Hewlett-Packard HP 3000 Series

MANAGEMENT SUMMARY

UPDATE: *Hewlett-Packard has significantly enhanced and expanded the capabilities of its HP 3000 Series in the past year. Most important was the introduction of its Precision Architecture systems, the Series 930 and 950. In addition, all models except the Series 58 have been replaced. The Series 37, 39, and 42 have been replaced with new low-end systems, the Micro 3000 and Micro 3000XE. A new mid-range system, the Series 52, was introduced. The Series 68 has been replaced by a new high-end conventional system, the Series 70. In the software area, an extended version of the operating system has been added for support of the Precision Architecture systems, as well as several new systems software packages. In addition, communications capabilities were enhanced.*

Hewlett-Packard is a multisegmented international manufacturer providing both engineering and commercial computer systems, as well as electronic measurement products. The company's total reported revenue earnings for fiscal year 1986 were $7.1 billion. Reported net earnings for its third quarter of fiscal 1986 were up 25 percent over the same quarter in 1985. HP also reported an eight percent increase in total orders from the second to third quarter of 1986. The computer segment of the company, along with peripherals (terminals, printers, disks, and tape drives), accounts for more than half of HP's sales revenues.

Hewlett-Packard introduced the HP 3000 Series in 1970, and has more than 25,000 systems installed today. Holding fifth place in market shares in the mid-range computer systems market, the company has remained quite steady in the share it holds in spite of certain factors. These factors include less intensive marketing efforts than other successful vendors, such as IBM and Digital Equipment Corporation, and no new innovative technologies until the newly introduced Reduced Instruction Set Computers (RISC) systems. The company's market share has only dropped from 6.7 percent in 1981 to 5.6 percent in 1985, according ▷

The Hewlett-Packard 3000 family offers seven processors ranging from the small departmental Micro 3000 up to the high-end Series 950. The 900 Series systems, even though they employ a Reduced Instruction Set Computer (RISC) architecture, are software compatible with the conventional HP 3000 Series systems and also support most of the same peripherals. Offering both interactive and batch processing, and targeted to the commercial marketplace, the HP 3000 systems support office automation, manufacturing, financial, and wholesale distribution applications.

MODELS: Micro 3000, Micro 3000XE, Series 52, Series 58, Series 70, Series 930, and Series 950.
MEMORY: 2MB to 64MB.
DISK CAPACITY: 55MB to 13.7GB.
WORKSTATIONS: 28 to 400.
**PRICE: $12,000 to $185,100 (base system prices).**

CHARACTERISTICS

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

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

DATA FORMATS

BASIC UNIT: 16-bit word or 8-bit byte for Models Micro 3000 through Series 70; 32-bit word for the 900 Series.

FIXED-POINT OPERAND: For the conventional HP 3000 systems, 16-bit operands can be used by logical or ▶
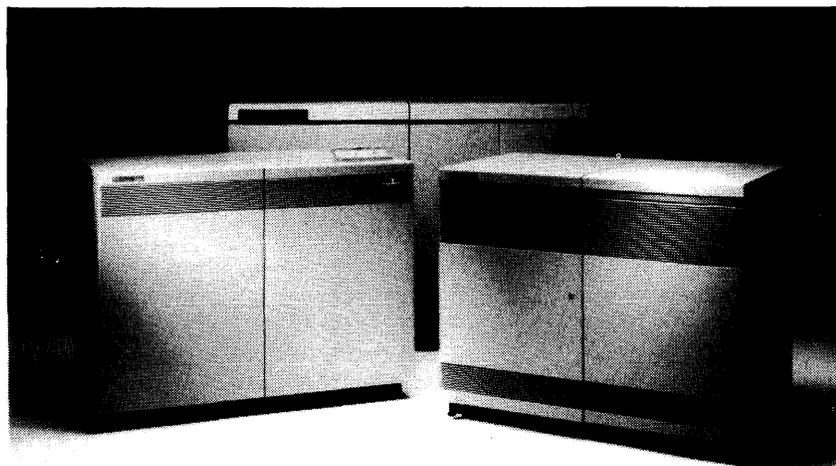
Pictured are the high-performance systems of the HP 3000 Series family. The Series 70 (background) is the high end of the conventional HP 3000 Series and offers a 35 percent performance increase over the Series 68. The Series 930 (right foreground) and the Series 950 (left foreground) are the first of the HP 3000 Series to implement the Reduced Instruction Set Computer (RISC) Precision Architecture.

Hewlett-Packard HP 3000 Series

CHART A. SYSTEM COMPARISON

MODEL	Micro 3000	Micro 3000XE	Series 52	Series 58
SYSTEM CHARACTERISTICS				
Date of introduction	November 1986	November 1986	August 1986	August 1985
Date of first delivery	December 1986	December 1986	September 1986	—
Operating system	MPE-V	MPE-V	MPE-V	MPE-V
Upgradable from	Series 37A	Series 37XE, Micro 3000	Series 39, 40, 42	Series 44, 48
Upgradable to	Micro 3000XE	Not applicable	Not applicable	Not applicable
MIPS	—	—	—	—
Relative performance (based on a rating of the Micro 3000 at 1.0)	1.0	1.5	2.0	2.0 to 2.5
MEMORY				
Minimum capacity, bytes	2M	2M	4M	4M
Maximum capacity, bytes	4M	8M	8M	8M
Type	NMOS III	NMOS III	NMOS	NMOS
Cache memory	None	128KB	32KB	32KB
Cycle time, nanoseconds	113	113	145	145
Bytes fetched per cycle	—	—	—	—
INPUT/OUTPUT CONTROL				
Number of channels	1	up to 3	—	2-5
High-speed buses	1	up to 3	—	—
Low-speed buses	1	up to 3	—	—
MINIMUM DISK STORAGE	81MB	55MB	55MB	55MB
MAXIMUM DISK STORAGE	2.2GB	4.5GB	4.5GB	4.5GB
NUMBER OF WORKSTATIONS	16	56	92	152
COMMUNICATIONS PROTOCOLS	Bisync, HDLC/SDLC, RS-232-C, RS-422, X.25, 2780/3780, HASP, SNA, NS 3000 V, 3270, OSI, AdvanceNet	Bisync, HDLC/SDLC, RS-232-C, RS-422, X.25, 2780/3780, HASP, SNA, NS 3000 V, 3270, OSI, AdvanceNet	Bisync, HDLC/SDLC, RS-232-C, RS-422, X.25, 2780/3780, HASP, SNA, NS 3000 V, 3270, OSI, AdvanceNet	Bisync, HDLC/SDLC, RS-232-C, RS-422, X.25, 2780/3780, HASP, SNA, NS 3000 V, 3270, OSI, AdvanceNet

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

▷ to International Data Corporation of Framingham, MA (IDC). The fact that this decline has not proceeded more quickly can be attributed, in part, to HP's loyal client base.

However, fifth place and slowly declining is not the slot any company wishes to fill. So, to rectify this, Hewlett-Packard has made some very definite and positive moves with the HP 3000 Series, which is targeted to the commercial marketplace, as well as to its scientific and engineering systems (see the HP 9000 Series report, also published in this service). The newly introduced systems and designs should boost HP's market share by allowing it to effectively compete with the "big boys," IBM and Digital Equipment Corporation, in the high end of the mid-range computer market.

