

# Hewlett-Packard HP 3000 Series

## MANAGEMENT SUMMARY

In an effort to increase its consumer marketability, Hewlett-Packard revised its organization marketing structure. Prior to this restructuring, H-P's computer and test instruments divisions operated as autonomous groups, selling the two types of products individually rather than as a package. In addition, H-P's efforts concentrated more on product development than market research, test marketing, and marketing technique. After researching the current market, H-P realized that the test instruments and computer markets are converging (instruments manufacturers require computers). The new organizational plan, which began in July 1984, revamped the corporate marketing division and combined the computer and instrument sales forces allowing "integrated solutions" to be sold. H-P, once known only for engineering and scientific computers, is now focusing its efforts more on the general purpose business computer market.

In the systems area, Hewlett-Packard enhanced its HP 3000 product line by adding the Series 37, revamping its data communications product line, introducing two new line printers, and adding new software functions.

The entry-level Series 37 has increased H-P'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. 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

The HP 3000 Series 37, newest addition to the product line, is designed for the small to medium-sized office and departmental user. With the introduction of the Series 37, Hewlett-Packard reaffirms its interest in the general purpose business user. The Series 37 joins the the four other currently marketed HP 3000 systems, which range in size from low-end to high-end minicomputers. **MODELS:** Series 37, Series 39, Series 42, Series 48, and Series 68.

**MEMORY:** 512KB to 8MB.

**DISK CAPACITY:** 28MB to 9.7GB.

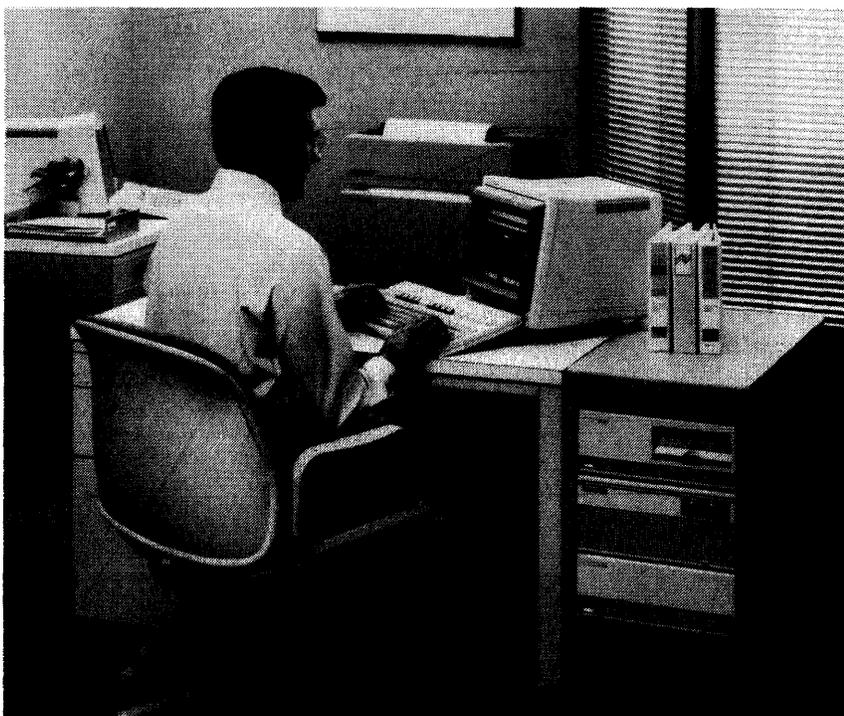
**WORKSTATIONS:** Up to 28 on the Series 37; up to 92 on the Series 39 and Series 42; up to 152 on the Series 48; and up to 400 on the Series 68.

**PRICE:** \$12,000 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, the Series 37 can be upgraded to the Series 42, 48, and 68.*

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**CHART A. SYSTEM COMPARISON**

MODEL	Series 37	Series 39	Series 42	Series 48	Series 68
<b>SYSTEM CHARACTERISTICS</b>					
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
<b>MEMORY</b>					
Minimum capacity, bytes	512K	512K	1M	1M	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	—	—	—	—	—
<b>INPUT/OUTPUT CONTROL</b>					
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			

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

➤ Series 37 or its satellite personal computers. Peripherals such as hard disks and printers can be centralized and shared.

Housed in a cabinet the size of a two-drawer file cabinet, the Series 37 includes 512KB of memory, one 55MB hard disk, one 67MB cartridge tape backup, one HP 2392A terminal; one modem port; six direct ports and the Image database management system. In addition to the 55MB drive, the Series 37 supports 132MB and 404MB hard disks.

The Series 37XE offers greater expandability than the basic Series 37. 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 same on-line, interactive abilities, software productivity tools, networking, and multivendor data communications facilities that are shared by other H-P systems are available on the Series 37. The Series 37 is object code compatible with other HP 3000 systems, including the high-end Series 68. The Series 37 can be upgraded to the Series 42, Series 48, and Series 68, without requiring reprogramming.

### ➤ 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

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▶ The HP Series 37 joins the four other members of the HP 3000 family members: the Series 39, Series 42, Series 48, and Series 68. All of the models support an upgraded version of the operating system, MPE V. The Series 42, 48, and 68 include a disk caching feature to speed I/O transfers.

The Series 39 comes standard with 512KB of main memory, with expansion capability to 3MB, and is packaged with an integral cartridge tape and a 28-, 65-, or 132-megabyte Winchester disk. The Series 39 will support up to three data communication lines, 3.2GB of disk storage, two line printers, and four tape drives. A maximum of 92 terminals is supported, 32 of which may be connected point-to-point.

The Series 42 includes 1MB of main memory, expandable to 3MB, and supports up to three data communications lines, 3.2GB of disk storage, two line printers and four tape drives. In addition, the Series 42 supports up to 92 terminals, 32 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 communication lines, 4.2GB of disk storage, two line printers and eight tape drives are supported. The Series 48 has the ability to support a total of 152 terminals, 104 of those may be connected point-to-point. H-P's Advanced Terminal Processor (ATP) is also available on the Series 48.

The Series 68 is the most powerful HP 3000 to date with a performance level of one-million-instructions-per-second. 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 and can be expanded to 8MB. The system will support 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 H-P Advanced Terminal Processor (ATP). The ATP provides communications capabilities while reducing system overhead via the ATP's own microprocessors.

The Multiprogramming Executive (MPE) operating system allows transaction processing on-line program developments, data communications and batch processing. An on-line HELP command is one illustration of H-P's user friendly software approach. The full complement of language processors available include Basic, Cobol, Fortran, Pascal, Transact, RPG, and SPL.

Disk caching 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 an optional feature on the Series 39, but is standard with the Series 42, 48, and 68. ▶

▶ functions (count fields, bit positions, index specification, immediate operand, etc.) and is called the argument.

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: The HP 3000 Series 37, 39, and 42 support a minimum of 512KB of main memory. The Series 37 supports up to 2MB of memory. With the Series 39 and 42 additional memory is available in increments of 256KB or 1MB, up to a maximum of 3MB. The memory capacity of the Series 48 ranges from 1MB to 4MB in increments of 512KB or 1MB. The Series 68 supports a minimum of 2MB and a maximum of 8MB. The memory upgrades for the Series 68 are available 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. ▶

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CHART B. MASS STORAGE

Model	7911	7912	7914/7914	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	

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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 gigabytes of disk storage	7935G is an add-on unit providing 1.2 gigabytes of disk storage		opt. 010-single drive

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

➤ The HP 3000 uses a stack architecture to provide a number of system advantages. Storage allocation is dynamic and temporary storage of intermediate values is automatically provided. Compilers, then, do not need to save and restore registers for intermediate results. Code compression is possible by the omission of operands in many of the instructions. The HP 3000 includes a separate code area and data stack. Added to the fact that code is not modifiable while active in the system, this allows code to be shared among several users. H-P code is reentrant, and when combined with stack processing, makes possible subprogram recursion—a subprogram calling itself. This combination is essential for efficient compilers and system software.

