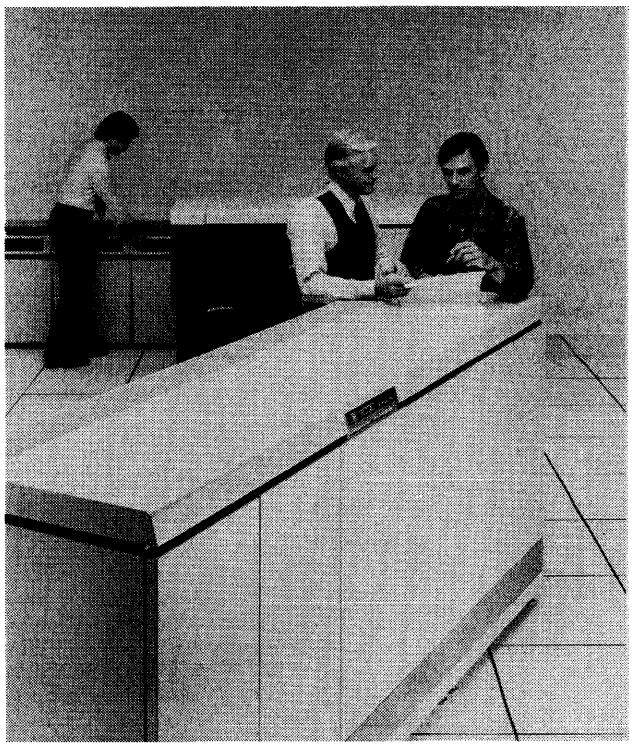
Hewlett-Packard 3000 Series



The Series 68, the top-of-the-line Series 3000, performs at the one-million-instructions-per-second level. The system offers many advantages of a 32-bit machine—a 32-bit data path, a 32-bit memory word, and dual arithmetic logic units—while maintaining full compatibility with existing HP software. The system shown here includes multiple disk units, an additional I/O bay, and HP's laser printer.

Hewlett–Packard has again upgraded its HP 3000 Series with the introduction of the Series 39, 42, 48, and 68; these models replace the earlier 40SX, 40, 44, and 64, respectively. A new version of the operating system, MPE V, supports up to 400 users and 24 disk drives. Disk caching is offered to provide faster response times and higher throughput for I/O intensive applications. The disk caching feature is optional on the Series 39, but standard on all other HP 3000 models.

MAIN MEMORY: 512K bytes to 8 megabytes.
DISK CAPACITY: 28 megabytes to 9.7 gigabytes.
WORKSTATIONS: Up to 92 on the Series 39 and Series 42; up to 152 on the Series 48; and up to 400 (200 active) on the Series 68.
PRINTERS: 20 cps to 1000 lpm.
OTHER I/O: Magnetic tape drives, factory data collection terminals, graphics plotters, digitizers, and an intellegent laser page printer.

MANAGEMENT SUMMARY

Hewlett–Packard continues to improve the price/performance of its HP 3000 Distributed Mainframe Series with the introduction of four models, the Series 39, 42, 48, and 68. These are enhanced versions of the earlier Series 40SX, 40, 44, and 64, respectively. All of the new systems support more terminals than their predecessors; all run under an upgraded version of the operating system, MPE V; and all offer a disk caching feature to speed I/O transfers.

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 3 megabytes of main memory and can be expanded to 8 megabytes. The system will support up to 24 data communication lines, 24 disks, 8 tape drives, and 3 I/O channels. The Series 68 supports 400 terminals, of which 336 may be connected point-to-point. This system comes standard with the HP Advanced Terminal Processor (ATP). The ATP provides communications capabilities while reducing system overhead via the ATP's own microprocessors.

CHARACTERISTICS

MANUFCATURER: Hewlett–Packard Company, Computer Systems Division, 19447 Pruneridge Avenue, Cupertino, California 95014. Telephone (408) 725–8111.

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

Hewlett–Packard Company is a major designer and manufacturer of precision electronic equipment for measurement, analysis and computation. HP makes more than 5000 products for application in the fields of science, engineering, business, industry, medicine, and education. The company's principal product categories include computers and computer systems, handheld calculators, and computer/calculator peripheral products; test and measuring instrumentation and solid-state components; medical electronic equipment; and instrumentation of chemical analysis.

The computer divisions at Hewlett–Packard are organized into five groups: the Computer Products Group, the Information Products Group, the Personal Computer Group, the Business Development Group, and the Computer Marketing Group. The responsibilities of each of the groups are: the Computers Products Group—central processing units, operating system software, and very large-scale integrated circuitry (VLSI); the Information Products Group—system peripherals, data communications products, data base resources, print centers, and the software to combine all of these products into information networks; the Personal Computer Group—workstations (terminals), personal computers, and other personal computation products; the Busi-

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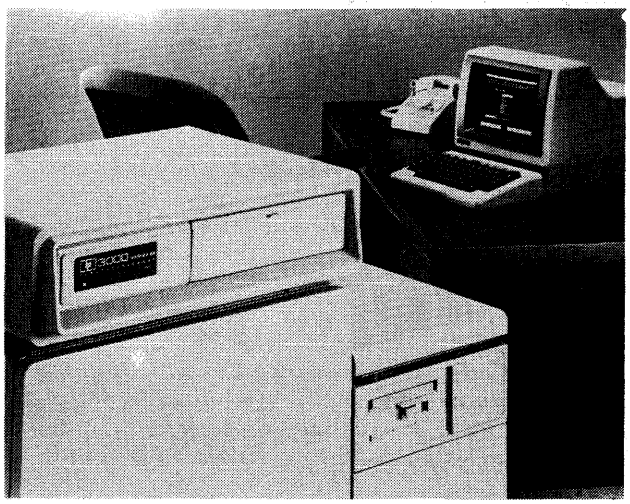

The Series 39 is the first model in the HP 3000 model line to break the $42,000 (U.S. list) price barrier. Memory sizes range from 512K bytes to three megabytes. Up to 92 terminals may be configured on the Series 39, as well as up to eight disk drives. The Series 39 comes packaged with an integral cartridge tape and a Winchester disk.

The Series 48 is one of Hewlett-Packard's two new 16-bit, mid-range systems. This system comes standard with 2 megabytes of main memory, and is expandable to 4 megabytes. Up to 7 data communication lines, 16 disks, and 8 tape drives are supported. The Series 48 has the capacity to support a total of 152 terminals, 104 of those may be connected point-to-point. HP's Advanced Terminal Processor (ATP) is also available on the Series 48.

The other new 16-bit mid-range system is the Series 42. The Series 42 comes standard with 1 megabyte of main memory, and is expandable to 3 megabytes. Up to 3 data communications lines, 8 disks, and 4 tape drives are supported on this system. In addition, the Series 42 supports up to 92 terminals, 32 of which may be connected point-to-point.

The Series 39—utilizing a 16-bit microcoded processor—is the low-cost, entry level member of the HP 3000 family. At roughly $42,000, the Series 39 is the lowest cost HP 3000 ever. The Series 39 comes standard with 512K bytes of main memory, with expansion capability to 3 megabytes, and is packaged with an integral cartridge tape and a 28-, 65-, or 132-megabyte Winchester disk. The Series 39 will support up to 3 data communication lines, 8 disks, and 4 tape drives. A maximum of 92 terminals is supported, 32 of which may be connected point-to-point.

Even though the Series 68, 48, 42, and 39 use MPE V, a new operating system with expanded capabilities, these systems are fully compatible with the entire HP 3000 installed base.

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 going to

ness Development Group—market development and merchandising of HP systems, workstations, networks, and application software; the Computer Marketing Group—sales, field marketing, maintenance services, and application support for all HP computer products in all markets.

Hewlett-Packard products are sold and serviced by 312 sales offices and distributorships in 72 countries. They are manufactured by about 33 domestic divisions and 17 overseas divisions which are located in the United Kingdom, Germany, France, Japan, Malaysia, Singapore, Puerto Rico, Mexico, and Brazil. The company employs about 68,200 people worldwide, with about 15,400 involved worldwide in computational products. Total sales for 1982 were 4.25 billion dollars.

MODELS: HP 3000 Series 39; HP 3000 Seris 42; HP 3000 Series 48; HP 3000 Series 68.

DATE ANNOUNCED: HP 3000 Series 39: February 1983; HP 3000 Series 42: June 1983; HP 3000 Series 48: June 1983; HP 3000 Series 68: June 1983.

DATE OF FIRST DELIVERY: The Series 42, 48, and 68 are scheduled for delivery in September 1983; delivery information is not available for the Series 39.

NUMBER INSTALLED TO DATE: A total of 11,544 HP 3000s.

DATA FORMATS

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

FIXED-POINT OPERANDS: 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 OPERANDS: 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: The HP 3000 Series has an unusually rich and varied complement of instructions; all, 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. Invariably, the first field is always four bits long and is used to define a specific operation code (for memory reference or loop control instructions) or one of four sub-opcode groups. All sub-opcode type instructions have an operation code extension field whose length and position in the instruction vary depending upon which of the four sub-opcode groups is specified. In some cases, a third operation code field (mini-opcode or special opcode) is used to extend the basic operation code. The rest of the 16-bit instruction is used for a variety of functions (count fields, bit positions, index specification, immediate operand, etc.) and is called the argument.

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	MANUFACTURER
MAGNETIC TAPE EQUIPMENT	All HP magnetic tape units accept 10½-inch reels, read and record on IBM/ANSI-compatible tape, and contain read-after-write features.	
7970B	9-track, 800 bpi, NRZI, 45 ips; 7970B-304 or -305 is the 1st drive, 7970B-300 or -302 the 2nd, 3rd or 4th drive; 36 KBS	Hewlett-Packard
7970E	9-track, 1600 bpi, phase encoded ips; 7970E-304 or -305 is the 1st drive, 7970E-300 or -302 the 2nd to 4th master drive, 7970E-301 or -303 the 2nd to 4th slave drive; 72 KBS	Hewlett-Packard
7976A	9-track, 1600 bpi; phase encoded, 6250 bpi; group encoded; 75 ips; burst transfer rate=120 KBS (1600 bpi) or 469 KBS (6250 bpi); streaming mode=110 KBS (1600 bpi) or 320 KBS (6250 bpi); auto load and auto thread features included. Maximum of 1 unit supported on series 40, 40SX, and 44, up to 2 on Series 64	STC
PRINTERS		
2601A	Daisywheel; letter quality; 40 cps; automatic proportional spacing; center and right justification, auto underline, shadow and bold print; bi-directional forms tractors; single or multipart forms	Diablo 360
2602A	Daisywheel; letter-quality; 20 cps, proportional spacing, bidirectional forms tractors for multipoint forms up to 15.2 inches wide; RS-232-C interface with an HB-IB option	Diablo
2608A/S	Comb matrix, 5 x 7 dot matrix (5 x 9 for lower case in 128-char. set); S indicates remote print capability, two print densities, and enhanced forms handling	Hewlett-Packard
2611A	Chain-train printer; 600 lpm, 132 positions, 64-character set (ASCII), optional 96-character set (ASCII), 12-channel VFU (vertical-format unit), dual-power paper tractors, and a paper puller, and enclosed stand	Dataprinter 1260
2631B/2631G	Dot matrix, 7 x 9, 136 positions, 128-character set, 10 characters per inch, 6 or 8 lines per inch, 1.2 to 15.75-inch paper, 8-channel VFU; 180 cps, may be used as remote spooled printer with RS-232-C interface. G suffix adds graphics capabilities with a line drawing character set, a high intensity print character set, and a Factory Data Collection Printer as option	Hewlett-Packard
2617A/2617A-001	Drum, 132 positions, 64/96-character sets, 10 characters per inch, 6 or 8 lines per inch, 4 to 16.8-inch paper, 12-channel VFU, OCR-B character font available; 600/436 lpm	Dataproducts 2260
2619A/2619A-001	Drum, 132 positions, 64/96-character sets, 10 characters per inch, OCR-B character font available, 6 or 8 lines per inch, 4 to 19-inch paper, 12-channel VFU; 1000/750 lpm	Dataprinter 1210
2680A	Intelligent Page Printer; laser printing, 45 11 x 8.5 inch pages per minute, up to 32 character fonts, up to 32 user defined forms	Hewlett-Packard
PRINTING TERMINALS		
2635B	Printing Terminal; 180 cps, automatic bidirectional printing, underline and display function modes, 16-channel computed VFU, EIA RS-232-C interface without modem control	Hewlett-Packard

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 on all other new HP 3000s.

