

Hewlett-Packard HP 3000 Series

MANAGEMENT SUMMARY

UPDATE: Hewlett-Packard has added to as well as enhanced the HP 3000 in the past six months. A new model, the Series 58, was introduced, the Series 68 model was enhanced, and a new upgrade model (42XP) was announced. New software was also introduced, which includes an extended Basic program and the Silhouette/3000 program.

The new Series 58 model is positioned mid-range in the HP 3000 series between the Series 48 and 68. Hewlett-Packard desired to fill the gap between these two systems to satisfy the needs of clients requiring more processing capability than the Series 48 offered, but not requiring as much processing power (or the cost) offered by the Series 68.

The Series 58 supports up to 8MB of main memory, available in 1MB or 2MB increments. It also supports a 32KB cache memory. The Series 58, as do all other models of the HP 3000 family, offers disk caching, which utilizes available main memory to optimize I/O performance. Also supported on the Series 58 are up to 16 disk drives, for a maximum disk storage capacity of 4.2GB; up to eight tape drives; and a 67MB cartridge tape, which is supported only as a media transfer and file copy device. Up to eight serial printers (those that connect through the Asynchronous Data Communications Controller (ADCC) or Advanced



The Series 58 is the mid-range system in the HP 3000 family, and according to HP, offers 50 percent higher performance than the Series 48. The Series 58 supports up to 152 users, 8MB memory, 32KB cache memory, and 4.2GB storage. Up to eight tape drives are also supported. The Series 58 is fully compatible with all other members of the HP 3000 family.

The Hewlett-Packard 3000 family offers a total of six processors ranging from the small departmental Series 37 to the high-end Series 68. All systems are both hardware- and software-compatible. Offering both interactive and batch processing, and targeted to the commercial marketplace, the HP 3000 systems support office automation, manufacturing, financial, and wholesale distribution applications.

MODELS: Series 37, Series 39, Series 42, Series 48, Series 58, and Series 68.

MEMORY: 512KB to 16MB.

DISK CAPACITY: 28MB to 9.7GB.

WORKSTATIONS: Up to 28 on the Series 37; up to 92 on the Series 39 and Series 42; up to 152 on the Series 48 and Series 58; and up to 400 on the Series 68.

PRICE: \$13,000 to \$186,100.

CHARACTERISTICS

MANUFACTURER: Hewlett-Packard Company, 1820 Embarcadero Road, Palo Alto, CA 94303. Contact your local sales office.

CANADIAN ADDRESS: Hewlett-Packard Canada Ltd., 6877 Goreway Drive, Mississauga, Ontario L4V 1M8. Telephone (416) 678-9430.

DATA FORMATS

BASIC UNIT: 16-bit word or 8-bit byte.

FIXED-POINT OPERAND: 16-bit operands can be used by logical or fixed-point arithmetic instructions to represent unsigned 16-bit integers from 0 to 65,535 or signed 15-bit integers from -32,768 to +32,767. Double-integer fixed-point formats provide 32 bits of representation of values from -2 billion to +2 billion. Bit 0 for the most significant word is the sign bit. Logical operands are represented in positive integer format, while fixed-point operands are represented in two's-complement format. Also provided is 28-bit packed decimal arithmetic in hardware.

FLOATING-POINT OPERAND: Includes single-precision 32-bit (2-word) operands with signed 9-bit exponent and 22-bit positive fraction and extended-precision 64-bit (4-word) operands with signed 9-bit exponent and 55-bit positive fraction.

INSTRUCTIONS: All HP 3000 instructions, except the stack operation instruction, are one-word types with 23 distinct formats for 13 different instruction groups. The 65 stack instructions can be packed two per word.

INTERNAL CODE: ASCII.

MAIN STORAGE

TYPE: MOS utilizing 64KB or 256KB RAMs.

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CHART A. SYSTEM COMPARISON

MODEL	Series 37	Series 39	Series 42	Series 48	Series 58	Series 68
SYSTEM CHARACTERISTICS						
Date of introduction	September 1984	February 1983	June 1983	June 1983	August 1985	June 1983
Date of first delivery	Not applicable	April 1983	December 1983	December 1983	—	December 1983
Operating system	MPE-V	MPE-V	MPE-V	MPE-V	MPE-V	MPE-V
Upgradable from	Not applicable	Series 37	Series 37, 39	Series 37, 39, 42	Series 37, 39, 42, 48	Series 37, 39, 42, 48, 58
Upgradable to	Series 39, 42, 48, 58, and 68	Series 42, 48, 58, and 68	Series 48, 58, and 68	Series 58 and 68	Series 68	Next generation (when available)
MIPS	—	—	—	—	—	1
Relative performance (based on a rating of the Series 37 at 1.0)	1.0	1.8	2.0	2.0	—	5.0
MEMORY						
Minimum capacity, bytes	512K	512K	1M	2M	4M	4M
Maximum capacity, bytes	2M	3M	3M	4M	8M	16M
Type	NMOS	NMOS	NMOS	NMOS	NMOS	NMOS
Cache memory	None	None	None	None	32K	8K
Cycle time, nanoseconds	170	430	430	430	—	134
Bytes fetched per cycle	—	—	—	—	—	—
INPUT/OUTPUT CONTROL						
Number of channels	Up to 3	2 - 4	2 - 4	2 - 5	2 - 5	2 - 15
High-speed buses	Up to 3	Up to 2	Up to 2	Up to 2	—	Up to 6
Low-speed buses	Up to 3	Up to 2	Up to 2	3 - 5	—	9 - 15
MINIMUM DISK STORAGE						
	55MB	28MB	28MB	28MB	28MB	50MB
MAXIMUM DISK STORAGE						
	2.1GB	3.2GB	3.2GB	4.2GB	4.2GB	39.7GB
NUMBER OF WORKSTATIONS						
	28	92	92	152	152	400
COMMUNICATIONS PROTOCOLS						
	Bisync, RS-232-C, X.25	Bisync, HDLC/SDLC, RS-232-C, RS-422, X.25	Bisync, HDLC/SDLC, RS-232-C, RS-422, X.25	Bisync, HDLC/SDLC, RS-232-C, RS-422, X.25	Bisync, HDLC/SDLC, RS-232-C, RS-422, X.25	Bisync, HDLC/SDLC, RS-232-C, RS-422, X.25

A dash (—) in a column indicates that the information is unavailable from the vendor.

➤ Terminal Processor (ATP) via RS-232-C interface) or six system printers (those that connect directly to the interface channel via the Hewlett-Packard Interface Bus (HP-IB)) can be attached. In addition, a total of 152 personal computers or terminals can be supported, 120 of which may be connected point to point. Up to seven synchronous lines for system-to-system or multipoint communications are available on the Series 58.

The Series 58 is fully software compatible with the other members of the HP 3000 family. Models 39 through 48 can be field-upgraded to the Model 58 without any modifications to applications software, allowing for a 25 to 50 percent performance improvement, according to HP. The Series 58 can also be upgraded to the Series 68 as the user's requirements expand.

HP has enhanced the Series 68 by doubling the maximum memory available. The Series 68 is now offered with 4MB of main memory, which can be expanded to 16MB. It was previously offered with 3MB, expandable to 8MB. The expanded memory capacity is available in either 1MB or 4MB increments. Hewlett-Packard has priced the Series 68 with 4MB of memory as a standard configuration at the same cost as was previously offered without any memory included—a cost savings to the user.

The Series 42XP is a field upgrade model for the Series 39 and 42 models. According to HP, with this field upgrade, a 25 to 50 percent performance gain can be achieved over that previously attained on the Series 39 and 42 models. The Series 42XP, like the Series 58, supports a 32KB cache memory, which is the basic reason for the performance increase. It also supports an increase in maximum main

➤ **CYCLE TIME:** The Series 37 has a cycle time of 170 nanoseconds with a read access time of 850 nanoseconds and write access time of 1,020 nanoseconds. The Series 39, 42, and 48 each have a cycle time of 430 nanoseconds for a 16-bit fetch and a read access time of 300 nanoseconds. The Series 58 includes a 32KB cache memory with a 90 to 97 percent hit rate providing an average read access time of 145 nanoseconds and a write cycle of 800 nanoseconds. The Series 68 includes an 8KB cache memory to provide an average memory access time of 134 nanoseconds. The cycle time of 840 nanoseconds is for an 8-word block.

CAPACITY: Main memory capacities range from a minimum of 512KB to a maximum of 16MB. See Chart A for specific system capacities. The Series 39 and 42 offer memory upgrades in increments of 256KB or 1MB, the Series 48 offers memory upgrades in increments of 512KB or 1MB, the Series 58 offers memory upgrades in 1MB or 2MB increments, and the Series 68 offers memory upgrades in 1MB or 4MB increments.

CHECKING: Automatic fault detection and correction memory is used in all current HP 3000 models, providing the system with the capability of detecting single-bit and double-bit errors and correcting single-bit errors.

STORAGE PROTECTION: Upper and lower address boundaries, provided by certain registers, define the limits of authorized program access in main memory. The microprogram routinely checks for bounds violations during execution (overlapped with operand fetch) and generates an interrupt if an unauthorized memory access attempt is made. Bounds violations may be classified under program transfer or reference, data reference, and stack overflow or underflow.

➤ **RESERVED STORAGE:** The first 11 main memory locations are reserved for global system pointers used in the firmware implementation of virtual memory and variable-length program segmentation. Following this is a device reference table containing a set of four-word entries (one per

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▷ memory from 3MB to 6MB. There is no increase in the number of peripherals supported. The Series 42XP cannot be purchased as such; a Series 39 or 42 must first be purchased and then upgraded to the Series 42XP.

The newly announced HP Business Basic/3000 features both interpreter and compiler capabilities. According to HP, the program extends Basic beyond the current minimal ANSI Basic standard. It offers an extended feature set, seven data types, and allows numeric data to be packed into strings. The program allows programmers to write both complex and straightforward applications for the HP 3000 and provides extensive debugging tools. It also allows HP 250 and HP 260 users to translate their existing applications to the HP 3000, and provides a migration path to future HP systems.

The HP Silhouette/3000 automatically duplicates HP TurboImage and Image databases on a company's main HP 3000 computer to other HP 3000 systems over network links, providing for high availability and data integrity. This allows users to continue accessing the databases if the primary system is down; one simply transfers production from the main HP 3000 to another HP 3000 in the network.

The introduction of the Series 58 brings the total number of models in the HP 3000 family to six; the other five being the Series 37, 39, 42, 48, and 68. The HP 3000 systems are designed as multipurpose business data processing systems and can be used as both standalone systems or in distributed processing environments. As a combined-function system, the HP 3000 can simultaneously perform transaction processing operations, interactive program development, word processing, batch processing, and data communications functions.

The entry-level Series 37 has increased HP's target market to include the small- to medium-size business, branch office, or departmental user who requires a powerful system that fits into a small space. Housed in a cabinet the size of a two-drawer file cabinet, the Series 37 can support as many as 28 workstations and communicate with larger computer systems or smaller personal computers. Functions specific to a group or department can be served by the Series 37 or its satellite personal computers. Peripherals such as hard disks and printers can be centralized and shared.

The Series 37 CPU is largely contained on a single CMOS gate array chip. According to HP, low power requirements, low cost, smaller size, and higher reliability are benefits of this technology.

The Series 37XE, an enhanced version of the Series 37, provides 5 more card slots than the basic Series 37, offering greater expandability. The basic 37 supports up to 14 terminals, whereas the 37XE supports up to 28. The 37XE comes with 1MB of memory and three synchronous communication lines. Both the 37 and 37XE can be expanded to include up to 2MB of memory and up to 2.1GB of disk storage. ▷

▶ controller, maximum of 119 entries on the Series 37, 39, 42, 48, and 58, and maximum of 485 on the Series 68) containing device interrupt vectors and the identity of the drives for each device.

CACHE MEMORY: Two models support cache memory. The Series 58 has 32KB of cache memory. The Series 68 has 8KB of cache memory.

CENTRAL PROCESSOR

GENERAL: The HP 3000 Series processors include a firmware-implemented instruction set; firmware-implemented repetitive functions such as subroutine linkage, string processing, and buffer transfers; firmware-assisted software; bus control clock; and crystal clock dedicated to process execution measurements. The hardware processors consist of an arithmetic-logic unit, shifting network, and, on the Series 39, 42, 48, and 58, 72 specific-purpose registers, 18 of which are user-accessible. The Series 68 CPU also contains 72 specific-purpose registers with 21 of those instructions user-accessible.

Auto restart after power failure is standard. When the line voltage falls below 90 percent, a power-fail warning is issued. All register contents are moved to memory, system activities are completed, and the system shuts itself down. All models include a rechargeable battery pack to maintain memory data during power failure. A minimum of 15 minutes is provided with the total amount of backup time dependent on memory size and battery condition (age and level of charge). When voltages reach 90 percent of their values, all registers are automatically restored and processing resumes.

The Series 37 CPU is largely contained on a single CMOS gate array chip.

The Series 39, 42, 48, and 58 feature a Hewlett-Packard-designed, microcoded, 16-bit processor using Schottky TTL technology. Each system is based on a modular design to allow independent elements to be interconnected through a central system bus structure. The independent elements consist of a CPU that controls memory via a memory controller, general I/O channels, Asynchronous Data Communications Controllers, and the bus system to allow communication between the I/O devices. The system also includes a console and a Control and Maintenance Processor (CMP).

The Series 68 CPU is an HP-designed, microcoded processor using high-speed Emitter Coupled Logic (ECL) technology and a dual arithmetic logic unit (ALU). This model provides the highest performance level achieved in an HP 3000: 1.0 MIPS. The modular Series 68 includes the following components: CPU with dual ALUs, cache memory, main memory, Writable Control Store, I/O Adapters, General I/O channels, and Advanced Terminal Processors. Communications between modules is accomplished using a high-speed Central System Bus and up to three Intermodule Buses. The Series 68 also includes a system display panel and a Diagnostic Control Unit (DCU).

Program code and data are maintained in strictly separate domains on all HP 3000 systems. Firmware-assisted software includes the interrupt handler, cold-start loader, power failure data-saving routines, automatic restart routines, and front panel-initiated diagnostics. The basic microprogramming architecture is asynchronous and designed to facilitate a multiprogrammed, variable-length, code-segmentation, virtual-memory mode of operation with extensive stack processing. ▶

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CHART B. MASS STORAGE

MODEL	7911	7912	7914	7920
Type	Winchester	Winchester	Winchester	Pack
Controller model	Built-in	Built-in	Built-in	Built-in
Drives per subsystem/controller	1	1	1	8
Formatted capacity per drive, megabytes	28	65.6	132	50
Number of usable surfaces	1.5	3.5	3.5	5
Number of sectors or tracks per surface	1,444 tracks	1,144 tracks	2,328 tracks	823 tracks
Bytes per sector or track	256/sector	256/sector	256/sector	256/sector
Average seek time	26.7 ms	26.7 ms	27.7 ms	25 ms
Average rotational/relay time	8.3 ms	8.3 ms	8.3 ms	8.3 ms
Average access time	35 ms	35 ms	36 ms	33.3 ms
Data transfer rate	983K bps	983K bps	983K bps	740K bps
Supported by system models	Series 39, 42, 48, 68	Series 39, 42, 48, 68	All models	All models
Comments	Includes built-in ¼", 67MB cartridge tape drive	Includes built-in ¼", 67MB cartridge tape drive	Includes built-in ¼", 67MB cartridge tape drive; 7914 TD includes ½", 1600 bpi tape drive	—

A dash (—) in a column indicates that the information is unavailable from the vendor.

