Hewlett-Packard HP 3000 Series

MANAGEMENT SUMMARY

UPDATE: *Hewlett-Packard's enhancements to its HP 3000 Series in the past six months include new communication facilities, an enhanced database management system, and a language system upgrade. Further efforts were also made in the office automation area with the HP Personal Productivity Center.*

New communication products that enhance HP's AdvanceNet local area network (LAN) include the HP LAN/3000 Link, HP Network Services (NS), and HP SNA Interactive Mainframe Facility (IMF). The LAN/3000 Link is a full implementation of the IEEE 802.3 carrier-sense-multiple-access with collision-detection (CSMA/CD) baseband LAN standard and the IEEE 802.2 logical link control specification. It contains both the hardware and software needed to connect an HP 3000 computer system to an IEEE 802.3 local area network. At a data transfer rate of 10 million bits per second, users can realize a two-to-six times improvement in data throughput, according to Hewlett-Packard. Up to 100 users can be connected to a single HP LAN/3000 Link.

The HP NS/3000 software, available with LAN/3000, provides virtual-terminal and remote-command execution; network file transfer; remote file, database, and peripheral access; network interprocess communication; and remote process management.

HP SNA IMF, an interactive SNA-compatible IBM 3270 emulation product, augments the already available HP-to- ▷

The five HP 3000 models range in size from low-end to high-end minicomputers and offer applications software for office automation, manufacturing, financial, and wholesale distribution. HP 3000 systems can be configured as ready-to-run production systems, as program development systems, as integrated elements of distributed data processing networks, and as personal productivity centers, integrating personal computers.

MODELS: Series 37, Series 39, Series 42, Series 48, and Series 68.
MEMORY: 512KB to 8MB.
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 up to 400 on the Series 68.
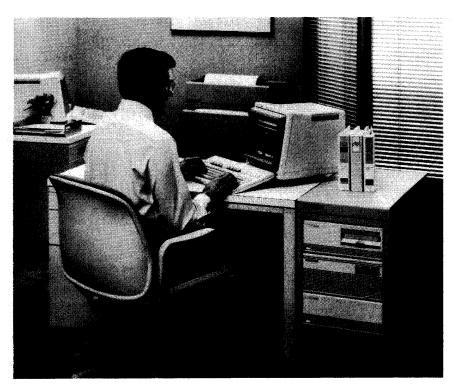PRICE: $13,000 to $186,100.

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. ▶

The Series 37 is the entry-level model in the HP 3000 product line. This system supports up to 28 workstations, and offers 512KB to 2MB of memory and 55MB to 2.1GB of disk storage. As the user's computing needs increase, software compatibility allows for migration from the Series 37 up to the Series 39, 42, 48, and 68.

Hewlett-Packard HP 3000 Series

CHART A. SYSTEM COMPARISON

MODEL	Series 37	Series 39	Series 42	Series 48	Series 68
SYSTEM CHARACTERISTICS					
Date of introduction	September 1984	February 1983	June 1983	June 1983	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
Upgradable from	Not applicable	None	Series 37, 40 (old system)	Series 37, 39, 42, 44 (old system)	Series 40, 44, 64 (old systems)
Upgradable to	Series 42, 48, and 68	Series 48, 68	Series 48	Series 68	Not applicable
MIPS	—	—	—	—	—
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	3M
Maximum capacity, bytes	2M	3M	3M	4M	8M
Type	NMOS	NMOS	NMOS	NMOS	NMOS
Cache memory	None	None	None	None	8K
Cycle time, nanoseconds	170	430	430	430	134
Bytes fetched per cycle	—	—	—	—	—
INPUT/OUTPUT CONTROL					
Number of channels	Up to 3	2	2	5	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	50MB
MAXIMUM DISK STORAGE	2.1GB	3.2GB	3.2GB	4.2GB	9.7GB
NUMBER OF WORKSTATIONS	28	92	92	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

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

▷ IBM communications. It allows users to access applications written for IBM 3270 devices using IBM SNA's communications protocol. The SNA Link provides the physical connection, via a leased or dial-up line, to an IBM host.

HP's TurboImage/3000 database management system (DBMS) is a new version of the Image/3000 DBMS and offers increased storage capacity and improved data recovery. At least twice the amount of information can be stored in the TurboImage database system than could be stored in Image. Each of the parameters that defines the maximum database size has been increased by at least 100 percent in HP TurboImage. TurboImage also includes a faster recovery method called roll-back recovery, in addition to the existing instrinsic-level recovery and roll-forward recovery methods. With the roll-back recovery method, transactions are logged to a tape or disk file, and in case of a hardware or software failure, the recovery system rolls back any incomplete transactions. According to HP, tasks operating concurrently can realize significant performance improvements.

The HP Fortran 77/3000 language product is based on the ANSI Fortran 77 (X3.9-1977) language standard and improves program management and flexibility. The system provides support for structured programming, control and management of sequential or direct-access files, extended precision computation for engineering and scientific applications, and conditional compilation. It also allows insertion of program text from another file. Products from the previous Fortran 66-based language can be upgraded to Fortran 77/3000.

One of HP's biggest thrusts for the HP 3000 has been in the area of office automation, or integrated office systems, with ▷

▶ 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. In both single- and extended-precision formats, the exponent can range between −256 and +255, while an assumed "one" is placed to the left of the binary point in the fraction. (The "one" is disregarded for floating-point zero.) All floating-point numbers are by definition normalized. The binary point is assumed to be between the exponent and fraction. Bit 0 of the first word is the sign bit; the exponent in bits 1 through 9 is biased by +256.

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. In general, each instruction has a number of basic fields. The first field is always four bits long and is used to define a specific operation code (for memory reference or loop control instructions) or one of four sub-opcode groups. All sub-opcode type instructions have an operation code extension field whose length and position in the instruction vary depending upon which of the four sub-opcode groups is specified. In some cases, a third operation code field (mini-opcode or special opcode) is used to extend the basic operation code. The rest of the 16-bit instruction is used for a variety of functions, including, count fields, bit positions, index specification, and immediate operand, and is called the argument. ▶

Hewlett-Packard HP 3000 Series

▷ 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.

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 HP 3000 has five processor models, the Series 37, 39, 42, 48, and 68.

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 37XE 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.

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, and is packaged with an integral cartridge tape and a 28-, 65-, or 132-megabyte Winchester disk. 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 ▷

▶ INTERNAL CODE: ASCII.

MAIN STORAGE

TYPE: NMOS utilizing 64KB or 256KB RAMs.

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 1020 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 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 8MB. See Chart A for specific system capacities. The Series 39 and 42 offers memory upgrades in increments of 256KB or 1MB, the Series 48 offers memory upgrades in increments of 512KB or 1MB, and the Series 68 offers memory upgrades in 1MB increments.

CHECKING: Automatic fault detection and correction memory is used in all current HP 3000 models. The word length transmitted over the intermodule bus is 16 bits. In the memory modules the word length is expanded to 39 bits; 32 data bits and 7 bits for the automatic fault detection and correction logic. This provides 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 violation 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 controller, maximum of 119 entries on the Series 37, 39, 42, and 48, and maximum of 485 on the Series 68) containing device interrupt vectors and the identity of the drives for each device.

CACHE MEMORY: The Series 68 has 8KB of cache memory and is the only HP 3000 system to support 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, and 48, 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 ▶

Hewlett-Packard HP 3000 Series

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	50MB
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	Includes built-in ¼", 67MB cartridge tape; 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	55MB	23
Number of usable surfaces	9	13	13	7	2
Number of sectors or tracks per surface	823	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	1.2MB/sec.	1.2MB/sec.	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 giga-bytes of disk storage	7935G is an add-on unit providing 1.2 giga-bytes of disk storage		Opt. 010-single drive

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

▷ drives. In addition, the Series 42 supports up to 92 terminals, 60 of which may be connected point-to-point.

The Series 48 comes standard with 2MB of main memory, and is 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 those 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 Series 68 comes with 3MB of main memory, which can be expanded to 8MB. The system supports up to 24 data communication 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 comes standard with the HP Advanced Terminal Processor (ATP). The ATP provides communications capabilities while reducing system overhead via the ATP's own microprocessors. ▷

▶ 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. According to HP, low power requirements, low cost, smaller size, and higher reliability are benefits of this technology.

The Series 39, 42, and 48 feature a Hewlett-Packard designed, microcoded, 16-bit processor using Schottky TTL technology. This technique provides high-speed execution of instructions while maintaining machine instruction set flexibility.

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 Communication 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) technol- ▶

Hewlett-Packard HP 3000 Series

▷ A disk caching facility 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. Disk caching is available on the Series 39, 42, 48, and 68.

All of the HP 3000s utilize 64K RAM memory chips to provide maximum memory with a minimum of boards. The Series 68 also adds an 8K-byte 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, and 48 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, group-encoded unit for burst-speed backup operations. Printers vary from a 40 cps letter quality printer to 45 pages per second laser page printing systems. HP also offers dot matrix printers printing up to 900 lpm. The wide range of terminals 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. Generally, a Network Service requires at most one Network Link in order to be useful, and at least one Network Service product is needed to be able to use a Network Link. The Network Services include the Distributed Systems Network, Network Services/3000, Multipoint Terminal Support, Workstation Configurator Network, and HP-IBM Data Communications Products.

All HP 3000 systems include the Fundamental Operating Software (FOS), and included in FOS is the Multiprogramming Executive (MPE) operating system, Edit/3000, FCopy/3000, Sort-Merge/3000, TurboImage/3000, ▷

▶ ogy 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 arithmetic logic units (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 and cannot be intermixed except in "immediate" data present in program instructions. This design was chosen so that all program code would be protected from alteration, thus permitting the development of reentrant programs for multithread operation.

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.

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, and 48. The Series 68 utilizes 64KB 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, and 48. 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, and 48; 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 registers (eight in the Series 68), and the Index and Status registers.