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. HP code is re-entrant which

INTERNAL CODE: ASCII.

MAIN STORAGE

STORAGE TYPE: NMOS utilizing 64K RAMs.

CYCLE TIME: 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 8K byte 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 39 and 42 support a minimum of 512K bytes of main memory. Additional memory is available in increments of 256K bytes or one megabyte, up to a maximum of three megabytes. These systems support memory sizes of 512K bytes, 756K bytes, one megabyte, 1.5 megabytes, two megabytes, 2.5 megabytes, and three megabytes. The Series 48's memory capacity ranges from

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	MANUFACTURER
INTERACTIVE DISPLAYS		
2382A/2622A	Interactive Display; inverse video, underline, half-bright, blinking, 8 standard user-definable soft keys, 128 Roman Character set, block or character mode, 48 lines of memory, 9600 bps	Hewlett-Packard
2621B/2623A	Interactive Display; inverse video, underline, half-bright (2623A only), blinking (2623A only), 8 standard user-definable soft keys, 128 Roman Character set, block (2623A only) or character mode, 48 lines of memory, 9600 bps	Hewlett-Packard
2624B	Interactive Display; inverse video, underline, half-bright, blinking, 8 standard user-definable soft keys, 128 Roman Character set, block or character mode, up to 32K bytes of memory, 9600 bps	Hewlett-Packard
2626A/W	Interactive Display; inverse video, underline and blinking, 8 standard user-definable soft keys, 128 Roman Character set, block or character mode, 119 lines of memory, 9600 bps	Hewlett-Packard
2627A	Interactive Display; inverse video, underline, half-bright, blinking, 8 standard user-definable soft keys, 128 Roman character set, block or character mode, 48 lines of alpha memory, 9600 bps	Hewlett-Packard
2641/2645A	Interactive Display; inverse video, underline, half-bright, and blinking standard for 2641A-2645A requires 13231A display option; 8 standard user-definable soft keys, 64 Roman and 128 APL character set for 2641A (APL 3000 is available only on HP 3000 Series III), 128 Roman character set for 2645A, block or character mode, 4 to 12K bytes of memory, 9600 bps	Hewlett-Packard
2647F	Interactive Display; inverse video, underline, half-bright, blinking, 8 standard user-definable soft keys, 128 Roman character set, block or character mode, up to 115 lines of alpha memory, 9600 bps	Hewlett-Packard
2648A	Interactive Display; inverse video, requires 13231A display option for underline, half-bright, and blinking 8 standard user-definable soft keys, 128 Roman character set, block or character mode, 8-12K bytes of memory, 9600 bps	Hewlett-Packard
2703A	Interactive Display; inverse video, underline, half-bright, blinking, 8 standard user-definable soft keys, 128 Roman character set, block or character mode, up to 32K bytes of alpha memory, 19,200 bps	Hewlett-Packard

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 adds an 8K byte cache memory to properly take advantage of its speed. The cache memory is said to have a 95 percent effective hit rate for memory accesses.

Hewlett–Packard set several design goals for the 3000 Series product line. They included a common operating system and object code compatibility, a broad range of price and performance options, a clear growth path, friendly software, and full networking capabilities. The current HP 3000 product line meets these goals admirably. A performance comparison of the new HP 3000 models with the earlier systems could be shown as follows:

Model	Performance Level
Series 30	Base-line
Series III	1.5 to 2 times Series 30
Series 39	3 times Series 30
Series 42	3.5 times Series 30
Series 48	4 times Series 30
Series 68	9 times Series 30

one megabyte to four megabytes in increments of 512K bytes or one megabyte. The Series 68 supports a minimum of two megabytes and a maximum of eight megabytes. Additional memory is available in one-megabyte 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 eleven 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 119 entries on the Series 39, 42, and 48, and 485 maximum on the Series 68) containing device interrupt vectors and the identity of the drives for each device.

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	MANUFACTURER
DATA COLLECTION TERMINALS		
3075A	Desktop data capture terminal; 15 position numerical display, protected data field, 17 user-defined prompting lights, 10 special function keys, supported in point-to-point or asynchronous multipoint configurations	Hewlett-Packard
3076A	Wall mounted data capture terminal; see description for 3075A Options for the 3075A and 3076A models include: alphanumeric keyboard, alphanumeric display (24 positions), 5 inch CRT, multifunction reader, type V reader, alphanumeric printer, low cost bar code reader, magnetic stripe reader, RS-232-C interface, and 220/240V operation	Hewlett-Packard
3077A	Time reporting terminal; large time display and type V badge reader, wall mounted, options include multifunction reader, alphanumeric display, and 220/240V operation	Hewlett-Packard
7260A	Optical mark reader: buffered serial output data, switchable baud rate, RS-232-C, up to 300 cards per minute; options include select hopper, encoder, bell, 220/240V operation, 50 Hz operation, and wider input hopper	Hewlett-Packard
PLOTTERS		
7220C/7220T	Multicolor graphics plotter, RS-232-C, optional 2K byte buffer, 11 x 17 inch maximum size for paper or overhead transparencies, auto pen changing; T indicates auto paper advance	Hewlett-Packard
7221C/7221T	Multicolor graphics plotter, RS-232-C, optional 1.8K byte buffer, 11 x 17 inch maximum size for paper or overhead transparencies; auto pen changing; T indicates auto paper advance	Hewlett-Packard
7240A	Plotter/Printer, thermal high-resolution plotting; 38 cps printer; RS-232-C	Hewlett-Packard
7245B	Printer/Plotter; 7.4-inch by 16.4-foot bidirectional paper drive for long-axis plotting; better than 0.06-inch resolution; up to 10.1 inches per second pen velocity; 7 x 9 dot-matrix characters at 38 cps; 14 x 9 dot-matrix characters at 19 cps	Hewlett-Packard
7470A	Low-cost, portable plotter; two pen, automatic changing; A size; .001-inch resolution; 2g acceleration; RS-232-C, IEEE-488, HP-IL	Hewlett-Packard
7580A	Digital plotter; D size; 8 selectable pens; uses paper, velum, or polyester film	Hewlett-Packard
7585A	Intelligent drafting plotter; E/A0-size, up to 24 inches per second, paper sizes from 36.5 x 46.8 inches to 8 x 10.5 inches, 8-pen carousel, auto-pen changing; uses paper vellum, or polyester file; addressable resolution is 0.001 inch, mechanical resolution is 0.00012 inch, and a repeatability of 0.002 inch, either HP-IB (IEEE 488) or RS-232-C/CCITT V.24 interface	Hewlett-Packard
9872C/9872T	Digital plitter; 11 x 15.75 inches, eight program-selectable pens, multicolor, 14 inches per second; T indicates auto paper advance	Hewlett-Packard
DIGITIZER/GRAPHICS TABLET		
9111A	Graphics tablet, single point or continuous line mode, 16 softkeys, resolution to 0.100mm (.00394 inch)	Hewlett-Packard
17623	Graphics tablet, single point or continuous line mode; resolution to 0.100mm (.00394 inch); supported only by the 2627A terminal	Hewlett-Packard

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

CENTRAL PROCESSOR

GENERAL: The HP 3000 Series processors are complex systems that 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.

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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 19.6 megabytes to 404 megabytes per drive. One magnetic tape model features a 6250 bits per inch, group-encoded unit for burst-speed backup operations. Printers vary from a 40 character per second letter quality printer to a 45 page per second Laser Page Printing System. The wide range of terminals available can allow the user to tailor each workstation according to its task. Hewlett-Packard also offers a broad range of personal computers which have the ability to communicate with an HP 3000 system as terminal emulators or standalone processors.

Internationally accepted, standard protocols are planned as the fundamental basis for the HP Distributed Systems Network (HP-DSN) Communications architecture. HP recognized and addressed the communications needs for workstation to HP system transmission, for an HP system to an HP system environment, for HP to an IBM distributed system arrangement. A variety of communications products allow the user to customize the system to his or her needs.

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 HP's user friendly software approach. The full complement of language processors available include Basic, Cobol, Fortran, Pascal, Transact, RPG, and SPL. The majority of HP 3000 systems are used in Cobol applications.

Other software includes HP's data base management system (IMAGE/3000 plus QUERY/3000). IMAGE/3000 compares favorably to larger, more powerful DBMS's currently available on medium and large-scale systems, except for more limited data capacities. Its companion package, QUERY/3000, provides a language to facilitate quick locating, reporting, and updating of data values within an IMAGE/3000 data base.

The close parallels between the Fortran and Basic language used on the HP 1000 Series computers and their counterparts on the HP 3000 systems make it possible for users with the HP 1000 to upgrade easily. (Even though conversion will be required, the standard portions of the languages will be unchanged, and only the discrepancies in language extensions and data format expressions will need to be resolved.)

The Fundamental Operating Software is standard on all HP 3000 models and includes the operating system, EDIT/3000, FCOPY/3000, SORT-MERGE/3000, IMAGE/3000, QUERY/3000, KSAM/3000, and HP VPLUS/3000.

HP is concentrating its applications development efforts on the HP 3000 Family in four major areas: manufacturing, distribution, administration, and office automation. Materials Management/3000 and Production Manage-

The Series 68 CPU also contains 72 specific-purpose registers with 21 user-accessible.

Auto restart after power failure is standard. When the line voltage falls below 90 percent, a power-fail warning is issued. All register contents are moved to memory, system activities are completed, and 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 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).

The Series 68 CPU is a Hewlett-Packard 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, one-million-instruction-per-second. The modular concept used in the Series 68 includes the following components: a CPU module 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 Busses. 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 re-entrant programs for multi-thread 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: Bipolar ROM (read-only memory) consisting of 12K 48-bit words for the Series 39, 42, and 48. The Series 68 utilizes 64K bytes of RAM (random-access memory) as its control storage. HP utilizes all of this space. Control storage is not directly accessible to the end user. Microinstruction cycle time is 105 nanoseconds for the Series 39, 42, and 48. The Series 68 microinstruction cycle time is 75 nanoseconds.

REGISTERS: There are 72 hardware registers on the HP 3000. Eighteen are accessible to the programmer on the Series 39, 42, and 48. Twenty-one 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 inter-

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ment/3000 are manufacturing packages intended for manufacturers of products assembled from discrete components. HP provides complete solutions for the wholesale distribution market with two products—SFD/3000 and OM/3000. These products are used for order processing, inventory management, and associated accounting functions. HP also provides a complete set of financial, cost, asset, and planning applications. Currently, eight interactive financial software packages are included under the umbrella name HP Financial Accounting. Office Systems products provide a system-wide solution to individual employee word processing and decision support needs. A series of programming aids, including RAPID/3000, is available to provide an improvement of two to ten times in programming productivity.

Customer services for the HP 3000 Series include preinstallation site planning, installation, several levels of training (given both at users' sites and at HP training centers), several levels of on-site hardware and software service, consulting, reference manual updates, information newsletters, and a users' group. Maintenance is handled through worldwide HP offices, with 84 offices in the U.S., 12 in Canada, 8 in Central and South America, 107 in Europe, Africa, Asia, the Far East, and Australia, and 27 distributors located in 21 additional countries.

The HP 3000 family is targeted to a broad range of EDP areas such as data communications, support for either centralized or distributed EDP operations, manufacturing, quality assurance, office automation, educational institutions, OEM accounts, and systems houses developing applications software.

The HP 3000 family is an integral part of Hewlett-Packard's Manufacturer's Productivity Network. HP-MPN includes integrated systems, applications software and communications facilities for use in four major application centers: administrative and office services; factory and plant automation; operational planning and control systems; and computer-aided engineering.

