.
- Supports broadcast and multicast addressing.
- User-executable diagnostics which can be run simultaneously with other network services.

Operation

LAN 9000 consists of a self-contained Ethernet Interfacing Unit (LAN Unit), a transceiver branch cable, a transceiver, LAN 9000 software and a dedicated HP-IB interface cable (HP 27110A). LAN 9000 is microprocessor based and is downloaded with link protocol software over the HP-IB interface from the host CPU (see Figure 1 for the physical configuration).

When addressed by another node on the network, the HP 2285A LAN Unit receives packets and checks the accuracy of data before passing the packet on to the host CPU. For transmission of packets, the host transfers the packet to the LAN Unit over the HP-IB cable and the LAN Unit in turn transmits the packet onto the network according to the Network Access Protocol.

To increase the length of the transceiver branch, up to two additional 15-metre cables can be ordered (HP Part No. 1150-1629).

The Ethernet cable installed must meet Ethernet Version 1.0, Sept. 30, 1980, Section 7.3 specifications. HP Computer Supplies Operation has two cables available: Ethernet Cable (92179E) and Non-Conduit Ethernet Cable (92179F). The 92179F is made with a Teflon† outer jacket and Teflon dielectric. This cable can be installed in air plenums. The 97179E cable must be installed in cable trays or conduit.

† Teflon is a trademark of DuPont.

Specifications

Transmission mode	Baseband digital
Impedance	50 Ohm
Electrical specifications	3 A, 50 Watts (115 Vac, 50 Hz) 1.5 A, 50 Watts (230 Vac, 60 Hz)
Dimensions	LAN Unit: 13.2cm (5.2 in.) high 43.2cm (17.0 in.) wide 35.6cm (14.0 in.) deep Transceiver: 3.5cm (1.4 in.) high 10.5cm (4.1 in.) wide 13.0cm (5.1 in.) deep
Weights	LAN Unit: 9.5 kg (21 lbs.) Transceiver: .83 kg (1.8 lbs.) Branch Cable: 1.9 kg (4.3 lbs.) HP-IB Interface: 234 grams (8.2 oz.) HP-IB Cable: 445 grams (15.6 oz.)
Environmental requirements	Temperature: 0° – 40°C (operating) –20° – 65°C (storage) Humidity: 5% – 80% (operating) 5% – 90% (storage) Altitude: 4,545m (15,000 ft.) operating 7,575m (25,000 ft.) storage

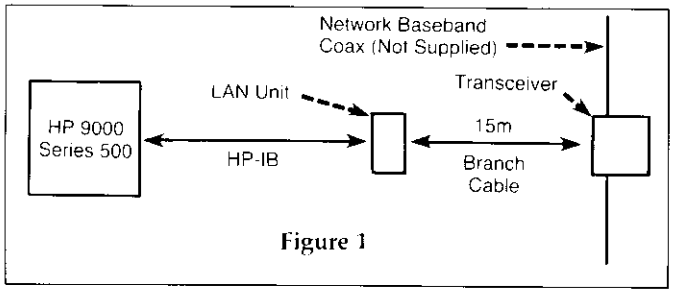

Figure 1

Local Area Network Installation Kit (HP 28656A)

This kit provides the connectors and tools needed to install the Ethernet standard coax cable and to connect the transceivers used in the LAN 9000 product. It is recommended that the installation kit be supplied for every network and not for every 2285A ordered.

The kit includes:

- Special Ethernet Cable Stripper (8710-1508)
- Precision engineered N-Type Connector Crimp Tool (8710-1507) that prevents over- and under-crimping
- F-F and M-M N-Type Adaptors (1250-0777, 78)
- 50 Ohm Terminator (1150-1627)
- M Crimp on N-Type Connector (1250-1627)
- Insulated N-Type Adaptor (5061-4932)
- Boot insulators (1150-1623)
- Cable Installation Manual (2285-90002)

A special Option 001 deletes the Ethernet cable stripper and the N-Type Crimp Tool. This option is recommended when there is more than one installed network per site.