Therefore, to reverse falling revenues, and to become more competitive, HP is pursuing new technologies as replacements for its older ones; RISC architecture is the primary new technology. This has led to HP's most significant announcement, the introduction of the HP 930 and 950 Series, HP's Precision Architecture systems, which embody and extend the RISC principles. These systems will add a higher level of performance to the HP 3000 Series, allowing the series to be more competitive in today's market. This system design is to be HP's architecture up through the 1990s, even though HP will continue to expand and market the conventional HP 3000 Series, which include the Micro 3000 up through the Series 70. The development of the ▷

▶ 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 twos complement format. Also provided is 28-bit packed decimal arithmetic in hardware.

On the 900 Series systems, 16-bit halfwords and 32-bit words can represent either signed or unsigned integers, with signed quantities using bit zero (most significant bit) as the sign bit.

FLOATING-POINT OPERAND: The conventional HP 3000 systems include 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.

The HP 900 Series supports binary floating-point representation that conforms to the ANSI/IEEE 754-1985 standard. Single-precision (32-bit quantity: 1 sign bit, 8-bit biased exponent, 23-bit fraction), and double-precision (64-bit quantity: 1 sign bit, 11-bit exponent, 52-bit fraction) floating-point formats are supported.

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

The 900 Series instruction set supports a total of 140 machine instructions. All instructions are fixed-format, fixed-length, 32-bit quantities. ▶

Hewlett-Packard HP 3000 Series

CHART A. SYSTEM COMPARISON (Continued)

MODEL	Series 70	Series 930	Series 950
SYSTEM CHARACTERISTICS			
Date of introduction	February 1986	February 1986	February 1986
Date of first delivery	April 1986	Mid-1987	Late 1987
Operating system	MPE-V	MPE-XL	MPE-XL
Upgradable from	Series 64, 68	Not applicable	Series 930
Upgradable to	Not applicable	Series 950	Not applicable
MIPS	1.6	4.5	6.7
Relative performance	6.0	10	15
(based on a rating of			
the Micro 3000 at 1.0)			
MEMORY			
Minimum capacity, bytes	8M	16M	—
Maximum capacity, bytes	16M	24M	64M
Type	NMOS	NMOS	NMOS
Cache memory	128KB	128KB	—
Cycle time, nanoseconds	134	—	—
Bytes fetched per cycle	—	—	—
INPUT/OUTPUT CONTROL			
Number of channels	2-15	3	—
High-speed buses	—	—	—
Low-speed buses	—	—	—
MINIMUM DISK STORAGE	55MB	404MB	—
MAXIMUM DISK STORAGE	13.7GB	13.7GB	—
NUMBER OF WORKSTATIONS	400	400	—
COMMUNICATIONS PROTOCOLS	Bisync, HDLC/SDLC, RS-232-C, RS-422, X.25, 2780/3780, HASP, SNA, NS 3000 V, 3270, OSI, AdvanceNet	Bisync, HDLC/SDLC, RS-232-C, RS-422, X.25, 2780/3780, HASP, SNA, NS 3000 V, 3270, OSI, AdvanceNet	Bisync, HDLC/SDLC, RS-232-C, RS-422, X.25, 2780/3780, HASP, SNA, NS 3000 V, 3270, OSI, AdvanceNet

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▷ RISC systems (code-named Spectrum) took place over a five-year period, costing the company over $250 million.

The 900 Series was introduced in February 1986, but problems associated with the system's input/output software have caused HP to extend the projected shipping date of the Series 930 from the end of 1986 to midyear 1987; the Series 950 remains on its original schedule for the second half of 1987. An HP spokesperson said that the I/O problems had no effect on the basic performance of the system, which is meeting or exceeding expectations.

HP claims to have held back on delivery of the Series 900 systems to serve the needs of its current user base. HP does not see the delay as affecting its revenues for 1987. However, it's dangerous for a computer vendor that has already lost market share and that really needs an additional boost to delay shipment of such a significant product. This could cause a loss of credibility both with current users, and most of all, with prospective users, who are the company's future bread-and-butter customers.

The initial interest level in the 900 Series systems was high; by mid-1986, according to IDC, 12 percent of HP 3000 users had already ordered a Series 930 system. But delay of the Series 930 has had to reduce some of the impact the system would have had on the market had it been released on time. The delay could cause long-term marketing efforts to be affected in two ways—the one with the lesser effect is that loyal HP clients may postpone their purchasing decisions until problems are solved; and the one with the greatest long-term effect is that formerly loyal clients with ▷

▶ INTERNAL CODE: ASCII.

MAIN STORAGE

TYPE: NMOS utilizing 64K-bit, 256K-bit, or 1024K-bit RAMs.

The 900 Series supports virtual memory, which is organized as a set of linear regions (spaces), with each space 4GB in length. Spaces are further divided into fixed-length 2KB pages, which can hold either code or data. Space registers hold either 16 bits (for 48-bit addressing) or 32 bits (for 64-bit addressing).

CYCLE TIME: The Micro 3000 and 3000XE have a cycle time of 113 nanoseconds. The Series 52 and 58 include a 32KB cache memory with a 90 to 97 percent hit rate, providing an average read access time of 145 nanoseconds and a write cycle of 800 nanoseconds. The Series 70 includes a 128KB cache memory to provide an average memory access time of 134 nanoseconds. The cycle time of 840 nanoseconds is for an 8-word block. The main memory cycle time for the Series 930 is 375 nanoseconds or greater. The Series 930 cache memory cycle time is 125 nanoseconds.

CAPACITY: Main memory capacities range from a minimum of 2MB to a maximum of 64MB. See Chart A for specific system capacities. The Micro 3000 offers memory upgrades in 2MB increments. The Micro 3000XE offers memory upgrades in 2MB or 4MB increments. The Series 52 and 58 offer memory upgrades in 1MB or 2MB increments. The Series 70, 930, and 950 offer memory upgrades in 1MB or 4MB increments.

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

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CHART B. MASS STORAGE

MODEL	7933H/7935	7936	7937	7957	7958
Type	Removable Pack	Winchester	Winchester	Winchester	Winchester
Controller model	Built-in	Built-in	Built-in	Built-in	Built-in
Drives per subsystem/controller	1	1	1	1	1
Formatted capacity per drive, megabytes	404	307	571	81	130
Number of usable surfaces	13	7	13	5	8
Number of sectors or tracks per surface	92 sectors	123 sectors	123 sectors	63 sectors	63 sectors
Bytes per sector or track	256/sector	256/sector	256/sector	256/sector	256/sector
Average seek time	24 ms	20.5 ms	20.5 ms	29 ms	29 ms
Average rotational/relay time	11.1 ms	8.3 ms	8.3 ms	8.3 ms	8.3 ms
Average access time	35.1 ms	28.8 ms	28.8 ms	37.3 ms	37.3 ms
Data transfer rate	1.2M bps	2.53M bps	2.53M bps	1.25M bps	1.25M bps
Supported by system models	All models	All models	All models	All models	All models
Comments	This is an add-on unit providing 1.2GB of disk storage.				

immediate needs may switch to competitive systems. But it is known that HP has an extremely loyal and satisfied customer base that will not be easily shaken loose. In a survey conducted by IDC of 100 users regarding the delay, only two said they would decrease their commitment to HP. Those customers who wish to remain with HP but have immediate expansion needs can purchase a Series 70 with 80 percent of the purchase price allowed toward a Series 930.