CHART B. MASS STORAGE (Continued)

MODEL	7925	7933	7935	7945	9895
Type	Pack	Fixed	Pack	Winchester	Dual 8-inch flexible disk
Controller model	Built-in	Built-in	Built-in	Built-in	—
Drives per subsystem/controller	8	1	1	1	2
Formatted capacity per drive, megabytes	120	404	404	55	23
Number of usable surfaces	9	13	13	7	2
Number of sectors or tracks per surface	823 tracks	1,321 tracks	1,321 tracks	968 tracks	77 tracks
Bytes per sector or track	256/sector	256/sector	256/sector	256/sector	256/sector
Average seek time	25 ms	24 ms	24 ms	30 ms	—
Average rotational/relay time	11.1 ms	11.1 ms	11.1 ms	8.3 ms	—
Average access time	36.1 ms	35.1 ms	35.1 ms	38.3 ms	179 ms
Data transfer rate	740K bps	1.2M bps	1.2M bps	625K bps	23K bps
Supported by system models	All models	All models	All models	All models	All models
Comments	7925T is an add-on unit providing 240MB of disk storage	7933 is an add-on unit providing 1.2 gigabytes of disk storage	7935G is an add-on unit providing 1.2 gigabytes of disk storage	Opt. 010-single drive	—

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➤ The Advanced Terminal Processor, revised for the Series 37 (ATP37), combines the Series 68 System Interface Board (SIB) and Direct Connect Port Controller onto one board to provide seven terminal ports (compared to 12 ports on the original ATP). The Series 37 supports two ATPs in the system processor unit and two ATPs on the I/O expansion unit.

The Series 39 comes standard with 512KB of main memory, expandable to 3MB. The Series 39 supports up to three data communications lines, 3.2GB of disk storage, four line printers, and four tape drives. A maximum of 92 terminals is supported, 60 of which may be connected point-to-point. HP's Advanced Terminal Processor (ATP) is also available on the Series 39, 42, and 48 models.

The Series 42 includes 1MB of main memory, expandable to 3MB, and supports up to three data communications lines, 3.2GB of disk storage, four line printers, and four tape drives. In addition, the Series 42 supports up to 92 terminals, 60 of which may be connected point-to-point. ➤

➤ **CONTROL STORAGE:** The Series 37 uses 10K 64-bit words; this is called Writable Control Store Random Access Memory (RAM). Bipolar Read Only Memory (ROM) consists of 12K 48-bit words for the Series 39, 42, 48, and 58. The Series 68 utilizes 64K of RAM as its control storage. All of this control storage is utilized and is not directly accessible to the end user. Microinstruction cycle time is 170 nanoseconds for the Series 37 and 105 nanoseconds for the Series 39, 42, 48, and 58. The Series 68 microinstruction cycle time is 75 nanoseconds.

REGISTERS: There are 256 hardware registers on the Series 37; 18 of these registers are addressable by the programmer. There are 72 hardware registers on the other HP 3000 models. As in the Series 37, 18 registers are accessible to the programmer on the Series 39, 42, 48, and 58; 21 registers are available for programmer use on the Series 68. Those dedicated to system use are mostly 16-bit registers. These include the current and next instruction registers; scratch pad, flag, and interrupt registers; I/O registers; memory address and data registers; and firmware address registers. The Series 68 adds four cache operand registers, a performance register, and four ALU registers to those provided on the other systems.

Registers accessible to the programmer include the four code segment pointers, seven stack pointers, four top-of-stack ➤

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▷ The Series 48 comes standard with 2MB of main memory, expandable to 4MB. Up to seven data communications lines, 4.2GB of disk storage, four line printers, and eight tape drives are supported. The Series 48 has the ability to support a total of 152 terminals; 120 of which may be connected point-to-point.

The Series 68 is the most powerful HP 3000 to date, with a performance level of one million instructions per second (MIPS). This system offers many 32-bit advantages—a 32-bit data bus, a 32-bit memory word, and dual arithmetic logic units capable of performing 32-bit arithmetic in a single cycle. The standard Series 68 comes with 4MB of main memory, which can be expanded to 16MB, and 8KB of cache memory. The system supports up to 24 data communications lines, 9.7GB of disk storage, eight tape drives, and up to eight line printers. The Series 68 supports 400 terminals, 336 of which may be connected point-to-point. This system utilizes the HP Advanced Terminal Processor (ATP). The ATP provides communications capabilities while reducing system overhead via the ATP's own microprocessors.

A disk caching facility is available on the Series 39, 42, 48, 58, and 68, which increases response time and provides higher throughput by caching information from disk in main memory. This feature anticipates code and data likely to be needed by working applications, stores it in main memory (as space is available), and checks memory before accessing the disk for information. The more I/O intensive the operation and the larger the size of memory, the more the user benefits from the caching feature.

The Series 39, 42, and 48 models utilize 64K RAM memory chips; the Series 37, 58, and 68 models utilize the 256K RAM technology to provide maximum memory with a minimum of boards. The Series 58 also adds a 32KB cache memory and the Series 68 adds an 8KB cache memory to speed processing. Hewlett-Packard claims the cache memory has a 95 percent effective hit rate for memory accesses.

The Series 39, 42, 48, and 58 models include an Intermodule Bus (IMB) to handle communications between the CPU, memory, and I/O modules. The CPU only releases control of the IMB upon request. The Series 68 has a Central System Bus (CSB) to perform the same general functions. The CSB features a 56 megabyte-per-second bandwidth and allows each module independent control of bus transfers. The Advanced Terminal Processor (ATP) is one of the independent microprocessor-based modules accessing the CSB.

Hewlett-Packard offers a wide range of peripherals, personal computers, and mass storage devices for use on the HP 3000. Disk storage is available in sizes ranging from 28MB to 404MB per drive. One available magnetic tape device is a 1600/6250 bits per inch (bpi), group-encoded unit for burst-speed backup operations. Printers vary from a 40 cps letter quality printer to 45 pages per minute (ppm) laser page printing systems. HP also offers dot matrix printers printing up to 900 lpm. The wide range of terminals

▷ registers (eight in the Series 68), and the Index and Status registers.

ADDRESSING: Only privileged instructions may use absolute addressing. All other addressing is performed using 1 of the 6 allowable relative techniques. Two techniques apply to code, while four apply to data. Except for privileged instructions (including I/O), all word addressing is direct, direct-indexed, indirect, or indirect-indexed.

INTERRUPTS: The interrupt system provides for up to 105 external interrupts. There are 16 levels of interrupt masking, and each device is initially assigned to one of the 16 levels to fix priorities and permit masking under software control. Under microprogram control, context switching for an interrupt is performed in an average time of 21 microseconds (minimum 18; maximum 24.5). The interrupt routines operate on a common interrupt control stack to permit nesting of interrupt routines for multiple interrupts; context switching time is reduced by about two microseconds should nested interrupts occur. Twenty internal interrupts for user errors, system violations, hardware faults, and power fail/restart are also provided, plus 14 traps for arithmetic errors and illegal use of instructions or privileged mode.

OPERATING ENVIRONMENT: The Series 37 is housed in a desk-high unit about the size of a two-drawer file cabinet. The Series 39 and 42 System Processing Units (SPUs) are housed in identical standalone cabinets, the Series 48 and Series 58 are housed in a desk-style cabinet, and the Series 68 is contained in a larger standalone cabinet. The dimensions for each model within the 3000 Series are given below:

Model	37	39	42	48/58	68
Height (inches)	29	40	40	28.5	48
Width (inches)	15	24	24	72.25	69
Depth (inches)	28.5	22.4	22.4	31.25	26
Weight (pounds)	73	190	190	240	1,150

The Series 37 requires a line voltage of 100 to 120 VAC \pm 10 percent or 200 to 240 VAC \pm 10 percent at 48 to 66 Hz. The Series 39 and 42 require a line voltage of 120 VAC at 60 Hz or 220 VAC at 50 Hz and a line current of 8.5 amp at 60 Hz or 4.5 amp at 50 Hz. Heat dissipation is 3000 Btu per hour. The Series 48 and 58 require a line voltage of 210 VAC at 60 Hz or 220 VAC at 50 Hz with a line current of 13.1 amp at 60 Hz or 12.4 amp at 50 Hz. The system dissipates 7350 Btu per hour. The Series 68 requires a line voltage of 200 VAC, 3 phase at 60 Hz, or 380 VAC, 3 phase at 50 Hz with a line current of 24 amp at 60 Hz or 13 amp at 50 Hz. Heat dissipation is 12,000 Btu per hour.

The recommended operating environment for the Series 37 ranges from 5 degrees to 40 degrees Celsius. The operating humidity at 40 degrees Celsius is 20 to 80 percent for the relative humidity. All the other HP 3000 models have a recommended operating temperature of 20 degrees Celsius to 25.5 degrees Celsius. The recommended relative operating humidity is 40 to 60 percent noncondensing.

INPUT/OUTPUT CONTROL

A Synchronous Intermodule Bus (SIMB) is included with the Series 37 to handle communications. The Series 39, 42, 48, and 58 utilize an Intermodule Bus (IMB) to handle communications among the CPU, memory, and I/O modules. The CPU, on the Series 39, 42, 48, and 58, generates over 90 percent of the bus activity and has continuous access

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CHART C. WORKSTATIONS

MODEL	2392A	2393A	2394A	2397A	2628A
DISPLAY PARAMETERS					
Max. chars./screen	1920	1920	1920	1920	1920
Buffer capacity	4 pages std., 80 pt.	Up to 12 pages	8 pages	12 pages	Up to 6 pages
Screen size (lines x chars.)	24 x 80	24 x 80	24 x 80	24 x 80	24 x 80
Tilt/swivel screen	Yes	Yes	Yes	Yes	Yes
Symbol formation	7 x 11 dot matrix	7 x 11 dot matrix	7 x 11 dot matrix	7 x 11 dot matrix	7 x 11 dot matrix
Character phosphor	P31 green	Green	Green	—	White std., green or amber opt.
Total colors/no. simult. displayed	None	None	None	8	—
KEYBOARD PARAMETERS					
Style	Typewriter	Typewriter	Typewriter	Typewriter	Typewriter
Character/code set	128 ASCII	128 ASCII	128 ASCII	128 ASCII	128 ASCII
Detachable	Yes	Yes	Yes	Yes	Yes
Program function keys	8	12	8	8	16
TERMINAL INTERFACE					
	RS-232-C	HP-HIL, HP-IB, RS-232-C, HP-422	RS-232-C, RS-422	RS-232-C, RS-422	RS-232-C, 20 ma

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available can allow the user to tailor each workstation according to its task. Hewlett-Packard personal computers also have the ability to communicate with an HP 3000 system as terminal emulators or standalone processors.

HP's data communications structure, AdvanceNet, requires 2 products at most to establish a networking connection: a Network Link and a Network Service. (Prior to this, anywhere from 3 to 6 hardware and software products were required.) The Network Link is the hardware connection; it connects the HP 3000 to the network. The Network Service product line includes the software which provides the user interface to the network.

All HP 3000 systems include the Fundamental Operating Software (FOS), and included in FOS are the Multiprogramming Executive (MPE) operating system, Edit/3000, FCopy/3000, Sort-Merge/3000, TurboImage/3000, Query/3000, KSAM/3000, and HP VPlus/3000. MPE allows transaction processing, online program developments, data communications, and batch processing. The full complement of language processors available include Basic, Cobol, Fortran, Pascal, Transact, RPG, and SPL.

HP continues to concentrate its applications development efforts on the HP 3000 family in the major areas of manufacturing, distribution, financial, administration, and office automation. HP's office automation efforts are centered around the HP Personal Productivity Center. The center is a combination of office software, personal computers, and terminals joined to the HP 3000 systems to allow the sharing of data and peripherals. The concept merges word processing, data processing, graphics packages, and communications facilities for a total office system. The system can be acquired as a preconfigured system or as a customized system. The Personal Productivity Center includes an HP 3000, a workstation, software, and office peripherals.

In addition to HP-marketed software packages, third-party software vendors continue to develop and sell applications packages for the HP 3000.

to the bus. The CPU relinquishes control to the I/O channels only on request. The SIMB and IMB have separate address and data paths, each with handshake controls operating in a master/slave mode to transfer data. Any channel request will cause the CPU to relinquish control of the SIMB or IMB so the request can be serviced.

The Series 68 Central System Bus (CSB) is the communications link among the CPU module, the main memory module, and the I/O adapter modules. The CSB has a 56 megabyte-per-second overall bandwidth to allow support of multiple IMBs. No module has implied control of the CSB; each operates independently except when it is necessary to transfer data or send commands. The initiating module asks for and receives control of the CSB. All transfers to and from memory are in eight-word blocks.

The I/O adapter modules (IOA) are interfaces between the Central System Bus and the Intermodule Busses to allow communications among the I/O system, main memory, and the CPU. Up to three Intermodule Busses are supported on the Series 68. The IOA synchronizes the slow speeds of the IMB to the Central System Bus. A 1024 byte buffer cache memory is included in each IOA to handle communications between the 16-bit IMB and the 32-bit CSB. To devices on the IMB, the IOA appears as memory responding to IMB requests generated by I/O controllers.

The Series 37 uses a Peripheral Interface Channel (PIC) to communicate with peripheral devices. The other HP 3000 models feature a General I/O Channel (GIC), which is the primary channel for communications to I/O devices other than terminals. Each GIC controls an HP Interface Bus (HP-IB) and translates I/O commands into the proper HP-IB protocol. Nearly all I/O transactions are accomplished without software interrupts. The GIC contains Direct Memory Access (DMA) hardware to allow large data records to be transferred at the maximum HP-IB speed of 1MB per second.

CONFIGURATION RULES

GENERAL: As is true with most minicomputers, the complement of peripheral equipment for HP 3000 systems is restricted only by the number of slots available in the CPU chassis or its extensions, by software restrictions, and by controller limitations.

WORKSTATIONS: A maximum of 28 workstations can be attached to a Series 37 configured with 0 multipoint. Up to 92 terminals may be configured on each Series 39 and 42 system and up to 60 of these may be point-to-point terminals; all may operate at 9600 baud. The Series 48 and

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CHART D. PRINTERS

MODEL	2563A	2565A	2566A	2601A	2602A	2619A
Type	Dot matrix	Dot matrix	Dot matrix	Letter-quality	Letter-quality	Drum
Speed	300 lpm	600 lpm	900 lpm	40 cps	25 cps	1000/750 lpm
Bidirectional printing	—	—	—	Yes	Yes	No
Paper size	Up to 16"	3"- 18"	3"- 18"	Up to 15"	Up to 15"	Up to 19"
Character formation	Varies	5 x 7 dot matrix	5 x 7 dot matrix	Full-formed	Full-formed	Chain
Horizontal character spacing (char./inch)	5, 10, 16.7	5, 10, 16.7	5, 10, 16.7	10 or 12	—	10
Vertical line spacing (char./inch)	6/8	6/8	6/8	6/8	6/8	6/8
Character set	182	182	182	88/92/96	98	64/96
Controller/Interface	RS-232-C, HP-IB	HP-IB (std.)	HP-IB (std.)	RS-232-C	RS-232-C	Parallel-Differential
No. of printers per controller/ interface	—	2/Controller	2/Controller	1	1	4
Printer dimensions, in. (h x w x d)	10.75 x 23.6 x 17.75	43.3 x 38.7 x 25.0	43.3 x 38.7 x 25.0	9¼ x 24¼ x 18¾	9¼ x 24¼ x 17¾	42¾ x 36½ x 26
Graphics capability	Yes	Yes	Yes	No	No	No

A dash (—) in a column indicates that the information is unavailable from the vendor.

CHART D. PRINTERS (Continued)

MODEL	2680A	2687A	2688A	2932A	2933A	2934A
Type	Laser	Laser	Laser	Dot matrix	Dot matrix	Dot matrix
Speed	45 ppm	12 ppm	12 ppm	200 cps	200 cps	40/67/200 cps
Bidirectional printing	Not applicable	Not applicable	Not applicable	—	Yes	—
Paper size	3" x 17"	8½" x 11"	Up to 11"	Up to 15.75"	Up to 15.75"	Up to 15.75"
Character formation	1 x 1 to 255 x 255 dpi	300 x 300 dpi	300 x 300 dpi	9 x 12 dot matrix	9 x 12 dot matrix	9 x 12; 36 x 24 dot matrix
Horizontal character spacing (char./inch)	—	10/12/15 cpi	—	5/10/16.36	5/10/16.36	5/10/12/16.36
Vertical line spacing (char./inch)	—	6 or 8	—	1, 2, 3, 4, 6, 8, 12	Up to 12	1, 2, 3, 4, 6, 8, 12
Character set	Varies	127	—	96, 128	Varies	96, 128
Controller/Interface	—	RS-232-C	HP-IB (IEE-488)	RS-232-C, HP-IB	RS-232-C	RS-232-C, HP-IB
No. of printers per controller/ interface	—	1	—	—	—	—
Printer dimensions, in. (h x w x d)	48 x 64.5 x 26.4	11 x 20 x 19.5	11 x 20 x 19.5	7.25 x 23.85 x 14.37	7.28 x 23.85 x 14.37	7.28 x 23.85 x 14.37
Graphics capability	Yes	No	Yes	Yes	Yes	Yes

A dash (—) in a column indicates that the information is unavailable from the vendor.