RJE Interface (HP 27122A)

The RJE interface, used in conjunction with the RJE software (97077A or 97087A) under HP-UX, allows the HP 9000 Series 500 to emulate an IBM 2780 or 3780 workstation. It permits the Series 500 to be used as a Remote Job Entry station for batched job communication with IBM 360/370 (or other compatible) computers using the IBM Bisync protocol.

The RJE interface features a plug-in card incorporating microprocessor intelligence that offloads all communications overhead from the host. This means the interface card performs all protocol generation and interpretation, as well as modem control tasks and pre-processing functions such as character conversion, blocking and deblocking.

The specific needs of many different RJE applications are met by selecting programmable configuration parameters.

Full trace log, communications status and statistics, as well as hardware self-test, are provided to facilitate complete monitoring and check-out of the interface.

Features

- 1200 to 19200 baud rates
- Compatible with EIA RS-232C and CCITT V.24 specifications
- Supports Bell type 208B, 2096 and 212 data sets or equivalent
- Supports Seimens MSV2 protocol
- Works with full or half duplex modems and supports AUTO ANSWER and ORIGINATE
- Provides link control functions: line bid, normal and transparent data modes, all responses, and link termination
- Assures data integrity with CRC error checking
- EBCDIC character recognition
- Space compression/truncation

Operation

The RJE interface works with modems (or modem eliminators) over switched or non-switched lines. The maximum data rate supported by the interface is 19.2 Kbps but it also operates at slower rates to accommodate different modems.

Link control is managed entirely by the on-card microprocessor. All functions and responses (ACK/NAK/WACK/TTD/RVI) are implemented by the card upon request by software from the Series 500.

Card parameters and special character handling may be configured from the HP 9000 Series 500 or allowed to retain their default values. Configurable parameters include: record and block sizes, timeouts, retry counts, conversion tables, record separators and formatting functions. Special character handling includes: character code translation, automatic record terminations, adding and stripping, record and block separator sequences, blank truncating and padding, and repeated character compression and expansion.

To assist in line quality and link troubleshooting, the RJE interface card accumulates communication statistics. A continuous trace log can collect all sent-or-received link control characters and independently collect all sent-or-received data characters. You can review the link control character trace log without having access to the data character trace log, thus permitting link trouble shooting without violating data security. A trace log also collects all internal firmware state changes.

The RJE interface does not recognize horizontal tabulation and vertical forms control codes. This capability must be host-resident.

Specifications

Max. current requirements	+5V = 1.62 Amps +12V = .087 Amps −12V = .108 Amps
Dimensions	172.7mm (6.8 in.) long 172.0mm (7.75 in.) wide
Weight	Interface Card: 235 grams (8.3 oz.) Modem Cable: 560 grams (19.7 oz.)
Environmental requirements	Operating temperature: 0° − 55°C Operating humidity: 5% − 95% RH @ 40°C Operating altitude: 4600 metres (15,000 ft.)

Shared Resource Manager Interface (HP 27123)

The HP 27123 Shared Resource Management (SRM) Interface allows an HP 9000 Series 500 HP-UX system or BASIC Language System to interconnect to an HP SRM system.

The SRM system consists of a dedicated Series 200 controller that manages shared peripherals and a hierarchical file system on a shared disc connected to it. BASIC, Pascal, and HP-UX workstations are linked to the SRM controller via SRM cables and multiplexers. The benefits of an SRM system are cost savings by sharing peripheral devices and the convenience of being able to access common information on a shared disc from multiple workstations.

HP 9000 Series 500 BASIC Language systems can perform the same mass storage operations to the SRM disc that are available with a local disc, except for system boot. HP-UX systems can copy files from the local HP-UX disc to the SRM disc and vice versa.