Hewlett-Packard has initiated a System R-Marketing Operation to sell or rent refurbished and rewarranted HP 3000 models. Sales channels for these systems will be the same as for new products. Standard HP 3000 quantity discounts apply to the re-marketed models. User upgrades, lease returns, and internal capital equipment are the sources for the equipment. These models are, of course, software and peripheral compatible with the new systems.

ADVANTAGES AND RESTRICTIONS

One of the advantages of the HP 3000 is the use of the same operating system throughout the series; this ensures that applications software can be moved from one 3000 model to another without conversion or recompilation. Also, HP continues to introduce hardware and software which is compatible with all HP 3000s, offering a growing product selection for users. According to HP, low-end 3000 systems can be easily upgraded to higher performance systems, with upgrades generally completed over a weekend. Another

rupt 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 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 data base of the current user's stack; the Q register, utilized to define the current stack master in the current data segment; the Data Limit register (DL), where the data limit of the current data segment is defined; and the Data Base Bank register (DBNK) which contains the location of the bank in which the stack or split stacks reside. DBNK is used in the Series 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 numer 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 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.

ADDRESSING: Only privileged instructions may use absolute addressing. All other addressing is performed using one of the six 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 two memory address instructions that automatically cause the index register contents to be incremented by two during development of the effective address.

INSTRUCTION REPERTOIRE: There are 216 machine instructions in the HP 3000 Series 68, 213 in the Series 48, and 212 in the Series 39 and 42. These are broken down into the following grouping: 65 stack op instructions, 17 shift

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advantage is the wide selection of software available for the series from both HP and third parties. An additional plus is HP's networking support of their own systems to each other as well as to non-HP systems (for use by multi-vendor customers). Finally, the powerful high-end Series 68, while a 16-bit machine, includes many capabilities of 32-bit systems. The 68 offers a 32-bit data path, a 32-bit memory word, and dual arithmetic logic units, however 32-bit addressing power is not available.

The HP 3000 is an impressive family of systems, lacking only a growth path for upward movement from the series to a true 32-bit HP business system.

COMPETITIVE POSITION

The HP 3000 Series competes with IBM systems as follows: the HP Series 39 with the Systems/34 and /36; the HP Series 42 with the System/38, Model groups 400, 500, 700, and 800; the HP Series 48 with the 4341 Model groups 9 and 10; and the HP Series 68 with the 4341 Model groups 1, 11, and 12.

HP also is targeted to the DEC VAX-11 Family as follows: HP Series 39 to the VAX-11/730, HP Series 42 and 48 to the VAX-11/750, and the HP Series 68 to the VAX-11/780.

HP states that their 16-bit systems are competitive in the 32-bit marketplace because of the 3000 Series' fast cycle times and strong support for large numbers of terminals in interactive environments.

USER REACTION

Datapro received 183 responses from HP 3000 users in answer to the 1983 Computer Users' Survey. The respondents described 235 HP 3000 systems that had been installed for an average of 36.8 months. A majority of systems (135) were purchased; 26 were leased from a third party; and 19 were rented or leased from the manufacturer. Only 53 were converted from other computer systems.

Many users reported that multiple applications were being processed on their HP 3000s. Accounting/billing was the most popular application, used at 135 sites; order processing/inventory control and payroll/personnel ranked next, with 86 responses. Manufacturing, sales/distribution, and purchasing were also mentioned by a number of users, with 61, 58, and 55 responses respectively.

Applications software was obtained from a number of sources. One hundred fifty-five users had programs developed by in-house personnel, 81 used proprietary software, 70 ran packaged programs from the manufacturer, and 68 had negotiated for contract programming.

An average installation consisted of from one to five local workstations, from one to five remote workstations, from 512K to 4096K bytes of memory, and from 200M to 1200M bytes of disk storage. Most HP 3000s were located in a central site with one to three distributed nodes.

instructions, 15 program control and special instructions (16 in the Series 48), 19 machine and I/O instructions (15 in the Series 39 and 42), 4 loop control instructions, 16 memory address instructions, 7 field and bit instructions, 13 branch instructions, 12 move instructions, 8 privileged instructions, 15 immediate instructions, and 7 register control instructions. Extended instructions includes 6 extended-precision floating point instructions and 12 decimal arithmetic instructions.

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

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.

PHYSICAL SPECIFICATIONS: The Series 39 and 42 System Processing Units (SPU) are housed in standalone cabinets 40 inches (101.6 cm) high, 24 inches (61 cm) wide, and 22.4 inches (56.9 cm) deep. The unit weighs 190 pounds (86 kg). 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 4.5A at 50 Hz. Heat dissipation is 3000 BTUs per hour.

The Series 48 SPU is housed in a desk-style cabinet 28.5 inches (72.4 cm) high, 72.25 inches (183.5 cm) wide, and 31.25 inches (79.4 cm) deep. The unit weighs 240 pounds (109 Kg). 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 12.4A at 50 Hz. The system dissipates 7380 BTUs per hour.

The Series 68 SPU is housed in a standalone cabinet 48 inches (121.92 cm) high, 69 inches (175.26 cm) wide, and 26 inches (66.04 cm) deep. The unit weighs 1200 pounds (546 kg). With the optional I/O bag, the SPU measures 48 inches (121.92 cm) by 105 inches (266.70 cm) by 26 inches (60.04 cm) and weighs 1500 pounds (681.8 kg). The system 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 24A at 60 Hz or 13A at 50 Hz. Heat dissipation is 12000 BTUs per hour.

All HP 3000 models have a recommended operating temperature of 20° C to 25.5° C or 680° F to 78° F. The recommended operating relative humidity is 40 to 60 percent noncondensing.

INPUT/OUTPUT CONTROL

The Series 39, 42, and 48 utilize an Intermodule Bus (IMB) to handle communications between the CPU, memory, and I/O modules. The CPU 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 IBM has 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 IMB so the request can be serviced.

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The majority of respondents (170) were using a Data Base Management System, and 160 of these were running HP's DBMS package.

Cobol was by far the most widely implemented programming language, with 123 users. Other languages in use were Fortran (17 respondents), Basic (16 respondents), RPG (14 respondents), and Pascal (2 respondents).

During 1983, 97 users plan to expand their present hardware; software-wise, 87 are acquiring proprietary software from other suppliers, while 64 are adding more HP software. Only 22 users plan to replace their HP 3000s during 1983, and of these, 19 will install new HP systems. Two users will replace with a different vendor's computer, and one has not decided on a vendor.

A table showing the users' ratings of the HP 3000 follows:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	116	61	4	0	3.6
Reliability of mainframe	147	34	2	0	3.8
Reliability of peripherals	113	66	3	0	3.6
Maintenance service:					
Responsiveness	88	82	10	3	3.4
Effectiveness	91	76	11	1	3.4
Technical support:					
Trouble-shooting	50	94	32	4	3.1
Education	43	108	28	1	3.1
Documentation	36	103	32	10	2.9
Manufacturer's software:					
Operating system	98	74	8	1	3.5
Compilers & Assemblers	79	87	13	1	3.4
Applications programs	27	83	22	3	3.0
Ease of programming	70	92	11	3	3.3
Ease of conversion	59	66	20	4	3.2
Overall satisfaction	91	85	4	2	3.5

*Weighted Average based on a scale of 4.0 for Excellent.

As the ratings indicate, respondents were well-satisfied with their systems. Specifically, users identified these advantages of the HP 3000: 157 stated that the system was easy to expand/reconfigure; 144 said that the data base language was efficient and effective; 114 were happy with the response time; 85 found that HP's productivity aids helped to keep programming costs down; 62 mentioned that programs/data carried over from other systems were compatible (as the vendor promised); and 54 added that the system was power/energy efficient.

On the opposite side, users experienced the following problems with their systems: costs (for hardware, vendor-supplied software, and support) exceeded the expected total (17 users); vendor enhancements/changes to hardware/software were hard to keep up with (14 users); installation of the equipment was late (13 users); and the computer proposed by the vendor was too small (12 users).

Finally, when asked if they would recommend the HP 3000 to another user, 174 said yes, three said no, and six were undecided.□

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 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 General I/O Channel (GIC) is the primary channel for communications to I/O devices other than terminals. Each GIC controls a Hewlett-Packard Interface Bus 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 1 megabyte per second.

SIMULTANEOUS OPERATIONS: CPU activity accounts for greater than 90 percent of the Intermodule Bus (IMB) activity. Control is given to the I/O channels only on request. The General I/O Channel (GIC), the DSN/Advanced Terminal Processor (ATP), and the DSN/Intelligent Network Processor (INP) each contain DMA hardware to facilitate user data access. The Ansynchronous Data communications controller (ADCC) has no DMA facilities and must operate under direct CPU control.

CONFIGURATION RULES

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.

Maximum configuration parameters for an HP 3000 Series system are as follows:

- **Up to eight megabytes of main memory.**
- **Up to 9.7 billion bytes of on-line disk storage.**
- **Up to 400 multipoint terminals.**
- **Up to eight magnetic tape drives.**
- **Up to eight line printers.**
- **Up to two laser printer systems.**

WORKSTATIONS: Up to 92 terminals may be configured on each Series 39 and 42 system. Up to 91 of these may be multipoint terminals; all may operate at 9,600 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.

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MASS STORAGE: The Series 39 includes either a 28-, 65-, or 132-megabyte 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. The Series 48 and 68 increase the maximum number of disk drives supported per system to 16 and 24, respectively. All of the HP 3000s support only one Integrated Storage Unit per system. A second controller must be ordered to support the integral cartridge tape to prevent user-lockout during tape back-up operations. The disk units interface to the GIC; a dedicated GIC is required to support the integral cartridge tape unit on the Integrated Storage Unit.

MAGNETIC TAPE UNITS: 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 132 megabytes of disk capacity. When mass storage capacity exceeds 132 megabytes, additional magnetic tape drives must be added as the primary system backup. Each system can support both the HP 7970E 1600 bpi drive and the HP 7976A 1600/6250 drive. The Series 39 and 42 systems can have a maximum of four tape drives with two HP 7976s allowed. The Series 48 and 68 each handle up to eight magnetic tape drives with two HP 7976s supported on both the Series 48 and the Series 68. The magnetic tape drives interface through the GIC.

PRINTERS: The HP 3000 supports up to two printers on the Series 39 and 42, four printers on the Series 48, and eight printers on the Series 68. These printers may be the 2608S dot matrix line printers (maximum of two on Series 48, four on Series 68), or the 2611A and 2619A line printers. Each HP 3000 system also supports a maximum of two 2680A Intelligent Page Printers in addition to those discussed above. All printers interface through the GIC.

COMMUNICATIONS: The maximum synchronous communication lines supported for each of the four HP 3000 Series follows: Series 39—three lines, Series 42—three lines, Series 48—seven lines, and Series 68—24 lines.

MASS STORAGE

7911P, 7912P and 7914P INTEGRATED STORAGE UNITS: The 7911P, 7912P, and 7914P are standalone peripheral storage systems with either a 28-, 65-, or 132-megabyte fixed disk drive, an integral cartridge tape drive, a 67 megabyte tape cartridge, two intelligent controllers, and a power supply in a standalone cabinet. These units feature a 35.0 millisecond average access time and a 1 megabyte per second burst data transfer rate. Track-to-track seek time is 5 milliseconds and an average random seek is 26.7 milliseconds. The average data transfer rate is system dependent with a maximum of 983 kilobytes per second. The drive has a rotational speed of 3600 rpm and an average rotational delay of 8.3 milliseconds. The integral tape drive has a read/write tape speed of 60 inches per second and a search speed of 90 inches per second. The tape's maximum data transfer rate is 1 megabyte per second with burst transmission over the HP-IB. The average transfer rate over the internal data path is 35 kilobytes per second.