The code segment group consists of the Program Base register (PB), which defines the program base of the code segment being executed; the Program Counter (PC), which contains the 16-bit absolute address of the instruction being executed; the Program Limit register (PL), which defines the limit of the code segment being executed; and the Program Bank register (PBNK), which defines the bank of 64K words where the code segment resides (Series 37, 39, 42, and 48). The Series 68, instead of the PBNK register, includes a BNKP register, which performs the same function.

The stack pointer group is divided into the data segment group and the stack pointers. The data segment group includes the Data Base register (DB), used to define the database of the current user's stack; the Q register, utilized to define the current stack master in the current data segment; the Data Limit register (DL), where the data limit of the current data segment is defined; and the Data Base Bank register (DBNK), which contains the location of the ▶

Hewlett-Packard HP 3000 Series

CHART C. WORKSTATIONS

MODEL	2392A	2623A	2625A	2626A
DISPLAY PARAMETERS				
Max. chars./screen	1920	1920	1920	1920
Buffer capacity	4 pages std., 80 pt.	2 pages	Up to 6 pages	5 pages
Screen size (lines x chars.)	24 x 80	24 x 80	24 x 80	24 x 80
Tilt/swivel screen	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
Character phosphor	P31 green	P4 white std., P31 green opt.	White std., amber or green opt.	P4 white std., P31 green opt.
Total colors/no. simult. displayed	None	—	—	—
KEYBOARD PARAMETERS				
Style	Typewriter	Typewriter	Typewriter	Typewriter
Character/code set	128 ASCII	128 ASCII	96 EBCDIC/128 ASCII	128 ASCII
Detachable	Yes	Yes	Yes	Yes
Program function keys	8	8	16	8
TERMINAL INTERFACE	RS-232-C	RS-232-C, 20 ma	RS-232-C, HP 422	RS-232-C, 20 ma

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

CHART C. WORKSTATIONS (Continued)

MODEL	2627A	2628A	2645A	2393A
DISPLAY PARAMETERS				
Max. chars./screen	1920	1920	1920	—
Buffer capacity	2 pages	Up to 6 pages	4K std., 8K opt.	Up to 12 pages
Screen size (lines x chars.)	24 x 80	24 x 80	24 x 80	—
Tilt/swivel screen	Yes	Yes	No	—
Symbol formation	7 x 11 dot matrix	7 x 11 dot matrix	9 x 15 dot matrix	—
Character phosphor	—	White std., green or amber opt.	P39 white	—
Total colors/no. simult. displayed	8	—	—	—
KEYBOARD PARAMETERS				
Style	Typewriter	Typewriter	Data entry	—
Character/code set	128 ASCII	128 ASCII	128 ASCII	—
Detachable	Yes	Yes	Yes	—
Program function keys	8	16	8	12
TERMINAL INTERFACE	RS-232-C, RS-422	RS-232-C, 20 ma	RS-232-C, 20 ma	HP-HIL, HP-IB, RS-232-C, HP-422

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

▷ Query/3000, KSAM/3000, and HP VPlus/3000. MPE allows transaction processing, on-line program developments, data communications, and batch processing. An online HELP command is one illustration of HP's user-friendly software approach. 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.

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

COMPETITIVE POSITION

The HP 3000 system is a 16-bit system that can compete with 32- and 8-bit systems, depending on the specific application area addressed. For example, the HP 3000 systems compete against Data General's Eclipse MV/Family and Digital Equipment Corporation's (DEC) VAX systems in general purpose applications, and against Wang Laboratories VS systems and the IBM System/36 and ▷

▶ bank in which the stack or split stacks reside. DBNK is used in the Series 37, 39, 42, and 48 machines. The Series 68 uses the BNKD register to perform this function. The stack pointers include the SM register, which defines the number of top-of-stack elements that are in CPU Stack registers; the Z register, whose function is to define the stack limit of the current user's stack; and the Stack Bank register (SBNK), used to define the 64K-word bank in which the stack resides (Series 37, 39, 42, and 48). The Series 68 uses the BNKS register to perform this function.

The Status register indicates the current status of the computer hardware, including whether the system is in user or privileged mode. The Switch register (SWCH) is a 16-bit register representing front panel switches used for bootstrapping and fault diagnosis on the Series 39, 42, and 48. A performance register (PERF) in the Series 68 is used by Hewlett-Packard to make electrical measurements to monitor performance. The Series 37 can be brought up with the turn of a key.

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. Both word and byte addressing are relative to the Q-register (plus or minus), the DB-register (plus only), or the S-register (minus only). The S-register is a logical addition of the contents of the SM and SR-registers. In addition, word addressing is relative to the ▶

Hewlett-Packard HP 3000 Series

CHART D. PRINTERS

MODEL	2565A	2566A	2601A	2602A	2608S	2611A
Type	Dot matrix	Dot matrix	Letter-quality	Letter-quality	Dot matrix	Chain
Speed	600 lpm	900 lpm	40 cps	25 cps	400 lpm	600 lpm
Bidirectional printing	—	—	Yes	Yes	No	No
Paper size	3"-18"	3"-18"	Up to 15"	Up to 15"	Up to 16"	Up to 19½" x 15"
Character formation	5 x 7 dot matrix	5 x 7 dot matrix	Full-formed	Full-formed	Varies	Chain full-font
Horizontal character spacing (chars./inch)	5, 10, 16.7	5, 10, 16.7	10 or 12	10 or 12		10
Vertical line spacing (lines/inch)	6/8	6/8	6 or 8	6 or 8	6 or 8	6 or 8
Character set	182	182	88/92/96	98	128	64/96
Controller/Interface	HP-IB (std.)	HP-IB (std.)	RS-232-C	RS-232-C	HP-IB	Parallel-Differential
No. of printers per controller/interface	2 Controller	2 Controller	1	1	2/4	2
Printer dimensions, in. (h x w x d)	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	40 x 27 x 22	42¾ x 36½ x 26
Graphics capability	Yes	Yes	No	No	Yes	No

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

System/38 in office applications. Competition in the financial arena is mainly from the Burroughs V1900 system. The introduction of its low-end Series 37 model allowed Hewlett-Packard to become more agressive and price competitive in the office automation market.

In comparing the HP 3000 Series 68 system with the DEC VAX 11/750, the maximum memory is 8MB on both systems. Both systems have cache memory, with the Series 68 offering 8KB cache versus the 4KB cache on the VAX 11/750. The VAX 11/750 provides more storage with a maximum of 19GB, whereas the Series 68 provides a maximum of 9.7GB. A definite competitive edge that the HP 3000 Series 68 has over the DEC VAX 11/750 is the amount of workstations supported—the Series 68 supports up to 400, while the VAX 11/750 only supports up to 128. Support of technical applications is an advantage the DEC systems have over the HP 3000. Hewlett Packard depends upon its HP 9000 and HP 1000 systems to fill that gap in the marketplace.

ADVANTAGES AND RESTRICTIONS

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 five models to the top-of-the-line Series 68 without any operating or application software recompilation. This 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.

Hewlett-Packard's recently-created response centers and support programs have added additional reliability to the system. The response center offers remote diagnostics 24 hours a day. Various support programs offer 4-hour service response time with a qualified engineer for onsite trouble calls.

Even though only the HP 3000 Series 68 offers cache memory, all models except the Series 37 offer disk cache, which reportedly aids in speeding up processing functions.

P-register (plus or minus). Indirect addressing and indexing are both provided, individually or in combination. Up to 32K words (addresses) can be referenced by a memory reference instruction.

Double-word indexing is provided for 2 memory address instructions that automatically cause the index register contents to be incremented by 2 during development of the effective address.

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 1 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.

The priority assigned to external devices is determined by the device's logical proximity to the I/O processor (IOP) on the interrupt poll line. Masking is permissible through the 16-bit mask word, which will enable or disable an interrupt request according to the bit pattern of the word.

OPERATING ENVIRONMENT: The Series 37 is housed in a desk-high unit that is about the size of a two-drawer file cabinet. The Series 39 and 42 System Processing Units (SPU) are housed in identical standalone cabinets, the Series 48 is 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	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	1150

The Series 37 requires a line voltage of 100 to 120 VAC ±10 percent or 200 to 240 VAC ±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 8.5 amp at 60 Hz or 4.5 amp at 50 Hz. Heat dissipation is 3000 Btu per hour. The Series 48 requires a line voltage of 210 VAC at 60 Hz or

Hewlett-Packard HP 3000 Series

CHART E. MAGNETIC TAPE EQUIPMENT

MODEL	7970E	7974A	7976A	7978A	9144A
TYPE	Reel-to-reel	Reel-to-reel	Reel-to-reel	Reel-to-reel	Cartridge
FORMAT					
Number of tracks	9	9	9	9	16
Recording density, bits per inch	1600	800/1600	1600 or 6250	1600/6250	10,000
Recording mode	PE	PE/NRZI	PE or GCR	GCR/PE	MFM
CHARACTERISTICS					
Controller model	30215A	Included	Included	Included	Included
Drives per controller	4	1	1	1	1
Storage capacity, bytes	40M	20M (NRZI); 40M (PE)	140M	40M (PE); 140 (GCR)	67.1M
Tape speed, inches per second	45 ips	100	75 ips	75	60
Data transfer rate, units per second	72K bps	160K bps (streaming); 80K bps (start/stop)	120K bps or 468K bps	486K bps (GCR); 120 (PE)	33K bps
Streaming technology	No	No	Yes	Yes	Yes
Start/stop mode; speed	—	50 ips	—	—	NA
Switch selectable	No	No	Yes	Yes	No
Comments		Auto. thread and load	Auto. thread and load		

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

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 functionallity 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.