- Cable Specifications
- The HP 272123A Interface is connected to the SRM system by any of the following SRM cables:

- 97061A − 10 Metres
- 97061B − 25 Metres
- 97061C − 60 Metres
- 97061D − 60 Metres (unterminated on one end to facilitate pulling cable thru cable trays.)

Refer to the HP 9000 Data Communications Technical Supplement (Publication Number 5953-4692) for detailed configuration and ordering information concerning the SRM system.

HP 97060A Graphics Processor

The 97060A Graphics Processor is an intelligent external graphics processor implemented with LSI/VLSI bipolar and MOS technology. Its bit-slice processor features a high-level instruction set which offers full access to a 1024 x 768 x 8 graphics display system. Fast vector generation speeds are obtained by interfacing the HP 9000 with the 27112A's 16-bit parallel, direct memory access interface. The 97060A's drawing processor can perform area shading at speeds approaching 16M pixels per second.

The 97060A can interface the HP 13279B Color Monitor or any other RS-343 compatible color monitor which can support the 97060A's horizontal scan rate. Included in the 97060A is a built-in HP-IB Interface which can communicate with the 9111A Graphics Tablet. While using the Graphics/9000 DGL/AGP libraries, this connection permits the 97060A to offload the HP 9000 of cursor tracking responsibilities and improve the interaction of the HP 9000 system.

Specifications

Dimensions	172.7mm (6.8 in.) long 172.0mm 6.75 in.) wide
Weight	Interface Card: 235 grams (8.3 oz.)
Environmental requirements	Temperature: 0° – 55°C (operating) Humidity: 5% – 95% RH @ 40°C (operating) Altitude: 4,572m (15,000 ft.) operating
Resolution	1024 x 768 x 8 (33 Hz refresh) or 735 x 550 x 8 (60 Hz non-interlaced)
Colors	256 displayed from 2^{24}
Horizontal scan rate	28.3 KHz at 33 Hz vertical 35.4 KHz at 60 Hz vertical
Cables	3 meter, 75 ohm cables with BNC termination
Power	200 Watts nominal
Line	90 – 125V or 198 – 250V at 48 – 66 Hz
Max. current	3A (nominal) 4A (in-rush)
Dimensions	17" x 5¼" x 21"

Color Video Interface (HP 97062A)

The 97062A is a lower-cost, medium-resolution interface to a color graphics monitor. The Interface consists of two printed circuit boards which plug into the Series 500's I/O backplane and produce RS-343-compatible signals across three coaxial cables. It has four planes of memory to implement a 16 element color map and utilizes gate-array technology to perform vector generation. It supports all Graphics/9000 plotter commands including area shading. If a terminal interface to the host computer is desired, a display terminal is necessary.

Resolution	576 x 455 x 4 (60 Hz, non-interlaced)
Colors	16 displayed from 4,096
Horizontal scan rate	29.4 KHz
Cables	Includes three 75 Ohm, 2m cables with BNC termination (red, green/sync, blue)

HP 13279B 19" Color Monitor

The HP 13279B is a high-quality 19-inch color display monitor designed for video output of computer generated information. The product, utilizing raster scan display technology, finds numerous applications in CAD/CAM, general graphics display, process control and computer imaging.

Features

- Precision In-Line (PIL) CRT technology
- Selectable Horizontal Scan Frequency
- High Density Shadow Mask CRT
- Preset Calibration Control