7914/TD WINCHESTER DISK SUBSYSTEM: The 7914/TD subsystem combines the 132.1 megabyte disk drive with the 7970E ½-inch, 1600 bpi magnetic tape drive. Average access time for the 7914 disk is 36.0 milliseconds, data transfer rate is system dependent with a maximum of 983 kilobytes per second, track-to-track seek time is 5 milliseconds, and an average random seek is 27.7 milliseconds. The drive has a rotational speed of 3600 rpm, and an average rotational delay of 8.3 milliseconds. The 7970E magnetic tape has a read/write tape speed of 45 inches per second and a search speed of 45 inches per second. The tape's maximum data transfer rate is 72 kilobytes per second.

Option 114 is available for the 7914TD, which adds a second 7914 disk drive to the subsystem. An integrated cartridge tape drive and a second controller can be added to the first 7914 disk by specifying option 002.

7920M/S DISK PACK DRIVE: The 7920M is a 50-megabyte drive employing a five-platter disk pack of the IBM 3330 type. Three of the five platters are actually used, with five surfaces for data and the sixth for servo use. The remaining two platters are for protection, with one located on top of the pack and the other on the bottom. The add-on drive is the 7920S.

Data is recorded at 4680 bpi on 815 tracks per surface, using 256-byte sectors and 48 sectors (12,288 bytes) per track. Track density is 384 tracks per inch. Spare tracks are not included in the rated drive capacity of 50,073,600 bytes; 8 spare tracks per surface are provided. Track-to-track, average, and across-all-tracks head positioning times are 5, 25, and 45 milliseconds, respectively. The drive has a rotational speed of 3600 rpm with an average rotational delay of 8.3 milliseconds. The data transfer rate is 937,500 bytes per second.

7925M/S/T DISK PACK DRIVE: The 7925M has essentially the same design as the 7920M except that it is a 120-megabyte drive with 7 platters, 9 functional surfaces, 64 sectors per track, and 16,348 bytes per track. The rotational speed is 2700 rpm and the average rotational delay is 11.1 milliseconds. The add-on drive is the 7925S. The 7925T is an add-on unit providing 240 megabytes of disk storage.

7933H/G DISK DRIVE: This unit provides 404 megabytes of formatted storage and features a totally enclosed media module. The controller can provide sector and track sparing to maximize media utilization and perform automatic error detection and correction to reduce the probability of errors. The unit has a 31.6 millisecond average access time and a nominal data transfer rate of one megabyte per second with an internal burst rate of 1.25 megabytes per second. Track-to-track seek time is 5 milliseconds with an average random seek of 24 milliseconds. The rotational speed is 2700 rpm with an average latency of 11.1 milliseconds. The 7933H provides extensive front panel diagnostics and microprocessor-controlled automatic head alignment to increase the unit's serviceability and reliability. The 7933G is an add-on unit providing 1.2 gigabytes of disk storage.

7935H DISK DRIVE: The 7935H has essentially the same design as the 7933H except that it has a removable media module thus enabling private data volume configurations, disk-to-disk backup, and data transfer among systems.

INPUT/OUTPUT UNITS

Refer to the Peripherals/Terminals table.

HP is also an OEM peripherals supplier, and its OEM products are covered behind the Peripherals tab (Section M13). HP can also provide a vast array of instrumentation, data acquisition, process control, numerical control, and analog/digitial I/O equipment.

COMMUNICATIONS CONTROL

DSN/ASYNCHRONOUS DATA COMMUNICATIONS CONTROLLER (ADCC): The ADCC is used in

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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 essentially for terminals the same functions as the GIC but not in the same manner. Data is transferred from memory to the ADCC in parallel form and then is converted to a serial bit stream for transmission over RS-232-C lines.

The ADCC does not have DMA facilities and so cannot control the IMB or memory. Terminals on the ADCC do not respond to a parallel poll. The ADCC must be directly controlled by the CPU through channel programs. Circuitry on the ADCC decodes address information and selects the proper device for each operation. Four full-duplex ports are provided on each Main ADCC, the Extender ADCC boards increase the capacity to eight full-duplex ports. Multiple 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.

DSN/ADVANCED TERMINAL PROCESSOR (ATP): The ATP provides an intelligent interface between terminals and the CPU for the Series 48 and 68 systems. The ATP supports data transfer rates up to 19,200 bits per second, handles character processing to eliminate CPU interrupts, and provides direct memory access of user data. RS-232-C and RS-422 support is provided for local terminal hook-ups, with distances to 50 or 4000 feet respectively. The Series 68 ATP adds full-duplex asynchronous modem support (Bell type 103, 202T, 212A, and CCITT V.24) to the list of features.

An ATP is composed of one System Interface Board (SIB) and supports up to eight port controllers. The SIB provides a hardware interface to the Intermodule Bus (IMB) and performs byte packing/unpacking and direct memory access of user data. Port Controllers provide the hardware interface to the terminal/workstation devices. The Port Controller handles all handshaking between the system and the terminal, all character echoing, speed sensing, and input character buffering. The ATP supports character or block transmission.

2333A CLUSTER CONTROLLER: The 2333A allows from four to 16 RS-232-C computer peripherals to communicate with one or two HP 3000s. When two computers are connected, any device in the cluster can address or be addressed by either computer. Also, the two lines can be used for redundant connections to a single computer to prevent line loss. Speed of transmission from the cluster controller to the system is up to 19,000 bits per second (bps). Speed of transmission from the controller to the peripherals is up to 9600 bps. The 2333A cluster controller combined with enhanced HP 3000 DSN/Multipoint terminal software provides error-checking and retransmission of data if errors are found.

INTELLIGENT NETWORK PROCESSOR (INP): The INP allows HP 3000 computers to be linked to other computers in a distributed data processing environment and to support multipoint terminals. The INP uses a 16-bit silicon-on-sapphire (SOS) microprocessor to perform all of the data link protocol support. This includes serialization, protocol management, frame/block management, and data buffering. This reduces CPU utilization to free it for other tasks. The INP provides direct memory access for data. Data rates are up to 19,200 bps using modems or up to 56,000 bps hardwired.

Throughput is increased by overlapping data transfer with data processing and buffering from the communications channel. The protocol driver may be dynamically changed to allow the INP to be reconfigured from one data link protocol to another. This allows several subsystems to use a single INP. The INP is Bisync and HDLC/SDLC protocol compatible. RS-232-C, RS-422, CCITT V.24 and V.35 interfacing is available, as is full- and half-duplex asynchronous modem support. An autocall capability allows dial-up remote connections to be completed without human intervention.

COMMUNICATIONS SOFTWARE: The Distributed Systems Network (DSN) software provides capabilities in three broad areas: 1) workstation to HP system communication, 2) HP system to HP system communications, and 3) HP system to IBM mainframe communications.

Each HP 3000 system can support point-to-point terminal capabilities. The DSN/Multipoint Terminal Software (DSN/MTS) provides half-duplex data transmission over a single communications line between an HP 3000 system and up to 32 multi-dropped terminals. In both interactive and page modes, data can be entered, edited, and transmitted at up to 9600 bps.

To meet the need for HP system to HP system communication, DSN/Distributed Systems (DSN/DS) is a communications facility that makes it possible to interconnect HP 3000 Series computer systems in distributed processing networks. The DSN/DS software allows multiple interactive or batch users of a 3000 Series to communicate concurrently with a remote 3000 Series system in a full multiprogramming environment. According to HP, network operation with DSN/DS makes remote processing as easy as processing on a local 3000. The only special programming needed to interact with a remote processor is placement of a single word in some commands.

Although multiple users can share the same communications line, one user can command exclusive use of the line when necessary for increased volume of data transfer. A variety of processes can be in progress at the same time, including local and remote batch operations, local and remote transaction processing, interactive problem solving, remote job entry, and inter-system program-to-program communication. One HP 3000 can store, modify, or retrieve data in IMAGE/3000 data bases in other 3000s in the network. The HP file copier can be used to copy whole files from one system to another.

HP states that when existing 3000 Series computers are networked with DSN/DN, the user's investment in application software will be protected. Similarly, DSN/DS has been implemented with a "layered" architecture, with the intent that user-created software shall not be affected by future changes that may occur in communications link protocols or in electrical interfaces. A network accounting structure and file security measures provide protection against unauthorized use, and multi-level security schemes can be implemented.

DSN/DS offers remote command processing, remote file access, program-to-program communications through the use of nine intrinsics, virtual terminal capability (terminals physically connected to one system operate logically as if they were connected to one another), simultaneous local and remote processing, remote data base access, inter-system data transfer, bidirectional interleaving of applications from either end of the communications line, and peripheral sharing.

HP has also implemented distributed system software on the HP 1000, thus allowing these systems to become a part of an intercomputer communications network. For example,

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an HP 1000 system supports its own interactive terminals, which then can also function as terminals to any HP 3000 in the network.

The 37230A Short Haul Modem provides synchronous transmission of data at rates of 2.4K, 4.8K, 9.6K, and 19.2K bps over short distances (from four to twenty-two miles) and is designed for half-duplex, full-duplex, and operation over local circuits. Using intelligent microprocessor-based interface cards, line speeds of up to 56,000 bps can be achieved over RS–449 direct connections or RS–232–C connections to common carriers. DSN/DS supports connections via either switched or leased lines, X.25 Public Data Networks, or Digital Dataphone service.

Both DSN/RJE and DSN/MRJE are software subsystems that provide a means for 3000 users to submit batch jobs to, or receive output from, an IBM or IBM plug-compatible host mainframe.

- DSN/RJE is compatible with host systems that support standard 2780/3780 devices.
- DSN/MJRE is compatible with hosts that support-HASPII, ASP, JES2 or JES3 job entry systems.

DSN/IMF allows programs on the HP 3000 to access host program products such as CILS, IMS, CMS and TSO through a set of 21 high-level intrinsics. In addition, user terminals connected to the HP 3000 may use DSN/IMF to send and receive data to the host. DSN/IMF supports both BSC and SDLC protocols.

SOFTWARE

OPERATING SYSTEM: The Multiprogramming Executive (MPE) enables the HP 3000 to perform transaction processing, on-line program development, data communications and batch processing concurrently. System resources can be accessed simultaneously by multiple users. An on-line HELP facility guides the user through the MPE command set. MPE monitors and controls program input, compilation, execution, and output. MPE 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 as follows: Configurator, Initiator, System Console Manager, Command Interpreter, File Management System, Input/Output System, Virtual Memory Manager, Disk Space Manager, Disk Cache Manager, Private Volumes Facility, Serial Disk Interface, Tape Labels Facility, Spooling Facility, Job/Session Scheduler, Process Dispatcher, Segmenter, Loader, User Trap Manager, Utility Intrinsics, Accounting Facility, Logging Facility, Backup/Restore Facility, and Power Fail/Auto restart. Support is provided for Basic, Cobol II, Fortran, Pascal, RPG, and SPL (Systems Programming Language).

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 disks subsystems. Internal file system management has been enhanced to make internal control block handling more efficient. 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 32K bytes in length, and each data segment up to 64K bytes. 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 HP) 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 HP-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 manages retrieval and replacement of disk "domains" in excess main memory. It locates and replaces these disks' domains so that a significant portion of the references to disk storage can be resolved before actually having to physically access the disk. Disk Caching policies are integrated into the MPE kernel, file system, and I/O system. The operator 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 domains 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

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access mode, whether sequential or direct, security is maintained for users, groups, accounts, and individual files.

The MPE Accounting Facility insures that information susch 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.

Recommended disk space allocation for MPE, the subsystems, and virtual memory is somewhat over seven million bytes. MPE is disk-resident, with less than one percent (approximately 50K bytes) resident in memory at any one time.