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, ➤

➤ 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 then the system shuts itself down. All models include a rechargeable battery pack to maintain memory data during power failure. A minimum of 15 minutes is provided with the total amount of backup time dependent on memory size and battery condition (age and level of charge). When voltages reach 90 percent of their values, all registers are automatically restored and processing resumes.

The Series 37 CPU is largely contained on a single CMOS gate array chip. 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 which controls memory via a memory controller, general I/O channels, DSN/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). ➤

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▷ 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 magnetic tape model features 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. The newest dot matrix printers are: the HP 2566A, a 900 lpm printer, and the HP 2565A, which prints up to 600 lpm. Features of the HP 2566A and 2565A allow up to 14 fonts to be installed at one time and mixed in a line of print. Both printers can print bar codes. 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.

H-P has streamlined its data communications products in an effort to make them easier to understand. With the new structure 2 products, at most, are required to establish a networking connection; they are 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 least 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, Multipoint Terminal Support, Workstation Configurator Network, and HP-IBM Data Communications Products. The Network Links that work with each of the Network Services are as follows: the Distributed Systems software requires a Point-to-Point Hardwired Link, Point-to-Point Modem Link, X.25 Network Link, or Satellite Network Link; Multipoint Terminal Support requires an MTS Data Link Connection, MTS Synchronous Modem Link, or MTS 3270 Device Link; the HP-IBM Connection software which includes SNA NRJE Network Remote Job Entry Service, RJE Remote Job Entry Service, MRJE Multileaving Remote Job Entry Service, or IMF Interactive Mainframe Facility Service, works with an SNA Link or a BSC Link; and the Workstation Configurator links with the ADCC or ATP.

The Fundamental Operating Software is included with all HP 3000 models and includes the operating system, MPEV, Edit/3000, FCopy/3000, Sort-Merge/3000, Image/3000, Query/3000, KSAM/3000, and HP VPlus/3000. ▷

▶ The Series 68 CPU is an H-P designed, microcoded processor using high-speed Emitter Coupled Logic (ECL) technology and a dual arithmetic logic unit (ALU). This 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 DSN/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 console, system display panel, and a Diagnostic Control Unit (DCU).

Program code and data are maintained in strictly separate domains and cannot be intermixed except in "immediate" type 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 and mode of operation with extensive stack processing.

**CONTROL STORAGE:** The Series 37 uses 10K 64-bit words; this is called Writable Control Store 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 Random Access Memory (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 to the programmer. There are 72 hardware registers on the other HP 3000 models. Like 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 (P), 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 ▶

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➤ Software available for the HP 3000 includes H-P's database management system made up of Image/3000 plus Query/3000. Image/3000 allows information to be related logically between data sets (files), minimizing data redundancy and facilitating information retrieval. Its companion package, Query/3000, allows both programmers and non-programmers to access an Image database with simple, English-like commands.

H-P continues to concentrate its applications development efforts on the HP 3000 Family in four major areas: manufacturing, distribution, administration, and office automation. In keeping with that concentration, H-P introduced HP Pay, a payroll system that works with the HP General Ledger. The HP Pay package integrates payroll software with an implementation service and a tax-update service. HP Pay, developed by Argonaut Information Systems, is marketed and supported by H-P.

Emphasizing compatibility rather than conversion, H-P introduced Transform/3000, a software product used to transfer IBM System/34 software to the HP 3000. Transform/3000 consists of four parts: an enhanced RPG compiler, translation tools and utilities, a menu processor, and H-P's consulting assistance.

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

### ADVANTAGES AND RESTRICTIONS

The HP 3000 product line offers users a group of systems the range from a low-end product that supports 28 workstations to a high end product the supports up to 400 workstations. All the HP 3000 Series systems are based on the same operating system, run the same software, and support the same peripheral devices. This allows the users to upgrade to more powerful systems without requiring to invest in new software packages or peripherals.

With the introduction of the Series 37, H-P increases its interest in the distributed processing environment. The Series 37 is also enforcing its interest in the low-end user, such as a small office or department. Because the Series 37 does not require a lot of space and runs under standard electrical power, a special computer room is not necessary.

H-P's effort to serve both the engineering and business user could be a positive as well as negative decision. Because the engineering/scientific user will undoubtedly require some business applications, more may be available. The increase in business applications will invite more general business users. One disadvantage of serving two markets is trying to please everyone; that can be a difficult job. By revamping its marketing organization, H-P in enforcing its effort to learn more about its users' needs.

### COMPETITIVE POSITION

Hewlett-Packard set several design goals for the 3000 Series product line. They included a common operating system ➤

CHART C. WORKSTATIONS

MODEL	2392A
<b>DISPLAY PARAMETERS</b>	
Max. chars./screen	1920
Buffer capacity	
Screen size (lines x chars.)	24 x 80
Tilt/swivel screen	Yes
Symbol formation	7 x 11 dot matrix
Character phosphor	Green
Total colors/no. simult. displayed	None
<b>KEYBOARD PARAMETERS</b>	
Style	Typewriter
Character/code set	128 ASCII
Detachable	Yes
Program function keys	8
<b>TERMINAL INTERFACE</b>	RS-232-C

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

Eleven additional display terminals are available from H-P. Information on these terminals was not provided by the vendor.

➤ 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 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 is 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 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. ➤

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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	Fully-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.

CHART D. PRINTERS (Continued)

MODEL	2619A	2563A	2932A	2933A
Type	Drum	Dot matrix	Dot matrix	Dot matrix
Speed	1000/750 lpm	300 lpm	200 cps	200 cps
Bidirectional printing	No	No	Yes	Yes
Paper size	Up to 19"	Up to 16.7"	Up to 15¾"	Up to 15¾"
Character formation	Chain	Varies	9 x 12 dot matrix	9 x 12 dot matrix
Horizontal character spacing (char./inch)	10	5/10/16.7	5/10/16.7	5/10/16.36
Vertical line spacing (lines/inch)	6 or 8	6 or 8	Up to 12	Up to 12
Character set	64/96	256	Varies	Varies
Controller/Interface	Parallel-Differential	HP-IB or RS-232-C	RS-232-C	RS-232-C
No. of printers per controller/interface	4	2/4	—	—
Printer dimensions, in. (h x w x d)	42¾ x 36½ x 26	10¾ x 23.6 x 17¾	7.28 x 23.85 x 14.37	7.28 x 23.85 x 14.37
Graphics capability	No	Yes	Yes	Yes

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

CHART D. PRINTERS (Continued)

Model	2934A	2680A	2687A	2688A
Type	Dot matrix	Laser	Laser	Laser
Speed	40/67/200 cps	45 pages/minute	12 pages/minute	12 pages/minute
Bidirectional	Yes	Not applicable	Not applicable	Not applicable
Paper size	Up to 15¾"	8½" x 11"	8½" x 11"	8½" x 11"
Character formation	9 x 12 or 36 x 24	Varies	300 x 300 dots/inch	6 lines/inch
Horizontal Character spacing (char/line)	5/10/12/163	Varies with character set	10/12/15 cpi	15 cpi
Vertical line spacing (lines/inch)	Up to 12	Varies with character set	6 or 8 lines/inch	6 lines/inch
Character set	Varies	over 100 different sets	127	182
Controller/Interface	RS-232-C	HP-IB	RS-232-C	HP-IB controller included
No. of printers per controller/interface	—	2	1	1
Printer dimensions (h x w x d) inches	7.28 x 23.85 x 14.37	48 x 64.5 x 26.4	11 x 20 x 19.5	11 x 20 x 19.5 plus 29 x 37 x 28-controller
Graphics capacity	Yes	Yes	No	Yes

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

➤ and object code compatibility, a broad range of price and performance options, a clear growth path, friendly software, and full networking capabilities. By running the same operating system, the HP 3000 models offer compatibility of software products throughout the product line, which allows for easy upgradability. H-P is focusing on its software compatibility and growth path features throughout its new product brochures.