Specifications

Visual performance:	
Resolution	1080 Horiz. x 809 Vert. pixels
Pitch	0.012 in. (0.31 mm)
Brightness	P22 Phosphor – 9.37 fl. (nom.) A22 Phosphor – 13.07 fl. (nom.)
Phosphor	P22 Short persistance A22 Long persistance
Circuit performance:	
Video bandwidth	100 Hz to 40 Mhz @ –3 dB
Pulse response	Rise time: 8.5 nanoseconds Fall time: 13 nanoseconds
Scan rate	15–37 KHz interlaced or non-interlaced with three 8 KHz wide, jumper-selectable scam ranges
Environmental requirements:	
Temperature	32°C to 122°F (50°C)
Humidity	10% to 90% relative, non-condensing
Altitude	Up to 10,000 feet (3000 meters)
Power requirements:	
Voltage	100, 117, 200, 234 Vac ± 10%
Frequency	50–60 Hz, ± 10%
Consumption	155 watts nom., 170 watts max, at 117 Vac
Physical specifications:	
Dimensions	15.7 in. height x 18.97 in. width x 23.56 in. depth
Weight	81.00 lb. (36.74 Kg)

System Software

The Series 500 can be configured with the HP BASIC System or with HP-UX, a UNIX system that has been specially enhanced for the engineering environment. The HP BASIC System can only be ordered for the Model 520 Integrated Workstation version. HP-UX can be ordered on all models. Both systems require a mass storage device from which the operating system can be loaded into memory as part of the power-up procedure.

HP BASIC Language System

The HP BASIC System provides the BASIC Language and Operating System (single-user) which allows access to the following BASIC software:

Description	HP Prod. No.
BASIC 2D-3D Graphics	97052B
IMAGE/QUERY-9000 DBMS	97053B
BASIC Asynchronous Terminal Emulator	97056A
Shared Resource Management Software	97058A

For more information on the Series 500 BASIC System consult the Series 500 BASIC Language System Technical Supplement (HP Publication No. 5953-4691).

HP-UX Operating System

The HP-UX System offers both single- and multi-user capabilities. The "C" language is standard.

Model 520	HP Prod. No.	Models 530, 540, 550	HP Prod. No.
Single-user HP-UX	97070B	Single-user HP-UX	97079B
Multi-user HP-UX (to 16-user)	97080B	Multi-user HP-UX (to 16-user)	97089B
Multi-user HP-UX (to 32-user)	97078B	Multi-user HP-UX (to 32-user)	97088B

The HP-UX System provides access to the following software:

	HP Product No.	
	Single-user	Multi-user
FORTRAN 77 Compiler	97071A	97081A
HP Pascal Compiler	97072A	97082A
IMAGE-9000 DBMS	97073A	97083A
HP-UX Graphics (AGP)	97075A	97085A
RJE Communications Software	97077A	97087A
Local Area Network	2285A	
Applications Migration Package	97086A	

For more information on the HP-UX System, consult the HP 9000 HP-UX Technical Supplement (HP Publication No. 5953-9509).

All Series 500 HP-UX software is available only on the 88140L/S ¼" Tape. The HP BASIC software is available only on 5¼" Flexible Disc.