In addition to the high-end 900 Series, HP has also thrown additional power and performance into its conventional systems. The Series 70, the high end of the conventional systems, offers a 20 to 35 percent performance increase over the Series 68 (which it replaces), but is priced 20 percent lower at $150,000 versus $186,100. The HP 3000 Series 52 uses the same processor as the Series 58, and offers a 30 percent performance improvement as well as four times more main memory than the Series 42. The entry-level Micro 3000 CPU performs at a 50 to 60 percent improvement over the Series 37 CPU, with total system level performance similarly improved by up to 35 percent, yet is priced at $12,000, 21 percent lower that the $22,000 price for the Series 37. The HP Micro 3000XE, offering performance comparable to that of the HP 3000 Series 42, costs about 30 percent less, and is expected to save users up to 70 percent on monthly hardware support costs as compared to the Series 42.

COMPETITIVE POSITION

The HP 3000 systems are basically commercial systems, but do offer floating-point processing for compute-intensive mathematical applications. The major marketing efforts for the Series 3000 are made in the areas of office automation, manufacturing, distribution, financial, and administration, offering both batch and interactive processing in an SNA environment. The HP 3000 office automation efforts are centered around the HP Personal Productivity Center, a combination of office software, personal computers, and terminals joined to the HP 3000 systems. This concept merges word processing, data processing, graphics packages, and communications facilities for a total office system.

The low-end HP Micro 3000 and Micro 3000XE office systems offer a lower cost as well as increased performance

STORAGE PROTECTION: The conventional HP 3000 Series systems have upper and lower address boundaries provided by certain registers that define the limits of authorized program access in main memory. The microprogram routinely checks for bounds violations during execution (overlapped with operand fetch) and generates an interrupt if an unauthorized memory access attempt is made. Bounds violations may be classified under program transfer or reference, data reference, and stack overflow or underflow.

The HP 900 Series systems support a multilevel protection scheme. For each storage access, hardware compares protection parameters associated with the page of virtual storage being accessed against the privilege level of the currently executing process to ensure that the process has sufficient authorization to perform that access.

RESERVED STORAGE: On the HP 3000 Series conventional systems, the first 11 main memory locations are reserved for global system pointers used in the firmware implementation of virtual memory and variable-length program segmentation. Following this is a device reference table containing a set of four-word entries (one per controller, maximum of 119 entries on the Micro 3000, Micro 3000XE, Series 52, and Series 58, and maximum of 485 on the Series 70) containing device interrupt vectors and the identity of the drives for each device.

On the Series 930 Precision Architecture system, the first 2KB is reserved for system use.

CACHE MEMORY: Cache memory is supported on four models. The Series 52 and 58 have 32KB of cache memory. The Micro 3000XE, Series 70, and Series 930 have 128KB of cache memory, which is divided into a 64KB instruction cache and a 64KB data cache.

CENTRAL PROCESSOR

GENERAL: The conventional HP 3000 Series processors include a firmware-implemented instruction set; firmware-implemented repetitive functions such as subroutine linkage, string processing, and buffer transfers; firmware-assisted software; bus control clock; and crystal clock dedicated to process execution measurements. The hardware processors consist of an arithmetic logic unit, shifting network, and, on the Micro 3000 and 3000XE and Series 52 and 58, 72 specific-purpose registers, 18 of which are user accessible. The Series 70 CPU also contains 72 specific-purpose registers with 21 of those instructions user accessible.

Auto restart after power failure is standard on all HP 3000 Series systems. When the line voltage falls below 90 percent, a power-fail warning is issued. All register contents are moved to memory, system activities are completed, and the system shuts itself down. All models include a rechargeable

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CHART C. WORKSTATIONS

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

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

over their predecessors and will strengthen HP's position in the office market. The Micro 3000 systems are targeted to small offices and companies that have four to 16 users, while the Micro 3000XE systems are aimed at departments, large branch offices, and businesses with eight to 56 users. These systems are very much needed to help HP in combating its most intense competitors in these environments—the IBM System/36, the Data General Eclipse MV/2000 DC and MV/7800 DC, and the Wang VS 65 and VS 7110.

An entry-level, four-user HP Micro 3000 system with 2MB of memory, 81MB of disk storage, four terminals, a cartridge tape drive, and operating system and utilities costs $25,750. This is approximately 10 percent less than a Data General MV/2000 DC with the same features—a savings of around $670 per user. The monthly maintenance cost for the HP Micro 3000 is also lower, at $34 versus $85.

The HP 3000 mid-range Series 52 and 58 systems will do battle with competitors such as the high-end IBM System/36, the IBM System/38 Models 300 and 400, the Wang VS 7110, and Data General's MV/7800 DC and MV/7800 systems. The Series 70, the high end of the conventional HP 3000 systems, competes basically with the same companies, but with systems offering more capabilities, such as the IBM 9370, 4381, and System/38 Model 700; the Wang VS 300 and VS 7310; and Data General's MV/10000.

The Series 930 is designed for use as a dedicated standalone system in a smaller company, or as a major node or central distributed network computer in a large company. It is HP's answer to user demands for a higher performance system at a more competitive price.

The Series 900 systems, for the first time, allow HP to offer a system competitive with the Digital Equipment and IBM higher end minicomputer systems. Competing specifically with the Digital Equipment Corporation VAX 8550 and the IBM 4381-13, the Series 930 offers a MIPS rate of 4.5 at an approximate cost of $53,000 per MIPS. This compares with the 6.4 MIPS on the VAX 8550 at an approximate cost of $68,300 per MIPS, and the approximately 3.8 MIPS on

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 Micro 3000 and Micro 3000XE CPU is largely contained on a single NMOS III Very Large Scale Integration (VLSI) chip, operating with an 18MHz internal clock and a 9MHz microinstruction rate.

The Series 52 and 58 feature a Hewlett-Packard-designed, microcoded, 16-bit processor using Schottky TTL technology. Each system is based on a modular design to allow independent elements to be interconnected through a central system bus structure. The independent elements consist of a CPU that controls memory via a memory controller, general I/O channels, Asynchronous Data Communications Controllers, and the bus system to allow communication among the I/O devices. The system also includes a console and a Control and Maintenance Processor (CMP).

The Series 70 CPU is an HP-designed, microcoded processor using high-speed Emitter Coupled Logic (ECL) technology and a dual arithmetic logic unit (ALU). This model provides a performance level of 1.7 MIPS. The modular Series 70 includes the following components: CPU with dual ALUs, cache memory, main memory, Writable Control Store, I/O Adapters, General I/O channels, and Advanced Terminal Processors. Communications between modules is accomplished using a high-speed Central System Bus and up to three Intermodule Buses. The Series 70 also includes a system display panel and a Diagnostic Control Unit (DCU).