▷ COMPETITIVE POSITION

The introduction of the Series 58 allows the HP 3000 to be more competitive in the mid-range area. It is priced only 11 percent above the base system price of the Series 48, yet offers up to 50 percent higher performance, according to HP.

HP feels that the introduction of the new mid-range system, as well as future high-end extensions bridging the HP 3000 family and the yet-to-be-introduced Spectrum family, will further strengthen the position of the HP 3000 family in the commercial marketplace. HP expects the Spectrum, although, a totally different architecture (Reduced Instruction Set Computer), to be an extension of the HP 3000 family, and to be fully software-compatible for software portability. (The Spectrum is expected to be announced early in 1986.)

With HP's increased emphasis on integrated office systems, it is coming into stronger competition with Wang Laboratories, Inc., IBM, Digital Equipment Corporation, and Data General. Although these are tough competitors to come up against, HP's reputation and established customer base will help in establishing its position in this market. ▷

▶ Series 58 increase the maximum number of terminals to 152, and 95 of these units may operate in a multipoint environment. The Series 68 is physically capable of configuring 400 multipoint terminals, but software dictates that only 200 may be simultaneously active.

DISK STORAGE: The basic Series 37 unit houses one 55MB hard disk. The storage capacity of the Series 37 can be expanded to 2.1GB through the addition of external 132MB and 404MB disk drives. The Series 39 includes a 132MB Integrated Storage Unit with an integral Cartridge Tape Drive. A total of eight disk drives, including the unit packaged with each system, is supported on the Series 39. The Series 42 does not include any prepackaged disk unit as part of the basic configuration, but, like the Series 39, does support a maximum of eight disk drives. A maximum storage capacity of 3.2GB is supported by both the Series 39 and Series 42. The Series 48, 58, and 68 increase the maximum number of disk drives supported per system to 16 and 24, respectively. The Series 48 and Series 58 support up to 4.2GB of disk storage; the Series 68 offers up to 9.7GB of disk storage. The 3000 Series systems require a second controller to support the integral cartridge tape to prevent user-lockout during tape backup operations. The disk units interface to the GIC; a dedicated GIC is required to support the integral cartridge tape unit on the Integrated Storage Unit.

MAGNETIC TAPE UNITS: All of the HP 3000s support only one integrated cartridge tape storage unit per system. ▶

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CHART E. MAGNETIC TAPE EQUIPMENT

MODEL	7974A	7978A	9144A
TYPE	Reel-to-reel	Reel-to-reel	Cartridge
FORMAT			
Number of tracks	9	9	16
Recording density, bits per inch	800/1600	1600/6250	10,000
Recording mode	PE/NRZI	GCR/PE	MFM
CHARACTERISTICS			
Controller model	Included	Included	Included
Drives per controller	1	1	1
Storage capacity, bytes	20M (NRZI); 40M (PE)	40M (PE); 140 (GCR)	67.1M
Tape speed, inches per second	100	75	60
Data transfer rate, units per second	160K bps (streaming); 80K bps (start/stop)	486K bps (GCR); 120K bps (PE)	33K bps
Streaming technology	No	Yes	Yes
Start/stop mode; speed	50 ips	—	—
Switch selectable	No	Yes	No
Comments	Auto. thread and load	—	—

A dash (—) in a column indicates that the information is unavailable from the vendor.

➤ The low-end Series 37 has provided the means for Hewlett-Packard to become more aggressive and price-competitive in the office automation market. HP's office automation concept, the Personal Productivity Center, links the HP 3000 with HP and IBM personal computers, and provides software that runs on both the personal computer and the host. This has resulted in an effective total office solution, which is the solution users want.

In comparing the low-end HP 3000 Series 37 office system with the high-end IBM System/36 5360 models, we find that the HP Series 37 tops the System/36 by providing more memory (2MB for the Series 37 versus 1.75MB for the System/36), and also by providing more storage capacity (2.1GB for the Series 37, 800MB for the System/36). However, the System/36 has the advantage of offering more workstations (36) than the Series 37 (28). Another advantage offered by the Series 37 is that it is both software- and hardware-compatible with the other members of the HP 3000 family, offering a growth path up through the other five models. This is not true with the IBM System/36 as the 5360 Models are the top-of-the-line models, and to expand would require both hardware and software reconfigurations.

The HP 3000 competes against the above mentioned companies in the general-purpose computing area as well.

In the general-purpose area, we chose to compare the new HP Series 58 against the Data General Eclipse MV4000. Both systems support 8MB of main memory. The HP Series 58, supporting 4.2GB of disk storage, is surpassed by the MV4000, supporting 9.6GB. However, the MV4000 only supports 64 workstations, and is topped by the Series 58, supporting 152. A 32KB cache memory is available on the HP Series 58, a plus for the Series 58; no cache memory is offered on the MV4000. Until Hewlett-Packard extends the HP 3000 family (with the introduction of the Spectrum), the Series 58 has only the Series 68 for expansion purposes. The MV4000 also is not directly upgradable; there are, however, four compatible systems above it, offering a software migration path.

➤ The cartridge tape drive included with the Integrated Storage Unit is required as a system backup and for software updates on the Series 39. The cartridge tape is designed as a backup device for a maximum of 132MB of disk capacity. When mass storage capacity exceeds 132MB, additional magnetic tape drives must be added as the primary system backup. The HP 7974A 1600 bpi drive and the HP 7978A 1600/6250 drive are supported by all models. The Series 39 and 42 systems can have a maximum of four tape drives. The Series 48, 58, and 68 each handle up to eight magnetic tape drives: four HP 7974As and four HP 7978s. The magnetic tape drives interface through the GIC.

The Series 37 unit houses one 67MB cartridge tape drive; a second cartridge tape drive can be added.

PRINTERS: The HP 3000 supports up to 2 printers on the Series 37, 4 printers on the 39, 42, 48, and 58, and 8 for continuity printers on the Series 68. Each HP 3000 system also supports a maximum of two intelligent page printers. All printers interface through the GIC.

MASS STORAGE

See CHART B for information on mass storage devices.

INPUT/OUTPUT UNITS

See CHART C for workstations, CHART D for printers, and CHART E for tape drives.

In addition, the HP 3000 supports a wide range of graphics plotters, graphics tablets, and data collection terminals. HP's plotters offer a range of choices in paper size, pens, and interfaces.

COMMUNICATIONS CONTROL

GENERAL: The maximum synchronous communications lines supported for each of the six HP 3000 Series is as follows: Series 37, 39, and 42—3 lines, Series 48 and 58—7 lines, and Series 68—24 lines.

HP's communications network, HP AdvanceNet, consists of HP's data communications networking products that tie together everything from personal computers to mainframes. The data communications structure requires two products—a Network Link and a Network Service—to establish a networking connection. The *Network Service* provides the entire user interface to the network. The *Network*

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▷ ADVANTAGES AND RESTRICTIONS

The introduction of the HP 3000 Series 58 provides the user with a wider choice for system selection and provides a stronger mid-range growth path. It provides a cost alternative for companies that need mid-range performance but do not require the computing power and cannot afford the price of the high-end HP 3000 Series 68. According to HP, a 50 percent performance increase is achieved by the Series 58 over the Series 48, yet it is priced at only 11 percent above the Series 48. The Series 58 also doubles the main memory offered on the Series 48 and supports a 32KB cache memory.

HP has made the Series 68 more appealing, not only by the increase in memory to 16MB, but also by offering a standard configuration with 4MB of memory at the same cost as was previously offered on a standard system with no memory included; a cost savings of \$12,000.

An added benefit is offered to users of the Series 39 and 42 with the option of upgrading to the Series 42XP. According to HP, this upgrade provides for performance gains of 25 to 50 percent. This is accomplished by field upgrading the Series 39 and 42 to the Series 42XP. The Series 42XP also supports increased main memory (6MB) and 32KB of cache memory. This upgrade can be accomplished at the user's site.

Although the HP 3000 is not a fault tolerant system, the Silhouette/3000 package provides fault tolerant features for the HP 3000 by automatically copying the database management packages onto another HP 3000 in the network should the host go down. This provides for data integrity, and allows for continuation of processing during system failure.

With all models of the HP 3000 computer systems using the same system software, users can expand from the smallest Series 37 system up through all six models to the top-of-the-line Series 68 without any operating or application software recompilation. This capability provides users with a time-saving and cost-effective expansion program as their data processing needs grow. On the negative side, expanding the hardware end of the system is not just a matter of changing CPU boards; the entire box must be replaced. The ability to interface all HP peripherals to the HP 3000 systems is, however, a plus.

Many users list HP's variety of programming productivity tools and ready-to-run applications software as one of the HP 3000's greatest advantages. In addition, a large assortment of third-party applications software is available for the HP 3000 systems.

We cannot ignore HP's communications facilities, which are constantly being enhanced. The AdvanceNet network service products offer all the functions of the previous Distributed Service, plus additional functionality for network control. The ability to access IBM host files and applications in an interactive environment is definitely an asset to the HP 3000 system. ▷

▶ Service products are comprised entirely of software; they provide the user interface for accomplishing batch job submittals, file transfers, virtual terminal access, or whatever services are available.

The *Network Link* products are the items needed to connect the HP 3000 system to the network. Protocol management software, hardware interfaces, cables, and adapters are examples of Network Links.

Service products provide the user interface, but they lack protocol management and the physical interface. Few of the current Link products provide any direct user-callable routines or intrinsics; therefore, Links and Services are not usually standalone products. Generally, a Network Service requires at least one Network Link in order to be useful, and at least one Network Service product is necessary to be able to use a Network Link. One exception is the X.25 Network Link, which can be used by itself for PAD terminal communications over an X.25 network.

While one Link may support several Services, and one Service may work with several Links, not all Links and Services are compatible. The table below summarizes the Network Link/Network Service compatibility structure:

<u>Network Links</u>	<u>Network Services</u>
SNA Link	SNA NRJE Service, SNA IMF Service
Pt.-to-Pt. Hardwired Link, Pt.-to-Pt. Modem Link, X.25 Link, Satellite Network Link	DS Services
LAN/3000	NS Service
ATP or ADCC	Workstation Configurator Service
BSC Link	RJE Service, MRJE Service, IMF Service
MTS Data Link Connection, MTS Modem Link, MTS 3270 Device Line	MTS Service

The *Point-to-Point Hardwired Link* provides the local network connection for an HP 3000 system running DS Network Services software to connect to another HP 3000 or an HP 1000. It provides the lower level protocol management software, a hardware interface card, and cables.

The *Point-to-Point Modem Link* provides the network connection for an HP 3000 system running DS Network Services software to communicate with another HP 3000, or with an HP processor with DS. The connection can be made using a leased line with modem, switched line with manual dial modem, switched line with auto-dial modem, or Digital Phone Network modem. Like the hardwired link, the modem link provides the lower level protocol management software, a hardware interface card, and cables.

The *X.25 Link* communication products provide communications capabilities between HP computer systems, personal computers, and terminals over X.25 Packet Switched Networks (PSNs). The three main communications capabilities provided over X.25 PSNs are system-to-system communications; system-to-dial-up terminal communications; and system-to-remote terminal X.25 multiplexer (HP 2334A) communications. ▶

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▷ USER REACTION

The Datapro 1985 Computer Users Survey received responses from 174 HP 3000 users. At the time the survey was taken, the average age of the systems was 10 months. In terms of disk storage capacity, the majority of users worked with medium to large systems. Fifty-nine respondents indicated that their systems were supporting from 100MB to less than 600MB of disk storage. Fifty-eight users had systems with 600MB to less than 1.2GB of storage. The remaining users configured their systems as follows: 47 had from 1.2GB to less than 4.8GB; 5 users worked with less than 10MB; and 1 user each indicated that the system worked with 50MB to less than 100MB and 10MB to less than 50MB of disk storage.

The number of workstations configured with these HP 3000 systems varied for both the local and remote installations. The highest number of respondents (50) said that between 31 and 60 workstations were installed locally; 49 respondents answered with a range of 16 to 30 workstations; 39 installed between 6 and 15 local workstations; 27 had over 60; and 6 had between 1 and 5. In regard to remote workstations, 62 users had installed between 1 and 5 workstations; 32 users had 6 to 15; 22 users had 16 to 30; 16 had between 31 and 60; and 9 had over 60. Forty-three users did not have any remote workstations installed.

When asked the type of industry represented, the majority of respondents (63) cited the manufacturing industry; 21 represented the education industry; and 20 represented government organizations. Other industries represented include retail/wholesale, with 13 users; service bureau, 16 users; engineering/scientific, 10 users; chemical/petroleum, 7 users; health care/medical, 4 users; legal and public accounting, 3 users each; transportation with 2 users; and banking/finance, construction, insurance, media, and utilities, all with 1 user each.

Principal applications used by the respondents included accounting (148 users), payroll (109 users), order processing/inventory (103 users), purchasing (82 users), sales/distribution (59 users), manufacturing (63 users), education (38 users), mathematics/statistics (29 users); engineering/scientific (18 users), and health care (11 users). Other applications represented by less than 16 respondents included process control, petroleum/fuel analysis, construction, banking, and insurance.

In relation to integrated office automation functions, 61 users stated they presently have office automation, 34 planned to add office automation functions, and 73 didn't plan to add any at all.

When asked if the system did what it was expected to do, 166 users stated that it did, 3 said it did not, and 2 respondents were undecided. To the question, "Would you recommend this system to another user?," 165 said they would, 2 said they would not, and 7 were undecided. The respondents rated the HP 3000 as follows:

▷ The *Satellite Network Link* interface provides the HP 3000 computer system user with the ability to link remote site HP 3000s via space segment at data rates up to 56K bps. The space segment is implemented by connecting an HP 3000 Series 4X, 5X, or 6X to a Vitalink Communications Corporation earth station. The user may then operate any DS-supported application over the space segment.

The *Multipoint Terminal Support (MTS) Data Link Connection* enables an HP 3000 running MTS Service to connect to and communicate with MTS devices and/or HP 2333A Multipoint Cluster Controllers connected to a local or remote Data Link. The MTS Data Link provides asynchronous connection between an HP 3000 and a local or remote Data Link. The connection consists of software, an interface card, a Data Link Adapter, and cables (asynchronous modem is not included). Each MTS Modem Link connects directly to a Data Link, or indirectly via a switched or leased data communications line.

The *MTS Modem Link*, also used with the MTS Service, provides a synchronous connection between an HP 3000 and a remote cluster of daisy-chained MTS devices or an HP 2333A Multipoint Cluster Controller. It supports multi-dropped clusters of MTS devices and/or HP 2333As. Each modem link connects to a switched or leased data communications line. The MTS Modem Link consists of software, an interface card, and a modem cable.

The *3270 Device Link* enables a system running the MTS Service to communicate with local or remote IBM 3270 devices on a multipoint line. The MTS 3270 provides asynchronous connections between the HP 3000 and a local or remote 3270 cluster controller, and the 3270 devices attached to it. This link supports multidropped IBM cluster controllers. The 3270 Device Link is packaged with protocol handling software, an interface card, and a modem or direct-connect cable.

The *SNA Link* provides the network connection for SNA NRJE and SNA IMF to connect an HP 3000 to an IBM System/370-compatible host processor in an IBM System Network Architecture environment. The SNA Link allows HP 3000 systems to emulate the functions of the Transmission Control, Path Control, and Data Link Control SNA layers on an HP 3000. Each SNA link connects to a single switched or nonswitched data communications line. The HP 3000 supports multiple SNA Links for connection to multiple IBM mainframes, or multiple data communications lines to a single mainframe.