➤ 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.

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**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.

➤ Hewlett-Packard has added business computer to the systems that compete with the HP 3000. H-P no longer markets its computers to an engineering market. In order to compete with the already established leaders in the business computing marketplace, H-P revamped its marketing structure and is introducing more products for the business user.

The Series 37 is being marketed as a distributed processing system for office and department use; its target market is both the business and engineering user. The Series 37, which offers 512KB to 2MB of memory, 55MB to 2.1GB of disk storage, and support for up to 28 workstations, computers with the Wang VS15 and VS45 for the business market. While the VS25 is close in physical size, its memory disk storage, workstation support capacities are less. The VS15 offers 256KB to 1MB of memory, up to 76MB of storage, and support for 10 workstations. When comparing the characteristics, the XE550 is closer to the VS45. The VS45 offers up to 1MB of memory, up to 2.5GB of disk storage, and support for up to 20 workstations. The size of the VS45 is larger than the Series 37.

H-P's commitment to the general purpose business computer user is enforced by the company's introduction of Transform/3000 for IBM System/34 to HP 3000 software migration. By offering the Transform/3000 option, H-P hopes to bring the System/34 users who require larger computers over to the H-P camp instead of automatically upgrading to a System/36 or /38.

As a general business system, the HP 3000 is competing for the same market as the IBM System/38. The HP 3000 Series 42 is a close match for the IBM System/38 Model 4XX. The Series 42 offers from 1MB to 3MB of main memory, from 28MB to 3.2GB of disk storage, and support for up to 92 workstations. This compares the the S/38 Model 400 with 1MB to 2MB of memory, 64.5MB to 3.3GB of disk storage, and support for up to 128 users. The Series 48 offers characteristics that are similar to the S/38 Model 6XX. The HP 3000 Series 48 provides 1MB to 4MB of memory; the memory range for the Model 6XX ranges ➤

➤ 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)	28	40	40	28.5	48
Width (inches)	15	24	24	72.25	69
Depth (inches)	28	22.4	22.4	31.25	26
Weight (pounds)	66	190	190	240	1200

The Series 37 requires a line voltage of 100-120 VAC ± 10 percent or 200-240 VAC ± 10 percent at 45-66 Hz. The Series 39 and 42 require a line voltage of 120 VAC at 69 Hz or 220 VAC at 50 Hz and a line current 8.5A at 60 Hz or 4.5 amp at 50 Hz. Heat dissipation is 3000 Btus per hour. The Series 48 requires a line voltage of 210 VAC at 60 Hz or 220 VAC at 50 Hz with a line current of 13.1A at 60 Hz or 12.4 amp at 50 Hz. The system dissipates 7380 Btus 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 13A at 50 Hz. Heat dissipation is 12,000 Btus per hour.

The recommended operating environment for the Series 37 ranges from 5 degrees Centigrade to 40 degrees Centigrade. The operating humidity @ 40 degrees Centigrade is 20 to 80 percent for the relative humidity. All the other HP 3000 models have a recommended operating temperature of 20 degrees Centigrade to 25.5 degrees Centigrade. The recommended operating relative 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, ➤

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▷ from 2MB to 4MB. Disk storage on the Series 48 starts with 28MB and can be expanded to 4.2GB; Model 6XX disk storage ranges from 64.5MB to 3.3GB. A maximum of 152 workstations are supported by the Series 48; the Model 6XX supports up to 128 workstations. At the high end, the HP 3000 Series 68 is configured with 3MB to 8MB of memory and 50MB to 9.7GB of disk storage. The S/38 Model 8XX offers from 2MB to 8MB of memory and from 64.5MB to 6.3GB of disk storage. Like the Model 4XX and 6XX, the Model 8XX supports up to 128 workstations. The Series 68 can accommodate up to 400 workstations.

Both the IBM System/38 and HP 3000 offer a growth path for their users. The low-end S/38s can be upgraded to the Model 8XX; the low-end HP 3000 users can upgrade their systems to the Series 68. The difference between the two systems is that once the S/38 user has reached the Model 8XX, the next set up in power is the 4300 Series which runs under a different operating system than the S/38. The Series 68, H-P's high-end system, is op-code compatible with the Series 37 entry-level system. Each model within the HP 3000 family runs the same operating system and supports the same software.

Other minicomputers competing for the same business market H-P 3000 models include: the Burroughs 900 and 1900, DEC PDP-11 and VAX-11, and Sperry System 80. Honeywell DPS 6 and Data General Eclipse compete with models in the HP 3000 line for the engineering/scientific market.

### 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 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 from 8MB to less than 16MB.

In terms of disk storage capacity, the majority of users worked with medium- to large-range 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 answered with a range of 6 to 15 workstations; and 40 ▷

▷ 42, and 48 utilize an Intermodule Bus (IMB) to handle communications between the CPU, memory, and I/O modules. The CPU, which is featured with 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 between the CPU module, 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 an interface between the Central System Bus and the Intermodule Busses to allow communication between 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.

**I/O CHANNELS:** 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 H-P 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 91 of these may be multipoint terminals; all may operate at 9600 baud. The Series 48 increases the maximum number of terminals to 152, and 151 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 prepacked 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 ▷

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➤ installed between 31 and 60 local workstations. Eight users said they had over 60 workstations instantly 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 installations.

The majority of respondents (46) worked in the manufacturing industry. The field of education employed 22 survey respondents. Fifteen users represented government organizations. Other industries represented include: retail/wholesale, with 11 users; service bureau, 8 users; chemical/petroleum, 7 users; health 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) are the principal applications being used on the HP 3000. Other applications represented by less than 15 respondents include process control, petroleum, mathematics, health care, petroleum/fuel analysis, construction, banking, and insurance. Thirty users worked with applications that were not given as survey answers.

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:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	82	67	7	0	3.48
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 cited, 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 ➤

➤ 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. A second controller must be ordered 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 not 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 7914E 1600 bpi drive and the HP 7978A 1600/6250 drive are supported by all models except the Series 37. The Series 39 and 42 systems can have a maximum of four tape drives with two HP 7978s allowed. The Series 48 and 68 each handle up to eight magnetic tape drives: four HP 7914s 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, 39, and 42, four printers on the Series 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.

**COMMUNICATIONS:** 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.

### MASS STORAGE

For information on the available mass storage devices, please refer to CHART B, Mass Storage Devices.

### INPUT/OUTPUT UNITS

Please refer to CHART C for terminals, CHART D for printers and CHART E for magnetic tape units. Other peripherals supported on the HP 3000 Series are described below.

**PLOTTERS:** H-P's plotters offer a range of choices in paper size, pens and interfacing.

The HP 7470A and HP 7475A Graphics Plotters are desktop units utilizing 2-pen and 6-pen plotting, respectively and A-size paper (8½ by 11 inches). Multicolor plotting is possible on the 2-pen plotter by halting a program through front panel or program control, installing new pens and then resuming plotting. The two-pen plotter offers 5 character sets, while the six-pen plotter uses 19 character sets. A choice of two interface options is offered: RS-232-C/CCITT V.24 or HP-IB (IEEE 488-1978). With RS-232-C, a dual input/output cable is available allowing connection of the plotter to a terminal.

**Drafting Plotters** utilize microgrip technology to provide D/E size plots from a device only 42.8 inches wide by 21.9 inches deep. Features of these plotters include: 6 character sets contained in 2 fonts; 8-pen capability; 3 types of pens, fiber tip, drafting and roller ball; 0.003 mm mechanical resolution; and D-size paper (24.5 by 48.5 inches) on the Model 7580B or E-size paper (36.5 by 48.5 inches) on the Model 7585B. ➤

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➤ 3000 Series III systems ten years ago because H-P offered the best engineering computer and Fortran compiler at the best price. As Fortran improvements were made throughout the industry, this user said H-P Fortran stayed the same. Because the firm has engineering applications requirements, other alternatives were investigated when the H-P became too small for its needs. For the engineering side of the business, replace one Series III with a Honeywell DPS 6. Because of additional system needs, the firm plans to convert its business applications, which run on the other Series IIIs, 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. H-P 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 H-P systems. The HP 3000's positive attributes, for this user, include H-P'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 architecture has been limiting for this user. In addition to a changed architecture, the user would like to see H-P increase the 3000's communications capabilities and reduce peripheral and update cost, its backup procedures enhanced, and its speed increased (this user feels that the 3000 is slower than it should be).