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

The Series 930 and 950 systems, termed HP's Precision Architecture, are Reduced Instruction Set Computers (RISCs) that execute machine instructions directly in hardware in a single CPU cycle without the use of a microcoded control store. Translation Lookaside Buffers (TLB) are provided in hardware for performing translations from virtual addresses to actual physical memory locations. The 900 Series CPUs support a delayed-branch capability,

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CHART D. PRINTERS

MODEL	2563A	2564B	2565A	2566A	2567B
Type	Dot matrix	Dot matrix	Dot matrix	Dot matrix	Dot matrix
Speed	300 lpm	600 lpm	600 lpm	900 lpm	1200 lpm
Bidirectional printing	—	—	—	—	—
Paper size	Up to 16"	3" to 16.7"	3" to 18"	3" to 18"	3" to 18"
Character formation	Varies	5 x 7 dot matrix	5 x 7 dot matrix	5 x 7 dot matrix	5 x 7 dot matrix
Horizontal character spacing (char./inch)	5/10/16.7	5/10/16.7	5/10/16.7	5/10/16.7	5/10/12/13.3/15/16.7
Vertical line spacing (char./inch)	6/8	6/8	6/8	6/8	6/8
Character set	182	182	182	182	182
Controller/Interface	RS-232-C, HP-IB	RS-232-C, HP-IB	HP-IB (std.)	HP-IB (std.)	HP-IB (std.)
No. of printers per controller/interface	—	2/Controller	2/Controller	2/Controller	2/Controller
Printer dimensions, in. (h x w x d)	10.75 x 23.6 x 17.75	23.6 x 17.9 x 39.37	43.3 x 38.7 x 25.0	43.3 x 38.7 x 25.0	43.3 x 38.7 x 25.0
Graphics capability	Yes	Yes	Yes	Yes	Yes

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

CHART D. PRINTERS (Continued)

MODEL	2603	2680A	2686	2687A	2688A
Type	Letter quality	Laser	Laser	Laser	Laser
Speed	48 cps	45 ppm	8 ppm	12 ppm	12 ppm
Bidirectional printing	Yes	Not applicable	Not applicable	Not applicable	Not applicable
Paper size	Up to 16"	3" x 17"	8½" x 11½"; 8½" x 14"; A4, B5	8½" x 11"	Up to 11"
Character formation	Full formed	1 x 1 to 255 x 255 dpi	300 x 300 dpi	300 x 300 dpi	300 x 300 dpi
Horizontal character spacing (char./inch)	10/12/15	—	10/12/16.6	5/12/15 cpi	—
Vertical line spacing (char./inch)	Up to 12	—	4/6/8/12	6 or 8	—
Character set	188	Varies	182	127	—
Controller/Interface	RS-232-C	—	RS-232-C	RS-232-C	HP-IB (IEE-488)
No. of printers per controller/interface	1	—	—	1	—
Printer dimensions, in. (h x w x d)	5.6 x 21.66 x 13.0	48.0 x 64.5 x 26.4	11.4 x 18.5 x 16.2	11.0 x 20.0 x 19.5	11.0 x 20.0 x 19.5
Graphics capability	No	Yes	Yes	No	Yes

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▷ the IBM 4381-13 at $154,000 per MIPS. Comparing base systems with support of 16 users, the cost per user is approximately $17,000 for the HP Series 930, $27,000 for the VAX 8550, and $39,000 for the IBM 4381-13.

All three systems are designed for compute-intensive applications. However, the VAX 8550 and the IBM 4381 offer more flexibility and expandability than the HP 930. For example, the IBM 4381 family supports an unsurpassed amount of disk storage in its size class, and incorporates System/370 architecture. This provides the large database user with an advantage while communicating with, and downloading from, other System/370 architecture systems, such as the 308X and 3090 mainframes. While the VAX 8550 does not support as much disk storage as the IBM 4381, it does support far more than the Series 930. The IBM 4381-13 also offers additional high-end systems for upgrading, whereas the HP 930 currently offers none until the Series 950 is released. The VAX 8550 also offers its users a choice of a Unix-based operating system.

ADVANTAGES AND RESTRICTIONS

The introduction of the new systems has provided the Series 3000 with increased performance, additional capabilities, and lower costs at all system levels.

The 900 Series specifically has provided the Series 3000 with an additional growth path. The portability of existing ▷

▶ whereby compilers may specify that the next sequential instruction is to be executed while the branch to the target location is performed, thus increasing performance by utilizing a CPU cycle which would otherwise not be used for processing.

The Series 930 processor consists of five printed circuit boards and employs the Schottky TTL technology. One machine instruction is executed with every 125-ns CPU cycle, providing a 4.5 MIPS performance rating. Instruction pipelining on the Series 930 allows up to three instructions to be executed simultaneously. The CPU, memory, and I/O modules are interconnected via the high-speed Central Bus (CTB), a 32-bit-wide data path supporting data transfer rates up to 20MB per second.

The Series 950 CPU delivers 6.7 MIPS of CPU power, and is implemented in HP proprietary NMOS III VLSI. Use of this VLSI technology allows the Series 950 CPU and cache memory to be fully contained on a single printed circuit board.

The floating-point co-processor is available to extend the performance of the Series 930 for compute-intensive applications. The co-processor supports the floating-point operands of the ANSI/IEEE 754-1085 standard. It has twelve 64-bit-wide registers for operands, and three HP proprietary NMOS-III VLSI chips to perform calculations. The floating-point co-processor operates in parallel with the CPU, with the CPU performing integer calculations and other functions while the co-processor performs floating point calculation.

CONTROL STORAGE: The Micro 3000 and Micro 3000XE use 10K 64-bit words; this is called Writable Con- ▶

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CHART D. PRINTERS (Continued)

MODEL	2932A	2933A	2934A
Type	Dot matrix	Dot matrix	Dot matrix
Speed	200 cps	200 cps	40/67/200 cps
Bidirectional printing	—	Yes	—
Paper size	Up to 15.75″	Up to 15.75″	Up to 15.75″
Character formation	9 x 12 dot matrix	9 x 12 dot matrix	9 x 12; 36 x 24 dot matrix
Horizontal character spacing (char./inch)	5/10/16.36	5/10/16.36	5/10/12/16.36
Vertical line spacing (char./inch)	1/2/3/4/6/8/12	Up to 12	1/2/3/4/6/8/12
Character set	96, 128	Varies	96, 128
Controller/Interface	RS-232-C, HP-IB	RS-232-C	RS-232-C, HP-IB
No. of printers per controller/interface	—	—	—
Printer dimensions, in. (h x w x d)	7.25 x 23.85 x 14.37	7.28 x 23.85 x 14.37	7.28 x 23.85 x 14.37
Graphics capability	Yes	Yes	Yes

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

▷ HP software from the conventional HP 3000 systems to the new RISC systems offers the user an effective stepping-stone in a system growth situation. However, the 900 Series runs software in two modes—compatibility and native. The compatibility mode allows conventional HP 3000 Series software to be run on the Series 900 systems without any recompilation. But this is not the best of situations. In order for the Series 900 systems to achieve maximum performance, the software must be run in the native mode, meaning that it must be recompiled. While recompilation of software is not a major nightmare, it is still an additional task that eats up varying amounts of time, depending on the size and number of programs in each application.

The 900 Precision Architecture systems are RISC based, providing a higher performance than that ever achieved by the conventional Series 3000 systems. This high performance is achieved through the implementation of the HP Precision Architecture, which enhances pipelining and eliminates the chip space required for microcode, allowing data to be transferred on chip instead of between components. Memory-hierarchy design is also responsible for improved system performance and allows frequently used instructions and data stored in the central processing unit registers to operate up to eight times faster than main memory. In addition, optimizing compilers generate efficient code, allocate registers, and schedule instruction sequences to maintain efficient pipeline operation.

HP's Precision Architecture has the advantage over the traditional systems by transparently supporting 48-bit virtual addressing, thus providing a virtual address space of 256 trillion bytes. This is over 65,000 times larger than the addressability provided with typical 32-bit systems. Future Precision Architecture implementations will support 64-bit virtual addressing. This virtual memory allows the programmer to use a memory space that is actually many times larger than the physical memory installed in the system. This means the programmer does not have to be concerned about limitations in available memory space.