LANGUAGES: All of the HP 3000 computers are multilingual systems that support six programming languages plus a data base 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 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 tyupes 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 nine of the twelve modules defined by the ANSI Cobol X3.23-1974 specifications. The nine 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 HP include microcoded instructions, pre-processor functions (provides statments which allow the programmer to equate a particular section of code or a file to an indentifier), program debugging aids, access to subprograms, access to all MPE System Intrinsics, ACCEPT FREE option (allows a free format for low-volume data entry), file locking capability, special registers, packed decimal, and multiple entry points to subprograms. Cobol II provides access to both sequential MPE and indexed sequential (KSAM) files through the use of ANSI Standard Cobol Input and Output operations and to-IMAGE/3000, HP's data base 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 fifteen characters instead of the usual six. 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 three. 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 HP computer systems, includes extensions such as a string data type and associated string functions and procedures, direct access I/O, structured constants, and the ability to read and write enumerated types. 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 HP include parameters for external subroutine calls, an interface to the data base management system, three methods for run-time error options, a cross-reference error option, EBCDIC/ASCII automatic translation, input/output terminal files, and no requirements for calculation indicator repetition for duplicate conditioning indicators. Data can be processed in binary, packed and unpacked decimal, unpacked decimal with leading or trailing sign, and alphanumeric formats. RPG/3000 also provides automatic 2K- to 8K-byte program segmentation for a virtually unlimited-size RPG program.

SPL is the Systems Programming Language for the HP 3000 Series. It is ALCOL-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. HP states that MPE and all compilers are written in SPL.

DATA BASE MANAGEMENT SYSTEM: *IMAGE/3000,* the data base management system for the HP 3000 Series, is oriented toward general purpose data base management and operates in both interactive and batch environments.

IMAGE consists of three parts: a data base definition subsystem (DBDS), a data base management subsystem (DBMS), and a data base utility subsystem (DBUS). Typi-

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cally, a data base manager would use DBDS to define the data base and DBUS to create and maintain the data base. The applications programmer, in writing his/her programs, would use the data base management language (DBML), which operates on the data base using DBMS.

IMAGE uses a network data structure as its data base 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 accomplished by identifying the proper chain and searching the chain until the desired entry (if it exists) is found.

Security is provided at the data base, data set, and data item levels using a classs 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 data base concurrently. Restructing of the data base 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 sixteen 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 sixteen keys per detail data set and sixteen detail data sets per master data set is permitted. Each chain may have up to 65,535 entries. Up to sixteen different pointer pairs can be maintained for each data item; this permits each data item to be a member of sixteen different chains or access paths. There may be six characters per data base name, eight characters per password, and 8,388,607 entries per data set.

IMAGE allows thirty-two data extents; the capability for data sets to cross volume boundaries; the intrinsic-DBEXPLAIN, which explains the result of a CALL to the data base; 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 data base. 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 be implemented for this purpose, using GROUP and TOTAL.

KSAM/3000: The Keyed Sequential Access Method subsystem extends the file system by allowing files to have one primary and up to fifteen alternate keys, with retrieval based on the value of the data. KSAM also supports key access by physical or logical record numbers or by chronological order.

PROGRAMMING AIDS: HP offers the following programming aids—RAPID/3000, HP Toolset, and APS/3000 Application Program Sampler. RAPID/3000 is a family of software programming tools consisting of four individual but integrated products. These are Dictionary/3000, Transact/3000, Report/3000, and Inform/3000. HP states that improvements of two to ten 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 HP data files. The data dictionary consists of an IMAGE data base, 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 256K bytes, 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 instruction does what would take many instructions in a traditional language. The ability to do prototyping is also an inherent part of the product. Transact/3000 is designed to work in conjunction with HP's 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, non-procedural report writer for use with HP Dictionary/3000 (HP 32244A). 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. Report's friendly interface makes it easy to use and maintain.

HP Inform/3000 is an interactive inquiry and report generator for non-programmers. 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

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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 consist 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 2 to 3 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 HP terminal supported by an HP 3000 system using a current MPE IV operating system.

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 lower case alphanumerics in the form of lines, strings, or individual characters. Sort-Merge/3000 allows the user to order records in a file and merge sorted files. FCopy/3000 performs general file copying tasks.

VPLUS/3000 is a data entry and forms management software product to help users implement 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 stand-alone 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. HP 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 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.

Applications Software: HP's application software is grouped into several major categories: manufacturing, distribution, administration, office automation, as well as HP Plus for third party software.

The products included in the manufacturing area are the *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 Plannning (MRP) and Capacity Requirements Planning (CRP).

Materials Management/3000 includes the following modules:

- Master Production Scheduling
- Rough Cut Resource Planning
- Parts and Bills of Materials
- Routings and Wordcenters
- Material Issues and Receipts
- Inventory Balance Management
- Work Order Control
- Purchase Order Tracking
- Material Requirements Planning
- Standard Product Costing

Production Management/3000 includes these modules:

- Routing and Workcenters
- Work In-Process Control
- Work Order Scheduling
- Shop Floor Dispatching
- Work Order Tracking
- Capacity Requirements Planning

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

SFD/3000 and *OM/3000* are HP's two products for wholesale distribution. 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:

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

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

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

HPWord is HP's full-feature word processor for secretaries, for general business needs such as memos, listers, 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 128K-byte memory. Editing commands are entered through specially-labeled keys; additional functions are added via the screen-labeled keys. The 2626W is a full-function, multi-screen 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.

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

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 multi-color 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.

To meet the organizational communications needs of the modern business, HP provides their Distributed Systems Network (DSN) software (discussed earlier in this report), the HP 2680 Laser Printing System, and an electronic mail capability, HPMail.

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 pass-words, 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 data base for document storage and local distribution. Documents are stored only once on each system in a network, with pointers for each intended recipient.

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.

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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.

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.

A *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.

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 data base management system. QUERY/3000 data base 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 new System Re-Marketing Operation. The HP 3000 Series 30R with 512K bytes of main memory, disk, tape and system console is priced at $36,850. This system, when offered new, costs $70,275. The Series 33R, in the same configuration, is priced at $37,600 through resale rather than $82,645 as new. The Series IIIR, until 1980 the top of the Series 3000 line, is now priced at $46,550 as opposed to $104,755 new. The configuration includes 512K bytes of memory, disk, tape, and system consoles. User upgrades are one source of equipment for resale, as are lease returns and internal capital requipment. Re-market 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. The HARDWARE COMPARISON table positions these refurbished models in respect to HP's new product offerings.

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

The leases are noncancellable, but a special provision is available that permits cancellation on nine 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.

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

Maintenance is separately priced and offered through 84 U.S. offices, 12 Canadian offices, and 121 international offices. The HP 3000 provides a Guaranteed Uptime Service which provides a service credit guarantee that the uptime shall exceed 99 percent over any three consecutive months. If 99% 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.

HP's *Standard System Maintenance Series (SSMS)* provides same day reponse, 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 preventive maintenance for these products is either unnecessary or performed by the user. An approximate 50 percent savings can be had 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 present software support policy for the HP 3000, which became effective in August 1979, 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 mulitple 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, HP will provide an additional 90-day period of the services ordered at no charge.

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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 HP 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 HP documentation. Software bulletins and updates also offer an avenue for interpretation of HP documentation.

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

On-site consulting services by HP systems engineers 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 HP software design error or system malfunction, the on-site services are considered outside the scope of HP's software and support agreement and subject to a time and materials charge. HP is not obligated to provide any on-site services for HP 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 HP holidays, during HP working hours, at distances not more than 100 miles from the nearest HP office designated to provide on-site SE services. Support for facilities farther away can be provided at additional cost.

HP 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, HP system engineers are guaranteed to respond by telephone within 2 hours after receiving a customer's call. If the problem can't be handled over the phone, system 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 HP field office and the user's type of software coverage.

Customers have three ways to purchase this service: separately, as an extension to HP's Customer Support Service (CSS), or on an as-needed basis.

For system discount purposes, each HP 3000 system counts as 2 to 4 Functional Units depending on the system. All HP computer systems carry functional units and may be combined for discount purposes. The following table shows the end-user and OEM discount schedules:

Functional Units	End-User Schedule	OEM Schedule
1-4	0%	5%
5-7	4	9
8-14	7	12
15-24	10	15
25-34	13	18
35-49	15	20
50-74	17	22
75-99	19	24
100-149	20	25
150-199	22	27
200-249	23	28

Training courses are available at an HP Technical Center at a per student charge or on-site classes at a per class charge (for up to ten students). Typical classes are: Programmer's Introduction, Management and Operation, MPE Special Capabilities, HP VPLUS/3000, IMAGE/3000, Application Design, and IML/3000 Training/Consulting Package.

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.

EQUIPMENT: The HP 3000 computers are offered as system processor units onto which the user configures the peripherals required by his/her application. Prices for each of the system processor units and peripherals will be found in the following Equipment Prices.

Hewlett-Packard 3000 Series

HARDWARE COMPARISON

Feature	Series 30R	Series 33R	Series IIIR	Series 39	Series 42	Series 48	Series 68
Fault control memory	512KB Std. 1MB max.	512KB Std. 1MB max.	512KB Std. 2MB max.	512KB Std. 3MB max.	512KB Std. 3MB max.	2MB Std. 4MB max.	3MB Std. 9.7MB max.
Max. disk drives	8 1.8GB	8 1.8GB	8 7920/7925 2.58GB	8 3.2GB	8 3.2GB	16 4.2GB	24 6.5GB
Max. tape drives	Up to 4 1600 and 1600/ 6250 drives, max. one 1600/6250 unit	Up to 4 1600 and 1600/ 6250 drives, max. one 1600/6250 unit	Up to 8 800 or 1600 drives and one 1600/ 6250 unit	Up to 4 1600 and 1600/ 6250 drives, max. two 1600/6250 unit	Up to 4 1600 and 1600/ 6250 drives, max. two 1600/6250 units	Up to 8 1600 and 1600/ 6250 drives, max. two 1600/6250 units	Up to 8 1600 and 1600/ 6250 drives, max. two 1600/6250 units
Max. line printers	2	2	4	2	2	4	8
Max. term.	48 (32 PT to PT)	48 (32 PT to PT)	96 (64 PT to PT)	92 (32 PT to PT)	92 (32 PT to PT)	152 (104 PT to PT)	400 (110 Simultaneous sessions)
Communications lines	3	7	7	3	3	7	24

EQUIPMENT PRICING

		Purchase* Price	Standard Monthly Maint.
SYSTEM PROCESSOR UNITS			
3251A	HP 3000 Series 39 System Processor Unit; 120V/60 Hz; single phase; 512K bytes fault control memory; 2 General I/O Channels (GICs); remote diagnostic capability; system cabinet; Fundamental Operating Software FOS; complete user manual set	33,200	243
011	Model 11 Packaged System	-11,400	0
012	Model 12 Packaged System	-8,200	0
014	Model 14 Packaged System	-5,200	0
507	Expand memory to 1024K bytes	8,200	16
32542A	HP 3000 Series 42 System Processor Unit; 120V/60 Hz; single phase; 1 megabyte fault control memory; 2 General I/O Channels (GICs); remote diagnostic capability; disk caching; system cabinet; Fundamental Operating Software; complete user manual set	42,400	259
32548A	HP 3000 Series 48 System Processor Unit; 220-240V/60 Hz; single phase; 2 megabytes fault control memory; 2 General I/O Channels (GICs); remote diagnostic capability; disk caching; system cabinet; Fundamental Operating Software; complete user manual set	79,500	297
32468B	HP 3000 Series 68 System Processor Unit; 208V/60 Hz; three phase; 3 megabytes fault control memory; 1 Intermodule Bus (IMB); 2 General I/O Channels (GICs) remote diagnostic capability; disk caching; system cabinet; Fundamental Operating Software; complete user manual set	186,000	765
250	Add Expansion Bay and I/O Adapter (IMB)	25,000	53
30464A	HP 3000 Series 68A Expansion Bay and I/O Adapter (IMB)	30,000	74
30464B	HP 3000 Series 68B Expansion Bay and I/O Adapter (IMB)	30,000	53
35030A	Power Line Conditioner (Series 30, 39, 40 and 42)	1,100	6
FIELD UPGRADE PRODUCTS			
30539A	HP 3000 Series 39 Disk Cache Upgrade; includes disk caching software; 512K bytes memory; and MPE-V firmware	14,000	—
170	Delete 256K bytes memory	-4,500	—
180	Delete 512K bytes memory	-6,000	—
30400A	HP 3000 Series 39/4x Firmware Upgrade	4,000	0
30542A	HP 3000 Series 40 and 42 Field Upgrade; includes disk caching software; 1 megabyte memory; and MPE-V firmware	17,000	25
180	Delete 512K byte memory	-2,800	-16
190	Delete 1 megabyte memory	-8,000	-32
30548A	HP 3000 Series 44 to 48 Field Upgrade; includes disk caching software; 1 megabyte memory; and MPE-V firmware	20,000	25
190	Delete 1 megabyte memory	-8,000	-32
30468A	HP 3000 Series 64A to Series 68A Field Upgrade; includes disk caching software; 1 megabyte memory; and MPE-V firmware	25,000	75
190	Delete 1 megabyte memory	-8,000	-75
250	Add Expansion Bay and I/O Adapter (IMB)	25,000	53
30468B	HP 3000 Series 64B to Series 68B Field Upgrade; includes disk caching software; 1 megabyte memory; and MPE-V firmware	25,000	75
190	Delete 1 megabyte memory	-8,000	-75
250	Add Expansion Bay and I/O Adapter (IMB)	25,000	53

*The U.S. list price includes freight charges.