Because this firm 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 from 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) H-P 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 H-P 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." ➤

➤ **GRAPHICS TABLETS:** *Model 17623* is supported by the *Model 2627A* color graphics terminal or the *Model 2623A* monochrome graphics terminal. This tablet also offers single or continuous line mode and resolution to 0.100 mm.

**DATA COLLECTION TERMINALS:** *Model 3075A* is a desktop data capture terminal supported in point-to-point or asynchronous multipoint configurations, with a 15 position numerical display, protected data fields, 17 user-defined prompting lights, and 10 special function keys. *Model 3076A* is a wall mount version of this same device with an inverted keyboard and display. Any 2 (but only 1 of each) of the following options are supported with either of these terminals: bar code reader, magnetic stripe reader, multi-function reader (reads punched cards, marked cards and type III badges), Type V badge reader, printer, serial I/O card or HP-IB card.

*Model 3077A* is a time and attendance terminal with an internal clock and a time display for mounting on a wall. A Type V badge reader is standard; options include a multi-function reader or magnetic stripe reader.

### COMMUNICATIONS CONTROL

The HP 3000 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.

Services 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 omtrinsics; 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
Pt-to-Pt Hardwired Link, Pt-to-Pt Modem Link, X.25 Link, Satellite Network Link	DS Services
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

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➤ 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 users, H-P does not update and enhanced 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, its felt, are the system's biggest drawback.

The user feels H-P 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 an HP processor with DS. The connection can be made using a leased line with modem, switched line with manual dial modem, switched line with auto-dial modem, or Digital Phone Network modem. Like the hardwired link, the modem link provides the lower level protocol management software, a hardware interface card, and cables.

**The X.25 Link** communication products provide communications capabilities between H-P 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-pint remote processor connections
- data transmission rates up to 56K bps
- Bit error rates of typically using less than 1 in 10<sup>7</sup>
- Multipoint transmission using the Vitalink Codamux
- Transparency to the HP 3000 system user in that no modifications will be required to existing DS-based applications
- Full support of networking capabilities over the space segment

**The 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 to connect an IBM System/370-compatible host processor in an IBM System Network Architecture environment. The SNA Link allows HP 3000 Series 37, 39, 42, 48, and 68 systems to emulate the functions of the Transmission Control, Path Control, and Data Link Control SNA layers on an HP 3000. Each SNA link connects to a single switched or nonswitched data communications line. The HP 3000 supports multiple SNA Links for connection to multiple IBM mainframes, or multiple data communications lines to a single mainframe.

**The 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 H-P's RJE, MRJE, and IMF Services; A separate BSC Link product and data communications line is 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 capability
- Built-in diagnostics and self-test
- On-line diagnostics run under the MPE operating system
- Collects data volume and error statistics
- Battery backup prevents loss of buffered data during a power failure

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- ▶ • Bisync and HDLC/SDLC protocol compatible
- 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 supports 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 also 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 *Advanced Terminal Processor (ATP)* is designed to interface asynchronous workstations to the HP 3000 Series 39, 42, 48, and 68 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 offloads 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; 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 minimum ATP subsystem consists of one System Interface Board (SIB) and one Direct Connect or Modem Port Controller. It requires two I/O slots and supports up to 12 workstations. The maximum ATP subsystem, including one SIB and several Direct Connect and/or Modem Port Controllers, varies with the system configuration.

The SIB provides the hardware interface to the HP 3000 Inter-Module Bus (IMB) and performs the byte packing and unpacking which is 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, provide data buffering and control speed sensing, special character detection and character echoing functions.

Local workstations are connected to the system via the Direct Connect Port Controller. Using the HP-Direct Connect Type 422 interface, workstations can operate at speeds up to 19.2K bps to be connected to the Direct Connect Port Controller with cables up to 1220 meters (4,000 ft.) long. The Type 422 interface is H-P's implementation of the EIA RS-422 standard. HP-Direct Connect Type 232, H-P's version of the EIA RS-232-C standard, allows workstation 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 free-standing Junction Panel are included in the Direct Connect Expansion Package. The Modem Expansion Package contains one SIB, one Modem Port Controller, and one free-standing 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 H-P. The peripheral devices can be connected directly on all 7 ports; 1 of these ports can alternatively be used for remote connection of these devices through asynchronous full-duplex modems. The remote port may also connect the Series 37 to the H-P 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 direct 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 ▶

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► 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 ADCC 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 which 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 allow the controller to act as a private Packet Assembler Disassembler (PAD). The standard 18 parameters defined in the X.3 recommendation are supported, plus additional H-P defined local parameters are available for enhanced functionality with H-P 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: Northern Telecom's SL-1 PABX line, ROLM Corp.'s CBX line, and InteCom's S/40 IBX. H-P does not supply the PBX equipment needed to interface with the HP 3000. And while H-P guarantees the proper operation of H-P systems and applications, support for the actual PBX and its associated equipment remains the responsibility of the customer and its PBX supplier.

The *Synchronous Short Haul Modem* provides synchronous transmission at data rates of 2.4K, 4.8K, 9.6K, and 19.2K bps. The unit is designed for half-duplex, full-duplex, and multipoint operations over local circuits. It can be used over unloaded metallic circuits which are either installed privately or leased from the telephone company.

The *Asynchronous Repeater (AR)* is a standalone device which converts RS-232-C communication signals to allow extended asynchronous point-to-point communications between an HP 3000 and SRTs, character printers, and printing terminals. The AR is used to extend the distance between the HP 3000 and a single asynchronous RS-232 device to up to 1,219 meters (4,000 ft.)

### 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 multi-

ple users. An on-line HELP facility guides the user through the MPE command set. MPE monitors and controls program input, compilation, execution, and output, arranges the order in which programs are executed and dynamically allocates hardware and software resources as required.

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

According to HP, the latest version of the MPE operating system provides a marked improvement in performance over earlier MPE systems. In addition, internal system data structure expansions now support 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. This reduces I/O contention on the system domain disk and improves system I/O performance. The disk caching facility further improves I/O performance by using excess main memory to buffer reads and writes to disk subsystems. Internal file system management has been enhanced 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 insure better access to disk and memory resources. A TUNE command allows users to filter out long transactions, such as batch operations, to improve on-line 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. Program execution for a particular user (called a process by H-P) then proceeds until additional segments are needed. 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 H-P-developed algorithm called the segment trap frequency algorithm. The 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 as much as possible. 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 physi-

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► cally access the disk. Disk Caching policies are integrated into the MPE kernel, file system, and I/O system. The operator will be able to use external commands to activate and deactivate caching on a disk by disk basis and to display general caching statistics.

Disk Caching will use the MPE Kernel resource management mechanisms and strategies. These mechanisms are extended to handle cached disk "domains" in the same manner as segments. These cached disk domains can be of variable size, fetched in parallel with other segments or cached domains, garbage collected, and replaced in the same strategies as stacks, data segments, and code segments. The relative use of main memory between stacks, data and code segments, and cached disk domain objects is dynamic.

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 the use of 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 JCL. In any access mode, whether sequential or direct, security is maintained for users, groups, accounts, and individual files.

The MPE Accounting Facility insures 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 log-on 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:** *Image/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.

Image 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.

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

In serial access, Image starts at the most recently accessed data record and searches all adjacent records sequentially until the desired entry (if it exists) 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 accom-

plished by identifying the proper chain and searching the chain until the desired entry (if it exists) 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 Image 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.