The Series 930, with reportedly fewer system components, is housed in a compact, two-bay cabinet, and consumes less electrical power and requires a less elaborate cooling sys- ▷

▶ trol Store Random Access Memory (RAM). Bipolar Read Only Memory (ROM) consists of 12K 48-bit words for the Series 52 and 58. The Series 70 utilizes 64K of RAM as its control storage. All of this control storage is utilized and is not directly accessible to the end user. Microinstruction cycle time is 113 nanoseconds for the Micro 3000s and 105 nanoseconds for the Series 52 and 58. The Series 70 micro-instruction cycle time is 75 nanoseconds.

Because the 900 Series systems execute instructions directly in hardware, there is no control store for the Series 930 and 950 systems.

REGISTERS: There are 256 hardware registers on the Micro 3000s; 18 of these registers are addressable by the programmer. There are 72 hardware registers on the Series 52 through 70 models. As in the Micro 3000 models, registers are accessible to the programmer on the Series 52 and 58; 21 registers are available for programmer use on the Series 70. Those dedicated to system use are mostly 16-bit registers. These include the current and next instruction registers; scratch pad, flag, and interrupt registers; I/O registers; memory address and data registers; and firmware address registers. The Series 70 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 900 Series HP 3000 systems feature register-intensive operation, whereby all calculations are performed only between high-speed CPU registers. This type of operation allows for simplified data and control paths and increased processor performance. Both the Series 930 and Series 950 support 32 high-speed, general-purpose registers (each 32bits long), 32 control registers, and eight space registers which point to multiple 4GB virtual address spaces that can be addressed simultaneously. Two CPU registers are used to point to the next instruction to be executed. These are called the Instruction Address Space Register and the Instruction Address Offset Register.

ADDRESSING: On the HP 3000 conventional systems, 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 ▶

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CHART E. MAGNETIC TAPE EQUIPMENT

MODEL	7974A	7978B	9144A	35401A
TYPE	Reel-to-reel	Reel-to-reel	Cartridge	Cartridge w/Auto changer
FORMAT				
Number of tracks	9	9	16	16
Recording density, bits per inch	800/1600	1600/6250	10,000	10,000
Recording mode	PE/NRZI	GCR/PE	MFM	MFM
CHARACTERISTICS				
Controller model	Included	Included	Included	Included
Drives per controller	1	1	1	1
Storage capacity, bytes	20M (NRZI); 40M (PE)	40M (PE); 140M (GCR)	67.1M	504M
Tape speed, inches per second	100	75	60	60
Data transfer rate, units per second	160K bps (streaming); 80K bps (start/stop)	486K bps (GCR); 120K bps (PE)	33K bps	33K bps
Streaming technology	No	Yes	Yes	Yes
Start/stop mode; speed	50 ips	—	—	—
Switch selectable	No	Yes	No	No
Comments	Auto. thread and load			

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

▷ tem than typical systems in its performance class. Because the system has fewer components, the reliability of the system is enhanced.

The performance increase in the HP 3000 systems is attributable to enhancements in the operating system software, and to a cache memory that decreases memory access time. This performance increase is especially important when performing any interactive applications, providing for necessary quick response time. All of the HP 3000 systems, except the Micro 3000, now offer a cache memory; it was previously available only on the Series 58 (32KB) and the Series 68 (8KB). The cache memory of the Series 930, 70, and Micro 3000XE is enlarged to 128KB, with 64KB allotted for an instruction cache and 64KB allotted for a data cache. This allows the Series 930 to double the performance of the Series 68, the Series 70 to boost performance over the Series 68 by 20 to 35 percent, and the Micro 3000XE to double the performance of the Series 37. The Series 52 offers the same cache memory as the Series 58 (32KB), aiding in a performance increase of 30 percent over the Series 42.

HP also offers considerable communications features, allowing the HP 3000 Series to be used with a host mainframe as decentralized systems, as servers for personal computers in a local network environment, and in integrated office environments. These communications features allow HP systems to connect to and communicate with not only other HP systems, but to other vendors' systems, such as IBM's, Digital Equipment Corporation's, and Wang's. The HP systems offer both batch and online processing in the SNA environment, as well as DISOSS compatibility and LU6.2 protocols. X.25 packet switched network features are also supported, as is HP's own local area network, AdvanceNet. HP also provides network services for communications with the Digital Equipment Corporation VAX systems.

The processor design being used for the Micro 3000 and 3000XE is totally new to the Series 3000. This processor is ▷

▶ (including I/O), all word addressing is direct, direct-indexed, indirect, or indirect-indexed.

The Series 930 and 950 both support full 48-bit virtual addressing, representing a significant expansion over typical 32-bit systems. Absolute addressing is also supported. The virtual address space is divided into a set of 65,536 spaces, each of which is 4GB in length. Spaces are further divided into fixed-length 2KB pages. Virtual addresses generated in software are translated into actual physical addresses by Translation Lookaside Buffer hardware. The Series 930 TLB holds 4,096 virtual page translations.

INTERRUPTS: The HP 3000 conventional systems' 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 900 Series systems define 25 interruptions, which are categorized in four groups based on their priorities. CPU control registers provide information for vectoring to appropriate software interrupt handler routines, for saving the current machine state when handling an interrupt, and for restoring machine state after the interruption is handled.

OPERATING ENVIRONMENT: The Micro 3000s are housed in a desk-high unit about the size of a two-drawer file cabinet. The Series 52 is housed in a cabinet about twice the size of the Micro 3000 cabinet. The Series 58 is housed in a desk-style cabinet, and the Series 70 is contained in a larger standalone cabinet. The Series 930 is housed in a compact, two-bay cabinet. Based on a simplified design, the Series 930 system requires less electrical power and a less elaborate cooling system than the more complex computers. The dimensions for each model within the 3000 Series are given below. ▶

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based on the NMOS III chip design (formerly used only on the HP 9000 engineering workstations). This technology, along with the new 1-megabit memory chips, reduces the number of components needed in the system, providing faster data transfer and higher reliability, thus allowing the systems to be priced lower than their predecessors. The single microchip actually replaces the equivalent of 80 devices found on the HP 3000 Series 37 CPU board, and occupies four square inches, compared to the 74 square inches needed by the Series 37 CPU.

While all Series 3000 systems are software compatible, they are limited in their hardware upgradability. The only currently marketed system that can be upgraded by the switching of boards is the Series 930 to the Series 950. However, the current systems can be hardware upgraded from their outmoded predecessors by board switching (please refer to Chart A for specific upgradability information).

USER REACTION

The Datapro 1986 Computer Users Survey received responses from 283 HP 3000 users. At the time the survey was taken, the average age of the systems was 40 months. Only 10 percent of the systems were used as departmental systems, while 88 percent were used as organizational systems.

Of the 283 respondents, 128 said their systems supported from 1MB to 4MB of main memory, 117 said their systems supported 4MB to 8MB, 21 users said from 8MB to 16MB, 11 users said from 512KB to 1MB, and two users each said their systems supported from 16MB to 32MB and 256KB to 512KB.