Hewlett-Packard 3000 Series

		Purchase* Price	Standard Monthly Maint.
UPGRADE PRODUCTS			
32445AH	Upgrade to the Series 40 (32445A) w/512K bytes memory	29,400	224
507	Expands Memory to 1024K bytes memory	8,200	16
601	Upgrade from pre-Series II or HP 2000 w/128K bytes memory	-2,500	0
602	Upgrade from Series II w/128K bytes memory	-3,000	0
603	Upgrade from Series III w/256K bytes memory	-7,000	0
605	Upgrade from S/33A/B w/256K bytes memory, 2649E	-8,000	46
606	Upgrade from S/33C/U w/256K bytes memory, 2649E	-8,000	26
607	Upgrade from S/30A/B w/256K bytes memory, 2649E	-6,000	23
608	Upgrade from S/30C/U w/256K bytes memory, 2649E	-6,000	13
32542AH	Upgrade to the Series 42 (32542A) w/1 megabyte memory	38,600	233
601	Upgrade from pre-Series II or HP 2000 w/128K bytes memory	-2,500	0
602	Upgrade from Series II w/128K bytes memory	-3,000	0
603	Upgrade from Series III w/256K bytes memory	-7,000	0
605	Upgrade from S/33A/B w/256K bytes memory, 2649E	-8,000	26
606	Upgrade from S/33C/U w/256K bytes memory, 2649E	-8,000	26
607	Upgrade from S/30A/B w/256K bytes memory, 2649E	-6,000	13
608	Upgrade from S/30C/U w/256K bytes memory, 2649E	-6,000	13
32440BH	Upgrade to Series 44B (32440B) w/1 megabyte memory	60,700	288
601	Upgrade from pre-Series II or HP 2000 w/128K bytes memory	-7,500	0
602	Upgrade from Series II w/128K bytes memory	-8,000	0
603	Upgrade from Series III w/256K bytes memory	-12,000	0
605	Upgrade from S/33A/B w/256K bytes memory, 2649E	-13,000	46
606	Upgrade from S/33C/U w/256K bytes memory, 2649E	-13,000	26
607	Upgrade from S/30A/B w/256K bytes memory, 2649E	-11,000	23
608	Upgrade from S/30C/U w/256K bytes memory, 2649E	-11,000	13
611	Upgrade from Series 40 w/no memory	-13,825	26
613	Upgrade from Series III w/256K bytes memory and 30341A HP-IB Adapter	-15,000	0
32548AH	Upgrade to Series 48 (32548A) w/2 megabytes memory	75,700	252
601	Upgrade from pre-Series II or HP 2000 w/128K bytes memory	-7,500	0
602	Upgrade from Series II w/128K bytes memory	-8,000	0
603	Upgrade from Series III w/256K bytes memory	-12,000	0
605	Upgrade from S/33A/B w/256K bytes memory, 2649E	-13,000	26
606	Upgrade from S/33C/U w/256K bytes memory, 2649E	-13,000	26
607	Upgrade from S/30A/B w/256K bytes memory, 2649E	-11,000	13
608	Upgrade from S/30C/U w/256K bytes memory, 2649E	-11,000	13
611	Upgrade from Series 40 w/no memory	-13,825	26
613	Upgrade from Series III w/256K bytes memory and 30341A HP-IB Adapter	-15,000	0
614	Upgrade from Series 39 w/no memory	-11,650	13
615	Upgrade from Series 42 w/no memory	-15,075	26
32460BH	Upgrade to Series 64 (32460B) w/2 megabytes memory	162,300	693
601	Upgrade from pre-Series II or HP 2000 w/128K bytes	-2,500	0
602	Upgrade from Series II w/128K bytes memory	-3,000	0
603	Upgrade from Series III w/256K bytes memory	-27,000	0
605	Upgrade from S/33A/B w/256K bytes memory, 2649E	-8,000	26
606	Upgrade from S/33C/U w/256K bytes memory, 2649E	-8,000	26
607	Upgrade from S/30A/B w/256K bytes memory, 2649E	-6,000	13
608	Upgrade from S/30C/U w/256K bytes memory, 2649E	-6,000	13
609	Upgrade from Series 44 w/1 megabyte memory	-43,000	26
611	Upgrade from Series 40 w/no memory	-13,825	26
613	Upgrade from Series III w/256K bytes memory and 3034A HP-IB Adapter	-30,000	0
32468BH	Upgrade to Series 68 (32468B) w/3 megabytes memory	182,300	739
250	Add Expansion Bay & I/O Adapter (IMB)	25,000	53
601	Upgrade from pre-Series II or HP 2000 w/128K bytes memory	-2,500	0
602	Upgrade from Series II w/128K bytes memory	-3,000	0
603	Upgrade from Series III w/256K bytes memory	-27,000	0
605	Upgrade from S/33A/B w/256K bytes, 2649E	-8,000	26
606	Upgrade from S/33C/U w/256K bytes memory, 2649E	-8,000	26
607	Upgrade from S/30A/B w/256K bytes memory, 2649E	-6,000	13
608	Upgrade from S/30C/U w/256K bytes memory, 2649E	-6,000	13
609	Upgrade from Series 44 w/1 megabyte	-43,000	26
611	Upgrade from Series 40 w/no memory	-13,825	26
613	Upgrade from Series III w/256K bytes memory and 30341A HP-IB Adapter	-30,000	0
614	Upgrade from Series 39 w/no memory	-11,650	13
615	Upgrade from Series 42 w/no memory	-15,075	26
616	Upgrade from Series 48 w/1 megabyte memory	-45,500	26
RE-MARKETED SYSTEMS			
32412CR	HP 3000 Series 33R System (Re-Marketed) (60 Hz) includes 512K bytes memory, 2649E console, FOS on 1600 bpi tape. Must order all ADCCs and GICs separately	12,225	307
507	Expands memory to 1024K bytes memory	6,030	40
720	7920S Slave 50-megabyte disk drive (Re-Marketed) with cables (60 Hz)	9,825	95
721	7920S Slave 50-megabyte disk drive (Re-Marketed) with cables (50 Hz)	9,825	95
725	7925S Slave 120-megabyte disk drive (Re-Marketed) with cables (60 Hz)	13,725	85
726	7925S Slave 120-megabyte disk drive (Re-Marketed) with cables (50 Hz)	13,725	85
920	7920M Master 50-megabyte disk drive (Re-Marketed) with HP-IB interface and cable (60 Hz)	13,175	139

*The U.S. list price includes freight charges.

Hewlett-Packard 3000 Series

		Purchase* Price	Standard Monthly Maint.
921	7920M Master 50-megabyte disk drive (Re-Marketed) with HP-IB interface and cable (50 Hz)	13,175	139
925	7925M Master 120-megabyte disk drive (Re-Marketed) with HP-IB interface and cable (60 Hz)	17,750	129
926	7925M Master 120-megabyte disk drive (Re-Marketed) 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)	12,200	154
971	7970E 1600 bpi tape drive HP-IB master in upright cabinet (230 VAC)	12,200	154
32430CR	HP 3000 Series 30R System (Re-Marketed) (60 Hz) includes 512K bytes memory, 2649E console, FOS on 1600 bpi tape. Must order all ADCCs and GICs separately	11,475	296
507	Expands memory to 1024K bytes memory	6,030	40
720	7920S Slave 50-megabyte disk drive (Re-Marketed) with cables (60 Hz)	9,825	95
721	7920S Slave 50-megabyte disk drive (Re-Marketed) with cables (50 Hz)	9,825	95
725	7925S Slave 120-megabyte disk drive (Re-Marketed) with cables (60 Hz)	13,725	85
726	7925S Slave 120-megabyte disk drive (Re-Marketed) with cables (50 Hz)	13,725	85
920	7920M Master 50-megabyte disk drive (Re-Marketed) with HP-IB interface and cable (60 Hz)	13,175	139
921	7920M Master 50-megabyte disk drive (Re-Marketed) with HP-IB interface and cable (50 Hz)	13,175	139
925	7925M Master 120-megabyte disk drive (Re-Marketed) with HP-IB interface and cable (60 Hz)	17,750	129
926	7925M Master 120-megabyte disk drive (Re-Marketed) 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)	12,200	154
971	7970E 1600 bpi tape drive HP-IB master in upright cabinet (230 VAC)	12,200	154
32435BR	HP 3000 Series IIIR System (Re-Marketed) includes 512K bytes 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 1024K bytes	7,020	50
509	Expands memory to 1524K bytes	14,030	108
511	Expands memory to 2048K bytes	21,035	158
720	7920S Slave 50-megabyte disk drive (Re-Marketed) with cables (60 Hz)	9,825	95
721	7920S Slave 50-megabyte disk drive (Re-Marketed) with cables (50 Hz)	9,825	95
725	7925S Slave 120-megabyte disk drive (Re-Marketed) with cables (60 Hz)	13,725	85
726	7925S Slave 120-megabyte disk drive (Re-Marketed) with cables (50 Hz)	13,725	85
820	7920M Master 50-megabyte disk drive (Re-Marketed) with cables (60 Hz)	12,175	135
821	7920M Master 50-megabyte disk drive (Re-Marketed) with cables (50 Hz)	12,175	135
825	7925M Master 120-megabyte disk drive (Re-Marketed) with cables (60 Hz)	16,750	125
826	7925M Master 120-megabyte disk drive (Re-Marketed) 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
I/O EXPANSION			
30018A	Asynchronous Data Communications Controller (ADCC)—main	1,695	10
30019A	Asynchronous Data Communications Controller (ADCC)—extender	1,695	10
30079A	General I/O Channel (GIC)	1,900	13
30087A	HP 3000 Seris 44 I/O expansion kit	9,000	26
30143A	I/O Adapter Module for Series 64, 68 (IMB)	10,100	34
	NOTE: Advanced Terminal Processor (DSN/ATP) consists of an SIB (30144A) and port controller		
30144A	DSN/ATP System Interface Board (SIB)	3,145	15
30145A	DSN/ATP Direct Connect Port Controller. Standard Provides 12 RS-422 Ports	6,530	28
001	First Port Controller on Series 64, 68	-250	0
30155A	DSN/ATP Modem Port Controller	8,070	34
001	First Port Controller on Series 64, 68	-250	0
MEMORY EXPANSION			
30092A	512K-byte Memory Module for Series 39, 4x	8,500	16
30094A	Add-on Series 44, 48 Memory Controller	1,600	11
30142A	1 megabyte Memory Module for Series 64, 68	12,000	75
30161A	1 megabyte Memory Module for Series 39, 4x	12,000	32
30171A	256K-byte Memory Module for Series 39, 40, 42	4,500	8
MASS STORAGE			
7906M	Master 20-megabyte Cartridge Disk Drive	17,350	156
102	HP-IB interface and cable	1,200	4
7906S	Add-on 20-megabyte Disk Drive	13,270	116
7911P	28-megabyte Disk Drive with Cartridge Tape Drive and One Controller with cable	14,800	54
001	Adds second controller	1,840	24
140	Deletes Cartridge Tape Drive	-3,570	-11
7912P	65-megabyte Disk Drive with Cartridge Tape Drive and One Controller with cable	17,350	56
001	Adds second controller	1,840	24
140	Deletes Cartridge Tape Drive	-3,570	-11
7914P	132-megabyte Disk Drive with Integral 67-megabyte Tape Cartridge	19,900	66
001	Adds dedicated controller	1,840	24
140	Deletes Cartridge Tape Drive	-3,570	-14

*The U.S. list price includes freight charges.