Limiting parameters for Image/3000 include the following. In each data base there can be a maximum of 255 data item names and 99 data sets; a single set cannot exceed the capacity of a disk drive. There may be up to 16 characters per item or data set name. In each data entry there may be up to 127 data items. The maximum size of a data entry is 4094 bytes. A maximum of 16 keys per detail data set and 16 detail data sets per master data set is permitted. Each chain may have up to 65,535 entries. Up to 16 different pointer pairs can be maintained for each data item; this permits each data item to be a member of 16 different chains or access paths. There may be 6 characters per database name, 8 characters per password, and 8,388,607 entries per data set.

Image 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.

*Query/3000* uses such commands as FIND, REPORT, and UPDATE to locate, report, and update values in an Image/3000 database. Reporting of retrieved data can be formatted to include page titles, column headings, group subtotals, etc., if desired. All security provisions invoked through Image 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* (The 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.

**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, therefore, providing uniform access to disk and tape.

*Basic* is implemented as an interpreter and a compiler. The interpreter offers an effective way to debug programs interactively, while the compiler yields more efficient code with ►

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► 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.

Basic also provides the following HP extensions. 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 Inter-program Communication.

Language extensions implemented by H-P include micro-coded 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 Intrinsic, 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 the use of ANSI Standard Cobol Input and Output operations and to Image/3000, H-P's database management package, through the use of procedure libraries.

*Fortran* is based on American National Standard Fortran, X3.9-1966, and is a full implementation of that standard. 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 the 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 H-P 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. Implementations of HP Standard Pascal are available on the HP 1000, HP 9000, HP 9826, and HP 9836.

*Pascal/3000* also includes extensions beyond the HP Standard Pascal to allow calls to HP 3000 subsystems such as Image/3000, and VPlus/3000, to HP 3000 system intrinsics, and to external procedures written in Fortran, Cobol or SPL, as well as Pascal. The compiler has numerous compiler options which include flagging all extensions beyond the ANSI standard or the HP Standard. It 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 H-P 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 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 (direct register references, bit extraction, etc). 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. H-P states that MPE and all compilers are written in SPL.

**COMMUNICATIONS:** The *HP AdvancedNet* software provides capabilities in three broad areas: 1) workstation to HP system communication, 2) H-P system to H-P system communications, and 3) H-P system to IBM mainframe communications. Four Network Services comprise the H-P AdvanceNet software products; they are Distributed Systems (DS) Network Services; Multiterminal Support (MTS) Service; Workstation Configurator; and HP 3000-to-IBM Communications products, which include SNA NRJE Network Remote Job Entry, 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 H-P computer systems: HP 3000s, HP 1000s, HP 250 general-purpose business computers, and HP 9845 desktop technical computers. Multiple network access methods are available to provide network database access, file access, peripheral access, file transfer, terminal access, and inter-program communication. DS Network Services capabilities are integrated with their MPE counterparts, providing accessibility from applications in any language, including Cobol, Cobol II, Fortran, Basic, Pascal, and SPL. ►

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► **The Multipoint Terminal Support Service (MTS)** is the user level software which enables an HP 3000 to communicate with multiple multipoint devices. A variety of terminals and printers can be connected directly to an MTS communications line or through the 2333A Multipoint Cluster Controller. The devices can be hardwired to the HP 3000 or connected by means of a modem. The MTS works in conjunction with the MTS Data Line, 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 and 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 they can be 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, and control functions can be specified and saved as workstation types. The software driver uses the workstation types in communicating with the attached devices. The following list shows WSC 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.
- Choice of three workstation flow control protocols—Enquiry/Acknowledge or Delay handshakes controlled by the software driver or Xon/Xoff mechanism controlled by the attached device.
- Supports block mode workstations by allowing the user to define the block mode alert and trigger characters.
- Special characters can be defined for system attention, backspace, cancel line, end-of-record, or subsystem break.
- Control setting can be specified for echo, line feed, backspace response, or parity.
- A set of characters can be defined to be stripped and ignored by the serial I/O driver.
- Printer control information such as initialization string and Vertical Format Control can be defined.

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 allow 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 require 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 emulated 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 alphanumeric 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 straight forward 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. The user can isolate bottlenecks and improve performance by tracking CPU utilization, memory management activity, I/O traffic, program and process activity, and system table usage. Performance data is regularly updated and may be presented in the form of charts, graphic displays, or summary reports. H-P offers a System Performance Training Course to teach users how to use the performance related data from OPT/3000. This training is required for each initial OPT/3000 installation.

**Flexible Diskcopy/3000** allows conversion of IBM 3741 format flexible disk data set files to HP 3000 disk files while

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► translating EBCDIC code to ASCII. It can operate in either an interactive environment or in batch mode, and can convert either single or multiple data sets and volumes. A complete error, warning, and status message file is included to provide the user messages about program status, user prompts, and error conditions.

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.

**RELATED PRODUCTS:** H-P offers the following programming aids—Rapid/3000, HP Inform/3000, HPToolset/3000, and APS/3000. *Rapid/3000* is a family of software programming tools consisting of four individual but integrated products: Dictionary/3000, Transact/3000, Report/3000, Inform/3000, and Transform/3000. H-P states that improvements of 2 to 10 times in programming speed have been demonstrated with RAPID/3000.

*Dictionary/3000* is a relational data dictionary and data directory facility to control and coordinate all H-P data files. The data dictionary consists of an Image database, a high-level user interface, and maintenance utilities. The dictionary contains information about a company's data processing and user environment. This includes data definitions, data structures, files, programs, security rules, and locations. The user-world is separated from the system environment with relational user views of the data. The data dictionary interface, in interactive mode, accepts commands and then prompts the user through entry, update, deletion, and reporting operations. Minimum memory required for the dictionary is 256KB, although the customer's actual job mix may necessitate more. Both character and block mode terminals are supported.

*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 H-P's system-wide data dictionary, 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 (something most high-level languages require the user to forego). Programmers are not forced to give up the control they need to do an effective job. 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.

*Report/3000* is a command driven, nonprocedural report writer for use with HP Dictionary/3000. Report/3000 provides extensive layout, heading and editing capabilities. Since Report/3000 operates with Dictionary/3000, programmers are freed 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 IMAGE, KSAM and MPE sequential files through the data dictionary, with only specification of the element name. Report/3000 is self-contained, no procedure calls are required and no intrinsic calls need to be made for report generation. Quick reports can be generated utilizing the default headings and edit masks in conjunction with prompts from the system. More complex reports cover the entire range of formatting.

*HP Inform/3000* is an interactive inquiry and report generator for nonprogrammers. A series of menus guide the user through the specification process. The more experienced user can bypass lower-level 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. Detail information including subtotals, grand totals, break-points and sort order are user specified. Reports can be displayed on the terminal or sent to the line printer. Commands can be stored for future execution.

*HPToolset* is a productivity aid which 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 workspace manager manages all source files, versions of source files, INCLUDE files, USL files, and program files and listings. Since source files may be shared, individual and team programming efforts are simplified. The full-screen editor provides direct editing of text to simplify source-code entry and modifications. The Cobol II interface program key set consists of function keys which permit the user to compile, prepare, and run programs. The Cobol II symbolic debug locates run-time errors by using actual program variable and paragraph names rather than primitive-level memory locations and code addresses. The programmer can set breakpoints, trace/retrace execution, and display and modify data-item values.

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. Samples may be stored onto a disk file for later analysis. The APS/3000 typically uses two to three percent of the available CPU time as overhead when using the default sampling rate. The sampling rate is adjustable by the user. The samples can be run on any H-P terminal supported by an HP 3000 system using a current MPE IV operating system.