The *LAN/3000 Link* contains the hardware and software required to connect an HP 3000 Series 39, 42, 48, 58, or 68 to an IEEE 802.3 coaxial cable. It also provides programmatic access to network communications through a set of network interprocess communications calls. The 3000 Link consists of three major hardware components: the Local Area Network Interface Controller (LANIC), the Attachment Unit Interface (AUI) Cable, and the Medium Attachment Unit (MAU).

The LANIC is a microprocessor-based communications controller that handles buffering, IEEE 802.2 and 802.3 protocols, and error checking, and keeps track of network statistics. The AUI cable and 2-meter internal LANIC cable connect the LANIC to the Medium Attachment Unit. The MAU provides the physical and electrical connection to the network coaxial cable. The MAU receives signals from and sends signals to the coaxial cable, and also detects collisions resulting from two nodes starting to transmit simultaneously. The MAU performs several other functions to ensure network reliability.

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	Excellent	Good	Fair	Poor	WA*
Ease of operation	87	66	8	0	3.5
Reliability of system	117	43	1	0	3.7
Reliability of peripherals	115	42	3	1	3.7
Maintenance service:					
Responsiveness	106	60	4	1	3.6
Effectiveness	96	70	3	1	3.5
Technical support:					
Troubleshooting	53	103	12	2	3.2
Education	51	96	19	3	3.2
Documentation	43	87	37	4	3.0
Manufacturers software:					
Operating system	96	72	3	0	3.5
Compiler & assemblers	72	94	3	0	3.4
Application programs	27	88	23	2	3.1
Ease of programming	62	98	7	0	3.3
Ease of conversion	68	82	7	1	3.4
Overall satisfaction	84	83	4	0	3.5

*Weighted Average on a scale of 4.0 for Excellent.

In order to enhance these findings, three users who responded to the 1985 Users Survey were contacted during October 1985. To present a more significant system review, we talked to users who were from different parts of the country, used a different model of the HP 3000, and were from a different industry segment.

The first user we spoke to represented a retail firm in the Midwest using an HP 3000 Series 42 to run accounting, order processing/inventory, payroll, purchasing, and sales and distribution packages. When choosing a new system, the company looked at the IBM System/38 and Digital Equipment VAX systems, but felt the price/performance ratio was greater with the HP 3000 series. The company originally had an IBM System/3, but felt it was actually easier to convert its existing software from the System/3 to the HP 3000 than to another IBM system. When asked what the advantages of the system were, the user stated the system was built for interactive processing, not just batch processing, and had a good track record for reliability—in two years he had only two hours downtime. When asked about the system's disadvantages, he said he felt the operating system was complicated and not as user-friendly as it could be; it needed a data processing person to be on hand.

This user has 35 branches that will be going online in the future; three are online now. To accomplish this, the user has ordered the high-end Series 68 and feels that it will be fairly simple to expand up to the forthcoming Spectrum when the need arises because of HP's promised software portability. The user bases his faith in Hewlett-Packard because when he moved from the Series 40 to the Series 42, it took only a couple of hours to be up and running, and he expects the same upgrade time frame with the Series 68.

The second user represented a manufacturing firm in the Northeast. This firm has a Series 68 that supports 8MB of memory and 106 workstations. The company converted from an IBM System/3 to the HP 3000 because of its need for an interactive system versus a batch system. The company started with the Series 44, moved to the Series 64, and then to the Series 68. The user stated that overall, she is happy with the system. She said it is very reliable; they run

The *BSC Link* provides the network connection to an IBM System/370-compatible mainframe using bisynchronous protocol. The BSC Link interface card and cable connect to an IBM 3705 or 3725 communications controller on the host through a pair of synchronous modems. The BSC Link only supports operation of HP's RJE, MRJE, and IMF Services; a separate BSC Link product and data communications line are required for concurrent operation of IMF and RJE or MRJE.

The Point-to-Point Hardwired Link, Point-to-Point Modem Link, X.25 Link, MTS Data Link Connection, MTS Modem Link, SNA Link, and BSC Link include an *Intelligent Network Processor (INP)*, a serial communications controller. The INP architecture accommodates various protocols, interfaces, and line speeds. INP features include:

- 16-bit microprocessor and LSI circuitry
- Data communications protocols handling
- Character handling and buffer storage capabilities
- Built-in diagnostics and self-test
- On-line diagnostics running under the MPE operating system
- Collection of data volume and error statistics
- Battery backup to prevent loss of buffered data during a power failure
- Bisync and HDLC/SDLC protocol compatibility
- EIA RS-232-C, RS-422, CCITT V.24, and V.35 interfacing standards
- Compatibility with HP and common Telco/PTT modems in full- and half-duplex modes
- Support of auto-dial capability

The *Data Link* is a data communications capability used to interface an HP 3000 (primary station) and several widely distributed devices (secondary station). The HP 3000 initiates data transfers to and from the devices using Multipoint Terminal Support (MTS) Service and the MTS Data Link Connection. The Data Link is a shielded, twisted-pair cable onto which terminals and printers are connected in parallel. Devices can be connected anywhere along the same link, with no spacing restrictions. The maximum distance between the two most distant devices is 4,000 meters. All connected devices operate independent of each other and can be powered on or off, and connected or disconnected from the link without disturbing data transmission. The connected devices operate at the same speed.

The *2333A Multipoint Cluster Controller* can be used locally or remotely to connect up to 16 point-to-point devices to a multipoint line. The 16 ports are RS-232-C interfaces that operate at speeds up to 9600 bps. The controller automatically converts the multipoint format to a point-to-point format and vice versa. The HP 2333A supports the HP 262X, HP 264X, HP 307X, 2382A, and 2392 families of terminals and the HP 2563A, HP 2601A/02A/31B, and HP 2932A/33A/34A printers. Up to 32 HP 3081A factory data collection terminals can be supported via the 2333A's current loop interface card option.

The *HP 2334A X.25 Statistical Multiplexer* can be used over analog or digital leased line, dial-up line, or X.25 Packet Switched Network (PSN). It uses a four-port interface that supports full-duplex, asynchronous RS-232-C, CCITT V.24/V.28 point-to-point connection at speeds rang-

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▷ it three shifts a day, seven days a week, and has had less than 1 percent downtime. However, the user feels that with 106 terminals on the system, there is too much degradation of response time as well as of processing speed, and that the claim that the system will support 400 terminals is misleading. She did say, though, that the support is good and that HP is working with her to try to tune the system for better performance. She was also a little unhappy because she had expanded the system memory to the maximum of 8MB two months prior to the introduction of the 4MB boards and the increased maximum capacity of 16MB. She now feels that to do the tradeoff on the boards to achieve the maximum memory would be too costly, even though HP does offer a trade-in allowance.

When asked about the company's plans for future expansion, the user said it depends not only on the cost but also on the availability of Spectrum, as the company may not be able to wait for its release. She said the alternative route is to add another Series 48 or Series 58 and split the terminals between the systems, which is what her company will probably do.

The final user, a Mid-Atlantic government facility, uses an HP 3000 Series 48 to run education, accounting, payroll, and tax programs. Twelve local workstations and 15 remote workstations are supported. The user converted from an IBM 360/30 system because "It was a very limited system." He looked at the IBM 4331, but chose the HP system because of "purely economical" reasons—cost of hardware, software, and in-house support personnel versus system programmers. When asked what the advantages of the HP Series 48 were, he said it is user-friendly, performs a great deal more work with a much smaller staff than an IBM environment, has a database system that is easy to teach and to learn, has good screen handling software, and has high reliability. On the negative side, he said HP could improve the documentation; the system has a lot of design flexibility and options, but it is difficult to sift through the documentation to come up with the right composition.

This user plans to expand the hardware of the system by adding another 404MB disk drive, which is now on order, and by possibly adding another megabyte of memory. However, the memory order is on hold as he may decide to field upgrade to the newly announced Series 58, providing him with more memory capability. The user also plans to expand his communications facilities to 3 multipoint leased lines and more dial-up lines. □

► ing from 110 bps to 9600 bps. Up to four interfaces (direct connect and/or modem control) can be installed in the same HP 2334A, allowing up to 16 connections. These connections can be between the HP 2334A and remote workstations (terminals, personal computers, printers, plotters), or HP 2334A and host computer ports. The HP 2334A can be configured as an X.25 statistical multiplexer or as an X.25 cluster controller and is connected to the remote HP 3000 systems via the X.25 Link.

The *Advanced Terminal Processor (ATP)* is designed to interface asynchronous workstations to the HP 3000 Series 39, 42, 48, 58, and 68 systems in a point-to-point

configuration. Interfaces are available to allow workstations to be connected either directly or through full-duplex modems. The ATP is an intelligent workstation controller which off-loads character processing from the HP 3000 CPU by transferring data directly to and from the HP 3000's memory. It allows workstations to transmit and receive in either character or block mode.

Five products are included in the ATP structure: System Interface Board (SIB); Direct Connect Port Controller; Modem Port Controller; Direct Connect Expansion Package; and Modem Expansion Package. The ATP uses LSI technology with a separate microprocessor chip for each workstation port. Each chip is an 8-bit microprocessor with 128 bytes of RAM, 2KB of ROM, and an asynchronous receiver/transmitter to handle data transmission and reception. An additional microcomputer for every 12 modem ports handles the modem control signals. Each additional Port Controller requires one I/O slot and supports 12 additional workstations. A single HP 3000 computer may have multiple ATP subsystems installed.

The SIB provides the hardware interface to the HP 3000 Intermodule Bus (IMB) and performs the byte packing and unpacking necessary to optimize utilization of the IMB. The SIB also controls the Direct Memory Access data transfer to the HP 3000's memory.

The Direct Connect and Modem Port Controllers provide the physical interfaces for connecting local and remote workstations to the HP 3000. Each port controller supports up to 12 workstations. They also handle handshaking between the system and the workstations, and provide data buffering control speed sensing, special character detection, and character echoing functions.

Local workstations are connected to the system via the Direct Connect Port Controller. Using the HP-Direct Connect Type 422 interface, workstations can be connected to the Direct Connect Port Controller with cables up to 1,220 meters (4,000 ft.) long. The Type 422 interface is HP's implementation of the EIA RS-422 standard. HP-Direct Connect Type 232, HP's version of the EIA RS-232-C standard, allows workstations to be connected to the Direct Connect Port Controller with cables up to 15 meters (50 ft.) long. Both the HP-Direct Connect Type 422 and Type 232 interfaces allow transmission of data at speeds up to 19.2K bps.

The Modem Port Controller has one interface for connecting remote workstations to the system. Local workstations may also be connected. The HP-Modem Connect Type 232 Interface allows asynchronous, full-duplex modems to be connected to the Modem Port Controller with cables up to 15 meters long. The workstation operation speed is limited by the maximum speed at which the asynchronous modem can transfer data.

One SIB, one Direct Connect Port Controller, and one freestanding Junction Panel are included in the Direct Connect Expansion Package. The Modem Expansion Package contains one SIB, one Modem Port Controller, and one freestanding Junction Panel. The Junction Panel is a cabinet which contains an ATP junction panel; it offers junction panel space for four Direct Connect Port Controllers or two Direct Connect Port Controllers and one or two Modem Port Controllers.

The *Advanced Terminal Processor for the Series 37 (ATP37, ATP37/M)*, a communication interface board designed for the Series 37, provides connection of up to eight asynchronous workstations to the system in a point-to-point local or remote configuration. ATP37 or ATP37/M supports personal computers, terminals, and workstation printers available from HP. ▶

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► There are three versions of the ATP37/M interface, all providing 8 ports:

- Seven direct connect HP type 232 ports plus one remote port for connection to an asynchronous full-duplex modem
- Four direct connect RS-232-C ports plus four remote ports for connection to asynchronous full-duplex modems
- Seven direct connect HP type 422 ports plus one remote port for connection to an asynchronous full-duplex modem

The ATP37 provides a total of seven ports, of which six are direct connect HP type 232 and one is a remote port for connection to an asynchronous full-duplex modem.

The ATP37 uses VLSI technology with a separate chip for each workstation port. Each 8-bit chip features 128 bytes of RAM, 2KB of ROM, and an asynchronous receiver/transmitter to handle data transmission and reception.

The ATP37/M consists of the main processor board, the connection panel, and the connection panel cable.

The *Asynchronous Data Communications Controller (ADCC)* is used in the Series 39, 42, 48, and 58 to provide direct connect and modem connections for terminals. One ADCC is required to connect the system console. Data is transferred from memory to the ADCC in parallel form and then is converted to a serial bit stream for transmission over RS-232-C lines.

The ADCC does not have DMA facilities and so cannot control the IMB or memory. Terminals on the ADCC do not respond to a parallel poll. The ADCC must be directly controlled by the CPU through channel programs. Circuitry on the ADCC decodes address information and selects the proper device for each operation. Four full-duplex ports are provided on each Main ADCC; the Extender ADCC boards increase the capacity to eight full-duplex ports. Multiple ADCCs are supported on each system but, as the Main ADCC includes specific control circuitry, each Extender ADCC requires a Main ADCC to function. The Main ADCC supports full-duplex operation only via Bell type 103, 212, and 202T modems; Extender ADCCs are required for European half-duplex support.

The *Fiber Optic Multiplexer*, connected with fiber optic cable, allows the interconnection of a remote cluster of up to 8 RS-232-C devices at distances up to 1,250 meters (4,100 ft.). Each of 8 full channels can accommodate asynchronous data at rates up to 9600 bps. The multiplexer is compatible with all HP 3000 family point-to-point EIA RS-232-C/CCITT V.24 interfaces. Any HP 3000-supported point-to-point EIA RS-232-C/CCITT V.24 terminal, printer, or plotter device may be connected to the multiplexer.

The *PBX Data Communications Interface Certification* provides HP 3000 systems with the opportunity to utilize their PBX telephone systems for data transmission between the host HP 3000 and HP terminals and personal computers. The PBX manufacturers that have data communications capability and are certified for connection to HP computer systems are AT&T, Northern Telecom's SL-1 PABX line, Rolm Corp.'s CBX line, and InteCom's S/40 IBX. HP does not supply the PBX equipment needed to interface with the HP 3000. And while HP guarantees the proper operation of HP systems and applications, support for the actual PBX and its associated equipment remains the responsibility of the customer and the customer's PBX supplier.

SOFTWARE

OPERATING SYSTEM: The Multiprogramming Executive (MPE) operating system enables the HP 3000 to per-

form transaction processing, on-line program development, data communications, and batch processing concurrently. System resources can be accessed simultaneously by multiple users. An on-line HELP facility guides the user through the MPE command set. MPE monitors and controls program input, compilation, execution, and output, arranges the order in which programs are executed, and dynamically allocates hardware and software resources as required.

The major components of the MPE operating system are Configurator, Initiator, System Console Manager, Command Interpreter, File Management System, Input/Output System, Virtual Memory Manager, Disk Space Manager, Disk Cache Manager, Private Volumes Facility, Serial Disk Interface, Tape Labels Facility, Spooling Facility, Job/Session Scheduler, Process Dispatcher, Segmenter, Loader, User Trap Manager, Utility Intrinsic, Accounting Facility, Native Language Support, Application Message Facility, Logging Facility, Backup/Restore Facility, and Power Fail/Auto Restart. Support is provided for Basic, Cobol II, Fortran, Pascal, RPG, and SPL (Systems Programming Language).

MPE internal system data structure supports up to 400 concurrent sessions. Virtual memory can be spread across multiple system domain disks so that more and larger applications can run simultaneously on one system. The disk caching facility is intended to further improve I/O performance by using excess main memory to buffer reads and writes to disk subsystems. Internal file system management is used to make internal control block handling more efficient, and all changes to the file system are transparent to the user. The dispatcher-scheduler gives users more control over system workload. Disk access is queued on a priority basis to ensure better access to disk and memory resources. A TUNE command allows users to filter out long transactions, such as batch operations, to improve online performance during periods of heavy interactive load.

Under virtual memory allocation, each program can be segmented into as many as 63 segments. Each code segment can be up to 32KB in length, and each data segment up to 64KB. The principle of memory allocation dictates that only the essential segments be in memory at any particular time. The operating system remembers all segments brought into memory under a concept called segment trapping. The goal is to keep as much as possible of a program's working set—the code, data, and system data segments used most recently—in memory. This is accomplished by the use of an HP-developed algorithm called the segment trap frequency algorithm. This algorithm remembers the frequency of use of each segment of each working set and overlays only the least-used segment of a low-priority work set.