The majority of users worked with medium to large disk storage systems, with 117 respondents indicating that their systems were supporting between 1.2GB and 4.8GB of disk; 85 users had systems with 600MB to 1.2GB of storage; and 55 users said their systems supported from 100MB to 600MB. The remaining users configured their systems as follows: eight had from 4.8GB to 10GB; eight users worked with 10MB to 50MB; four users indicated that the system worked with 50MB to 100MB; and two users had less than 10MB of disk storage.

The number of workstations configured with these HP 3000 systems varied for both the local and remote installations. The highest number of respondents (32 percent) said that between 31 and 60 workstations were installed locally; 27 percent answered with a range of 16 to 30 workstations; 12 percent installed between 6 and 15 local workstations; 25 percent had over 60; and 3 percent had between 1 and 5. In regard to remote workstations, 29 percent of the users had installed between 1 and 5 workstations; 24 percent had 6 to 15; 16 percent had 16 to 30; 9 percent had between 31 and 60; and 6 percent had over 60. Fifteen percent of the users did not have any remote workstations installed.

Citing principal applications, 77 percent of the respondents used their systems for accounting, 54 percent for payroll ▷

Model	Micro 3000s	52	58	70	930/ 950
Height (inches)	29.0	40.0	28.5	48	39
Width (inches)	15.0	24.0	72.25	69	46.8
Depth (inches)	28.5	22.4	31.25	26	31.2
Weight (pounds)	73	190	240	1,200	700

The electrical requirements for the HP 3000 Series are shown in the following chart.

Model	Micro 3000s	52	58	70	930/ 950
Line V	100-240	120-220	210-220	200-380	200-240
Hz	48-66	50/60	50/60	50/60	—
Line current (A)	—	4.5-8.5	12.4-13.1	13-24	—
Heat Dissipation Btu/hr)	—	3000	7350	12,000	7300

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

INPUT/OUTPUT CONTROL

A Synchronous Intermodule Bus (SIMB) is included with the Micro 3000 and Micro 3000XE to handle communications. The Series 52 and 58 utilize an Intermodule Bus (IMB) to handle communications among the CPU, memory, and I/O modules. The CPU on the Series 52 and 58 generates over 90 percent of the bus activity and has continuous access to the bus. The CPU relinquishes control to the I/O channels only on request. The SIMB and IMB have separate address and data paths, each with handshake controls operating in a master/slave mode to transfer data. Any channel request will cause the CPU to relinquish control of the SIMB or IMB so the request can be serviced.

The Series 70 Central System Bus (CSB) is the communications link among the CPU module, the main memory module, and the I/O adapter modules. The CSB has a 56 megabyte-per-second overall bandwidth to allow support of multiple IMBs. No module has implied control of the CSB; each operates independently except when it is necessary to transfer data or send commands. The initiating module asks for and receives control of the CSB. All transfers to and from memory are in eight-word blocks.

The I/O adapter modules (IOA) are interfaces between the Central System Bus and the Intermodule Busses to allow communications among the I/O system, main memory, and the CPU. Up to three Intermodule Busses are supported on the Series 70. The IOA synchronizes the slow speeds of the IMB to the Central System Bus. A 1024-byte buffer cache memory is included in each IOA to handle communications between the 16-bit IMB and the 32-bit CSB. To devices on the IMB, the IOA appears as memory responding to IMB requests generated by I/O controllers.

The Micro 3000XE uses a Peripheral Interface Channel (PIC) to communicate with peripheral devices. The Micro 3000 includes this circuitry on the CPU board. The ▶

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▷ and personnel, 53 percent for order processing/inventory, 47 percent for purchasing, 34 percent for sales/distribution, 35 percent for manufacturing, 19 percent for education, 9 percent for engineering/scientific, 7 percent for mathematics/statistics, and 7 percent for health care.

When asked if the system did what it was expected to do, 94 percent of the users stated that it did, 3 percent said it did not, and 3 percent of the respondents were undecided. To the question, "Would you recommend this system to another user?", 94 percent said they would, 2 percent said they would not, and 4 percent said they were undecided.

The respondents rated the HP 3000 as follows:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	191	85	5	2	3.6
Reliability of system	218	60	2	1	3.7
Reliability of peripherals	186	85	8	2	3.6
Maintenance service:					
Responsiveness	180	89	11	2	3.6
Effectiveness	179	90	9	2	3.6
Technical support:					
Troubleshooting	123	122	33	2	3.3
Education	89	152	36	3	3.2
Documentation	61	142	69	7	2.9
Manufacturers software:					
Operating system	166	106	8	1	3.6
Compiler & assemblers	118	143	10	1	3.4
Application programs	49	137	40	6	3.0
Ease of programming	106	141	21	3	3.3
Ease of conversion	112	115	29	3	3.3
Overall satisfaction	144	122	13	0	3.5

*Weighted Average on a scale of 4.0 for Excellent.

Four users were contacted by telephone during January 1987. To present a more significant system review, we talked to users who were from different parts of the United States and used a different model of the HP 3000.

The first user we spoke to is with a manufacturing firm on the West Coast. The firm has an HP 3000 Series 68 installed, supporting 90 local workstations, six remote workstations, 7MB of memory, and 1.6GB of disk storage. The system is used in a manufacturing environment to run a comprehensive set of applications, including accounting/billing, order processing/inventory control, payroll/personnel, purchasing, bill of materials, scheduling, data collection, and MRP.

The company converted from an IBM 370 to the Series 68 in mid-1983 for a variety of reasons. In the first place, the user said the HP Series 68 was lower in cost—not just in initial purchase cost, but also in long-term overhead. He said the personnel cost alone was cut in half; the system is much easier to use than the IBM system, resulting in only half of the personnel required. Another reason given for converting was that the Series 68 offered manufacturing software with the type of functionality the user's company required. Even though this meant purchasing new software (to replace that from the System 370), the company was willing to do so to obtain this functionality. The user also stated that the IBM 370 was a batch system, whereas the HP system supported online applications with a good ▷

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

The Series 930 has a two-tier bus structure; the Central Bus (CTB) is the higher level bus, and the Channel I/O Buses (CIB) are the lower level buses. Channel I/O Adapters interface the two bus levels.

The CTB provides communications between the CPU, the main memory, and the channel I/O adapters. It provides a 32-bit-wide data path, runs synchronously with an 8MHz clock, and has a data transfer rate of 20MB per second. The CTB consists of 56 lines—36 time-multiplexed, bidirectional lines for addresses and data (including parity), one clock line, and 19 lines for status and control information.

The Channel I/O Adapters provide the interface between the CTB and the CIB, serving as a channel multiplexer providing full direct memory access for all HP-IB and LAN I/O channels, and synchronizing the differing speeds and bandwidths of the CTBs and CIBs. The Series 930 includes two Channel I/O Adapters as standard; a third one is optional.

Up to three Channel I/O Buses are supported on the Series 930. Each CIB provides a 16-bit-wide, bidirectional data path, which runs synchronously with a 250-nanosecond clock. The 40 lines in each CIB include 16 for data, four for channel address, and 20 for status and control. Data is transferred in bursts ranging from 2 to 32 bytes in length. Each CIB can provide a sustained data throughput rate of up to 5MB per second.

Peripheral devices on the Series 930 (disks, tapes, and printers) are interfaced to the system via the HP-IB. Up to six peripheral devices can be connected to a single HP-IB on the Series 930. An HP-IB channel consists of an HP-IB cable connected to an HP-IB interface card. The interface card is connected to the system's backplane and performs protocol translation between the CPU and HP-IB. It is an 8-bit-wide, asynchronous bus with eight data lines and eight control lines. HP-IB is HP's implementation of the IEEE standard 488-1975 interface.