*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. According to H-P, the RPG compiler is 99 percent compatible with the System/34's RPG II. The translation tools and utilities convert EBCDIC to ASCII, load files in proper formats, create accounting structures, change syntax on machine dependent commands and running programs through the compiler. The function of the menu processor is to provide a System/34-like environment that is menu driven, interprets OCL commands, and passes HP 3000 commands through to the operating system. The consulting assistance is provided by a Conversion Specialist, who offers help during the transition period and introduces the HP 3000 capabilities.

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

*HPWord* is H-P's full-feature word processor for general business needs such as memos, lists, and reports. The large disk storage capabilities provide for more than a million pages of HPWord documents to be stored on-line. HPWord uses the 2626W Word Processing Station with its internal microprocessor and 128KB memory. Editing commands are entered through specially-labeled keys; additional functions are added via the screen-labeled keys. The 2626W is a full-function, multiscreen intelligent data-entry station when not being used in HPWord applications.

*HPSlate* is a commandless, text processor 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. ►

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► **HPDeskManager** operates from any terminal connected to an HP 3000. Working within HP's DSN capabilities, HPDeskManager manages to provide electronic mail, electronic filing of mail, word processing for composing memos, and an electronic time and calendar manager. Users only specify the name of their intended recipient; actual routing paths are invisible to the user. A general delivery feature provides a way to route messages to a number of locations for manual distribution.

HPDeskManager includes a HELP facility to quickly answer any questions. If a sender requests acknowledgement of a message, it is sent automatically after the message is read. Users can send messages to offices that are closed, the electronic In Tray continues to receive messages for delivery as soon as the recipient signs on. An Out Tray and Pending Tray function is also provided. Other features include:

- **Work Areas**—allows composing and editing of longer messages and for assembling packages of information files including graphics.
- **File Cabinet**—stores messages and documents.
- **Distribution directory**—provides the ability to construct, use, and store standard distribution lists.
- **Administrative Area**—allows the user to tailor the HPDeskManager environment with passwords, auto forward instructions, auto-answer messages, and the choice of an alternate to handle mail on a user's behalf.

To reduce on-line storage requirements, HPDeskManager uses the Image/3000 database for document storage and local distribution. Documents are stored only once on each system in a network, with pointers for each intended recipient.

The *Text and Document Processor/3000* (TDP)/3000 has extensive formatting features used in the creation of manuals, contracts, and lengthy proposals.

**APPLICATIONS:** HP's application software is grouped into several major categories: manufacturing, distribution, administration, as well as HP Plus for third-party software.

*HP Maintenance Management* is an application solution designed to help manage the maintenance department. According to H-P, this application will increase machine uptime, reduce space part inventories, and increase labor productivity.

H-P's manufacturing applications include *Materials Management/3000* and *Production Management/3000*. Each is an interactive system that can work separately or together, on single systems or distributed networks. *Materials Management/3000* allows the user to manage materials planning and control functions for a manufacturing operation. *Production Management/3000* adds production planning and control. Each consists of software modules using the techniques of Material Requirements Planning (MRP) and Capacity Requirements Planning (CRP).

H-P's manufacturing packages provide a customizable user interface and data base. Menus, data entry and retrieval screens, hard-copy reports; and Image/3000 database are all available for user's modifications. Query/3000 may be used to meet the need for ad hoc reports. H-P states that these applications packages are designed for manufacturers who build in batches or lots with a variety of products and processes.

*SFD/3000* (System For Distributors) and *OM/3000* (Order Management) are H-P's two products for wholesale distri-

bution. The SFD/3000 application software consists of the following modules:

- Sales Order Processing
- Purchase Order Processing
- Inventory Control
- Sales Analysis
- Accounts Receivable
- Accounts Payable
- General Ledger

The OM/3000 package is a subset of SFD/3000 geared specifically toward sales. OM/3000 consists of the following modules:

- Sales Order Processing
- Inventory Control
- Sales Analysis
- Accounts Receivable

H-P also offers applications for accounting, payroll, educational, and graphic needs.

*HP Financial Accounting* is an on-line, interactive, totally integrated software package comprised of the following eight modules:

- General Ledger
- Accounts Payable
- Accounts Receivable
- Dual Ledger
- Allocator
- Report Facility
- Interface Facility
- General Accounting

All of the modules, except HP General Accounting, allow customizing of databases, user interfaces, and security, without programming, through the use of H-P's Customizer technology. For all the HP Financial Accounting modules, H-P recommends that a minimum system configuration include 1MB memory.

The *General Accounting/3000* software system includes three standard programs: General Ledger, Accounts Payable, and Accounts Receivable. Each module may be used separately or together as an integrated system. These packages link with the *Materials Management/3000* software to provide increased capabilities for the manufacturer.

The features of *HPPay* include:

- Extended Security in defining user access
- Menu/table driven
- On-line entry, edits, and updates
- On-line inquiry
- User-defined pay types, deduction types, and pay frequencies
- Report writer
- Labor distribution
- Automated interface to HP General Ledger
- Automatic check reconciliation
- Up to 99 different organizational levels per payroll run

H-P indicates that HPPay can run on a minimally configured HP 3000. The amount of memory needed depends upon ►

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► each system configuration, installation of other applications, and performance and response time requirements and expectations. HPPay requires MPE IV, Q Mit, or later release of the HP 3000 operating system, including VPlus/3000, Image/3000 and KSAM/3000.

SIS/3000 (*Student Information System*) and CIS/3000 (*College Information System*) are two software packages that handle either school or college data via an integrated data base. The packages handle such area as grading, attendance, and registration.

The *HP Decision Support Graphics/3000* (DSG/3000) is an interactive graphics software package which allows non-technical users to create and save fully-annotated line graphs, horizontal and vertical bar charts, pie charts, and scattergrams. The package includes a set of high-level procedure calls that can be used by any of the HP 3000 languages. Access is menu-driven with screen prompts. Charts created DSG/3000 can be displayed on the HP graphics terminal or printed on any of HP's digital plotters, plotter/printers, or graphics printer. An interactive option allows multicolor graphs.

*HPMenu* is a menu-building software facility that makes it easier for 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 see the choices available, and make a selection by pressing screen-labeled function keys. Menu choices can include other menus in a tree structure.

The HP 3000 *Business Graphics Package* includes *HPEasychart*, *HPDraw*, and an enhanced *Decision Support Graphics/3000* (DSG/3000). The entire package may be purchased at a discount, or individual products may be purchased separately.

*HPEasychart* is designed for office users to produce quick charts. Small examples of pie charts, bar charts, line charts, or scattergrams are displayed. Up to six variables, each with as many as 70 values, may be entered. Plotting is done at the press of the Draw button.

*HPDraw* provides presentation text and figure design multi-color output on paper and overhead-transparency slides. Users perform high-quality visual-aid design, production, and revision through the use of menus keyed to their appropriate experience level (beginner, regular, or expert). *HPDraw* provides a choice of fonts, basic geometric shapes, symbols, and simple figures.

Additional graphics software packages are *AutoPlot*, *Word*, and *Forms*. *AutoPlot* enables users to produce pie, bar, and linear charts and text slides. *Word* allows users to perform text processing functions through a combination of menu and command keys. Page formatting offers automatic page breaks, footing, headings, and file merging. Included with *Word* is *Forms*, to design forms for data entry or documentation.

*HP Plus* is a marketing program which finds software written by independent software suppliers, qualifies the packages, and then merchandises them with the software suppliers. The HP Plus program currently offers 580 packages. Contact the local HP sales office for a current and complete listing of these 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 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*, *Image/3000* database management system. *Query/3000* database inquiry language, *KSAM/3000* keyed sequential access method, *HP VPlus/3000* forms management software, and the facility to execute 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.

Refurbished, previously owned, earlier model HP 3000 systems can be purchased through HP's System Re-Marketing Operation. User upgrades are one source of equipment for resale, as are lease returns and internal capital requirement. Remarket products are refurbished, warranted, installed, and supported as new equipment. Sales channels are the same as for new products, as are discount schedules. All software products are compatible with these systems.