Features also include a local compression algorithm, memory allocation manager, and program dispatcher. The local compression algorithm functions to keep user segments tight together by executing large block moves within memory whenever necessary so that the need for frequent overlays is reduced. The memory allocation manager uses the segment trap frequency and local compression algorithms to optimize system throughput. The program dispatcher schedules processes for execution by using an algorithm which handles three concurrently existing queues, the new crystal process clock, and instruction set enhancements for privileged operations.

Disk Caching, featured with all models except the Series 37, manages retrieval and replacement of disk "domains" in excess main memory. It locates and replaces these disk domains so that a significant portion of the references to disk storage can be resolved before actually having to physically access the disk. Disk Caching policies are integrated into the MPE kernel, file system, and I/O system. The operator is able to use external commands to activate and

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► deactivate caching on a disk-by-disk basis and to display general caching statistics.

The MPE file system is a collection of routines in the system segmented library (SL). A user may open a file, obtain status information, read or write data, perform control functions, and close the file. File security is provided either through passwords to limit access or through file access modes and user restrictions. File access modes are Reading, Appending, Writing, Executing, Locking, or Save Files. User types are Any User, Account Member, Account Librarian, Group Users, Group Librarian, and Creator. This combination allows files to be controlled at several levels ranging from unrestricted access to file access limited to its creator only.

Under MPE, all I/O is handled by the file system; thus, programs are essentially device-independent. The IOP allows for file manipulation without extensive Job Control Language (JCL). In any access mode, whether sequential or direct, security is maintained for users, groups, accounts, and individual files.

The MPE Accounting Facility ensures that information such as CPU time, connect time, and disk file space is kept by user, group, and account. A REPORT command allows extraction of this information for each logon group.

Other features of MPE include utilization of the machine's hardware-implemented stack architecture, recursive/reentrant code, spooling from both terminal and batch devices, and remote processing via terminals.

DATABASE MANAGEMENT SYSTEM: *TurboImage/3000* is oriented toward general-purpose database management and operates in both interactive and batch environments.

TurboImage consists of three parts: a database definition subsystem (DBDS), a database management subsystem (DBMS), and a database utility subsystem (DBUS). Typically, a database manager would use DBDS to define the database and DBUS to create and maintain the database. The applications programmer, in writing the programs, would use the database management language (DBML), which operates on the database using DBMS.

TurboImage uses a network data structure as its database organization. Data entry selection is made utilizing one of four access methods: serial, directed, calculated, and chained.

In serial access, TurboImage starts at the most recently accessed data record and searches all adjacent records sequentially until the desired entry is found. In directed access, the calling program specifies the record address of the data entry where the requested data items should be located. In calculated access, master entries are retrieved by calculating an address based on a key. In chained access, entries having a common search item (key) value are linked together through pointers forming a doubly linked chain. A doubly linked chain allows for fast forward and backward searches. Access to data is accomplished by identifying the proper chain and searching the chain until the desired entry is found.

Security is provided at the database, data set, and data item levels using a class type scheme with 63 levels. The scheme is such that a user with a level 10 security does not have access to level 9 data.

TurboImage provides for 1,023 data items in a database; 199 data sets (files) in a database; 255 data items per data set; a total of 2 billion records in a data set; and 2 billion records in a data chain.

TurboImage offers three methods of recovery: intrinsic level recovery (ILR), roll-forward recovery, and roll-back recovery. ILR ensures the physical integrity of the database. Intrinsic that alter the chains in the database are logged to an ILR log file. If a hardware or software failure occurs before the intrinsic completes, TurboImage will reapply the interrupted intrinsic.

Roll-forward and roll-back recovery ensures the logical and physical integrity of the database. Transactions are logged automatically to a tape or disk log file. In the event of a failure, the roll-forward recovery systems reads the log file and reexecutes those transactions that have been successfully completed. With roll-back recovery, the recovery system will roll back any incomplete transactions.

Query/3000 is a database support tool included with TurboImage. It uses such commands as FIND, REPORT, and UPDATE to locate, report, and update values in a TurboImage/3000 database. Reporting of retrieved data can be formatted to include page titles, column headings, and group subtotals, among others items, if desired. All security provisions invoked through TurboImage are adhered to in Query. A command file can be utilized to store complex or often used command sets on disk. For display purposes, nine data types may be converted and error-checked. Query/3000 also provides computation power for crossfooting.

KSAM/3000 (Keyed Sequential Access Method) allows the user to create and maintain disk files whose records are accessed by the value of the key fields within the data records. Each data record contains 1 primary key field and may include up to 15 alternate key fields. Data records are written to a KSAM/3000 file in any order without regard to a key sequence. Records are accessed sequentially or randomly by primary or alternate key value, by logical record number, or in chronological order.

Dictionary/3000 provides information about the organization's data processing and user environments: its data definitions, data structures, files, programs, security, and locations. The Dictionary documents the user world as well as the system environment by supporting relational user views of the data.

LANGUAGES: All of the HP 3000 computers are multilingual systems that support several programming languages: Business Basic, Cobol II, Fortran 77, Pascal/3000, RPG, SPL (Systems Programming Language for the HP 3000 Series), and Transact/3000 (a high-level programming language specifically designed for transaction processing). All implemented languages have the ability to call a subroutine written in another language. Of equal importance is the facility provided by the file system for all languages to utilize a common file structure, providing uniform access to disk and tape.

COMMUNICATIONS: The *HP AdvanceNet* software provides capabilities in three broad areas: 1) workstation to HP system communications, 2) HP system to HP system communications, and 3) HP system to IBM mainframe communications. Network Services that comprise the HP AdvanceNet software products include Distributed Systems (DS) Network Services; Multipoint Terminal Support (MTS) Service; Workstation Configurator; LAN/3000; NS/3000; and HP 3000-to-IBM Communications products, which include SNA NRJE Network Remote Job Entry, SNA IMF Interactive Mainframe Facility, Multileaving Remote Job Entry, and RJE/Remote Job Entry.

Distributed Systems (DS) products are designed to be used in applications that involve transaction processing and are geographically or functionally dispersed. Any local system command may be executed remotely through an extension to ►

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that command. Many operating system intrinsics are extended in a similar fashion. DS products on the HP 3000 provide facilities for point-to-point connections between processors. Communication lines may be switched, leased, or hardwired, and may be mixed throughout the network. Every DS Network Service operates transparently across each Network Link alternate. At least one Network Link—Point-to-Point Hardwired Link, Point-to-Point Modem Link, X.25 Network Link, or Satellite Network Link—is required.

The DS products provide networking capabilities between HP computer systems: HP 3000s, HP 1000s, HP 9000s, HP 260, and HP 9845. Multiple network access methods are available to provide network database access, file access, peripheral access, file transfer, terminal access, and inter-program communication. DS Network Services capabilities are integrated with their MPE counterparts, providing accessibility from applications in any language, including Cobol, Cobol II, Fortran, Basic, Pascal, and SPL.

The *Multipoint Terminal Support Service (MTS)* is the user level software that enables an HP 3000 to communicate with multiple multipoint devices. A variety of terminals and printers can be connected directly to an MTS communications line or through the 2333A Multipoint Cluster Controller. The devices can be hardwired to the HP 3000 or connected by means of a modem. The MTS works in conjunction with the MTS Data Link, MTS Synchronous Modem Link, and MTS 3270 Device Link.

With MTS, the HP 3000 communicates with one device at a time; other devices on the network wait in a passive, monitoring state. The devices communicate only with the control station, never with each other. MTS provides half-duplex data transmission of up to 9600 bps over a single communications line between an HP 3000 system and up to 32 multiplexed terminals.

The *Workstation Configurator (WSC)* allows the configuring of connection parameters for a given asynchronous port and device. WSC has the following features:

- Provides a Workstation Configurator utility routine for an interactive, menu-driven interface to create, modify, and manipulate workstation type files.
- Supports Advanced Terminal Processor (ATP and ATP37) and Asynchronous Data Communication Controller (ADCC) hardware.
- Provides a choice of three workstation flow control protocols—Enquiry/Acknowledge or Delay handshakes controlled by the software driver, or X-on/X-off mechanism controlled by the attached device.
- Supports block mode workstations by allowing the user to define the block mode alert and trigger characters.
- Allows special characters to be defined for system attention, backspace, cancel line, end-of-record, or subsystem break.
- Offers a control setting that can be specified for echo, line feed, backspace response, or parity.
- Provides a set of characters that can be defined to be stripped and ignored by the serial I/O driver.
- Provides printer control; information such as initialization string and Vertical Format Control can be defined.

The *LAN/3000 Link* contains the hardware as well as the software required to connect an HP 3000 Series 39, 42, 48, 58, or 68 to an IEEE 802.3 coaxial cable. The software

components consist of transport protocols, network protocols, IEEE 802.2 logical link control, and IEEE 802.3 media access control. The transport protocol provides end-to-end connection-oriented services with flow control and multiplexing. The network protocol provides fragmentation/reassembly and internetworking capability. The IEEE 802.2 and 802.3 protocols give every node on the coaxial cable equal access to the network and monitor the network, eliminating transmission collisions. Node management software is also included in the 3000 Link and provides a friendly user interface for the network management functions of configuration, tracing, and logging.

The *NS/3000* allows an HP 3000 system to communicate with up to 99 other HP 3000s running NS/3000 over an IEEE 802.3 local area network. Functions include file transfer, remote database access, interprocess communication, remote process management, and remote file and peripheral access.

The *HP 3000-to-IBM Communications Services* include SNA NRJE, IMF, MRJE, and RJE.

SNA NRJE Network Remote Job Entry, along with the SNA Link, provide batch data communications between the HP 3000 and an IBM System/370-based-compatible mainframe in a System Network Architecture (SNA) environment. With SNA NRJE, HP 3000 systems emulate the functions of an IBM 8100 DPPX/RJE workstation.

IMF/Interactive Mainframe Facility, used with the BSC Link, allows an HP 3000 to communicate interactively with an IBM System/370-based-compatible mainframe computer system using BSC protocol. IMF allows programs on the HP 3000 to access host program products such as CICS, IMS, CMS, and TSO through a set of high-level intrinsics. User terminals connected to the HP 3000 may also use IMF to send and receive data from the host system. IMF requires the BSC Link, which manages the data communications protocol and link between the HP 3000 and the IBM-compatible mainframe and communications controller.

SNA IMF provides functionality similar to that offered by IMF. The primary difference in the products lies in SNA IMF's compatibility with IBM's SNA architecture. SNA IMF uses the SNA Link.

The *MRJE/3000 Multileaving Remote Job Entry Service* permits the HP 3000 to emulate workstations that work with one of the following job entry systems on the host: HASP, HASP II, ASP, JES2, JES3, RSCS, and RES.

RJE/3000 Remote Job Entry Service, also used with the BSC Link, allows an HP 3000 system to emulate the major functions of an IBM 2780 or IBM 3780 workstation.

UTILITIES: Several major utilities are included with each HP 3000.

Edit/3000 is the HP text editor used to create, manipulate, and store files of upper- and lowercase alphanumerics in the form of lines, strings, or individual characters.

Sort-Merge/3000 allows the user to order records in a file and merge sorted files.

FCopy/3000 performs general file copying tasks.

VPlus/3000 is a data entry and forms management software product.

The following optional utilities are also available for the HP 3000:

The *Text and Document Processor/3000 (TDP/3000)* is a text editing and document formatting system.

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► *Silhouette/3000* provides database as well as system-processing-unit redundancy by transparently duplicating the TurboImage and Image databases on a main HP 3000 to other HP 3000 systems over network links, creating "shadows" of the primary database. This shadowing allows users to continue database applications during a hardware or software failure.

On-Line Performance Tool/3000 (OPT/3000) is an interactive performance measurement package for the systems analyst. Bottlenecks can be isolated and performance improved by tracking CPU utilization, memory management activity, I/O traffic, program and process activity, and system table usage.

Flexible Discopy/3000 allows conversion of IBM 3741 format flexible disk data set files to HP 3000 disk files while translating EBCDIC code to ASCII.

The *HP Copycat/3000* allows copying of files to HP's 404MB disk or any removable media disks at data transfer rates up to 40MB per minute.

The *Scientific Library* is a collection of routines that perform the most often used scientific functions. The routines may be utilized by all implemented languages except RPG.

Report/3000 is a command-driven, nonprocedural report writer for use with HP Dictionary/3000 providing layout, heading, and editing capabilities.

HP Inform/3000 is a menu-driven, interactive inquiry and report generator for nonprogrammers.

HPToolset is a productivity aid that includes a workspace manager, a full-screen editor, and HP Cobol II symbolic debugging.

The *APS/3000 Application Program Sampler* identifies procedures consuming a large proportion of CPU time. On-line histograms display CPU time spent directly in user code or indirectly in system services.

Transform/3000 is designed to simplify the conversion from an RPG-based system, such as an IBM System/34, to an HP 3000.

OFFICE AUTOMATION: Hewlett-Packard's office solution is the Personal Productivity Center, which uses the concept of the workgroup computer (the HP 3000) linked with Hewlett-Packard and IBM personal computers. Key office products include software that runs both on the personal computer and on the host. Products fall into several classes: information access and management, document management, decisions support, and organizational communications.

HPWord is HP's full-feature word processor for general business needs, such as memos, lists, and reports. Connected to the HP 3000, the user can access all the functions of the Personal Productivity Center, including graphics, data management, and electronic mail.

AdvanceWrite is a word processing package integrated into the Personal Productivity Center; it uses the HP Vectra Personal Computer to provide full function word processing performance and functionality.

HPAccess and *HPAccess Central* work together to provide personal computer users access to Image/3000 data for downloading and reformatting for use in personal computer applications, such as dBase II and Condor.

HP Slate software is a commandless text processing system with a menu-driven set of functions used to enter, format, revise, print, and save shorter documents.

HPDeskManager III, using HP's AdvanceNet capabilities, offers a set of integrated fundamental office facilities such as multisystem electronic mail integrated with HPWord, VisiCalc/3000, HP Telex II, and HPMessage; basic word processing with HP Slate and HPWord; personal electronic filing; and time management.

HPMenu is a menu-building software facility that allows users to call up HP Interactive Office products. Users no longer need to type in operating system commands. Instead, they can choose from the options already available by pressing screen-labeled function keys.

HP Telex allows messages to be prepared, stored, and automatically forwarded over the Telex network.

HP Convert/WPS enables Wang-produced documents to be converted to HPWord. Documents produced in HPWord can also be sent back to the Wang system.

HPDraw is a graphic software subsystem for presentation text and figure design. Drawings can be plotted on paper or overhead transparencies, transformed into 35 mm slides, printed on an HP dot matrix printer, merged with a textual document for printing on an HP laser printer, or sent via HPDeskManager's electronic mail facility to other HP 3000 users. In addition, charts and graphs created with HPEasyChart, HPMap, and HP DSG/3000 can be integrated into HPDraw designs.

HPEasyChart allows interactive production of pie, bar, and line charts as well as of scattergrams. Charts can be displayed the same as with HPDraw.

HPMap/3000 allows graphics data stored in Image/3000 to be viewed in an easy-to-understand format. The system can produce zone, dot, and composite maps. The software comes with a map editor and a base library of maps including the U.S., States, Zip Codes, and other world locations.

APPLICATIONS: In addition to office automation, HP's proprietary applications software is grouped into several major categories, such as manufacturing, wholesale distribution, and financial management systems. For more detailed information on applications available for the HP 3000 systems, please refer to the DATAPRO DIRECTORY OF SOFTWARE.

Additional graphics packages offered by HP other than those mentioned in the Office Automation section of this report include the following:

- HP Decision Support Graphics/3000 (DSG/3000)
- Autoplot
- Word
- Forms

In addition, HP offers *HP Plus*, a marketing program which finds software written by approximately 450 independent software suppliers, qualifies the packages, and then merchandises them in conjunction with the software suppliers. The HP Plus program currently offers close to 1,000 products. Contact the local HP sales office for a current and complete listing of those packages.