Worthy of mention is the HP Personal Productivity Center. This is an integration of office application software, workstations (including personal computers), distributed data processing, data and peripheral sharing, and telecommunications facilities with the HP 3000 in a departmental environment, all working together to provide a total answer to a user's requirements.

Nothing has been done to enhance the hardware end of the system in recent months. The reason for this can probably be attributed to all efforts being spent on the soon-to-be-offered Spectrum system. Spectrum is a reduced instruction set computer (RISC), and will be initially offered as the next step up from the HP 3000 Series 68. Even though the Spectrum will sport different architecture than the Series 68, Hewlett-Packard claims that the Spectrum will initially support the same operating system, and that all software will be compatible with HP 3000 systems. Until the Spectrum is released, the Series 3000 growth path ends with the Series 68.

USER REACTION

The Datapro 1984 Computer Users Survey received responses from 157 HP 3000 users. At the time the survey was taken, the average age of the systems was 43.4 months. Because the Series 37 was introduced after our survey was taken, it is not represented in the ratings. Most users (61 out of 157) worked with systems configured with 2MB to less

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

Hewlett-Packard HP 3000 Series

▷ than 4MB of main memory. Fifty-eight users had from 1MB to less than 2MB of main memory on their systems. The third highest memory configuration was from 512KB to less than 1MB (27 users). The remaining respondents worked with large configurations: 9 users had from 4MB to less than 8MB and 2 had 8MB.

In terms of disk storage capacity, the majority of users worked with medium to large systems. Eighty-four respondents indicated that their systems were supporting from 100MB to less than 600MB of disk storage. Fifty users had systems with 600MB to less than 1.2GB of storage. The remaining users configured their systems as follows: 14 had from 1.2GB to less than 4.8GB; 2 users each worked with over 4.8GB, from 50MB to less than 100MB, or less than 10MB; and 1 user indicated working with 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 responses (52) said that between 16 and 30 workstations were installed locally; 47 respondents answered with a range of 6 to 15 workstations; and 40 installed between 31 and 60 local workstations. Eight users said they had over 60 workstations installed locally and another 8 had between 1 and 5. Remotely, 58 users installed between 1 and 5 workstations; 29 users had 6 to 15; and 14 users had 16 to 30. Forty-one users did not work with remote workstations.

The majority of respondents (46) worked in the manufacturing industry. The field of education employed 22 survey respondents. Fifteen users respresented government organizations. Other industries represented include: retail/wholesale, with 11 users; service bureau, 8 users; chemical/petroleum, 7 users; heath care/medical and transportation, with 4 users each; banking/financial/securities, engineering/scientific, and media, with 3 users each; public accounting/consulting, 2 users; and construction, insurance, and utilities, with 1 user each. Twenty-five respondents work in industries or professions that were not represented by survey answers. Accounting (114 users), payroll (88 users), order processing/inventory (77 users), purchasing (58 users), sales/distribution (50 users), manufacturing (47 users), education (34 users), and engineering/scientific (20 users) were the principal applications being used on the HP 3000. Other applications respresented by less than 15 respondents included process control, mathematics, health care, petroleum/fuel analysis, construction, banking, and insurance. Thirty users worked with applications that were not listed on the survey.

When asked if the system did what it was expected to do, 155 users stated that it did; 2 respondents were undecided. All but one user answered the question "Would you recommend this system to another user?" Out of the 156 who did respond, 146 would recommend the HP 3000; 3 said they would not; and 7 were undecided about recommending it. The respondents rated the HP 3000 as follows: ▷

▶ 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, by controller limitations, and by marketing considerations.

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 increases 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 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 and 68 increase the maximum number of disk drives supported per system to 16 and 24, respectively. The Series 48 supports up to 4.2GB of disk storage; the Series 68 offers up to 9.7GB of disk storage. The Series 3000 systems requires 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. 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 with four 7978s allowed. The Series 48 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, and 48, and eight printers on the Series 68. Each HP 3000 system also supports a maximum of two 2688A Intelligent Page Printers. All printers interface through the GIC. ▶

Hewlett-Packard HP 3000 Series

	Excellent	Good	Fair	Poor	WA*
Ease of operation	82	67	7	0	3.50
Reliability of system	114	40	2	1	3.70
Reliability of peripherals	101	52	3	1	3.61
Maintenance service:					
Responsiveness	93	55	7	2	3.52
Effectiveness	89	62	4	1	3.53
Technical support:					
Troubleshooting	47	89	18	1	3.17
Education	31	96	23	4	2.98
Documentation	27	96	29	4	2.90
Manufacturers software:					
Operating system	84	63	6	3	3.45
Compiler & assemblers	70	74	8	2	3.37
Application programs	29	76	17	2	3.05
Ease of programming	54	88	7	3	3.26
Ease of conversion	41	82	16	2	3.11
Overall satisfaction	80	71	6	0	3.44

*Weighted Average on a scale of 4.0 for Excellent.

In order to enhance these findings, four users who responded to the 1984 Survey were contacted during October 1984. Although certain problems or annoyances were sited, each user was happy with the system's performance.

One respondent, representing a consulting engineering firm located in the Northwest, said the firm installed three HP 3000 Series III systems ten years ago because HP offered the best engineering computer and Fortran compiler at the best price. As Fortran improvements were made throughout the industry, this user said HP Fortran stayed the same. Because the firm has engineering applications requirements, other alternatives were investigated when the HP became too small for the firm's needs. For the engineering side of the business, one of the Series IIIs was replaced with a Honeywell DPS 6. Because of additional system needs, the firm plans to convert its business applications, which run on the other Series III, to an HP 3000 Series 68. Because of system compatibility among the HP 3000 models, conversion is expected to proceed very smoothly.

This user's main area of dissatisfaction includes the Basic compiler, which he feels is "ancient"; inconvenient backup procedures; and the Image database management system. If Image performed adequately, he asks, why are software tools being sold to make it better? Also, the HP 3000 has a batch-oriented file system; the user says it is adequate, but it could be friendlier. This user feels the system's operating system is one of its best assets; it's easy to use and continually improved upon. HP support is also very good. If a prospective HP 3000 user were to ask about the system, this user would recommend the 3000, explaining its drawbacks in the Fortran area.

Our second user worked for an East Coast software developer that develops software primarily for HP systems. The HP 3000's positive attributes, for this user, include HP's ongoing commitment to continually enhance the product and the 3000's "rock stable" reputation. As a software developer, this user has found the HP 3000 to offer a "nice environment" for software development and operation. On the negative side, the system's 64K address space ▷

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 graphic plotters, graphic tablets, and data collection terminals. HP's plotters offer a range of choices in paper size, pens, and interfacings.

COMMUNICATIONS CONTROL

GENERAL: The maximum synchronous communication lines supported for each of the 5 HP 3000 Series is as follows: Series 37 and 39—3 lines, Series 42—3 lines, Series 48—7 lines, and Series 68—24 lines.

HP's communication network, 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 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 do provide the user interface, but they lack protocol management and the physical interface. None of the current Link products provide any direct user-callable routines or intrinsics; therefore, Links and Services are not 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:

Network Links	Network Services
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

▶

Hewlett-Packard HP 3000 Series

architecture has been limiting for this user. In addition to a changed architecture, the user would like to see HP increase the 3000's communications capabilities, reduce peripheral and update cost, enhance its backup procedures, and increase its speed (this user feels that the 3000 is slower than it should be).

Because this user works with the Series 40, which is no longer an actively marketed model, the user is interested in the Series 40 to Series 42 enhancements. The updates enhance the operating system by adding disk caching. Because disk caching is the difference between the two systems, this firm feels it should not be billed for this enhancement.

The third user we spoke with represented an educational institution located in the Midwest. The computer center chose the HP 3000 for two reasons: 1) several universities in the area were using a 3000 model and were pleased with the performance, and 2) HP bundled its Image database management systems with the cost of the 3000. Unlike our first respondent, this user is very happy with Image and its performance. The computer center recently installed HP office automation software, and so far, is pleased with the results. High grades are given down the line; this user recommends the HP 3000 with "no qualifications."

Lastly, we contacted a health care organization in the Southwest. Like the previous user, our fourth respondent feels the bundled software helped sell him on the HP 3000. The compilers, however, are "out of line" with the industry. According to this user, HP does not update and enhance its programming languages; the languages are not competitive with the currently available languages from other manufacturers. This user feels that the Basic compiler could be more powerful, and the Cobol compiler does not include modules that are included with other Cobol compilers. The compilers, according to this user, are the system's biggest drawback.

The user feels HP offers a "tremendous" growth path. At present, the organization uses the Series 44 (no longer actively marketed), which can be expanded to the Series 48. This user does intend to expand his present system by adding peripherals such as disk drives. This user also comments that the maintenance service has been very good, and that the documentation is updated regularly. He "couldn't recommend a better system." □

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 mo-

dem 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-leased-line remote terminal cluster communications.

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 or 6X to a Vitalink Communications Corporation earth station. The user may then operate any DS-supported application over the space segment. Using the Vitalink earth station in conjunction with the HP 3000 computer system provides the following features:

• Point-to-point remote processor connections

• Data transmission rates up to 56K bps

• Bit error rates of typically less than 1 in 10^7

• Multipoint transmission using the Vitalink Codamux

• Transparency to the HP 3000 system user in that no modifications required to existing DS-based applications

• Full support of networking capabilities 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 multidropped 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 ▶

Hewlett-Packard HP 3000 Series

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, or 68 to an IEEE 802.3 coaxial cable. It also provides programmatic access to network communication through a set of network interprocess communication calls. Lan/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).

LANIC is a microprocessor-based communication 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.

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 included with the Point-to Point Hardwired Link. 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

In addition to the features listed above, the INPs included with all but the Point-to Point Hardwired Link offer compatibility with HP and common Telco/PTT modems in full and half-duplex modes and support 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 independently 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 Statistical Multiplexer* can be used over analog or digital leased line, dial-up line, or X.25 Packet Switching 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 ranging 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. Two types of configuration are supported for each 2334A port: stat mux and cluster controller.