Workstations (terminals and personal computers) are interfaced to the system via an IEEE standard 802.3 local area network. Each LAN cable is connected to a LAN interface card on the system's backplane. Workstations are attached to the LAN via HP's Distributed Terminal Controller. Individual workstation-to-system data transfer rates can be up to 19.2KB per second. The maximum data transfer rate over the LAN is 10M bps per second. (HP's AdvanceNet LAN is further described in the COMMUNICATIONS section of this report.)

CONFIGURATION RULES

GENERAL: As is true with most minicomputers, the complement of peripheral equipment for HP 3000 systems is restricted only by the number of slots available in the CPU chassis or its extensions, by software restrictions, and by controller limitations. Disk drives, tape drives, and system printers attach to the system through the General I/O Channel or Peripheral Interface Channel via the HP-IB. Serial printers, workstations, and personal computers (which can be used as terminals) are connected to the system via HP's Advanced Terminal Processors (ATPs) for the conventional 3000 systems, and via the Distributed Termi- ▶

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▷ response time. He also felt the HP system was much more reliable than the IBM 370.

When asked what problems or disadvantages he had found with the Series 68, he said that company officials were previously somewhat worried about what expansion the Series 68 offered, but that this was not a concern since Hewlett-Packard had introduced the Series 900 RISC systems. The delivery delay of the Series 930 does not affect this user, because he feels his company will not need to upgrade for some time yet. He also said he expects the upgrade and conversion to run smoothly at that time.

The second user represented a midwest manufacturing firm using the system for manufacturing functions that include inventory control, MRP, and shop floor control, as well as for order processing, inventory control, purchasing, sales and distribution, and payroll and personnel. This company just upgraded its HP Series 68 to the Series 70 in October 1985; the Series 70 supports 90 local workstations, nine remote workstations, over 3GB of disk storage, and 9MB of memory.

This user said his company was originally a Honeywell shop, but converted to the HP system because the Honeywell software was no longer supported. The Honeywell system also only provided a batch environment and his company required an online environment. He stated that Honeywell left "a bad taste in the mouth" and, therefore, was not even asked to bid when his company decided to convert. This user's company did look at both IBM and Digital Equipment systems when converting, but, like the first user, said that HP's price was better than IBM's. The second user also said the ease of use for the HP system was fantastic, and had his company gone with IBM, it would have needed a much larger support staff. In addition, he said the HP systems provided an easy upgrade growth path—HP upgraded the Series 68 to the Series 70 by simply adding boards. The user also listed reliability as a system advantage, with both hardware and software doing precisely what they were reported to do. When asked about applications software, the user said he had no problem getting the software he needed, and that it was extremely easy to use. The user added that HP provided good and knowledgeable support in his area of the country.

This user feels the delay of the Series 930 does not pose any problems for his company, because the company will not be ready for that upgrade for about two more years.

The third user was a systems manager for a finance corporation located in the Northeast. He is also on the Board of Directors of a local chapter of the HP Users Group, and says he hears very few complaints from the other users within the group. This user's company owns an HP Series 48, supporting 30 local workstations, 28 remote workstations, 4MB of memory, and 524MB of disk storage. The company's applications are a little different than most financial institutions'. While supporting accounting and general ledger applications, the company's most significant application revolves around a daily report that monitors ▷

▶ nal Controllers (DTCs) for the HP 900 Series. Modem, RS-232-C, and RS-422 interfaces are available for these workstation products.

WORKSTATIONS: A maximum of 16 workstations can be attached to a Micro 3000 configured with 0 multipoint, and up to 56 can be configured on the 3000XE. Up to 92 terminals may be configured on each Series 52 system and up to 60 of these may be point-to-point terminals; all may operate at 19.2K bps. The Series 58 increases the maximum number of terminals to 152, and 120 of those units may operate in a point-to-point environment. The Series 70 is physically capable of configuring up to 336 point-to-point terminals or a total of 400 point-to-point and multipoint terminals. Up to 400 workstations may be simultaneously active on the Series 930.

DISK STORAGE: The Micro 3000 houses up to 260MB of hard disk storage. The total capacity can be expanded to 2.2GB through the addition of external 307MB and 571MB disk drives. The Micro 3000XE and Series 52 do not include any prepackaged disk units as part of the basic configuration, but do support a maximum of eight disk drives for a total storage capacity of 4.5GB. The Series 58 and 70 increase the number of disk drives supported per system to 16 and 24, respectively, allowing a total capacity of 4.5GB on the Series 58 and 9.7GB on the Series 70. The Series 930 supports the 7933H and 7935H disk drives, each with a 404MB capacity; up to 24 can be attached, providing for a total storage capacity of 13.7GB.

MAGNETIC TAPE UNITS: The Micro 3000 system houses either one or two 67MB cartridge tape drive(s) or a tape auto changer drive. The Series 52 can have a maximum of four tape drives. The Series 58, 70, and 930 each handle up to eight magnetic tape drives.

PRINTERS: Up to two printers are supported on the Micro 3000; up to four are supported on the Micro 3000XE, Series 52, and Series 58; and up to eight on the Series 70. Each conventional HP 3000 system also supports a maximum of two intelligent page printers.

Up to 12 printers are supported on the Series 930, including up to eight line printers (600 or 900 lpm) or four intelligent page printers.

MASS STORAGE

See CHART B for information on mass storage devices.

INPUT/OUTPUT UNITS

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

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

COMMUNICATIONS CONTROL

GENERAL: The maximum synchronous communications lines supported for each of the HP 3000 Series are as follows: Micro 3000—one line; Micro 3000XE and Series 52—three lines; Series 58—seven lines; and Series 70—24 lines. Each HP 3000 also supports one local area network. Communications servers for the Series 930 are available for supporting up to seven remote data communications lines. An IEEE 802.3 LAN link is utilized for local communications.

All data communications of the HP 3000 Series are conducted through HP's communications network, *HP AdvanceNet.* ▶

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▷ and provides updated status on the clients' financial situation.

This user said the HP Series 48 was purchased on the recommendation of his company's third-party software supplier. He is extremely happy with all aspects of the HP system, including the hardware, hardware support, and the way the third-party software fits to the system. The system must be up and running from 8 a.m. to 6 p.m. for client use, and he feels the system is very reliable, providing a 99 percent uptime success rate. This user feels Hewlett-Packard provides his company with an adequate upgrade path. There is the possibility his company may upgrade to a Series 58 in the near future, but would consider the benefits of upgrading to the Series 70 instead for long-term needs.

The fourth and final user we talked to represented a retail/wholesale firm located in the Northeast. The company sells water treatment chemicals and services and uses engineering/scientific software in the laboratory to track water samples, employing mathematical functions to ensure that the chemicals are of the proper proportions. In addition, the system supports graphics, word processing, accounting/billing, order processing, purchasing, and sales applications. Up to 50 local and seven remote workstations are supported, as well as 7MB of memory and 1.2GB of disk storage.

This company previously had an IBM System/34 and considered upgrading to a System/38. However, the company was running Fortran and the System/38, at the time the purchase decision was made (1984), did not support Fortran. The company also considered an IBM 4381, but at that time, would have had to add on a Series/1 front-end processor for its word processing and graphics applications. In addition, the user said that IBM showed little interest in demonstrating the 4381 because his company was a small account at the tail end of the salesperson's territory. The user also liked the HP instructor-led training courses versus the self-support training supplied by IBM.