PRICING

POLICY: The HP 3000 Series systems are available on a purchase or lease basis. The U.S. list price includes freight charges. Individual models are offered as a system processor unit and selected software, with extensive separately priced peripheral and software options. Standard on each HP 3000 ►

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system is the Fundamental Operating Software, which includes MPE operating system, Edit/3000 text editor, FCopy/3000 file copying utility, Sort-Merge/3000, Turbo-Image/3000 database management system, Query/3000 database inquiry language, KSAM/3000 keyed sequential access method, HP VPlus/3000 forms management software, and a facility for executing compiled programs without the source language compiler on the system.

Software products can also be purchased separately. Customers purchasing multiple copies of the same HP applications software product are offered price reductions.

For system discount purposes, each HP 3000 system counts as 0.75 to 4.0 Functional Units, depending on the system. All HP computer systems carry functional units and may be combined for discount purposes.

Standard lease rates can be calculated as percentages of the list (purchase) price payable per month for terms from 1 to 5 years; rates vary according to the type of lease.

A purchase option provision is available throughout the duration of a lease; a substantial portion of the lease payments can be applied to the purchase price.

HP offers bundled financing for configurations where the third-party software is no more than 50 percent of the list price of HP equipment for the following third-party channels: software suppliers, software resellers, software OEMs acting as software suppliers, and selected OEMs where the OEM is a Value-Added Solutions Marketing National Program OEM and the equipment is shipped directly from HP to the customer.

The HP 3000 is listed on the G.S.A. vendor list.

Most peripherals are also available for operation at 230 VAC/50 Hz. Users may specify this feature as option 015.

SUPPORT: Maintenance is separately priced and offered through 84 U.S. offices, 12 Canadian offices, and 121 international offices. Various service plans are available through HP.

Guaranteed Uptime Service provides a service credit guarantee that the uptime shall exceed 99 percent over any three consecutive months. If 99 percent uptime is not achieved, the user will receive a credit equal to one month's service charge. The service provides continuous coverage, and four-hour response to all requests within 100 miles of an HP Primary Service Office. If this service is ordered prior to installation, it will be provided during the warranty period for no additional charge.

Standard System Maintenance Services (SSMS) provides same-day response, typically within four hours of the request, at sites within 100 miles of a Primary Service Office. Support coverage is from 8 a.m. to 9 p.m. each day of the standard workweek. Extended coverage options are available, which can provide service up to 7 days a week, 24 hours a day. Preventive maintenance is scheduled regularly. Site Environmental Surveys and installation services for new products are included at no extra charge under SSMS.

Basic System Maintenance Service (BSMS) provides the same features as SSMS but with a slower response time and a reduced cost. Next-day service is available for all sites within 100 miles of an HP Service Office.

Workstation Maintenance Service is provided for workstation products, such as personal computers, terminals, flexible disk drives, printers, and plotters. Onsite service is available with next-day response for sites within the typical 100-mile service radius. Scheduled preventive maintenance

for these products is either unnecessary or performed by the user.

The Volume Repair Center Maintenance program allows HP to make scheduled weekly visits to a customer with a minimum of 25 eligible units. The user site must be within 100 miles of the primary service office.

HP also provides a Pickup and Delivery Service that provides onsite pickup of the peripheral with return within four days.

Savings of approximately 50 percent can be realized through the use of Field Repair Center (FRC) Service. This service plan requires that defective units be shipped to the closest HP Repair Center Facility, where HP will repair the units and ship them back to the user within three days of receipt. Customers with 25 or more workstations also qualify for a discount and may receive weekly scheduled visits to specified work areas, with repairs being performed onsite.

HP's extended hours of coverage are as shown in the following table:

Period of Coverage	5 Days/Week Excluding HP Holidays	6 Days/Week Excluding HP Holidays	7 Days/Week Including HP Holidays
8 a.m. - 9 p.m. (Shift 1)	Standard Monthly Maintenance Charge (SMMC)	+10% SMMC	+20% SMMC
8 a.m. - 12 Mid- night (Shift 2)	+10% SMMC	+20% SMMC	+30% SMMC
8 a.m. - 8 a.m.	+20% SMMC	+30% SMMC	+40% SMMC

HP's software support services span a broad range, from materials only to local personal assistance. Key parts of the HP support program are the two Response Centers, located in Atlanta, Georgia, and Santa Clara, California. These centers use a call-management system which assigns calls to engineers, forwards information on the user's operating systems, and generates a summary of all activity. Combining the user's information with an online database containing solutions to problems previously encountered with HP software, the response center can provide an immediate response to critical questions and a response in less than two hours to other less critical questions.

There are three standard support services: Account Management Support, Response Center Support, and Software Materials Subscription. In addition, HP also provides the Custom Support Plan, an extension to the Account Management Support Plan.

The *Account Management Support* plan provides a locally assigned support representative who personally oversees the system support. The representative assists in preparing for future needs and avoiding potential problems. Services include support management reviews, software release planning, access to HP's Response Center, HP Remote Support, HP Trend System Performance Analysis Reporting, onsite assistance, software problem reporting, and software materials and documentation.

The *Custom Support* plan is an extension to the Account Management Support plan for users requiring additional personalized assistance. It allows the incorporation of any software support service HP offers into an annual plan developed by the user and the HP account support representative.

The *Response Center Support* plan includes a subset of the services available through Account Management Support, with all assistance from HP provided over the telephone. It

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is recommended that with this plan, the user have sufficient experience with the HP system so that onsite assistance or other local attention will rarely, if ever, be needed. Onsite assistance is available, if needed, on a time-and-material basis. This plan also provides the support materials necessary to keep current on the changes and improvements in HP software.

The *Software Materials Subscription* provides by mail all the materials and information required to keep up-to-date on HP software and documentation. It is an integral part of both Account Management and Response Center Support, but is also available as a separate service. The support materials include software and firmware releases, software status Bulletin (SSB), *HP Communicator* periodical, and reference manual updates.

Optional services that can be added to a support program are as follows:

- Additional system coverage—provides flexibility in structuring support for multiple systems by extending the central system coverage to additional systems.
- HP Trend System Performance Analysis plan—a year-long service that provides the customers with periodic reports on system usage overtime. HP Trend reports are an aid for high-level resource planning, and for balancing loads across multiple HP 3000s, and across shifts, hours in the day, and days in the month. Performance statistics are collected on the customer's computer, and at specific, predetermined times, are transmitted to the Response Center for analysis and report generation.
- Additional response center caller—with the Account Management or Response Center Support plans, only the system manager or designated alternate can call the Response Center. Each purchase of this option authorizes one additional response center caller, with no limit on the total number of calls allowed. Additional callers have the same benefits as the system manager, except for requesting onsite assistance, which remains the System Manager's responsibility.
- Off-hours emergency assistance—provides onsite emergency assistance outside normal business hours through a central dispatch center. An Account Management Support customer is charged a fixed fee for each call. A Response Center Support customer is charged a fixed fee per call, plus time-and-material charges for onsite assistance.
- Software update installation assistance—provides installation assistance for each software update.
- Off-hours software update installation assistance—allows the installation of one software update by an HP support representative between 6 a.m. and 8 a.m. or between 5 p.m. and 9 p.m. on weekdays (excluding HP holidays) if a planned interruption of system operation during normal business hours is undesirable.
- Extended materials subscription—extends the software materials subscription to one additional system. It provides the right to make one copy of all central system support materials for use on one additional system.

Hewlett-Packard indicates that if a software product is discontinued from sale, support will continue for an additional 5-year period. Thereafter, support will be provided on an as-available and time-and-material basis.

In addition, Hewlett-Packard provides *Capacity Planning and Performance Analysis (HPCaplan)*. This allows the customer to plan for systems to support future business

expansion by forecasting when to budget for additional computing power.

Also offered is *HPSnapshot System Performance Analysis* that provides a detailed analysis of system performance, together with HP's specific tuning recommendations to achieve improved performance.

Along with the above mentioned software support features, Hewlett-Packard offers bundled financing for third-party software configurations where the third-party software is no more than 50 percent of the list price of the HP equipment. This financing applies to software suppliers, software resellers, software OEMs acting as a software supplier, and selected OEMs.

TRAINING: Training courses are available at an HP Technical Center at a per-student charge; onsite classes are available at a per-class charge (for up to 10 students). Classes are offered for the following categories: Introduction, Programmer, Advanced Programmer, System Manager/Administrator, and Applications.

The *HP-Assist* program provides implementation and applications assistance. HP-Assist services are designed to fit specific needs. The three phases of HP-Assist include:

- Customer Applications Analysis, which provides defined and documented analysis of specific business requirements and shows how HP applications can meet the needs.
- Implementation Team Training, which teaches the customer's product team to manage the integration of the HP 3000 into the business.
- Project Implementation Assistance, which offers project management guidance. It includes product training and tracking implementation progress.

Through *HP Remote Support*, HP Response Center specialists test and access the system's problems and provide a diagnosis. Once the problem has been identified, system patches are installed remotely. HP Remote Support also allows for scheduled maintenance functions.

HP makes available, in advance of 3000 Series system shipments, a complete set of user manuals as part of the system.

The HP 3000 Users Group provides information interchange. The fee for membership is \$200 per year.

TYPICAL CONFIGURATIONS: Sample configurations for the HP 3000 follow:

Series 37:

32449A—System Processor Unit with 512KB memory, 6 direct and 1 modem ports, Fundamental Operating System, 55MB hard disk, 67MB cartridge tape, 1 HP 2392A terminal, system cabinet	\$21,950
2932A—200 cps printer	2,595
TOTAL PURCHASE PRICE	\$24,545

Series 42:

32542B—System Processor Unit with 1MB memory, 2 GICs, and FOS	\$39,800
Opt. 014 package	2,600
7914P—132MB disk drive	13,780

Hewlett-Packard HP 3000 Series

7974A—1600 bpi tape drive	13,000
2563A—300 lpm printer	6,210
2392A—3 display terminals @ \$1,375	4,125
30018A—ADCC main (4 ports)	1,795
TOTAL PURCHASE PRICE	\$76,110

Series 58:

32558A—System Processor Unit with 4MB memory, 2 GICs, 1 IMB, and FOS	\$ 94,500
7914ST—132MB disk with 1600 cpi tape drive	27,500
2565A—600 lpm printer	19,301
30018A—ADCC main (4 ports)	1,795
2392A—4 display terminals @ 1,375	5,500
TOTAL PURCHASE PRICE	\$148,596

Series 68:

32468C—System Processor Unit with 4MB memory, 2 GICs, 1 IMB, disk caching, and FOS	\$186,100
7933G—1.2GB disk subsystem	63,700
7978A—1600/6250 bpi tape	22,500
2566A—900 lpm printer	22,301
2392A—10 display terminals @ \$1,375	13,750
30144A—System interface board	3,175
30145A—ATP board (12 ports)	6,340
TOTAL PURCHASE PRICE	\$317,866

EQUIPMENT PRICES

		<u>Purchase</u>	<u>Std.</u>
		<u>Price</u>	<u>Month.</u>
		<u>(\$)</u>	<u>Maint.</u>
			<u>(\$)</u>
SYSTEM PROCESSOR UNITS			
32449A	HP 3000 Series 37 System Processor Unit with 512KB RAM	13,000	35
001	Add-On ATP37	2,400	8
015	200-240 VAC System Operation	0	0
508	Expands memory to 1MB	3,500	6
509	Expands memory to 2MB	9,000	20
252	French	—	—
253	German	—	—
256	Spanish	—	—
257	Italian	—	—
256	Dutch	—	—
32449Z	Series 37 Media Option for MPE-V/E	0	0
022	Cartridge Tape Media	0	0
051	1600 bpi Magnetic Tape Media	0	0
32450B	HP 3000 Series 37XE System Processor Unit with I/O Expansion Unit	24,000	43
015	200-240 VAC System Operation	0	0
509	Expands memory to 2MB	6,000	14
252	French	—	—
253	German	—	—
256	Spanish	—	—
257	Italian	—	—
259	Dutch	—	—
32450Z	Series 37XE Media Option for MPE-V/E	0	0
022	Cartridge Tape Media	0	0
051	1600 bpi Magnetic Tape Media	0	0
32514B	HP 3000 Series 39 System Processor Unit (60 Hz)	35,000	190
015	220 V/50 Hz single phase operation	0	0
051	Software on 1600 bpi magnetic tape	0	0
507	Expand memory to 1MB	8,200	16
32514Z	Series 39 Media Option for MPE-V/P	0	0
022	Cartridge Tape Media	0	0
051	1600 bpi Magnetic Tape Media	0	0
32542B	HP 3000 Series 42 System Processor Unit (60 Hz)	39,800	206
014	Model 14 Packaged System	-2,600	—
015	220-240 V/50 Hz single phase operation	0	—
022	Software on cartridge tape	0	0
409	Substitute MPE-V/E for MPE-V/P	0	0
32542Z	Series 42 Media Option for MPE-V/E	0	0
022	Cartridge Tape Media	0	0
051	1600 bpi Magnetic Tape Media	0	0
32548B	HP 3000 Series 48 System Processor Unit (60 Hz)	67,500	311
015	220-240 V/50 Hz single phase operation	0	0
022	Software on cartridge tape	0	0
410	Substitute MPE-V/E for MPE-V/P	0	-7
32548Z	Series 48 Media for MPE-V/E	0	0
022	Cartridge Tape Media	0	0
051	1600 bpi Magnetic Tape Media	0	0
32558A	HP 3000 Series 58 System Processor Unit (60 Hz) includes 4MB memory and DUS on 1600-bpi tape. Must order an ATP separately	94,500	289

* Required for use on MPE-based systems. (Only one tape cartridge tape supported per system.)

** Series 64 or 68 systems shipped before March 1, 1984 require a DCU firmware upgrade to use 7974A or 7978A as system cold load device.

NA—Not applicable.

Hewlett-Packard HP 3000 Series

		Purchase Price (\$)	Std. Month. Maint. (\$)
▶ 32468B	HP 3000 Series 68 System Processor Unit (60 Hz)	186,100	765
015	380 V/50 Hz three-phase operation	0	0
016	415 V/50 Hz three-phase operation	0	0
250	Add Expansion Bay and I/O Adapter (IMB)	25,000	53
411	Substitute MPE-V/P for MPE-V/E	0	0
32468C	HP 3000 Series 68 with 4MB memory. Must order an ATP separately	186,100	615
015	380 V/50 Hz 3-phase operation	0	0
016	415 V/50 Hz 3-phase operation	0	0
250	Add expansion bay and I/O Adapter (IMB)	25,000	53
411	Substitute MPE-V/P for MPE-V/E	0	0

BUNDLED SYSTEMS

27513A	Personal Productivity Center Advanced Office Pack (HPDeskManager, HPWord, HPSpell, HPListkeeper, HPDraw, HPEzchart, VisiCalc/3000)	32,500	—
32452B	Personal Productivity Center Professional System (S/37 with 1024KB; 7945A; 9144A; 2392A; HPDesk-Manager; (4) 150 II CPU plus CPU kit; (4) 9123D; (4) Ex. memomaker; (4) Services Pack/Touchscreen; HPDesk PIA)	49,885	—
001	Expands memory to 2048KB	5,500	—
32453B	Personal Productivity Center Workgroup System (S/37 with 1024KB; 7945A; 9144A; 2392A; HPDesk-Manager; PPC WP Pack; (3) 150 II CPU plus CPU kit; 150 II CPU plus terminal kit; (3) 9153A; (3) Prof. Pack/Touchscreen; HPDesk PIA, HPWord PIA)	57,615	—
001	Expands memory to 2048KB	5,500	—
36419A	Distribution Management System I, bundled package of SFD/3000, opt. 039 and HPInvision	42,500	—
36419M	Right-to-Copy Distribution Management System I	29,750	—
36421A	Distribution Management System II, bundled package of SFD/3000, opt. 044 and HPInvision software	54,700	—
36421M	Right-to-copy Distribution Management System II	36,290	—

I/O EXPANSION

30018A	Asynchronous Data Communications Controller (ADCC)—main	1,795	10
040	Series 39 and 42 internal cable	0	0
044	Series 48 internal cable	0	0
30018AR	ADCC-main (Remarketed)	1,440	10
040	Series 42 cable	0	0
044	Series 48 cable	0	0
30019A	Asynchronous Data Communications Controller (ADCC)—extender	1,795	10
040	Series 42 internal cable	0	0
044	Series 48 internal cable	0	0
30019AR	ADCC-extender (Remarketed)	1,440	10
040	Series 42 cable	0	0
044	Series 48 cable	0	0
30079A	General I/O Channel (GIC)	1,900	13
040	Series 39 and 42 internal cable	0	0
044	Series 48 internal cable	0	0
064	Series 68 internal cable	0	0
30143A	I/O Adapter Module for Series 68 (IMB)	10,100	34

NOTE: Advanced Terminal Processor (DSN/ATP) consists of an SIB (30144A) and port controller

30144A	ATP System Interface Board (SIB)	3,175	15
30145A	ATP Direct Connect Port Controller; standard provides 12 RS-422 ports	6,590	28
001	Order once to provide 6x first I/O bay junction panel	-250	0
002	Replace Quantity 4 Type 422 ports with Quantity 4 Type 232 ports (need to order Quantity 3 to replace all 12 ports)	0	0
003	Order once to provide 6x second I/O bay junction panel	0	0
042	S/42 Cable for direct connect or modem expansion package	0	0
048	S/48 Cable for direct connect or modem expansion package	0	0
30155A	ATP Modem Port Controller	8,140	34
001	Order once to provide Series 6x first I/O bay junction panel	-250	0
003	Order once to provide Series 6x second I/O bay junction panel	0	0
042	S/42 Cable for direct connect or modem expansion package	0	0
048	S/48 Cable for direct connect or modem expansion package	0	0
30273A	Direct connect expansion package; 12 RS-422 ports standard	7,510	43
001	Deletes SIB	-910	-15
002	Replaces 4 RS-422 ports with 4 RS-232-C ports	0	0
042	Series 42 Cable	0	0
048	Series 48 Cable	0	0
30274A	Modem Expansion Package; 12 RS-232-C ports standard	9,060	49
001	Deletes SIB	-910	-15
042	Series 42 Cable	0	0
048	Series 48 Cable	0	0

* Required for use on MPE-based systems. (Only one tape cartridge tape supported per system.)