Hewlett-Packard 3000 Series

		Purchase* Price	Standard Monthly Maint.
7914TD	Mass Storage Subsystem Consisting of 132-megabyte 7914 Disk Drive and 7970E ½" Mag Tape Drive (HP-IB Version) Mounted in a 72" high cabinet	26,540	193
002	Adds Cartridge Tape Drive and second controller	5,410	38
114	Adds second 7914 (opt. 140) Disk Drive	14,290	52
7920M	Master 50-megabyte Disk Drive	19,400	135
102	HP-IB interface and cable	1,200	4
7920MR	Master 50-megabyte Disk Drive (Re-Marketed)	12,175	135
102	HP-IB interface and cable	1,000	4
7920S	Add-on 50-megabyte Disk Drive	15,310	95
7920SR	Add-on 50-megabyte Disk Drive (Re-Marketed)	9,825	95
7925M	Master 120-megabyte Disk Drive	22,510	125
102	HP-IB interface and cable	1,200	4
7925MR	Master 120-megabyte Disk Drive (Re-Marketed)	16,750	125
102	HP-IB interface and cable	1,000	4
7925S	Add-on 120-megabyte Disk Drive	18,220	85
250	Disk Controller Upgrade	535	0
7925SR	Add-on 120-megabyte Disk Drive (Re-Marketed)	13,725	85
7925T	Add-on 240-megabyte Disk Storage System	32,190	170
7933H	404-megabyte Fixed Media Disk Drive, Standard Operating Voltage is 208V, wit cable	25,520	90
7933G	1.2-gigabyte Storage System, consists of three 7933H, 404-megabyte disk drives each with media, controller, power supply, and cable	63,560	270
7935H	404-megabyte Removable Media Disk Drive, Standard Operating Voltage is 208V, with cable	28,070	162
97935A	404-megabyte Removable Media Module for 7935H Disk Drive	1,531	37
97935K	Upgrade Kit for Upgrading a 7933H to 7935H	3,060	0
9895A	Flexible Disk System	5,910	84
13394A	7920M/S Disk Pack	560	N/A
13356A	7925M/S Disk Pack	905	N/A
MAGNETIC TAPE SUBSYSTEMS			
7970B	800 cpi/45 ips Magnetic Tape Subsystem	8,410	86
The following options apply to the Series III:			
324	Initial drive on 30215A controller in lo-boy cabinet	3,705	3
334	Initial drive on 30215A controller without cabinet	1,365	0
320	Add-on drive in lo-boy cabinet	3,805	3
330	Add-on drive without cabinet	1,120	0
7970E	1600 cpi/45 ips Magnetic Tape Subsystem	10,160	97
The following options apply to the Series III:			
324	Initial master drive on 30215A controller in lo-boy cabinet	3,585	3
320	Add-on master drive in lo-boy cabinet	3,785	3
330	Add-on master drive without cabinet	1,345	0
321	Slave drive in lo-boy cabinet	1,955	-7
331	Slave drive without cabinet	300	-7
The following options apply to the Series 3x, 4x, and 6x:			
426	HP-IB master drive in lo-boy cabinet	5,110	42
436	HP-IB master drive without cabinet	2,310	39
421	Slave drive in lo-boy cabinet	1,995	3
431	Slave drive without cabinet	300	-7
7971A	Magnetic Tape Subsystem in Upright Cabinet	11,200	0
The following options apply to the Series III:			
480	7970B Initial drive	1,935	89
410	7970B Add-on drive	2,035	89
481	7970B Two drives, initial and add-on	12,730	175
411	7970B Two drives, add-on	12,830	175
470	7970E initial master drive	3,565	100
420	7970E Add-on master drive	3,765	100
472	7970E Two masters, initial and add-on	14,460	197
422	7970E Two masters, add-on	14,660	197
430	7970E slave drive	1,935	93
433	7970E Two slave drives	12,520	183
473	7970E Two drives, initial master and slave	13,440	190
423	7970E Two drives, add-on master and slave	13,540	190
482	7970B Initial drive and 7970E add-on master	13,540	186

*The U.S. list price includes freight charges.

Hewlett-Packard 3000 Series

		Purchase* Price	Standard Monthly Maint.
	The following options apply to the Series 3x, 4x, and 6x:		
340	7970E HP-IB Master	5,090	139
344	7970E Two HP-IB masters (Series 44, 48, and 6x only)	16,700	275
330	7970E Slave drive	1,935	93
333	7970E Two slave drives	12,520	183
343	7970E Two drives, HP-IB master and slave	14,560	229
7976A	1600/6250 cpi Magnetic Tape Subsystem	44,440	586
7976A	Quantity Two (2) high speed 1600/6250 bpi Tape Systems. Must be ordered together	88,880	1,172
222	Twin-Pack credit	-7,500	0
	Total after credit	81,380	
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 fifth through eight 7970B or 7970E magnetic tape drives with 300 level options. (Re-Marketed)	2,710	17
PRINTERS			
	Options 301, 302, 344, and 364 for 2611/19A provide a 26069A interface; do not order 26069A separately		
26069A	2611/19A Line Printer Interface for Series 3x, 4x, and 6x. Must order one of the following options	2,475	22
	Cable set	700	0
30209AR	Line Printer Controller to interface 2608A, 2613A, 2617A, and 2619A line printers with option 300. (Re-Marketed)	1,285	6
2601A	40 cps Daisywheel Printer, Modem cable included (02631-60065, 13242N equivalent)	3,520	67
26010D	Dual bin sheetfeeder for 2601A	2,290	27
2602A	20 cps Daisywheel Printer, Cable not included	1,950	50
2608A	400 lpm Printer (1-69 print hrs/month)	11,890	109
2608S	400 lpm Printer (1-69 print hrs/month)	11,170	90
055	HP 3000 Multipoint I/O Subsystem	870	0
333	HP-IB interface and cable for S/3x	1,025	0
340	HP-IB interface and cable for S/39, 40, 42	1,025	0
344	HP-IB interface and cable for S/44, 48	1,025	0
364	HP-IB interface and cable for S/64, 68	1,025	0
2611A	600 lpm Printer (1-66 print hours per month)	18,560	303
001	96 character set; 430 lpm	1,455	0
002	64 character set with OCR-B font	700	0
003	96 character set with OCR-B font	2,155	0
2619A	1000 lpm Printer (1-66 print hrs/month)	26,370	363
001	96 character set; 750 lpm	1,455	0
002	64 character set with OCR-B font	700	0
003	96 character set with OCR-B font	2,155	0
	One of the following options must be ordered		
300	HP 3000 Series III cable	1,025	0
301	Series 30 HP-IB interface and cable	2,530	22
302	Series 33 HP-IB interface and cable	2,530	22
340	Series 39, 40, 42 HP-IB interface and cable	2,530	22
344	Series 44, 48 HP-IB interface and cable	2,530	22
364	Series 64, 68 HP-IB interface and cable	2,530	22
2631B	180 cps Dot Matrix Printer. Modem cable 02631-60065 included with standard RS-232 interface	3,970	39
2631G	Graphics Printer. Cable not included	4,970	45
200	Bar Code Printer	600	-9
2680A	Intelligent Page Printer. Includes 125,000 rotations. See options 300 thru 364 for cabling	91,600	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
060	Graphics/Extended Memory Management	2,565	0
300	Series III cable, documentation	1,550	0
301	Series 30 cable, documentation	1,550	0
302	Series 33 cable, documentation	1,550	0
340	Series 39, 40, 42 cable, documentation	1,550	0
344	Series 44, 48 cable, documentation	1,550	0
364	Series 64, 68 cable, documentation	1,550	0
505	Add-on 256K-byte memory module	4,550	6
520	One megabyte Memory (Deletes std. 256K-byte memory)	7,550	24
521	One megabyte Memory Addition	12,000	32
525	Vacuum Paper Splice Option	1,025	0
26080A	Add-on 256K-byte memory module for 2680A and 26804A	4,550	6
26085A	Add-on 1 megabyte memory for the 2680A and 26804A	12,000	32
26086A	Add-on graphics, extended memory management for the 2680A and 26804A	3,690	0
26804A	2685 Model 40 Print Station. Includes 125,000 rotations. Includes cables	164,000	1,085
	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

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Hewlett-Packard 3000 Series

		Purchase* Price	Standard Monthly Maint.
030	Adds Cobol II compiler	4,050	0
031	Adds Fortran compiler	2,100	0
040	Deletes 64 megabyte disk and adds 404 megabyte disk for U.S. 120 VAC	13,350	24
041	Deletes 64 megabyte disk and adds 404 megabyte disk for U.S. (Standard) 208 VAC	13,350	24
050	Expands disk capacity to 120 megabyte disk 120 VAC	10,400	74
051	Expands disk capacity to 120 megabyte disk 120 VAC	10,400	74
052	Deletes 7912/7971, adds 7914TD	-1,000	10
054	Deletes 7912/7971, adds 7914TD; 264 megabyte	13,290	62
060	Graphics/extended memory management	2,565	0
065	Graphics software interface	6,150	0
074	Deletes 7971A; adds 7976A, 120V/60 Hz	30,450	447
077	Deletes 7971A; adds 7976A, 120V/60 Hz	30,450	447
095	Deletes 7971; no replacement	-12,790	-154
096	Deletes 2382A console; no replacement	-1,820	-20
097	Deletes 65 megabyte disk; no replacement	-12,350	-45
098	Delete 1600 bpi magnetic tape unit and replace with cartridge tape unit on the 7912P	-8,750	-143
099	Delete design and formatting software and graphics terminal	-10,250	-41
505	256K-byte memory extension	4,550	0
520	One megabyte memory (Deletes std. K-byte memory)	7,550	24
521	One megabyte memory addition	12,000	32
525	Vacuum Paper Splice Option	1,025	0
607	Expand controller memory to 1 megabyte	8,200	16
26075A	Multiple System Access Selector. Order Cables Separately	725	6
GRAPHICS PLOTTERS			
7220C	Graphics Plotter, includes RS-232 cable	5,860	70
7220T	Graphics Plotter, with automatic paper advance, includes RS-232 cable	7,980	80
7221C	Graphics Plotter, includes RS-232 cable	5,860	70
7221T	Graphics Plotter, with automatic paper advance, includes RS-232 cable	7,980	80
001	Expanded Buffer Memory for Models 7220 and 7221	225	0
7240A	RS-232-C Plotter/Printer, includes RS-232 cable	7,260	64
7245B	Plotter/Printer	7,260	64
7470A	Graphics Plotter	1,575	24
016	Eavesdrop Cable for option 001	100	0
7580B	Drafting Plotter-combo HP-IB/RS-232	16,100	124
7585B	Drafting Plotter-combo HP-IB/RS-232	22,900	124
9872C	Graphics Plotter	5,860	70
9872T	Graphics Plotter, with automatic paper advance	7,980	80
DIGITIZERS			
9111A	Graphics Tablet; 16 softkeys	2,275	16
TERMINALS			
2382A	Office Display Terminal	1,720	20
2621B	Character Mode Terminal	1,645	24
2622A	Block Mode Terminal	2,210	28
2623A	Graphics Terminal	3,250	36
2624B	Data Entry Terminal	3,035	33
2626A	Display Station. 110V/60 Hz	4,400	41
2626W	Word Processing Station	5,000	55
050	Integral Thermal Printer for the 2621B, 2622A, 2623A, 2624A, and 2626W	1,210	16
2627A	Color Graphics Terminal	5,975	34
2641A	APL Display Station	5,850	34
2645A	Display Station	4,600	34
2647F	Intelligent Graphics Terminal	9,950	89
072	Second Flexible Mini Disk Drive	1,050	0
890	Series 64, 68 Console	-1,750	0
2648A	Graphics Terminal	7,150	41
096	Shared Peripheral Interface	735	0
007	Integrated dual cartridge tapes	1,400	12
2703A	High Performance Color Graphics Terminal	19,900	160
054	RGB video output interface	1,150	0
072	Dual integral flexible mini-disks	2,200	0
096	Shared peripheral interface	1,250	0
164	Application memory 128K bytes	1,250	0
165	Application memory 256K bytes	1,850	0
174	Increases vector memory by 64K bytes	300	0
175	Increases vector memory by 192K bytes	1,150	0
176	Increases vector memory by 448K bytes	2,650	0
177	Increases vector memory by 960K bytes	5,500	0
186	Double buffered graphics memory	1,350	0
555	Model 55 Technical Design Terminal	4,100	0

*The U.S. list price includes freight charges.