The *Advanced Terminal Processor (ATP)* is designed to interface asynchronous workstations to the HP 3000 Series 39, 42, 48, 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.

Hewlett-Packard HP 3000 Series

Local workstations are connected to the system via the Direct Connect Port Controller. Using the HP-Direct Connect Type 422 interface, workstations can operate at speeds up to 19.2K bps to 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 operating at speeds up to 19.2K bps to be connected to the Direct Connect Port Controller with cables up to 15 meters (50 ft.) long.

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)*, a communication interface board designed for the Series 37, provides the connection of up to 7 asynchronous workstations to the system in a point-to-point configuration. ATP37 supports personal computers, terminals, and workstation printers available from HP. The peripheral devices can be connected directly on all 7 ports; one of the ports can alternatively be used for remote connection of the devices through asynchronous full-duplex modems. The remote port may also connect the Series 37 to the HP Tele-Support service through a 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 consists of the main processor board with one RS-232-C full modem port and 2 connector miniboards each providing 3 HP Direct Connect Type 232 ports.

The *Asynchronous Data Communications Controller (ADCC)* is used in the Series 39, 42, and 48 to provide directly connect and modem connections for terminals or as an alternate way to direct connect terminals. One ADCC is required to connect the Control and Maintenance Processor. The channel performs for terminals essentially the same functions as the GIC. 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 *X.25 Cluster Controller* is designed to connect asynchronous devices to an X.25 Packet Switched Network (PSN). It permits up to 16 terminals and printers to communicate with a host computer system (HP 3000, HP 1000 or non-HP). The Cluster Controller uses a four-port interface card that supports asynchronous RS-232-C point-to-point devices at up to 9600 bps full duplex. Up to 4 terminal interface cards (with no modem control) can be installed in the controller, allowing up to 16 terminals to be connected.

The Cluster Controller supports the November 1980 version of CCITT X.3/X.28/X.29 recommendations, which allows the controller to act as a private Packet Assembler Disassembler (PAD). The standard 18 parameters defined in the X.3 recommendation are supported; additional HP-defined local parameters are available for enhanced functionality with HP devices.

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 perform 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 Intrinsics, 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 ▶

Hewlett-Packard HP 3000 Series

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 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 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*, the database management system for the HP 3000 Series, 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.

Eight different access modes are available for TurboImage users. Multiple users may access a database concurrently. Restructuring of the database is accomplished by using DBUS. The restructuring can be through a changed data item or data set name, changed security provisions, changed data set relationships, and increased data set capacities. Inverted data sets are not supported.

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 allows 32 data extents; the capability for data sets to cross volume boundaries; the intrinsic DBEXPLAIN, which explains the result of a CALL to the database; and the intrinsic DBERROR, which supplies an English-language message for an error code.

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. Intrinsics 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 interruped intrinsic.

Roll-forward 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 recovery systems reads the log file and reexecutes those transactions that have been successfully completed.

Hewlett-Packard HP 3000 Series

► Roll-back recovery insures the logical integrity of the database. As with roll-forward, transactions are logged automatically to a tape or disk log file. In the event of a hardware or software failure, 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.

For the HP 3000 Series, Query/3000 has been enhanced with computation power for crossfooting. Ten registers have been implemented for this purpose, using GROUP and TOTAL.

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, although they may be presorted if desired. Records are accessed sequentially or randomly by primary or alternate key value, by logical record number, or in chronological order. Duplicate key values are allowed, and records can be accessed by generic keys or by approximate keys.

Dictionary/3000 is a data dictionary and data directory facility that provides the means to control and coordinate an organization's data processing resources. The data dictionary consists of a TurboImage database, a high-level user interface facility, and a set of powerful utilities. The dictionary 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 six programming languages plus a database management system. 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.

Basic is implemented as an interpreter and a compiler. The interpreter offers a way to debug programs interactively, while the compiler reportedly yields more efficient code with average program execution speeds 10 to 30 times faster for CPU-bound programs and one to four times faster for I/O-bound programs. Four numeric data types are possible: real, integer, complex, and extended precision.

Mixed-mode arithmetic and program chaining with common storage are provided, along with a built-in debugging system. External routine calls, strings and string arrays, and multiple-line statements and functions are all permitted. Picture output formats can be implemented, and the programmer can use timed input by way of the ENTER statement. Both direct and sequential access to files are allowed. File creation and purging are under program control, while file security is user-definable with passwords.

Cobol II is the primary commercial language for the HP 3000s. Cobol II conforms to the Level-2 implementation (except the RERUN option for I/O) of 9 of the 12 modules defined by the ANSI Cobol X3.23-1974 specifications. The 9 modules, all implemented at the highest level, are Nucleus, Table Handling, Sequential I/O, Relative I/O, Indexed I/O, SORT-MERGE, Segmentation, Library, and Interprogram Communication.

Language extensions implemented by HP include microcoded instructions, preprocessor functions (provides statements which allow the programmer to equate a particular section of code or a file to an identifier), program debugging aids, access to subprograms, access to all MPE System intrinsics, ACCEPT FREE option (allows a free format for low-volume data entry), file locking capability, special registers, packed decimal, and multiple entry points to subprograms. Cobol II provides access to both sequential MPE and indexed sequential (KSAM) files through ANSI Standard Cobol Input and Output operations and to TurboImage/3000 through procedure libraries.

Fortran 77 is based on the American National Standards Institute Fortran 77 standard, X3.9-1977. Programs written in the previously offered Fortran 66-based language can be upgraded to take advantage of the Fortran 77 language capabilities. Described below are some of the Fortran language extensions implemented by HP.

Source programs may be written in a free-field as well as in a fixed-field format. Symbolic names may consist of up to 15 characters instead of the usual 6. Character type data may be used to facilitate string manipulation. Up to 99 files may be used during execution of a Fortran program. Arrays may have up to 255 dimensions instead of the standard 3. A label may be used as an actual argument in a CALL statement to allow alternative return points following execution of the subroutine referenced by CALL. Support is provided for user-written error-handling routines called in trap conditions, and a parameter statement is available for giving constants symbolic names. Seven data types can be processed: integer, double integer, logical, real, double precision, complex, and character. Subroutines and functions may have secondary entry points. A built-in cross-reference facility is available as a compile-time option. Undefined variables are detected at compute time, and generic functions are recognized.

Pascal/3000 is an implementation of Hewlett-Packard Standard Pascal, which is in turn a superset of the ANSI/IEEE 770 X3.97-1983 specification.

HP Standard Pascal, which was defined to provide portability between HP computer systems, includes extensions such as a string data type and associated string functions and procedures, direct access I/O, structured constants, and the ability to read and write enumerated types.

Pascal/3000 also includes extensions beyond HP Standard Pascal to allow calls to HP 3000 subsystems, such as TurboImage/3000 and VPlus/3000, HP 3000 system intrinsics, and to external procedures written in Fortran, Cobol, or SPL, as well as in Pascal. The compiler has numerous compiler options, which include flagging all extensions beyond the ANSI standard or the HP Standard. The compiler also supports separate compilation of sources; debugging aids such as a cross-reference facility, load maps, mnemonic code listings, and break point information; and optimization of storage and arithmetic.

RPG is compatible to a high degree with RPG and RPG II as developed by IBM. Language extensions implemented by HP include parameters for external subroutine calls, an interface to the data base management system, three methods for run-time error options, a cross-reference error option, EBCDIC/ASCII automatic translation, input/output terminal files, and no requirements for calculation indicator repetition for duplicate conditioning indicators. Data can be ►

Hewlett-Packard HP 3000 Series

▶ processed in binary, packed and unpacked decimal, unpacked decimal with leading or trailing sign, and alphanumeric formats. RPG/3000 also provides automatic 2KB to 8KB program segmentation for a virtually unlimited-size RPG program.

SPL is the Systems Programming Language for the HP 3000 Series. It is Algol-like, but is machine-dependent (for example, direct register references and bit extraction). It supports one-dimensional arrays and CALLs from any other language available to the system. SPL is free-form in structure and includes other features, such as recursive procedures, high-level statements with unlimited nesting, and arithmetic and logical expressions.

Transact/3000 is a high-level programming language specifically designed for transaction processing; one Transact/3000 instruction is equal to many instructions in a traditional language. The ability to do prototyping is also an inherent part of the product. Transact/3000 is designed to work in conjunction with HP's Dictionary/3000. Together with Dictionary/3000, Transact/3000 speeds up the development of applications and reduces maintenance costs.

Transact/3000 is designed to provide a balance between a high-level language and control of the operating environment. The user has a range of options, from using all the defaults that are built into Transact/3000 up to specifically controlling the run-time environment.

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 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 interprogram 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 connnected 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 supports spooled printers under the direct control of an application program in a multipoint workstation networking environment. With this support, printers can be locally dispersed within a building or located at a remote site.

The Series 39, 42, 48, and 68 models can support point-to-point terminal capabilities. MTS provides half-duplex data transmission over a single communications line between an HP 3000 system and up to 32 multidropped terminals. In both interactive and page modes, data can be entered, edited, and transmitted at up to 9600 bps.

The *Workstation Configurator (WSC)* software allows the HP 3000 user to configure connection parameters for a given asynchronous port and device. Using WSC characteristics such as flow control handshakes, parity setting, block mode operation, read trigger characters, special function characters, control functions can be specified and saved as workstation types. The software driver uses the workstation types in communicating with the attached devices. 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 *HP/3000 Link* contains the hardware as well as the software required to connect an HP 3000 Series 39, 42, 48, and 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 internetting capability. The IEEE 802.2 and 802.3 protocol gives every node on the coaxial cable equal access to the network and monitors 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. ▶

Hewlett-Packard HP 3000 Series

▶ The *NS/3000* network service provides networking capabilities among HP 3000 systems on 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 NS/3000 extends the bounds of the MPE operating systems by allowing application programs to read and write files and databases on remote systems. 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.