** Series 64 or 68 systems shipped before March 1, 1984 require a DCU firmware upgrade to use 7974A or 7978A as system cold load device.

NA—Not applicable.

Hewlett-Packard HP 3000 Series

		Purchase Price (\$)	Std. Month. Maint. (\$)
▶ 30459A	Peripheral Interface Channel (PIC) Series 37 and 37XE only	1,900	8
30460A	ATP/37	2,400	8
30464A	Series 68A Expansion Bay and I/O Adapter (IMB)	30,000	74
251	Junction Panels (required if no ATP is ordered)	0	—
30464B	Series 68B Expansion Bay and I/O Adapter (IMB)	30,000	53
251	Junction Panels (required if no ATP is ordered)	0	0
MEMORY EXPANSION			
30456A	1MB Series 37 Memory Module	6,000	10
30462A	2MB Series 37 Memory Module	12,000	24
30092A	512KB Series 39, 4X Memory Module (set of two 256KB boards)	7,500	16
30094A	Add-on Series 48 Memory Controller	1,600	11
30142A	1MB Memory Module for Series 68	12,000	75
30161A	1MB Memory Module for Series 39 and 4X	9,000	32
30165A	4MB Memory Module for Series 68	35,000	—
30171A	256KB Memory Module for Series 39 and 42	4,000	8
30173A	2MB Memory Module for Series 42XP and 58	15,000	18
MASS STORAGE			
7911P	28MB disk drive with cartridge tape drive and one controller with 1m HP-IB cable	13,750	54
001*	Adds dedicated controller for cartridge tape drive	1,840	24
140	Deletes cartridge tape drive	-3,570	-11
7912P	65MB disk drive with cartridge tape drive and one controller with 1m HP-IB cable	14,800	56
001*	Adds dedicated controller for cartridge tape drive	1,840	24
140	Deletes cartridge tape drive	-3,570	-11
7914CT	132MB disk with site installed 9144A cartridge tape drive, both mounted in a 92211R mobile minirack cabinet	17,280 76	
140	Deletes cartridge tape drive	-3,500	-14
7914P	132MB disk drive with integral 67MB tape cartridge	17,350	66
001*	Adds dedicated controller for cartridge tape drive	1,840	24
140	Deletes cartridge tape drive	-3,570	-14
7914R	132MB second disk drive for an installed 7914TD/ST that was ordered w/out the second disk drive	17,350	66
140	Deletes cartridge tape drive	-3,570	-14
7914ST	Mass Storage Subsystem consisting of 132MB 7914 disk drive and 7974A ½" magnetic tape drive mounted in a 56" high cabinet	27,500	143
002	Adds cartridge tape drive and second controller	5,410	38
114	Adds second 7914 (Opt. 140) disk drive	13,830	52
800	Dual-density operation; 800/1600 bpi	2,500	16
7914TD	Mass Storage Subsystem consisting of 132MB 7914 disk drive and 7970E ½" magnetic tape drive (HP-IB Version) Mounted in a 63" high cabinet	28,500	209
002	Adds Cartridge Tape Drive and second controller	5,410	24
114	Adds second 7914 (opt. 140) disk drive	13,830	52
7920M	Master 50MB Disk Drive	22,300	135
102	HP-IB interface and cable	1,200	4
7920MR	Master 50MB Disk Drive (Remarketed)	12,175	135
102	HP-IB interface and cable	1,000	4
7920S	Add-on 50MB Disk Drive	18,100	95
7920SR	Add-on 50MB Disk Drive (Remarketed)	9,825	95
7925M	Master 120MB Disk Drive	22,700	125
102	HP-IB interface and 2 m cable	1,200	4
7925MR	Master 120MB Disk Drive (Remarketed)	16,750	125
102	HP-IB interface and 2 m cable	1,000	4
7925MT	290MB Initial Disk Storage System	24,250	210
102	Add HP-IB	1,000	0
7925S	Add-on 120MB Disk Drive	18,500	85
250	Disk Controller Upgrade	535	0
7925SR	120MB Slave Disk Drive (Remarketed)	10,955	85
7925ST	240MB Add-on Disk Storage (Remarketed)	20,250	170
7925T	Add-on 240MB Disk Storage System	32,600	170
7933G	1.2GB Storage System, consists of three 7933H, 404MB disk drives each with media, controller, power supply, and 1m HP-IB cable	64,000	270
7933H	404MB Fixed Media Disk Drive; Standard Operating Voltage is 208 V w/1m HP-IB cable	25,700	90
7935G	1.2GB removable Disk system; consists of three 7935H, 404MB disk drives, each with media, controller, power supply, and 1m HP-IB cable, shipped to single destinations	74,400	507
7935H	404MB Removable Media Disk Drive; Standard Operating Voltage is 208 V, w/1m HP-IB cable	28,300	169
9895A	Flexible Disk System	5,910	77
010	1.2MB single drive system with manual for HP 3000 hook-up and use	-1,330	-36
7945A	55MB Disk Drive with 1-meter HP-IB cable	7,500	50
550	Delete 1-meter HP-IB cable	-85	—
9123D	Series 68 Console 3.5" Diskette Drive	715	8

* Required for use on MPE-based systems. (Only one tape cartridge tape supported per system.)

** Series 64 or 68 systems shipped before March 1, 1984 require a DCU firmware upgrade to use 7974A or 7978A as system cold load device.

NA—Not applicable.

Hewlett-Packard HP 3000 Series

		Purchase Price (\$)	Std. Month. Maint. (\$)
► MAGNETIC TAPE SUBSYSTEMS			
7974A	1600 cpi/50 ips start/stop, 100 ips streaming, Streaming Magnetic Tape Subsystem with HP-IB interface**	13,000	91
131	Delete cabinet; add hardware for installation in existing 7974A cabinet	-500	0
800	Add 800 cpi NRZI format	2,500	16
7978A	1600/6250 cpi, 75 ips Streaming Magnetic Tape Subsystem with HP-IB interface**	22,500	101
132	Delete cabinet; add hardware for installation in existing 7978A cabinet	-500	0
670	Return credit for 7970E tape drive	-1,000	NA
676	Return credit for 7976A tape drive	-7,500	—
26074A	Installation Kit for mounting the 7970B/E in the bottom rack of a 7971A cabinet	460	0
26075A	Multiple System Access Selector (order cables separately)	725	6
30215AR	Magnetic Tape Controller; interfaces five through eight 7970B or 7970E magnetic tape drives with 300 level options (Remarketed)	2,710	17
9144A	¼" cartridge tape drive	3,500	14
PRINTERS			
2566A	900 lpm printer	21,766	209
2565A	600 lpm printer	18,766	188
	Options for 2566A and 2565A		
022	128KB Vector to Raster Conversion Board	1,570	0
023	512KB Vector to Raster Conversion Board	3,145	0
065	HP 3000 Printer Graphics Support Software	3,150	0
2563A	300 lpm printer	5,780	52
022	128KB Vector Graphics Board	1,570	0
023	512KB Vector Graphics Board	3,145	0
065	HP 3000 Graphics Support Software (36583A)	1,575	0
2601A	40 cps daisywheel printer, RS-232-C standard (modem cable included)	3,520	86
2602A	20 cps daisywheel printer (cable not included)	1,545	50
046	HP-IB (no direct connect to HP 3000)	150	0
2932A	200 cps transaction printer, graphics, and RS-232 interface standard. Includes national languages, line drawing, and math symbols (cable not included)	2,495	26
2934A	40-67-200 cps office printer; Courier/10 cartridge, graphics, and RS-232-C interface are standard; includes bar code printing, large character set, national languages, line drawing set, and math symbols (cable not included)	2,895	30
2680A	Intelligent Laser Page Printer; includes 125,000 rotations	76,780	580
060	Graphics/extended memory management	2,565	0
062	Variable Density Print	2,550	0
500	Forms Design Package	15,250	41
501	Graphics Package	11,750	24
505	Add-on 256KB memory module	4,550	6
520	1MB memory (Deletes std. 256KB memory)	5,100	24
521	1MB memory addition	9,000	24
525	Vacuum Paper Splice Option	1,025	0
26804A	2685 Laser Print Station; includes 125,000 rotations; includes cables	140,800	1,032
015	220 V/50 Hz single-phase operation	300	0
017	240 V/50 Hz single-phase operation	300	0
030	Adds Cobol II compiler	5,000	0
031	Adds Fortran compiler	2,100	0
060	Graphics/extended memory management	2,565	0
062	Variable Density Print	2,550	0
065	Graphics software interface	6,000	0
095	Deletes 7971; no replacement	-12,790	-154
096	Deletes 2382A console; no replacement	-1,820	-20
097	Deletes 65MB disk; no replacement	-12,350	-45
098	Deletes 1600 bpi magnetic tape unit and replace with cartridge tape unit on the 7912P	-8,750	-143
099	Deletes design and formatting software and graphics terminal	-10,250	-41
503	Graphics Package	14,550	24
505	256KB memory extension	4,550	6
520	1MB memory (Deletes std. K-byte memory) for laser printer	5,100	24
521	1MB memory addition for laser printer	9,000	32
525	Vacuum Paper Splice Option	1,025	0
607	Expand controller memory to 1MB	8,200	16
26804B	2685 Laser Print Station (includes two 7945A disk drives, 9144 tape cartridge, and 2392A console terminal). Must be ordered with controller and printer option	19,560	126
337	Model 37XE controller	19,400	44
342	Model 42 controller	42,800	206
368	Model 68 controller	200,000	765
280	HP2680A Laser Printer Options	76,780	580
288	HP2688A Laser Printer	29,950	269
015	220 VAC 50 Hz	300	0
017	240 VAC 50 Hz	300	0
060	1680A Graphics Firmware upgrade	2,565	0
062	2680A Variable Density Print	2,550	0

* Required for use on MPE-based systems. (Only one tape cartridge tape supported per system.)

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NA—Not applicable.

Hewlett-Packard HP 3000 Series

		Purchase Price (\$)	Std. Month. Maint. (\$)
094	Forms Design Workstations. 2628A graphics terminal, IFS and IDS/Forms software	10,100	26
095	Deletes 9144A tape cartridge	-3,400	-14
096	Deletes 2392A console terminal	-1,320	-12
097	Deletes two 7945A disk drives	-14,550	-100
098	Add 7914ST disk/tape	23,225	143
503	2680A Graphics Package. Consists of options 060, 062, 520, 525, and 36583A	14,550	24
505	Adds 256KB memory to 2680A	4,550	6
520	Deletes standard 256KB memory from 2680 and replaces with 1024KB memory	5,100	24
521	Adds 1024KB memory to 2680A	9,000	32
2686A	LaserJet Personal Laser Printer. Includes 4000 pages/month, 150 V, 60 Hz	3,495	38
2686AU	LaserJet, 240 V, 50 Hz	3,650	38
2686AB	LaserJet, 220 V, 50 Hz	3,650	38
2687A	Desktop Laser Printer; includes 10,000 pages/month	9,300	151
2688A	Text and Graphics Laser Printer; includes 10,000 pages/month	29,950	269

GRAPHICS PLOTTERS AND DIGITIZERS

7470A	Graphics Plotter; 2-pen, A-size	1,095	12
001	RS-232-C interface	0	0
002	HP-IB interface	0	0
7475A	Graphics Plotter; 6-pen, B-size	1,895	13
001	RS-232-C interface	0	0
002	HP-IB interface	0	0
7550A	Graphics Plotter, 8-pen, automatic sheetfeed, B-size, dual I/O; eavesdrop capability, along with HP-IB and RS-232-C interfaces	3,900	40
7580B	Drafting Plotter; D-size, dual I/O, eavesdrop capability, HP-IB and RS-232-C interfaces	9,900	96
7585B	Drafting Plotter; E-size, dual I/O, eavesdrop capability, HP-IB and RS-232-C interfaces	12,900	96
7586B	Drafting Plotter; E-size, roll feed, dual I/O	16,900	96
9111A	Graphics Tablet	2,275	16
17623A	Graphics Tablet for 2623A and 2627A terminals	1,920	12

INTERACTIVE DISPLAY TERMINALS

2392A	Display Terminal (available with Swedish, Norwegian, French, German, U.K., Spanish, Canadian-French, Canadian-English, Italian, Dutch, Finnish, Danish, Swiss-German, Swiss-French, Spanish-Latin, or Flemish character sets/keyboards at no additional charge)	1,375	12
092	Port 2: 25-pin RS-232-C interface	200	0
093	Port 2: 8-bit Parallel Centronics-type interface	200	0
160	Extended Memory; adds up to 4 pages of display memory	200	0
2393A	Graphics Terminal	2,095	5
046	Port 2: HP-IB interface	200	0
092	Port 2: 25 pin RS-232-C interface	200	0
093	Port 2: 8-bit Parallel Centronics interface	200	0
2394A	Data Entry Terminal (all 2392A options are available on this terminal except Option 160)	1,795	5
2628A	HPWord Terminal (Swedish, Norwegian, German, U.K., Spanish, French, French-Canadian, Italian, Dutch, Finnish, and Danish character sets/keyboards available at no additional charge)	3,195	13
021	Port 1 Data Link	125	0
022	262X Pod Adapter	125	0
050	Integral Thermal Printer	1,210	8
061	Green CRT	50	0
062	Amber CRT	100	0
523	HP and TEK 4014 Graphics	640	0

DATA COLLECTION AND INDUSTRIAL TERMINALS

3075A	Desktop Data Capture Terminal	3,045	54
3076A	Wall Mounted Data Capture Terminal	3,625	54
The following options apply to 3075A and 3076A:			
004	Alphanumeric keyboard	270	0
005	Alphanumeric display	570	0
006	5" CRT	985	17
007	Multifunction reader	985	46
008	Type V badge reader	570	26
009	Alphanumeric printer	570	35
010	General-purpose bar code reader	640	12
011	Auxiliary HP-IB Port	805	0
012	Magnetic Stripe Reader	690	13
013	RS-232-C auxiliary interface	570	0
054	Low resolution industrial bar code reader	1,030	11
055	High resolution industrial bar code reader	1,030	11
3077A	Time Reporting Terminal	4,045	61

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NA—Not applicable.