Accessories and Support

Documentation

Part No.	Manual Title
5957-7925	Software Status Bulletin
0900-90007	HP-UX Reference
09020-90011	Installation and Test (Model 520)
09040-90010	Installation and Test (Models 530 & 540)
09050-90010	Installation and Configuration (Model 550)
09050-90040	Series 200/500 Site Preparation Manual
92836-90005	Structured FORTRAN 77 Programming with HP Computers
97050-80020	HP BASIC Manual Package (includes the following five HP BASIC manuals):
97050-90000	BASIC Programming Techniques (Model 520)
97050-90005	BASIC Language Reference (Model 520)
97050-90015	BASIC Condensed Reference
97050-90090	BASIC – Where Do I Start? (Brochure)
97052-90000	BASIC Graphics Programming Techniques (Model 520)
97053-90000	IMAGE-9000 Programming Techniques
97053-90001	QUERY User's Guide
97053-90002	Data Base Design Kit
97056-90000	HP BASIC Asynchronous Terminal Emulator User's Manual
97058-90000	SRM Supplement for HP 9000
97059-90000	LAN Local Area Network User's Guide
97059-90001	LAN Node Manager's Guide
97070-87901	HP-UX Manual Package (includes all HP-UX and C manuals for Series 500)
97070-90090	HP-UX 9000 Series 500 4.0
97076-90001	HP-UX Asynchronous Communications Guide
97077-90000	RJE User's Guide
97080-90092	Series 500 HP-UX Unpacking Instructions
97081-90001	FORTRAN/9000 Reference (Series 500 only)
97082-90001	Pascal/9000 Reference (Series 500 only)
97082-90002	Programming in Pascal with Hewlett-Packard Pascal
97084-90000	GRAPHICS/9000 DGL Programmer's Reference Library
97084-90001	HP-UX Supplement for above
97084-90002	Instruction DGL/AGP Demo
97084-90025	GRAPHICS/9000 Device Handler's Manual
97085-90000	Advanced Graphics Package (AGP) User's Guide
97085-90001	Supplement for HP-UX systems
97085-90005	AGP Reference Manual
97089-90000	The C Programming Language by Kernighan & Ritchie
97089-90002	HP-UX Selected Articles
97089-90004	HP-UX Concepts and Tutorials
97089-90048	HP-UX System Administrator's Manual
97098-90020	I/O Expander Installation and Service
98183-90000	HPSPICE User's Guide
98183-90005	HPSPICE Reference
98680-90021	FORTRAN Comparison Notes for the Series 200/500
98680-90025	Introducing the UNIX System

Documentation *(cont'd.)*

Part No.	Manual Title
27110-90001	HP 27110 HP-IB Installation Manual
27112-90001	HP 27112A GP-IO Interface Installation
27122-90001	27122A RJE Interface Installation Manual
27123-90001	27123A SRM Interface Installation Manual
27132A	MP-CIO Technical Reference Package
27128-90001	HP 27128A ASI Installation Manual
27130-90001	HP 27130A 8-channel Multiplex Interface Installation Manual
27132-90001	HP 27132A Reference Manual
27132-90003	27112A GP-IO Installation Manual
27132-90004	27122A RJE Interface Firmware Reference
27132-90006	27128A ASI Technical Reference Manual
27132-90005	PSI Hardware Reference Manual

Accessories Supplied

The following items are supplied with the Model 520:

Installation and Test Manual . . . . . HP Part No. 09020-90011
Flexible Disc Media . . . . . 2 each, 256 Kbyte
Special Function Key Overlays . . . . . 2 blank, HP Part No. 7120-3107
System Integrity Software . . HP Part No. 09020-10010

If a color CRT is ordered with the Model 520, add:

Fuse . . . . . 2110-0051 for 100 – 120 Vac
2110-0056 for 220 – 240 Vac

If optional Thermal Printer is ordered, add:

	HP Part No.
Paper Tray	09855-67951
For Opt. 590:	
Thermal Paper (8½" wide, black-on-white, 1 pkg. of 330 sheets)	9270-0640
For Opt. 591:	
Thermal Paper (210mm wide, black-on-white, 1 pkg. of 330 sheets)	9270-0642

The following items are supplied:

	HP Part No.
Installation and Test Manual	09040-90010 (Models 530 and 540)
Installation and Configuration	09050-90010 (Model 550)

Accessories Available

Here is a list of some of the key accessories and supplies available. See the Computer User's Catalog, HP Pub. No. 5953-2450(D) for a complete listing.

	HP Part/Prod. No.
Thermal Printer Paper (4 packs/box, 330 sheets/pack)	
8½" wide, black on white	9270-0640
8½" wide, blue on white	9270-0641
210mm wide, black on white	9270-0642
210mm wide, blue on white	9270-0643
5¼" Flexible Discs (box of 10)	92190A
Flexible Disc Head Cleaner Kit	92193A
Power Line Conditioner	35030A
Workstation Table (designed for the Model 540, same style, height and color)	92170G
Workstation Table (designed for the Model 520, two tiered)	92213A

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