Standard lease rates can be calculated as percentages of the list (purchase) price payable per month for terms from 3 to 5 years and 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, 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. Nine different coverage periods are available: 13, 16, or 24 hours per day and 5, 6, or 7 days per week. 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.

HP also provides *Product Support Services* for workstation items, such as: terminals, small printers, and plotters. On-site service is available with next-day response for sites within the typical 100-mile service radius. Scheduled

## Hewlett-Packard HP 3000 Series

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

An approximate 50 percent savings can be realized through the use of Field Repair Center (FRC) Service. This 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 similar discount and may receive weekly scheduled visits to specified work areas, with repair being performed on site.

The software support policy for the HP 3000 contains the following qualifications:

- An HP-trained System Manager responsible for maintaining the integrity of the system's hardware and software or a trained designated alternate must be identified as a contact for HP.
- The same level of service must be purchased for all of the HP software products which make up one computer system. Due to the interaction among software elements, service cannot be given to specific software products while omitting others.
- Additional phone-in service can be purchased as many times as desired. The name of a single authorized caller must be provided for each additional caller service purchased. Additional phone-in service cannot be purchased unless Customer Support Service (CSS) has been purchased.
- Central system CSS support of additional systems can be purchased only by customers with multiple installations. It cannot be purchased unless one of the installations has purchased Customer Support Service.
- A minimum of three months of support must be purchased.
- If twelve months of software support is ordered concurrently with the HP 3000 software, H-P will provide an additional 90-day period of the services ordered at no charge.

All HP 3000 software products are discountable under Hewlett-Packard Computer Products Purchase Agreements. Software support services are not discountable.

Services that accompany software purchased under the support policy include phone-in consulting with an HP systems engineer (with an advertised four-hour response time) within a 100-mile radius of the H-P sales office, software updates every three months, reference manual updates, software status bulletins every two weeks, and installation of software at the customer site. The phone-in consulting service may also be used for customer application bugs and interpretation of H-P documentation. Software bulletins and updates also offer an avenue for interpretation of H-P documentation.

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.

On-site consulting services by H-P systems engineers (SE) are available to resolve software and documentation problems which cannot be solved using the phone-in service. If the problem reported is not associated with an H-P software design error or system malfunction, the on-site services are considered outside the scope of H-P's software and support agreement and subject to a time and materials charge. H-P is not obligated to provide any on-site services for H-P software products which the customer has modified. When

on-site, the SE will help the customer to identify, verify, isolate, and work around problems caused by HP software. Assistance is available weekdays, excluding H-P holidays, during HP working hours, at distances not more than 100 miles from the nearest H-P office designated to provide on-site SE services. Support for facilities farther away can be provided at additional cost.

H-P also offers emergency software support service for customers with problems occurring on weekends, holidays, and from 5 p.m. to 8 a.m. Monday through Friday. With this service, H-P systems engineers are guaranteed to respond by telephone within 2 hours after receiving a customer's call. If the problem cannot be handled over the phone, systems engineers will travel to the customer's site. Maximum response time for an on-site visit is based on the distance of the installation from the H-P field office and the user's type of software coverage. Customers have three ways to purchase this service: separately, as an extension to H-P's Customer Support Service (CSS), or on an as-needed basis.

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

**TRAINING:** Training courses are available at an H-P Technical Center at a per student charge or on-site classes 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 how H-P 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, this phase offers project management guidance; it includes product training and tracking implementation progress.

Through *HP Tele-Support*, H-P 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	\$19,950
2932A—200 cps printer	2,495
<b>TOTAL</b>	<b>\$22,445</b>

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► **Series 39:**

32514B—System Processor Unit with 512KB memory, 2 GICs and Fundamental Operating Software (FOS) + Counsel	\$33,200
7911P—28MB disk with integrated cartridge tape	14,800
2563A—300 lpm printer	5,700
2392A—3 display terminals @ \$1,295	3,885
<b>TOTAL</b>	<b>\$57,585</b>

**Series 42:**

32542B—System Processor Unit with 1MB memory, 2 GICs, and FOS + Counsel	\$39,800
7914ST—132MB disk with 1600 bps tape drive	26,495
2563A—300 lpm printer	5,780
2392A— 3 display terminals @ \$1,295	3,885
<b>TOTAL</b>	<b>75,960</b>

**Series 48:**

32548B—System Processor Unit with 2MB memory, 2 GICs, FOS + Counsel	\$ 67,500
7914ST—132MB disk with 1600 bps tape drive	26,495
26081—400 lpm printer	11,890
2392A—4 display terminals @ \$1,295	5,180
<b>TOTAL</b>	<b>\$111,065</b>

**Series 68:**

32468B—System Processor Unit with 3MB memory, 2 GICs, 1 IMB, disk caching and FOS	\$186,100
7933G—1.2GB disk subsystem	63,560
7978A—1600/6250 cpi Tape	22,000
2619A—1000 lpm printer	26,370
2392A—10 display terminals @ \$1,295	12,950
<b>TOTAL</b>	<b>\$310,980</b>

**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 will be found in the following Equipment Price list.

## EQUIPMENT PRICING

	Purchase Price (\$)	Std. Month. Maint. (\$)
<b>SYSTEM PROCESSOR UNITS</b>		
32449A HP 3000 Series 37 System Processor Unit with 512KB RAM	12,000	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	6,500	20
252 French	—	—
253 German	—	—
256 Spanish	—	—
257 Italian	—	—
256 Dutch	—	—
32499Z Series 37 Media Option for MPE-V/E	0	0
022 Cartridge Tape Media	0	0
051 1600 bpi 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 Operation	0	0
509 Expands Memory to 2MB	4,000	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 Tape Media	0	0
32514B HP 3000 Series 39 System Processor Unit (60 Hz)	33,200	243
M01: Remote Support Service Credit	0	-65
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
32542B HP 3000 Series 42 System Processor Unit (60 Hz)	39,800	259
M01: Remote Support Service Credit	0	-25
014 Model 14 Packaged System	2,600	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.

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		Purchase Price (\$)	Std. Month. Maint. (\$)
<b>SYSTEM PROCESSOR UNITS (Continued)</b>			
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
32548B	HP 3000 Series 48 System Processor Unit (60 Hz)	67,500	297
	M01: Remote Support Service Credit	0	-25
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
32468B	HP 3000 Series 68 System Processor Unit (60 Hz)	186,100	765
	M01: Remote Support Service Credit	0	-50
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
35030A	Power Line Conditioner (Series 30, 39, 40, and 42)	1,100	6
<b>I/O EXPANSION</b>			
30018A	Asynchronous Data Communications Controller (ADCC)—main	1,695	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	1,695	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)	3,145	15
30145A	ATP Direct Connect Port Controller; standard provides 12 RS-422 Ports	6,530	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	8,070	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
302737A	Direct connect expansion package; 12 RS-422 ports standard	7,510	42
001	Deletes 51B	-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 51B	-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
<b>MEMORY EXPANISON</b>			
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.