Hewlett-Packard HP 3000 Series

		Purchase Price (\$)	Std. Month. Maint. (\$)
001	Replace Type V Reader with Multifunction Reader	460	0
002	Replace Type V Reader with Magnetic Stripe Reader	115	0
015	Alphanumeric display	635	0
3081A	Industrial Workstation Terminal	890	8
004	Alphanumeric keyboard	115	0
052	Office Wand, 12 mil	160	5
053	Office Wand, 6 mil	160	5
054	Industrial Wand, 45 mil	290	8
055	Industrial Wand, 7 mil	290	8
056	Slot Reader, 6 mil	315	8
057	Slot Reader, 15 mil	315	8
92920A	Standard Data Comm Cable for 3081A	475	0
92921A	Special Data Comm Cable for 3081A	705	0
92922A	4-channel Adapter for 3081A	945	8
39800A	Programmable bar code reader with 2 RS-232 ports and internal power supply	1,150	6
39801A	Bar code reader with 2 RS-232 ports and internal power supply	965	6

DATA COMMUNICATION

30246A	SNA Link (use processor options)	0	0
16A	Series 37	4,535	28
36A	Series 42	7,560	53
46A	Series 68	7,560	53
190	Series 37, no hardware	1,815	—
390	Series 42, no hardware	3,325	—
490	Series 48 through 68, no hardware	3,325	—
30251A	BSC Link (use processor option)	0	0
11A	Series 37	3,025	28
31A	Series 42	5,040	53
41A	Series 48 through 68	5,040	53
190	Series 37, no hardware	305	0
390	Series 42	805	0
490	Series 48 through 68	805	0
30270A	Point-to-Point Hardwired Link	0	0
10A	Series 37	3,530	28
30A	Series 42	5,040	53
40A	Series 48 through 68	5,040	53
190	Series 37, no hardware	805	0
390	Series 42, no hardware	805	0
490	Series 48 through 68, no hardware	805	0
30271A	Point-to-Point Modem Link (use processor option)	0	0
11A	Series 37	3,530	28
31A	Series 42	5,040	53
41A	Series 48 through 68	5,040	53
190	Series 37, no hardware	805	0
390	Series 42, no hardware	805	0
490	Series 48 through 68, no hardware	805	0
32187A	X.25 Network Link (use processor option)	0	0
17A	Series 37	5,240	28
27A	Series 42	7,560	53
47A	Series 48 through 68	7,560	53
190	Series 37, no hardware	2,520	0
390	Series 42, no hardware	3,330	0
490	Series 48 through 68, no hardware	3,330	0
32188A	Satellite Network Link (use processor option)	0	0
300	Series 42	20,160	0
400	Series 48 through 68	20,160	0
490	Series 68, no hardware	15,925	0
32026A	MTS Data Link Connection (use processor option)	0	0
36A	Series 42	5,845	59
46A	Series 68	5,845	59
390	Series 42, no hardware	805	0
490	Series 48 through 68, no hardware	805	0
32027A	MTS Synchronous Modem Link (use processor option)	0	0
300	Series 42	5,000	43
400	Series 48 through 68	5,000	53
390	Series 42, no hardware	805	0
490	Series 48 through 68, no hardware	895	0
32028A	MTS IBM 3270 Device Link	0	0
38A	Series 42	5,040	53
48A	Series 48 through 68	5,040	53

* Required for use on MPE-based systems. (Only one tape cartridge tape supported per system.)

** Series 64 or 68 systems shipped before March 1, 1984 require a DCU firmware upgrade to use 7974A or 7978A as system cold load device.
NA—Not applicable.

Hewlett-Packard HP 3000 Series

		Purchase Price (\$)	Std. Month. Maint. (\$)
390	Series 42, no hardware	805	0
490	Series 48 through 68, no hardware	805	0
2334A	HP Statistical Multiplexer	1,800	16
015	230 V/50 Hz operations	0	0
100	Initial configuration by HP AEO	350	0
122	4-Port Direct Connect Interface	750	0
123	4-Port Modem Control Interface	850	0
40250A	4-Port Terminal Serial Interface for 2333A	820	0
40251A	Second Host System Adapter for 2333A	550	0
021	Data Link Host	0	0
022	RS-232-C Host	0	0
40253A	8-Port Current Loop Interface for 2333A	2,050	0
2334A	X.25 Cluster Controller	2,350	16
015	230 V/50 Hz operation	0	0
122	4-Port Serial Interface	600	0
40260A	4-Port Serial Interface Card for 1334A	870	0
13265A	300 bps Modem Pod for 262X Terminals	500	0
39301A	Fiber Optic Multiplexer	2,500	18

UPGRADE PRODUCTS

Series 37XE:

32450BH	Series 37 to 37XE upgrade; provides I/O expansion with 512KB memory	17,500	12
190	Delete 1MB memory	-6,000	-10

Series 39:

30539B	Series 39 Disc Cache upgrade with 512KB memory (set of two 256KB boards)	11,000	16
170	Delete 256KB memory	-2,000	-14
190	Delete 1MB memory	-4,000	-28
408	Substitute MPE-V/P	0	0

Series 42:

30542B	Series 40 to Series 42 Field Upgrade	11,000	32
190	Delete 1MB memory	-6,000	-32
409	Substitute MPE-V/P	0	0
30550A	Series 29, 40, and 42 to 42XP Field Upgrade with new SPU and 2MB memory	40,000	65
042	Price adjustment for disk caching (39s, 42s)	-2,500	0
32542BH	Upgrade to the Series 42 with 1MB	36,000	180
022	Software on magnetic tape cartridge	0	0
617	Upgrade from Series 37 with no memory	-4,000	0
618	Upgrade from Series 37XE with no memory	-7,000	0

Series 48:

30548B	Series 44 to Series 48 field upgrade	14,000	32
190	Delete 1MB memory	-6,000	-32
410	Substitute MPE-V/E for MPE-V/P	-6,000	-7
32548BH	Upgrade to Series 48 with 2MB	63,700	274
410	Substitute MPE-V/P for MPE-V/P	0	0
614	Upgrade from Series 39 with no memory	-8,000	13
615	Upgrade from Series 42 with no memory	-13,500	26
617	Upgrade from Series 37 with no memory	-5,000	0
618	Upgrade from Series 37XE with no memory	-8,000	0

Series 58:

32558AH	Upgrade to Series 58 with 4MB memory	90,700	263
614	Upgrade from Series 39 with no memory	-8,000	13
615	Upgrade from Series 42 with no memory	-13,500	26
617	Upgrade from Series 37 with no memory	-5,000	26
618	Upgrade from Series 37XE with no memory	-8,000	26
30558A	Series 48 to Series 58 Upgrade with new SPU and 2MB memory	40,000	31
	Price adjustment for disk caching customers (48s)	-2,500	0

* Required for use on MPE-based systems. (Only one tape cartridge tape supported per system.)

** Series 64 or 68 systems shipped before March 1, 1984 require a DCU firmware upgrade to use 7974A or 7978A as system cold load device.

NA—Not applicable.

Hewlett-Packard HP 3000 Series

		Purchase Price (\$)	Std. Month. Maint. (\$)
Series 68:			
30468A	Series 64A to Series 68A Field Upgrade	25,000	75
190	Delete 1MB memory	-8,000	-75
250	Add expansion bay & I/O adapter (1MB)	25,000	53
251	Junction Panels (required if no ATP is ordered)	0	0
411	Substitute MPE-V/P for MPE-V/P	0	0
30468B	Series 64A to Series 68B Field Upgrade	25,000	75
190	Delete 1MB memory	-8,000	-75
250	Add expansion bay & I/O adapter (1MB)	25,000	53
251	Junction Panels (required if no ATP is ordered)	0	0
411	Substitute MPE-V/P for MPE-V/P	0	0
32468BH	Upgrade to Series 68 with 3MB	182,300	739
	MO1: Remote Support Service Credit	0	-75
250	Add expansion bay & I/O adapter	25,000	53
411	Substitute MPE-V/P for MPE-V/P	0	0
614	Upgrade from Series 39 with no memory	-11,650	13
615	Upgrade from Series 42 with no memory	-15,075	26
616	Upgrade from Series 48 with 1MB	-45,000	26
32468CH	Upgrade to HP 3000 Series 68 with 4MB memory	182,300	589
250	Add expansion bay (1MB) and I/O adapter	25,000	53
614	Upgrade from Series 39 with no memory	-11,650	13
615	Upgrade from Series 42 with no memory	-15,075	26
616	Upgrade from Series 48 with 1MB	-45,500	26

* Required for use on MPE-based systems. (Only one tape cartridge tape supported per system.)

** Series 64 or 68 systems shipped before March 1, 1984 require a DCU firmware upgrade to use 7974A or 7978A as system cold load device.

NA—Not applicable.

SOFTWARE PRICES

	Purchase Price (\$)
OPERATING SYSTEM	
— Multiprogramming Executive (MPE)	NC
DATABASE MANAGEMENT	
— Image/3000	NC
— Query/3000	NC
— KSAM/3000	NC
LANGUAGES	
32233A Cobol II/3000 Compiler	\$5,000
300 Basic/RPG/300 return credit	-1,575
301 SL/300 return credit	-2,100
32233R/M Right to copy 32233A with/without sublicense	2,500
300 Basic/RPG/300 return credit	-630
301 SL/300 return credit	-840
32213R/M Right to copy 32213C with/without sublicense	875
32104A RPG/3000 Compiler	3,000
32104R/M Right to copy 32104A with/without sublicense	1,500
300 Basic/RPG/3000 return credit	-630
301 SL/300 return credit	-840
32116A Fortran/77/3000 Compiler	5,000
301 Fortran/3000 return credit	-1,000
32116R Right to copy 32116A with/without sublicense	2,500
301 Fortran/3000 return credit	-500
32102B Fortran/3000 Compiler	2,050
300 Basic/RPG/300 return credit	-1,575
301 SL/300 return credit	-2,050
32102R/M Right to copy 32102B with/without sublicense	1,025
300 Basic/RPG/300 return credit	-630
301 SL/300 return credit	-840
32115A Business Basic/3000	5,500
300 Basic/3000 return credit	-1,000

NA—Not applicable.

NC—No charge.

Hewlett-Packard HP 3000 Series

		Purchase Price (\$)
▶ 32115R	Right to copy 32115A	2,750
300	Basic/3000 return credit	-1,000
32111A	Basic/3000 Interpreter and Compiler	2,050
300	Basic/RPG/300 return credit	-1,575
301	SL/300 return credit	-2,050
32111R/M	Right to copy 32111A with/without sublicense	1,025
300	Basic/RPG/300 return credit	-840
301	SL/300 return credit	-630
32105R/M	Right to copy APL/3000 compiler with/without sublicense	3,375
32106A	Pascal/3000 Compiler	5,000
300	Basic/RPG/300 return credit	-1,575
301	SL/300 return credit	-2,100
32106R/M	Right to copy 32106A with/without sublicense	2,500
300	Basic/RPG/300 return credit	-630
301	SL/300 return credit	-840
32100A	SPL/3000 Compiler	2,725
300	Basic/RPG/300 return credit	-1,575
301	SL/300 return credit	-2,100
32100R/M	Right to copy 32100A with/without sublicense	1,375
300	Basic/RPG/300 return credit	-630
301	SL/300 return credit	-840
COMMUNICATIONS		
30239	Workstation Configuration	0
310	Series 37	2,100
310R	Right to copy 310	1,050
320	Series 39 through 48	3,500
320R	Right to copy 320	1,750
330	Series 68	3,500
30245	SNA NRJE Network Remote Job Entry (use processor option)	0
310	Series 37	3,000
310R/M	Right to copy 310 with/without sublicense	1,500
320	Series 42 and 48	4,500
320R/M	Right to copy 320 with/without sublicense	2,250
330	Series 68	4,500
330R/M	Right to copy 330 with/without sublicense	2,250
30247	SNA IMF Interactive M/F Facility (use processor option)	0
310	Series 37	3,500
310R/M	Right to copy 310 with/without sublicense	1,750
320	Series 42 and 48	6,000
320R/M	Right to copy 320 with/without sublicense	3,000
330	Series 68	6,000
330R/M	Right to copy 330 with/without sublicense	3,000
30248	RJE Remote Job Entry. Requires BSC link. (use processor option)	0
310	Series 37	1,500
310R/M	Right to copy 310 with/without sublicense	750
320	Series 42 and 48	2,000
320R/M	Right to copy 320 with/without sublicense	1,000
330	Series 68	2,000
330R/M	Right to copy 330 with/without sublicense	1,000
30249	MRJE Multileaving Remote Job Entry (use processor option)	0
310	Series 37	2,500
310R/M	Right to copy 310 with/without sublicense	1,250
320	Series 42 and 48	3,500
320R/M	Right to copy 320 with/without sublicense	1,750
330	Series 68	3,500
330R/M	Right to copy 330 with/without sublicense	1,750
30250	IMF Interactive Mainframe (use processor option)	0
310	Series 37	3,500
310R/M	Right to copy 310 with/without sublicense	1,750
320	Series 42 and 48	6,000
320R/M	Right to copy 320 with/without sublicense	3,000
330	Series 68	6,000
330R/M	Right to copy 330 with/without sublicense	3,000
32185	DS Network Services (use processor option)	0
310	Series 37	2,500
310R/M	Right to copy 310 with/without sublicense	1,250
320	Series 42 and 48	4,000
320R/M	Right to copy 320 with/without sublicense	2,000
330	Series 68	4,000
300R/M	Right to copy 330 with/without sublicense	2,000

NA—Not applicable.
NC—No charge.

Hewlett-Packard HP 3000 Series

Purchase
Price
(\$)

▶ 32025	MTS Multipoint Terminal Support (use processor option)	0
320	Series 42 and 48	2,200
320R/M	Right to copy 320 with/without sublicense	1,100
330	Series 68	2,200
330R/M	Right to copy 330 with/without sublicense	1,100
32344	HP Network Services (NS/3000). Operation requires 30242A Link	0
320	Processor Option: Series 39 through 48	4,000
320R	Processor Option: right to copy 320	

UTILITIES

—	Edit/3000	NC
—	Sort-Merge/3000	NC
—	FCopy/3000	NC
—	VPlus/3000	NC
—	Text and Document Processor/3000	NC

PROGRAMMER PRODUCTIVITY TOOLS

19550A	Copycat/3000	4,000
—	Right to copy 19550A with/without sublicense	2,000
32199A	Flexible Discopy/3000	685
32199R	Right to copy 32199A	342
32215B	Scientific Library	410
32215R/M	Right to copy 32215B with/without sublicense	200
32238A	OPT/3000 On-line Performance Tool	6,400
32238M	Right to copy 32238A without sublicense	3,200
32244A	Dictionary/3000 Data Dictionary	5,500
32244R/M	Right to copy 32244A with/without sublicense	3,850
32245A	Report/3000 General-Purpose Report Writer	5,000
32245R/M	Right to copy 32245A with/without sublicense	2,500
32246A	HP Inform/3000 User Report Generator (requires Dictionary/3000)	6,000
32246R/M	Right to copy 32246A with/without sublicense	3,000
32247A	Transact/3000 Transaction Processing Language and Processor	6,000
32247R/M	Right to copy 32247A with/without sublicense	3,000
32248A	Programmer productivity package (Report/3000, Dictionary/3000, Transact/3000)	13,000
32248R/M	Right to copy 32248A with/without sublicense	6,500
32449A	Rapid/3000 Processor (execute only for Transact/3000 and Report/3000 programs)	500
32258A	HP Report Writer Package (Report/3000, Inform/3000, Dictionary/3000)	13,000
32258R/M	Right to copy 32258A with/without sublicense	6,500
32350A	HPToolset Program Development System (requires Cobol II/3000)	5,000
32350R/M	Right to copy 32350A with/without sublicense	2,500
27205A	SOM Speech Library/3000	100
32351A	Cobol Productivity Package	13,000
32351R/M	Right to copy 32351A with/without sublicense	6,500
32352A	Pascal Productivity Package	13,000
32352R/M	Right to copy 32352A with/without sublicense	6,500
32355A	HP Report Combination	9,000
32355R/M	Right to copy 32355A with/without sublicense	4,500
32180A	APS/3000 Application Program Sampler	2,000
32180R/M	Right to copy 32180A with/without sublicense	1,000

NA—Not applicable.

NC—No charge. ■