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

The *SNA NRJE Network Remote Job Entry*, along with the SNA Link, provide batch data communications between the HP 3000 and an IBM System/370-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. The SNA NRJE interface includes commands for submitting jobs, displaying job status, and canceling jobs.

The *IMF/Interactive Mainframe Facility*, used with the BSC Link, allows an HP 3000 to communicate interactively with an IBM System/370-compatible mainframe computer system using BSC or SDLC 3270 protocols. 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.

The *MRJE Multileaving Remote Job Entry Service* also requires the BSC Link to manage the data communications protocol and link between the mainframe and communications controller. When both the MRJE and BSC link are used, multiple users may submit batch jobs to, or receive output from, a host. With the MRJE facility, the HP 3000 emulates workstations that work with one of the following job entry systems on the host: HASP, HASP II, ASP, JES2, JES3, RSCS, and RES.

The *RJE/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. RJE can transmit batch jobs to, and receive output from, a host processor that can support standard IBM 2780/3780 devices. RJE can also exchange files between an HP 3000 and many other processors that emulate standard IBM 2780/3780 devices.

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 to help users implement straightforward interactive data entry tasks and to facilitate development of more complex applications through the use of a high-level program interface. VPlus/3000 may be used as a standalone source data entry facility or as a front-end to transaction processing applications. Features include a Forms Design Facility, a Source Data Entry Facility, a Data Reformatting Facility, and a Program Interface.

The *Text and Document Processor/3000 (TDP/3000)* is a text editing and document formatting system. Its features include text editing, document formatting, mathematical expression handling, table creation, built-in calculator, command files, form letters, automatic hyphenation, security, and MPE command execution. The only other software required is the MPE operating system. Certain MPE commands can be executed without exiting TDP/3000.

The *On-Line Performance Tool/3000* (OPT/3000) is an interactive performance measurement package for the system 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 Disccopy/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 of up to 40MB per minute. The four functions of the system include: Discstore, which organizes files and copies the files onto the backup disk; Discrestore, which replaces file sets from the backup disk device to the system- and private-volume domain disk; Tapecopy, which allows the storing of files on tape; and Filecopy, which provides high-speed copying of files, groups, or entire accounts from one location to another within the system- and private-volume domains.

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. Report/3000 operating with Dictionary/3000, frees programmers from data definitions and physical structure when accessing data for reporting. The dictionary provides for element resolution, definition and physical access. Access is available for TurboImage, KSAM and MPE sequential files through the data dictionary, with only specification of the element name.

HP Inform/3000 is a menu-driven, interactive inquiry and report generator for nonprogrammers. The more experienced user can bypass lowerlevel menus by stacking responses. With proper passwords the user can access logically related groups of data through Dictionary/3000. The user selects the individual data elements to be included in the report; Inform/3000 formats the report with no user specification required.

HPToolset is a productivity aid that includes a workspace manager, a full-screen editor, and HP Cobol II symbolic debugging. This combination eliminates the need to manage files while promoting an information sharing environment for programmers.

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. Transform/3000 consists of four parts: an enhanced RPG compiler, translation tools and utilities, a menu processor, and consulting assistance. The translation tools and utilities convert EBCDIC to ASCII, load files in proper ▶

Hewlett-Packard HP 3000 Series

▶ formats, create accounting structures, change syntax on machine dependent commands and running programs through the compiler.

OFFICE AUTOMATION: The Office Systems products for the HP 3000 include several classes of products: document management, decision support, and organizational communications.

HPWord word processing software uses the 2628A Word Processing Station or the HP Touchscreen Workstation to carry out much of the word processing locally, using the HP 3000 for file storage and retrieval and for access to a variety of shared printers. 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.

HPSlate software is a commandless, text processing system with a menu-driven set of functions used to enter, format, revise, print, and save shorter documents. It is intended for use by professionals who occasionally need such features. HPSlate utilizes screen-labeled function keys to perform the various editing tasks.

HPDeskManager III operates from any terminal connected to an HP 3000. Using HP's AdvanceNet capabilities, HPDeskManager offers a set of integrated fundamental office facilities such as multisystem electronic mail integrated with HPWord, VisiCalc/3000, HPTelex II, and HPMessage; basic word processing with HPSlate and HPWord; personal electronic filing; and time management. HPDeskManager includes a HELP facility to answer user questions.

HPMenu is a menu-building software facility that allows users to call up HP Interactive Office products. These products include word processing, electronic mail, graphics, and other applications. With HPMenu, 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. Menu choices can include other menus in a tree structure.

HPTelex allows messages to be prepared, stored, and automatically forwarded over the Telex network. HPTelex is designed to run on any HP 3000 with a VPlus/3000-compatible terminal. Messages can be prepared either directly in HPTelex or composed using HPSlate, HPWord, or TDP/3000.

HP Convert/WPS enables Wang-produced documents to be converted to HP Word. Documents produced in HP Word 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 33mm 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 and HP DSG/3000 may be scaled, rotated, combined with descriptive text and illustrations, or transformed into 35mm slides using HPDraw. HPDraw offers menu-driven user interface; text fonts in different faces, sizes and colors; lines, arcs, circles, arrows, and boxes; and rotation, scaling area filling, and simple figure creation.

HPEasyChart allows interactive production of pie, bar, and line charts as well as of scattergrams. Charts can be displayed the same as with HPDraw. EasyChart features a picture-oriented main menu, scrolling data entry, color and texture selection, and built-in help facility and sample charts, and is compatible with data files from other HP subsystems.

APPLICATIONS: In addition to office automation, HP's proprietary applications software is grouped into several major categories: manufacturing, wholesale distribution, and financial management systems.

Manufacturing systems offered by HP include the following:

- **HP Materials Management/3000**
- **HP Production Management/3000**
- **HP Maintenance Management/3000**
- **HP Lot Control and Traceability/3000**
- **HP Semiconductor Productivity Network (SPN)**
- **HP Just-In-Time (JIT)**
- **HP Production Cost Management (PCM)**

HP offers the following financial management systems:

- **HP Financial Accounting**
- **HP General Ledger**
- **HP Accounts Payable**
- **HP Accounts Receivable**
- **HP Dual Ledger**
- **HP Allocator**
- **HP Report Facility**
- **HP Interface Facility**
- **HP General Accounting**
- **HPPay**

Two software systems are offered for wholesale distribution:

- **System for Distributors/3000**
- **Order Management/3000**

Additional graphics packages offered by HP 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 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 (SPU processor and selected software), with extensive separately priced peripheral and software options. Standard ▶

Hewlett-Packard HP 3000 Series

▶ on each HP 3000 system is the Fundamental Operating Software which includes MPE operating system, Edit/3000 text editor, FCopy/3000 file copying utility, Sort-Merge/3000, TurboImage/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 application software product are offered price reductions.

For system discount purposes, each HP 3000 system counts as two to four 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 3 to 5 years; rates vary according to the type of lease.

The leases are noncancellable, but a special provision is available that permits cancellation on 9 months' notice for an additional premium of 1.25 percent of the list price per month.

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.

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

Most peripherals are also available for operation at 230 VAC, 50 Hertz. 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 reship them back to the user within three days of receipt. Customers with 25 or more workstations get a also qualify for a discount and may receive weekly scheduled visits to specified work areas, with repair being performed onsite.

HP's extended hours of coverage are as per 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 Midnight (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 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 Telesupport, 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 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 ▶

Hewlett-Packard HP 3000 Series

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.

• 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, wih 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 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.

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:

1) Customer Applications Analysis, which provides defined and documented analysis of specific business requirements and shows how HP applications can meet the needs.

2) Implementation Team Training, which teaches the customer's product team to manage the integration of the HP 3000 into the business.

3) Project Implementation Assistance, which offers project management guidance. It includes product training and tracking implementation progress.

Through *HP Tele-Support*, HP Response Center specialist test and access the systems' problems and provide a diagnosis. Once the problem has been identified, system patches are installed remotely. HP Tele-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	2,495
PRICE	**$24,445**

Series 39:

32514B—System Processor Unit with 512KB memory, 2 GICs and Fundamental Operating Software (FOS)	$33,200
Opt 011 package	−11,400
7911P—28MB disk with integrated cartridge tape	15,590
2563A—300 lpm printer	6,210
2392A—3 display terminals @ $1,395	4,185
PRICE	**$47,785**

Series 42:

32542B—System Processor Unit with 1MB memory, 2 GICs, and FOS	$39,800
7914ST—132MB disk with 1600 bps tape drive	27,500
2563A—300 lpm printer	6,210
2392A—3 display terminals @ $1,395	4,185
PRICE	**$77,695**

Series 48:

32548B—System Processor Unit with 2MB memory, 2 GICs, FOS	$ 67,500
7914ST—132MB disk with 1600 bps tape drive	26,500
2563A—300 lpm printer	6,210
2392A—4 display terminals @ $1,375	5,500
PRICE	**$105,710**

Series 68:

32468B—System Processor Unit with 3MB memory, 2 GICs, 1 IMB, disk caching and FOS	$186,100
7933G—1.2GB disk subsystem	64,000
7978A—1600/6250 cpi Tape	22,500

Hewlett-Packard HP 3000 Series

Series 68 (Continued):

2566A—900 lpm printer	22,301
2392A—10 display terminals @ $1,375	13,750
PRICE	$308,651

EQUIPMENT: The HP 3000 computers are offered as System Processor Units, onto which the user configures the peripherals required by the application. Prices for each of the System Processor Units and peripherals are found in the following Equipment Price list.