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		Purchase Price (\$)	Std. Month. Maint. (\$)
<b>► MASS STORAGE</b>			
7911P	28MB disk drive with cartridge tape drive and one controller with 1m HP-IB cable	14,800	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	17,350	56
001*	Adds dedicated controller for cartridge tape drive	1,840	24
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
015	220 V/50 Hz single phase operation	0	0
140	Deletes cartridge tape drive	-3,570	-11
7914P	132MB disk drive with integral 67MB tape cartridge	19,900	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	19,900	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 1/2" magnetic tape drive mounted in a 56" high cabinet	26,495	143
002	Adds cartridge tape drive and second controller	5,410	38
015	220 V/50 Hz single phase operation	5,410	38
015	220 V/50 Hz single phase operation	0	0
114	Adds second phase operation	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 1/2" magnetic tape drive (HP-IB Version) Mounted in a 63" high cabinet	26,540	209
002	Adds Cartridge Tape Drive and second controller	5,410	24
114	Adds second 7914 (opt. 140) Disk Drive	14,290	52
7920M	Master 50MB Disk Drive	22,130	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	17,850	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	22,510	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
7925S	Add-on 120MB Disk Drive	18,220	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
7925T	Add-on 240MB Disk Storage System	32,190	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	63,560	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
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	74,000	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

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

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## Hewlett-Packard HP 3000 Series

		Purchase Price (\$)	Std. Month. Maint. (\$)
<b>MASS STORAGE (Continued)</b>			
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
<b>MAGNETIC TAPE SUBSYSTEMS</b>			
7970B	800 cpi/45 ips Magnetic Tape Subsystem	8,410	103
015	230 V operation	0	0
7914E	1600 cpi/45 ips magnetic tape subsystem	10,160	97
015	230 V operation	0	0
426	HP-IB master drive in lo-boy cabinet	5,110	67
436	HP-IB master drive without cabinet	2,310	54
431	Slave drive without cabinet	300	-7
7970ER	1600 cpi tape drive in lo-boy cabinet (Remarketed)	6,940	97
015	Adds 230 V/50 Hz operation	0	0
426	HP-IB initial master	4,070	67
7971A	Magnetic Tape Subsystem in upright cabinet	11,200	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
7974A	1600 cpi/50 ips start/stop, 100 ips streaming, Streaming Magnetic Tape Subsystem with HP-IB inter- face**	12,500	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**	22,000	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
<b>PRINTERS</b>			
2566A	900 lpm printer	21,766	209
2565A	600 lpm printer	18,766	188
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
2602A	20 cps daisywheel printer	1,545	50
2608A	400 lpm printer	11,890	131
	UO2: 70-130 print hours per month		+31
	UO3: 131-360 print hours per month		+127
2608S	400 lpm printer	11,170	90
	UO2: 70-130 print hours per month		+22
	UO3: 131-360 print hours per month		+88
2611A	600 lpm printer	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
2933A	200 cps data capture printer; includes bar code printing, large character set, national languages, line drawing set and math symbols (RS-232-C interface standard; cable not included)	2,795	30

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

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### Hewlett-Packard HP 3000 Series

		Purchase Price (\$)	Std. Month. Maint. (\$)
<b>▶ PRINTERS (Continued)</b>			
2934A	100/200 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
2688A	Intelligent Page Printer; includes 125,000 rotations	69,950	580
	U02: 125,001 to 200,000 rotations		+400
	U03: 200,001 to 275,000 rotations		+770
	U04: 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)	7,550	24
521	1MB Memory Addition	7,550	24
521	1MB Memory Addition	12,000	32
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)	12,000	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
	U02: 125,001 to 200,000 rotations		+400
	U03: 200,001 to 275,000 rotations		+770
	U04: 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
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	149,000	835
505	256KB Memory Extension	4,550	0
520	1MB memory (Deletes std. K-byte memory) for laser printer	7,550	24
521	1MB memory addition for laser printer	12,000	32
525	Vacuum Paper Splice Option	1,025	0
607	Expand controller memory to 1MB	8,200	16
2687A	Desktop Laser printer; includes 10,000 pages/month	12,800	151
	U02: 10,001 to 20,000 pages		+63
	U03: 20,001 to 40,000 pages		+200
	U04: 40,001 to 70,000 pages		+388
015	220 V/50 Hz operation	0	0
017	240 V/50 Hz operation	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
	U02: 10,001 to 20,000 pages		+63
	U03: 20,001 to 40,000 pages		+200
	U04: 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 Intrinsic	-4,000	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
	U02: 10,001 to 20,000 pages		+63
	U03: 20,001 to 40,000 pages		+200
	U04: 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 Intrinsic	-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

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## Hewlett-Packard HP 3000 Series

		Purchase Price (\$)	Std. Month. Maint. (\$)
<b>▶ GRAPHICS PLOTTERS AND DIGITIZERS</b>			
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
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
17455A	Eavesdrop cable for 747X opt. 001	120	0
17623A	Graphics tablet for 2623A and 2627A terminals	1,920	12
<b>INTERACTIVE DISPLAY TERMINALS</b>			
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)	1,295	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/Norwegian, 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
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 Character Set	105	0
202	Line Drawing Set	160	0
203	Large Character Set	160	0

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## Hewlett-Packard HP 3000 Series

		Purchase Price (\$)	Std. Month. Maint. (\$)
<b>▶ INTERACTIVE DISPLAY TERMINALS (Continued)</b>			
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
061	Device Support Firmware	180	0
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)	125	0
054	Video Output Interface (except 2641A, 2645N/R/S, and 2647F)	160	0
<b>DATA COLLECTION AND INDUSTRIAL TERMINALS</b>			
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
010	General Purpose Bar Code Reader	540	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
92920A	Standard Data Comm Cable for 3081A	475	0
92921A	Special Data Comm Cable for 3081A	705	0
92922A	4-channel Adapter for 3081A	945	8
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
<b>DATA COMMUNICATION</b>			
30146A	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

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## Hewlett-Packard HP 3000 Series

▶ DATA COMMUNICATION (Continued)		Purchase Price (\$)	Std. Month. Maint. (\$)
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	805	0
490	Series 48 and 68	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
32026A	MTS Data Link Connection (use processor option)	0	0
36A	Series 42	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
2333A	Multipoint Cluster Controller	2,000	16
015	230 V/50 Hz operations	0	0
021	Data Link Host	225	0
022	RS-232-C Host	225	0
122	4-Port Serial Interface	700	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	1,572	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
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	26,540	209
30215AR	Magnetic Tape Controller; interfaces five through eight 7970B or 7970E magnetic tape drives with 300 level options (Remarketed)	2,710	17

## UPGRADE PRODUCTS

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

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## Hewlett-Packard HP 3000 Series

		Purchase Price (\$)	Std. Month. Maint. (\$)
<b>► UPGRADE PRODUCTS (Continued)</b>			
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
32543GH	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	-13,000	26
617	Upgrade from Series 37 with no memory	-5,000	0
618	Upgrade from Series 37XE with no memory	-8,000	0
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)	11,010	164
E73	7970E 1600 bpi tape drive HP-IB master in lo-boy cabinet (230 VAC)	11,010	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

\*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 lead device.

## Hewlett-Packard HP 3000 Series

		Purchase Price (\$)	Std. Month. Maint. (\$)
<b>REMARKETED SYSTEMS (Continued)</b>			
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
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 IIR 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 lead device.

## SOFTWARE PRICES

		Price (\$)
<b>OPERATING SYSTEM</b>		
—	Multiprogramming Executive (MPE)	NC
<b>DATABASE MANAGEMENT</b>		
—	Image/3000	NC
—	Query/3000	NC
—	KSAM/3000	NC
<b>LANGUAGES</b>		
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

NA—Not applicable.  
NC—No charges.

## Hewlett-Packard HP 3000 Series

Price  
(\$)

► LANGUAGES (Continued)

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
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
30249	MRJE Multileaving Remote Job Entry (use processor option)	0
310	Series 37	2,500
310R/M	Right to copy 310 with/without sublicense	1,250
320	Series 42 and 48	3,500
320R/M	Right to copy 320 with/without sublicense	1,750
330	Series 68	3,500
330R/M	Right to copy 330 with/without sublicense	1,750
30250	IMF Interactive Mainframe (use processor option)	0
310	Series 37	3,500
310R/M	Right to copy 310 with/without sublicense	1,750
320	Series 42 and 48	7,000
320R/M	Right to copy 320 with/without sublicense	3,500
330	Series 68	7,000
330R/M	Right to copy 330 with/without sublicense	3,500
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 processor option)	0
320	Series 42 and 48	2,200
320R/M	Right to copy 320 with/without sublicense	1,100
330	Series 68	2,200
330R/M	Right to copy 330 with/without sublicense	1,100

NA—Not applicable.  
NC—No charges.

Hewlett-Packard HP 3000 Series

Price  
(\$)

► COMMUNICATIONS (Continued)

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

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	500
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 charges.