Hewlett-Packard 3000 Series

		Purchase* Price	Standard Monthly Maint.
560	Model 60 Decision Support Workstation	4,100	0
565	Model 65 Presentation Graphics Workstation	8,100	0
2635B	180 cps Printing Terminal, includes Modem cable	4,370	41
3075A	Desk Top 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-inch CRT	985	17
007	Multifunction reader	985	46
008	Type V badge reader	570	26
009	Alphanumeric printer	570	35
010	General Purpose Bar Code Reader	640	12
011	Auxiliary HP-IB Port	805	0
012	Magnetic Stripe Reader	690	13
013	RS-232-C Auxiliary Interface	570	0
021	Delete reference manual	-50	N/A
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
005	Alphanumeric Display	635	0
021	Delete Reference Manual	-50	N/A
3092A	Industrial Display Terminal compatible with 2622A	4,305	30
3093A	Industrial Display Terminal compatible with 2623A	6,040	38
The following options apply to 3092A and 3093A:			
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
7260A	Optical Mark Reader	8,460	146
002	Select Hopper	460	0
003	Encoder	580	0
13231A	Display enhancements (except 2642A)	400	0
201	Math symbols alternate character set	105	0
203	Large character alternate character set	160	0
13234A	Terminal 4K memory module (except 2642A)	320	0
13261A	Device support firmware	185	0
13296A	Shared peripheral interface for 2647/48A graphics terminals	745	0
COMMUNICATIONS			
3074A	Data link adapter	715	11
3074M	Data link adapter (for asynchronous modem configurations)	820	6
13260C	Asynchronous Multipoint Communications Interface for 264x terminals	460	0
13260D	Synchronous Multipoint Communications Interface for 264x terminals	480	0
13264A	Data link adapter 2626A/2624B terminal	350	—
13267A	Asynchronous Multipoint Interface for first 2626A terminal	400	0
011	Synchronous Multipoint Interface	0	0
30010A	Intelligent Network Processor (NP) for Series III	4,760	43
001	New I/O card cage backplane	400	N/A
30020B	Intelligent Network Processor (NP) for Series 4x or 64	4,235	53
30055A	Synchronous single line controller	2,100	19
001	Replaces synchronous cable with asynchronous cable for hardwired operation	0	0

SOFTWARE PRICES

		Price
LANGUAGES		
32233A	Cobol II/3000 Compiler	$5,000
300	Basic/RPG/300 return credit	-1,575
301	SL/300 return credit	-2,100
32233R/M	Right to copy 32233A with/without sublicense	2,500
300	Basic/RPG/300 return credit	-630
301	SL/300 return credit	-840
32213R/M	Right to copy 32213C with/without sublicense	875

*The U.S. list price includes freight charges.

Hewlett-Packard 3000 Series

		Price
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
32102B	Fortran/3000 Compiler	2,050
300	Basic/RPG/300 return credit	-1,575
301	SL/300 return credit	-2,051
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 32105A 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 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

DATA COMMUNICATIONS

30130E	DSN/RJE Remote Job Entry	1,350
300	31447A RJE/300 credit	-525
30130R/M	Right to copy 30130E with/without sublicense	675
300	31447R RJE/300 credit	-105
32190A	DSN/DS Distributed Systems Software	5,000
300	31447A RJE/300 credit	-525
32190R/M	Right to copy, with/without sublicense	2,500
300	31447R RJE/300 crediit	-105
32192A	DSN/MRJE Multileaving Remote Job Entry	2,520
300	31447A RJE/300 credit	-525
32192R/M	Right to copy 32192A with/without sublicense	1,260
300	31447A RJE/300 credit	-105
32229A	DSN/IMF Interactive Mainframe Facilty	7,000
300	31447A RJE/300 credit	-525
32229R/M	Right to copy 32229A with/without sublicense	3,500
300	31447A RJE/300 credit	-105
32193A	DSN/MTS Multipoint Terminal Support	2,500
32193R/M	Right to copy 32193A with/without sublicense	1,200

PROGRAMMER PRODUCTIVITY TOOLS

32244A	Dictionary/3000 Relational Data Dictionary	5,000
32244R/M	Right to copy 32244A with/without sublicense	2,500
32245A	Report/3000 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 (32244A)	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	3,500
32258A	HP Report Writer Package	13,000
32258R/M	Right to copy 32258A with/without sublicense	6,500
32350A	HPToolset Program Development System. Requires Cobol II/3000 (32233A)	5,000
32350R/M	Right to copy 32350A with/without sublicense	2,500

OFFICE SYSTEMS SOFTWARE

32108A	HPDraw Text & Figure Presentation Graphics Software	4,000
32108R/M	Right to copy 32108A with/without sublicense	2,800
32109A	HPEasychart Chartmaker Graphics Package	3,000
32109R/M	Right to copy 32109A with/without sublicense	2,100

Hewlett-Packard 3000 Series

		Price
32110A	HP 3000 Business Graphics Package	10,750
32110R/M	Right to copy 32110A with/without sublicense	7,500
32112A	HPMenu Interactive Office Menu Facility	1,000
32112R/M	Right to copy 32112A with/without sublicense	700
32120A	HPWord Word Processing	5,000
32120R/M	Right to copy 32120A with/without sublicense	3,500
32120DA	HPWord Word Processing GERMAN	5,000
32120DR/M	Right to copy 32120DA with/without sublicense	3,500
32250A	HP DSG/3000 Decision Support Graphics	6,300
32250R/M	Right to copy 32250A with/without sublicense	4,400
36570A	HPDeskmanager Electronic Mail System	10,000
36570R/M	Right to copy 36570A with/without sublicense	7,000
36570DA	HPDeskmanager Electronic Mail System GERMAN	10,000
36570DR/M	Right to copy 36570DA with/without sublicense	7,000
36576A	HPSlate Screen Based Word Processing	3,000
36576R/M	Right to copy 36576A with/without sublicense	2,100
36576DA	HPSlate Screen Based Word Processing GERMAN	3,000
36576DR/M	Right to copy 36576A with/without sublicense	2,100
36578A	TDP/3000 Text & Document Processor	6,300
36578R/M	Right to copy 36578A with/without sublicense	4,400
36580A	IFS/3000 Interactive Formatting System	2,500
36580R/M	Right to copy 36580A with/without sublicense	1,750
36581A	IDS/3000 Interactive Design System	4,000
36581R/M	Right to copy 36581A with/without sublicense	2,800
36583A	HP 2680 Graphics Package	6,000
36583R/M	Right to copy 36583A with/without sublicense	4,200
36584A	HP Printer Support Package	10,000
36584R/M	Right to copy 36584A with/without sublicense	7,000

MANUFACTURING APPLICATIONS SOFTWARE

32904A	Materials Management/3000 Model 10	12,000
32904R/M	Right to copy 32904A with/without sublicense	8,400
32903A	Materials Management/3000 Model 20	21,000
32903R/M	Right to copy 32903A with/without sublicense	14,700
32916A	Materials Management/3000 Model 30	36,000
32916R/M	Right to copy 32916A with/without sublicense	25,200
32260A	Materials Management/3000 Model 25	31,500
32260R/M	Right to copy 32260A with/without sublicense	22,050
32910A	Materials Management/3000 Model 10/20 Upgrade	13,000
32910R/M	Right to copy 32910A with/without sublicense	9,100
32905A	Material Requirements Planning/3000	9,000
32905R/M	Right to copy 32905A with/without sublicense	6,300
32906A	Master Production Scheduling/3000	7,000
32906R/M	Right to copy 32906A with/without sublicense	4,900
32907A	Standard Product Costing/3000	4,000
32907R/M	Right to copy 32907A with/without sublicense	2,800
32908A	Factory Order Entry/3000	5,000
32908R/M	Right to copy 32908A with/without sublicense	3,500
32917A	Factory Order Entry/3000 for existing customers	4,500
32917R/M	Right to copy 32917A with/without sublicense	3,150
32909A	Lot Control and Traceability/3000	20,000
32909R/M	Right to copy 32909A with/without sublicense	14,000
32912A	Production Management/3000 Model 10	14,500
32912R/M	Right to copy 32912A with/without sublicense	10,150
32911A	Production Management/3000 Model 20	24,500
32911R/M	Right to copy 32911A with/without sublicense	17,500
32270A	Production Management/3000 Model 30	31,500
32270R/M	Right to copy 32270A with/without sublicense	22,050
32914A	Production Management/3000 Model 10/20 Upgrade	15,000
32914R/M	Right to copy 32914A with/without sublicense	10,500
32913A	Capacity Requirements Planning/3000	15,000
32913R/M	Right to copy 32913A with/without sublicense	10,500

FINANCIAL SYSTEMS APPLICATION SOFTWARE

32285A	General Ledger/3000	7,000
32285R/M	Right to copy 32285A with/without sublicense	4,900
32286A	Accounts Payable/3000	7,000
32286R/M	Right to copy 32286A with/without sublicense	4,900
32287A	Accounts Receivable/3000	7,000
32287R/M	Right to copy 32287A with/without sublicense	4,900
32292A	General Ledger/3000 Source code*	3,000
32293A	Accounts Payable/3000 Source code*	3,000
32294A	Accounts Receivable/3000 Source code*	3,000
32305A	HP General Ledger	6,000
32305R/M	Right to copy 32305A with/without sublicense	4,200
32306A	HP Dual Ledger	6,000

*Requires concurrent purchase of object code.

Hewlett-Packard 3000 Series

		Price
32306R/M	Right to copy 32306A with/without sublicense	4,200
32307A	HP Allocator	4,000
32307R/M	Right to copy 32307A with/without sublicense	2,800
32308A	HP Accounts Payable	6,000
32308R/M	Right to copy 32308A with/without sublicense	4,200
32309A	HP Accounts Receivable	6,000
32309R/M	Right to copy 32309A with/without sublicense	4,200
32310A	HP Report Facility	5,000
32310R/M	Right to copy 32310A with/without sublicense	3,500
32311A	HP Interface Facility	5,000
32311R/M	Right to copy 32311A with/without sublicense	3,500
32312A	HP General Accounting	10,000
32312R/M	Right to copy 32312A with/without sublicense	7,000

DISTRIBUTION SOFTWARE

36401A	SFD/3000 System for Distributors	37,200
36401M	Right to copy 36401A without sublicense	26,040
36415A	OM/3000 Order Management	24,200
36215M	Right to copy 36415A without sublicense	16,940

ADDITIONAL APPLICATIONS SOFTWARE

32180A	APS/3000 Application Program Sampler	2,500
32108R/M	Right to copy 32180A with/without sublicense	1,250
32199A	Flexible Disk copy/3000	685
32199R	Right to copy 32199A	342
32205B	Scientific Library	410
32205R/M	Right to copy 32205B with/without sublicense	200
32238A	OPT/3000 On-line performance tool	6,400
32238M	Right to copy 32238A without sublicense	3,200
32900B	SIS/3000 Student Information System	3,780
32900R	Right to copy 32900B	2,650
32902A	CIS/3000 College Information System	6,300
32902R	Right to copy 32902A	4,400 ■