EQUIPMENT PRICING

		Purchase Price ($)	Std. Month. Maint. ($)
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
507	Expands Memory to 1MB	2,500	4
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
32450A	HP 3000 Series 37XE System Processor Unit with I/O Expansion Unit	20,000	44
015	200-240 VAC System Opeation	0	0
509	Expands Memory to 2MB	6,000	16
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)	33,200	243
011	Model 11 Packaged System	−11,400	0
012	Model 12 Packaged System	−8,200	0
014	Model 14 Packaged System	−5,200	0
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-VP	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	259
014	Model 14 Packaged System	2,600	0
015	220-240 V/50 Hz single phase operation	0	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-VE	0	0
022	Cartridge Tape Media	0	0
051	1600 pbi Magnetic Tape Media	0	0
32548B	HP 3000 Series 48 System Processor Unit (60 Hz)	67,500	297
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	0
32548Z	Series 48 Media for MPE-VE	0	0
022	Cartridge Tape Media	0	0
051	1600 pbi Magnetic Tape Media	0	0
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

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.

Hewlett-Packard HP 3000 Series

		Purchase Price ($)	Std. Month. Maint. ($)

BUNDLED SYSTEMS

		Purchase Price ($)	Std. Month. Maint. ($)
27513A	Personal Productivity Center Advanced Office Pack (HPDeskManager, HPWord, HPSpell, HPListkeeper, HPDraw, HPEzchart, VisiCalc/3000)	32,500	—
32452A	Personal Productivity Center Professional System (S/37 with 1024KB, 7945A, 9144A, 2392A, HPDesk-Manager, (4) Touchscreen w/dusl floppy, (4) PPC- Screen SW Packs, HPDeskManager Assist-Pia	45,310	—
001	Expands memory to 2048KB	4,000	—
32453A	Personal Productivity Center Workgroup System (S/37 with 1024KB, 7945A, 9144A, 2392A, HPDesk-Manager, PPC WP Pack, 2628A, Palm Rest, (3) Touchscreen 2/dual floppy, (3) PPC Touchscreen SW Packs, HPDeskManager Assist-Pia, HPWord Assist-Pia)	57,615	—
001	Expands memory to 2048KB	4,000	—
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

		Purchase Price ($)	Std. Month. Maint. ($)
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 preassemble on Series 68	−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 preassemble ATP on the add-on I/O Bay on the Series 68	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 preassemble ATP on Series 68	−250	0
003	Order once to preassemble ATP on the 68 add-on I/O Bay on the Series 68	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	42
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
30464A	Series 68A Expansion Bay and I/O Adapter (IMB)	30,000	74
251	Junction Panels (required if no ATP is ordered)	0	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
30459A	Peripheral Interface Channel (PIC) Series 37 and 37XE only	1,900	8
30460A	ATP/37	2,400	8

MEMORY EXPANISON

		Purchase Price ($)	Std. Month. Maint. ($)
30456A	1MB Series 37 Memory Module	6,000	—
30462A	2MB Series 37 Memory Module	12,000	—
30461A	512KB Series 37, Series 37XE Memory Module	2,500	4
30092A	512KB Series 39, 4X Memory Module (set of two 256KB boards)	7,500	16
30084A	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
30171A	256KB Memory Module for Series 39 and 42	4,000	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.

Hewlett-Packard HP 3000 Series

		Purchase Price ($)	Std. Month. Maint. ($)
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
015	220 V/50 Hz single phase operation	0	0
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
015	220 V/50 Hz single phase operation	0	0
140	Deletes cartridge tape drive	−3,570	−11
7945A	55MB disk drive with 1-meter HP-IB cable	7,500	50
015	Voltage selector switch set for 230 VAC operation for non-U.S. shipments	0	0
550	Delete 1-meter HP-IB cable	−85	0
7914P	132MB disk drive with integral 67MB tape cartridge	17,350	66
001*	Adds dedicated controller for cartridge tape drive	1,840	24
015	220 V/50 Hz single phase operation	0	0
140	Deletes cartridge tape drive	−3,570	−14
7914R	132MB second disk drive for an installs 7914TD/ST that was ordered w/out the second disk drive	17,350	66
015	220 V/50 Hz single phase operation	0	0
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
015	220 V/50 Hz single phase operation	0	0
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
015	220 V/50 Hz single phase operation	0	0
114	Adds second 7914 (opt. 140) Disk Drive	14,290	52
7920M	Master 50MB Disk Drive	22,300	135
015	220 V/50 Hz single phase operation	0	0
102	HP-IB interface and cable	1,200	4
7920MR	Master 50MB Disk Drive (Remarketed)	12,175	135
015	220 V/50 Hz single phase operation	0	0
102	HP-IB interface and cable	1,000	4
7920S	Add-on 50MB Disk Drive	18,100	95
015	220 V/50 Hz single phase operation	0	0
7920SR	Add-on 50MB Disk Drive (Remarketed)	9,825	95
7925M	Master 120MB Disk Drive	22,700	125
015	220 V/50 Hz single phase operation	0	0
102	HP-IB interface and 2 m cable	1,200	4
7925MR	Master 120MB Disk Drive (Remarketed)	16,750	125
015	220 V/50 Hz single phase operation	0	0
102	HP-IB interface and 2 m cable	1,000	4
7925MT	290 MB Initial Disk Storage System	24,250	210
015	Add 50 Hz	0	0
102	Add HP-IB	1,000	0
7925S	Add-on 120MB Disk Drive	18,500	85
015	220 V/50 Hz single phase operation	0	0
250	Disk Controller Upgrade	535	0
7925SR	Add-on 120MB Disk Drive (Remarketed)	13,725	85
015	220 V/50 Hz single phase operation	0	0
7925ST	240MB Add-on Disk Storage	20,250	170
015	Add 50 Hz	0	0
7925T	Add-on 240MB Disk Storage System	32,600	170
015	220 V/50 Hz single phase operation	0	0
7933H	404MB Fixed Media Disk Drive, Standard Operating Voltage is 208V w/1m HP-IB cable	25,520	90
120	120 V/50 Hz/60 Hz	0	0
220	220 V/60 Hz for Canada	0	0
221	220 V/50 Hz for Continental Europe	0	0
222	220 V/50 Hz for Switzerland	0	0
223	220 V/50 Hz for Denmark	0	0
241	240 V/50 Hz for United Kingdom	0	0
242	240 V/50 Hz for Australia and New Zealand	0	0
7933G	1.2GB Storage System, consists of three 7933H, 404MB disk drives each with media, controller, power supply, and 1 m HP-IB cable	64,000	270
120	120 V/50 Hz/60 Hz	0	0
220	220 V/60 Hz for Canada	0	0
221	220 V/50 Hz for Continental Europe	0	0
222	220 V/50 Hz for Switzerland	0	0
223	220 V/50 Hz for Denmark	0	0
241	240 V/50 Hz for United Kingdom	0	0
242	240 V/50 Hz for Australia and New Zealand	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.

Hewlett-Packard HP 3000 Series

		Purchase Price ($)	Std. Month. Maint. ($)
MASS STORAGE (Continued)			
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	74,500	507
120	120 V/50 Hz/60 Hz	0	0
220	220 V/60 Hz for Canada	0	0
221	220 V/50 Hz for Continental Europe	0	0
222	220 V/50 Hz for Switzerland	0	0
223	220 V/50 Hz for Denmark	0	0
241	240 V/50 Hz for United Kingdom	0	0
242	240 V/50 Hz for Australia and New Zealand	0	0
7935H	404MB Removable Media Disk Drive, Standard Operating Voltage is 208 V, w/1m HP-IB cable	28,070	169
120	120 V/50 Hz/60 Hz	0	0
220	220 V/60 Hz for Canada	0	0
221	220 V/50 Hz for Continental Europe	0	0
222	220 V/50 Hz for Switzerland	0	0
223	220 V/50 Hz for Denmark	0	0
241	240 V/50 Hz for United Kingdom	0	0
242	240 V/50 Hz for Australia and New Zealand	0	0
97935A	404MB Removable Media Module for 7935H Disk Drive	1,531	38
9895A	Flexible Disk System	5,910	77
001	50 Hz operation	0	0
010	1.2MB single drive system with manual for HP 3000 hook-up and use	−1,330	−36
13394A	7920M/S Disk Pack	560	NA
13356A	7925M/S Disk Pack	905	NA
MAGNETIC TAPE SUBSYSTEMS			
7970B	800 cpi/45 ips Magnetic Tape Subsystem	10,310	103
015	230 V operation	0	0
7970BR	800 bpi Tape Drive, 45 ips NRZI (remarketed)	5,887	0
015	Add 230 V	0	0
236	M/E/F Series Master, no cabinet	2,528	0
334	Series III Master, no cabinet	963	0
7970AR	1600 pbi Tape Drive	6,940	0
015	Add 230 V	0	0
340	HP-IB Initial Master Upright Cabinet	4,070	154
470	S/III Initial Master Upright Cabinet	3,590	100
7970E	1600 cpi/48 ips Magnetic Tape Subsystem	12,070	97
015	230 V operation	0	0
7970ER	1600 cpi tape drive in lo-boy cabinet (Remarketed)	5,900	97
015	Adds 230 V/50 Hz operation	0	0
426	HP-IB initial master	3,600	67
7971A	Magnetic Tape Subsystem in upright cabinet	13,100	0
015	230 V operation	0	0
340	7970 HP-IB master	5,090	154
344	7970E Two HP-IB masters	16,700	305
333	7970E Two slave drives	12,520	183
343	7970E Two drives, HP-IB master and slave	14,560	244
7971AR	Upright Tape Drive System (remarketed)	6,940	0
015	Add 230V	0	0
140	A/L Series 7970ER Master	4,070	0
260	M/E/F/ Series 7970ER Master	4,070	0
340	HP 3000 HP-IB 7970ER	4,070	0
470	Series III 7970ER Master	3,590	0
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
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

* 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.

Hewlett-Packard HP 3000 Series

		Purchase Price ($)	Std. Month. Maint. ($)
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	HP3000 Printer Graphics Support Software	3,150	0
2563A	300 lpm printer	5,780	52
	UO2: 45-66 print hours per month		72
	UO3: 67-88 print hours per month		95
	UO4: 89-132 print hours per month		135
2601A	40 cps daisywheel printer (modem cable included)	3,520	86
2608A	400 lpm printer (1-69 print hrs/mo)	11,890	131
	UO2: 70-130 print hours per month		+31
	UO3: 131-360 print hours per month		+127
2608S	400 lpm printer (1-69 print hrs/mo)	11,170	90
	UO2: 70-130 print hours per month		+22
	UO3: 131-360 print hours per month		+88
2611A	600 lpm printer (1-66 print hrs/mo)	18,560	303
	UO2: 67-99 print hours per month		+144
	UO3: 100-132 print hours per month		+324
	UO4: 133-165 print hours per month		+566
2619A	1000 lpm printer (1-66 print hours per month)	26,370	381
	UO2: 67-99 print hours per month		+182
	UO3: 100-132 print hours per month		+409
	UO4: 133-165 print hours per month		+715
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 Page Printer; includes 125,000 rotations	76,780	580
	UO2: 125,001 to 200,000 rotations		+400
	UO3: 200,001 to 275,000 rotations		+770
	UO4: 275,001 to 350,000 rotations		+1,130
015	298-240 V/50 Hz operation	0	0
060	Graphics/Extended Memory Management	2,565	0
099	Replaces 8m cable with 2m cable	0	0
340	Series 39 cable and documentaiton	0	0
344	Series 48 cable and documentation	0	0
364	Series 68 cable and documentation	0	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
26080A	Add-on 256KB Memory Module for 2680A and 26804A (field upgrade)	4,550	6
26084A	Variable Density Print for 2680A and 26804A	3,550	0
26085A	Add-on 1MB Memory for the 2680A and 26804A (field upgrade)	9,000	32
26086A	Add-on graphics, extended memory management for the 2680A and 26804A (field upgrade)	3,690	0
26804A	2685 Laser Print Station; includes 125,000 rotations; includes cables	140,800	1,092
	UO2: 125,001 to 200,000 rotations		+400
	UO3: 200,001 to 275,000 rotations		+770
	UO4: 275,001 to 350,000 rotations		+1,130
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 54MB 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	835
505	256KB Memory Extension	4,550	0
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
2686A	LaserJet Personal Laser Printer. Includes 4000 pages/month, 150 V, 60 Hz	3,495	78
2686AU	LaserJet, 240V, 50 Hz	3,650	78

* 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.

Hewlett-Packard HP 3000 Series

		Purchase Price ($)	Std. Month. Maint. ($)
PRINTERS (Continued)			
2686AB	LaserJet, 220 V, 50 Hz	3,650	78
2687A	Desktop Laser printer; includes 10,000 pages/month	12,800	151
	UO2: 10,001 to 20,000 pages		+63
	UO3: 20,001 to 40,000 pages		+200
	UO4: 40,001 to 70,000 pages		+388
015	220 V/50 Hz operation	0	0
017	240 V/50 Hz operation	0	0
337	Series 37 Subsystem	0	0
340	Series 39 subsystem	0	0
344	Series 48 subsystem	0	0
364	Series 68 subsystem	0	0
2688A	Text and Graphics Laser printer; includes 10,000 pages/month	29,950	269
	UO2: 10,001 to 20,000 pages		+63
	UO3: 20,001 to 40,000 pages		+200
	UO4: 40,001 to 70,000 pages		+388
015	220 V/50 Hz operation	0	0
017	240 V/50 Hz operation	0	0
040	Deletes IFS/3000 and Graphics Intrinsics	−4,000	0
337	Series 37 Subsystem	0	0
340	Series 39 and 42 subsystem	0	0
344	Series 48 subsystem	0	0
364	Series 68 subsystem	0	0
26088A	Upgrade 2687A to 2688A; includes 10,000 pages/month	21,150	269
	UO2: 10,001 to 20,000 pages		+63
	UO3: 20,001 to 40,000 pages		+200
	UO4: 40,001 to 70,000 pages		+388
015	220 V/50 Hz operation	0	0
017	240 V/50 Hz operation	0	0
040	Deletes IFS/3000 and Graphics Intrinsics	−4,000	0
340	Series 49 and 42 subsystem	0	0
344	Series 48 subsystem	0	0
364	Series 68 subsystem	0	0
26075A	Multiple System Access Selector (order cables separately)	725	6
GRAPHICS PLOTTERS AND DIGITIZERS			
7470A	Graphics Plotter; 2-pen, A-size	1,095	24
001	RS-232-C interface	0	0
002	HP-IB interface	0	0
7475A	Graphics plotter; 6-pen, B-size	1,895	24
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	30
7580B	Drafting Plotter; D-size, dual I/O, eavesdrop capability, HP-IB and RS-232-C interfaces	13,900	124
7585B	Drafting Plotter; E-size, dual I/O, eavesdrop capability, HP-IB and RS-232-C interfaces	16,900	108
7586B	Drafting Plotter—E-size, roll feed; dual I/O	21,900	108
9111A	Graphics Tablet	2,275	16
17455A	Eavesdrop cable for 747X opt. 001	75	0
17623A	Graphics tablet for 2623A and 2627A terminals	1,920	12
17855A	RS-422-A Cable for 7550A	200	0
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
015	230 V/50 Hz operation	0	0
049	ANSI operation	0	0
092	Port 2: 25-pin RS-232-C interface	150	0
093	Port 2: 8-bit parallel Centronics-type interface	150	0
160	Extended Memory; adds up to 4 pages of display memory	200	0
2623A	Graphics Terminal	3,250	18
202	Line Drawing Character Set and Roman extension (provides national languages with U.S. ASCII keyboard)	105	0
26248B	Data Entry Terminal	3,035	16
160	Additional Display Memory (Finnish/Swedish, Danish/Norweigian, French, German, U.K., and Spanish character sets and keyboards available; $150 ea.)	210	0
201	Math and Large Character Set	105	0
013	240 V/50 Hz operation	0	0
014	100 V/60 Hz operation	0	0
015	220 V/50 Hz operation	0	0
016	100 V/50 Hz operation	0	0
035	RS-422 for ATP	125	0
050	Integral Thermal Printer	1,210	8
061	Green CRT	50	0
062	Amber CRT	100	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.

Hewlett-Packard HP 3000 Series

		Purchase Price ($)	Std. Month. Maint. ($)
INTERACTIVE DISPLAY TERMINALS (Continued)			
2625A	Dual System Terminal (Swedish, Norwegian, German, U.K., Spanish, French, Italian, Dutch, Finnish, Danish, character sets/keyboards available at no additional charge)	3,495	12
013	240 V/50 Hz operation	0	0
014	100 V/60 Hz operation	0	0
015	220 V/50 Hz operation	0	0
016	100 V/50 Hz operation	0	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
528	HPWord	400	0
2626A	Display Station; 110 V/60 Hz (Finnish/Swedish, French, German, U.K., and Spanish character sets/keyboards; $265 ea.)	4,400	26
050	Integral Thermal Printer	1,210	8
061	Green CRT	50	0
201	Math and Large Character Set (included w/language options)	265	0
2627A	Color Graphics Terminal (Finnish/Swedish, Danish/Norwegian, French, German, U.K., and Spanish keyboards available; $105 ea.)	5,975	20
013	240 V/50 Hz operation	0	0
014	100 V/60 Hz operation	0	0
015	220 V/50 Hz operation	0	0
016	100 V/50 Hz operation	0	0
087	Video Interface (includes cable)	250	0
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
013	240 V/50 Hz operation	0	0
014	100 V/60 Hz operation	0	0
015	220 V/50 Hz operation	0	0
016	100 V/50 Hz operation	0	0
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
2641A	APL Display Station	5,850	34
201	Math Charater Set	105	0
202	Line Drawing Set	160	0
203	Large Charater Set	160	0
2645A	Display Station (U.K. character set available at no additional charge)	4,600	34
008	Expands memory to 8KB	315	0
009	Expands memory to 12KB	525	0
061N	Device Support Firmware	180	0
2645N	Danish/Norwegian Display Station	4,900	33
2645R	Arabic Display Station	5,750	44
201	Math Character Set	105	0
202	Line Drawing Set	160	0
2645S	Swedish/Finnish Display Station	4,900	33
2647F	Intelligent Graphics Terminal	11,500	89
072	Second Flexible Mini Disk Drive	1,050	0
890	Series 68 Console	−1,750	0
2648A	Graphics Terminal	8,650	0
096	Shared Peripheral Interface	735	0
	The following options and products apply to 2641A, 2645A/N/R/S, 2647F, and 2648A except as noted:		
003	Display enhancements (except 2641A, 2645N/R/S, 2647F)	325	0
004	Display enhancements with Math and Large Character Sets (except 2641A, 2645N/R/S, 2647F)	525	0
007	Integrated dual cartridge tapes (except 2647F)	1,400	12
033	Delete communications interface; add async multipoint communication capability; includes monitor mode (except 2647F)	265	0
034	Delete communications interface; add sync multipoint communications capability; includes monitor mode (except 2647F)	290	0
054	Video Output Interface (except 2641A, 2645N/R/S, and 2647F)	160	0
DATA COLLECTION AND INDUSTRIAL TERMINALS			
3075A	Desktop Data Capture Terminal	2,715	54
3076A	Wall Mounted Data Capture Terminal	3,200	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

* *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.*

Hewlett-Packard HP 3000 Series

		Purchase Price ($)	Std. Month. Maint. ($)
DATA COLLECTION AND INDUSTRIAL TERMINALS (Continued)			
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	3,610	61
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	740	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 Adapeter for 3081A	945	8
3092A	Industrial Display Terminal (compatible with 2622A) (Finnish/Danish, Danish/Norwegian, French, German, U.K., and Spanish character sets/keyboards available; $150 ea.)	4,305	30
3093A	Industrial Display Terminal (compatible with 2623A) (Finnish/Danish, Danish/Norwegian, French, German, U.K., and Spanish character sets/keyboards available; $150 ea.)	6,040	38
054	Low resolution bar code reader	815	11
055	High resolution bar code reader	815	11
056	High resolution bar code slot reader	815	11
057	Low resolution bar code slot reader	815	11
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 with 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 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 and 68	5,040	53
190	Series 37, no hardware	305	0
390	Series 42	805	0
490	Series 48 and 68	895	0
30270A	Point-to-Point Hardwired Link	0	0
10A	Series 37	3,530	28
30A	Series 42	5,040	53
40A	Series 48 and 68	5,040	53
190	Series 37, no hardware	805	0
390	Series 42, no hardware	805	0
490	Series 48 and 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 and 68	5,040	53
190	Series 37, no hardware	805	0
390	Series 42, no hardware	805	0
490	Series 48 and 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 and 68	7,560	53
190	Series 37, no hardware	2,520	0
390	Series 42, no hardware	3,330	0
490	Series 48 and 68, no hardware	3,330	0
32188A	Satellite Network Link (use processor option)	0	0
300	Series 42	20,160	0
400	Series 48 and 68	20,160	0
490	Series 68, no hardware	15,925	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.*

Hewlett-Packard HP 3000 Series

		Purchase Price ($)	Std. Month. Maint. ($)
DATA COMMUNICATION (Continued)			
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 and 68, no hardware	805	0
32027A	MTS Synchronous Modem Link (use processor option)	0	0
300	Series 42	5,445	43
400	Series 48 and 68	5,040	53
390	Series 42, no hardware	805	0
490	Series 48 and 68, no hardware	895	0
32028A	MTS IBM 3270 Device Link	0	0
38A	Series 42	5,040	53
48A	Series 48 and 68	5,040	53
390	Series 42, no hardware	805	0
490	Series 48 and 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	1,575	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	700	0
13265A	300 bps Modem Pod for 262X Terminals	500	0
30037A	Asynchronous Repeater	1,900	7
39301A	Fiber Optic Multiplexer	2,500	18

UPGRADE PRODUCTS

		Purchase Price ($)	Std. Month. Maint. ($)
Series 37XE:			
32450AH	Series 37 to 37XE upgrade; provides I/O expansion with 512KB memory	12,500	6
180	Delete 512KB memory	−2,500	−4
Series 39:			
30539B	Series 39 Disc Cache upgrade with 512KB memory (set of two 256KB boards)	11,000	18
170	Delete 256KB memory	−2,000	−14
180	Delete 512KB memory	−4,000	−28
408	Substitute MPE-V/P	0	0
Series 42:			
30542B	Series 40 to Series 42 Field Upgrade	11,000	25
190	Delete 1MB memory	−6,000	−32
409	Substitute MPE-V/P	0	0
32542BH	Upgrade to the Series 42 with 1MB	36,000	233
	M01: Remote Support Service Credit	0	−75
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	25
190	Delete 1MB memory	−6,000	−32
410	Substitute MPE-V/E for MPE-V/P	−6,000	−32
32548BH	Upgrade to Series 48 with 2MB	63,700	252
	M01: Remote Support Service Credit	0	−75
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

* 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.

Hewlett-Packard HP 3000 Series

		Purchase Price ($)	Std. Month. Maint. ($)
UPGRADE PRODUCTS (Continued)			
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 (IMB)	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 (IMB)	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
	M01: Remote Support Service Credit	0	−75
015	380 V/50 Hz three-phase operation	0	0
016	415 V/50 Hz three-phase operation	0	0
250	Add expansion bay & I/O adapter	25,000	53
411	Substitute MPE-V/P for MPE-V/P	0	0
609	Upgrade from Series 44 with 1MB	−43,000	26
611	Upgrade from Series 40 with no memory	−13,825	26
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
REMARKETED SYSTEMS			
32412CR	HP 3000 Series 33R System (Remarketed) (60 Hz) includes 512KB memory, 2649E console, FOS on 1600 bpi tape. Must order all ADCCs and GICs separately	12,225	307
018	ADCC-main with 4 ports	1,185	10
019	ADCC-extender with 4 ports	1,185	10
507	Expands memory to 1MB memory	6,030	40
720	7920S Slave 50MB disk drive (Remarketed) with cables (60 Hz)	9,825	95
721	7920S Slave 50MB disk drive (Remarketed) with cables (50 Hz)	9,825	95
725	7925S Slave 120MB disk drive (Remarketed) with cables (60 Hz)	13,725	85
726	7925S Slave 120MB disk drive (Remarketed) with cables (50 Hz)	13,725	85
920	7920M Master 50MB disk drive (Remarketed) with HP-IB interface and cable (60 Hz)	13,175	139
921	7920M Master 50MB disk drive (Remarketed) with HP-IB interface and cable (50 Hz)	13,175	139
925	7925M Master 120MB disk drive (Remarketed) with HP-IB interface and cable (60 Hz)	17,750	129
926	7925M Master 120MB disk drive (Remarketed) with HP-IB interface and cable (50 Hz)	17,750	129
E72	7970E 1600 bpi tape drive HP-IB master in lo-boy cabinet (110 VAC)	9,500	164
E73	7970E 1600 bpi tape drive HP-IB master in lo-boy cabinet (230 VAC)	9,500	164
32430CR	HP 3000 Series 30R System (Remarketed) (60 Hz) includes 512KB memory, 2649E console, FOS on 1600 bpi tape. Must order all ADCCs and GICs separately	11,475	296
018	ADCC-main with 4 ports	1,185	10
019	ADCC-extender with 4 ports	1,185	10
507	Expands memory to 1MB memory	6,030	40
720	7920S Slave 50MB disk drive (Remarketed) with cables (60 Hz)	9,825	95
721	7920S Slave 50MB disk drive (Remarketed) with cables (50 Hz)	9,825	95
725	7925S Slave 120MB disk drive (Remarketed) with cables (60 Hz)	13,725	85
726	7925S Slave 120MB disk drive (Remarketed) with cables (50 Hz)	13,725	85
E72	7920M Master 50MB disk drive (Remarketed) with HP-IB interface and cable (60 Hz)	9,500	139
E73	7920M Master 50MB disk drive (Remarketed) with HP-IB interface and cable (50 Hz)	13,175	139
925	7925M Master 120MB disk drive (Remarketed) with HP-IB interface and cable (60 Hz)	17,750	129
926	7925M Master 120MB disk drive (Remarketed) with HP-IB interface and cable (50 Hz)	17,750	129
970	7970E 1600 bpi tape drive HP-IB master in upright cabinet (110 VAC)	11,010	164
971	7970E 1600 bpi tape drive HP-IB master in upright cabinet (230 VAC)	11,010	164
32435BR	HP 3000 Series IIIR System (Remarketed) includes 512KB memory, 1 ATC, with Bell 103, 202T, and 212 modem support, and FOS on 1600 bpi tape	20,400	538
010	INP Board	3,305	43
032	Additional ATC	2,205	15
033	Additional ATC (with modem control)	3,110	18
055	SSLC Board	1,255	19
209	Line Printer Controller	955	6
215	Additional Magnetic Tape Controller	1,985	17
507	Expands memory to 1MB	7,020	50
509	Expands memory to 1.5MB	14,030	108
511	Expands memory to 2MB	21,035	158
720	7920S Slave 50MB disk drive (Remarketed) with cables (60 Hz)	9,825	95
721	7920S Slave 50MB disk drive (Remarketed) with cables (50 Hz)	9,825	95
725	7925S Slave 120MB disk drive (Remarketed) with cables (60 Hz)	13,725	85
726	7925S Slave 120MB disk drive (Remarketed) with cables (50 Hz)	13,725	85
820	7920M Master 50MB disk drive (Remarketed) with cables (60 Hz)	12,175	135
821	7920M Master 50MB disk drive (Remarketed) with cables (50 Hz)	12,175	135
825	7925M Master 120MB disk drive (Remarketed) with cables (60 Hz)	16,750	125
826	7925M Master 120MB disk drive (Remarketed) with cables (50 Hz)	16,750	125
870	7970E 1600 bpi tape drive in new upright cabinet (110 VAC)	11,725	100
871	7970E 1600 bpi tape drive in new upright cabinet (230 VAC)	11,725	100

* 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.

Hewlett-Packard HP 3000 Series

SOFTWARE PRICES

		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
300	Basic/RPG/300 return credit	−1,575
301	SL/300 return credit	−2,100
32104R/M	Right to copy 32104A with/without sublicense	1,500
300	Basic/RPG/300 return credit	−630
301	SL/300 return credit	−840
—	Fortran 77/3000	685
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
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		
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 (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

NA—Not applicable.
NC—No charge.

Hewlett-Packard HP 3000 Series

		Price ($)
COMMUNICATIONS (Continued)		
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 siblicense	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
32025	MTS Multipoint Terminal Support (use procesor 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
30239	Workstation Configuration (use processor option)	0
310	Series 37	2,100
310R/M	Right to copy 310 with/without sublicense	1,050
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

UTILITIES

19550A	Copycat/3000	4,000
—	Right to coy 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
—	Edit/3000	NC
—	Sort-Merge/3000	NC
—	FCopy/3000	NC
—	VPlus/3000	NC
—	Text and Document Processor/3000	NC

RELATED PRODUCTS

32244A	Dictionary/3000 Data Dictionary	5,000
32244R/M	Right to copy 32244A with/without sublicense	2,500
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. ∎