The Digital Equipment VAX-11 systems were also a consideration during the purchasing decision, but the user said his company did not feel the VAX system would support nontechnical areas as well as the HP 3000 Series.

This user listed versatility as the HP Series 58's principal advantage; it performs word processing, graphics, inventory control, and engineering functions simultaneously. He said he is very pleased with the engineering job the system does. He also stated the Series 58 is very responsive as well as very reliable, with less than two hours' unscheduled downtime in two years.

The system problems this user mentioned related back to when the system was first purchased. He said there were problems in establishing a conversion method from the IBM to the HP; however, although difficult, it was not impossible. The problem stemmed from HP's having a young engineering force at the time of purchase that didn't know Fortran and RPG. The user feels HP has tried to ▷

▶ AdvanceNet is based on the seven layer Open Systems Interconnect (OSI) model of the International Standards Organization (ISO). This network consists of HP's data communications networking products that tie together everything from personal computers to mainframes. The data communications structure requires two products—a Network Link and a Network Service—to establish a networking connection. The *Network Service* provides the entire user interface to the network. The Network Service products are composed entirely of software; they provide the user interface for accomplishing batch job submittals, file transfers, virtual terminal access, or whatever services are available.

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

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

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

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

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

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

▷ remedy this situation since then. Another disadvantage he mentioned is that of poor documentation.

This user's only expansion plans for the near future include the upgrade of the disk drives. In discussing the new RISC systems, he said he was "cautiously optimistic" and felt the concept was well thought out. However, he was not going to rush out and buy the first release.

When each of the four users interviewed above was asked to list the disadvantages of his or her HP Series 3000 systems, the first three stated they could not list any; the fourth could only list start-up problems. The durability and the reliability of the systems seem to be the saving grace of the HP 3000 Series. □

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

The *HP X.25 Private Packet Network* includes a family of switching nodes comprised of three basic models: eight ports, 24 ports, and a large node that can accommodate several hundred ports. The system is designed to carry communications between HP and multivendor systems and networks.

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

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

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

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

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

The *LAN/3000 Link* and *LAN3000/XL Link* contain the hardware and software required to connect an HP 3000 system to an IEEE 802.3 coaxial cable. The LAN/3000 Link is supported by all systems from the Micro 3000 up through the Series 70, and the LAN3000/XL Link is supported by the HP 900 Series. The system provides programmatic access to network communications through a set of network interprocess communications calls. The 3000 Link consists of three major hardware components: the Local Area Network Interface Controller (LANIC), the Attachment Unit Interface (AUI) Cable, and the Medium Attachment Unit (MAU).

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

The Series 930 and 950 LANIC card is on the system backplane. Only one LANIC card is needed to support all workstation communication.

The *Distributed Terminal Controller (DTC)* for the 900 Series systems is an intelligent controller with microprocessors to handle workstation connection preprocessing, and another microprocessor to handle communications with the system. The DTC is compatible with the ATP used on the other HP 3000 systems. Each DTC can support up to 48 local workstations or 36 modem connections, or a combination of both. The DTC works in conjunction with the Asynchronous Serial Communications software, providing a data transfer rate of up to 19.2K bps, byte packing and unpacking, character and block mode support, and message-based operation that optimizes response time for block mode applications. The DTC also provides remote online diagnostics and a comprehensive configuration program.

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

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

• 16-bit microprocessor and LSI circuitry

• Data communications protocols handling   ▶

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➤ • Character handling and buffer storage capabilities

• Built-in diagnostics and self-test

• Online diagnostics running under the MPE operating system

• Collection of data volume and error statistics

• Battery backup to prevent loss of buffered data during a power failure

• Bisync and HDLC/SDLC protocol compatibility

• EIA RS-232-C, RS-422, CCITT V.24, and V.35 interfacing standards

• Compatibility with HP and common Telco/PTT modems in full- and half-duplex modes

• Support of auto-dial capability

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

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

The *HP 2334A Plus X.25 Statistical Multiplexer* can be used over analog or digital leased line, dial-up line, or X.25 Packet Switched Network (PSN). It uses a four-port interface that supports full-duplex, asynchronous RS-232-C, CCITT V.24/V.28 point-to-point connection at speeds ranging from 110 bps to 9600 bps. Up to four interfaces (direct connect and/or modem control) can be installed in the same HP 2334A, allowing up to 16 connections. These connections can be between the HP 2334A and remote workstations (terminals, personal computers, printers, plotters), or HP 2334A and host computer ports. The HP 2334A can be configured as an X.25 statistical multiplexer or as an X.25 cluster controller and is connected to the remote HP 3000 systems via the X.25 Link.

The *Advanced Terminal Processor (ATP)* is designed to interface asynchronous workstations to the HP 3000 Series 39, 42, 48, 58, and 68 systems in a point-to-point configuration. Interfaces are available to allow workstations to be connected either directly or through full-duplex modems. The ATP is an intelligent workstation controller which off-loads character processing from the HP 3000 CPU by transferring data directly to and from the HP 3000's memory. It allows workstations to transmit and receive in either character or block mode.

Five products are included in the ATP structure: System Interface Board (SIB); Direct Connect Port Controller;

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

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

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

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

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

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

The *Advanced Terminal Processor for the Micro 3000 (ATP/M)* is a communication interface board providing connection of up to eight asynchronous workstations to the system in a point-to-point local or remote configuration. ATP/M supports personal computers, terminals, and workstation printers available from HP.

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

• Seven direct connect HP type 232 ports plus one remote port for connection to an asynchronous full-duplex modem

• Four direct connect RS-232-C ports plus four remote ports for connection to asynchronous full-duplex modems ➤

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▶ • Seven direct connect HP type 422 ports plus one remote port for connection to an asynchronous full-duplex modem

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

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

The *Asynchronous Data Communications Controller (ADCC)* is used in the Series 52 and 58 to provide direct connect and modem connections for terminals. One ADCC is required to connect the system console. Data is transferred from memory to the ADCC in parallel form and then is converted to a serial bit stream for transmission over RS-232-C lines.

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

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

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

The *Distributed Network Design System* generates X.25 network implementation from the HP Vectra PC or IBM PCs.

The *Multipoint Network Design System* generates optimized terminal-to-computer connections from HP Vectra PC or IBM PCs.

Net/One provides high-speed connection of HP work-area subnetworks to a facility-wide broadband network.

Digital Multiplexed Interface (DMI) allows terminals to be connected to an HP 3000 system via a PBX network. DMI connects the HP 3000 to the PBX with a multiplexed RS-232-C interface. The DMI standard was developed by AT&T and uses the North American T1-DS1 transmission standard (1.544M bps) and reflects the new international Integrated Services Digital Networking (ISDN) standards.

HP 37204A Multipoint HP-IB Extender is an enhancement to the HP-IB, linking IEEE 488 devices dispersed throughout the factory or office.

SOFTWARE

OPERATING SYSTEM: The HP 3000 Series supports the Multiprogramming Executive (MPE) operating system, of which there are two versions—the MPE V and the MPE XL. The MPE V operating system is supported on the Micro 3000 up through the Series 70. The MPE XL is supported on the HP 900 Series systems only.

The *Multiprogramming Executive (MPE)* operating system enables the HP 3000 to perform transaction processing, online program development, data communications, and batch processing concurrently. System resources can be accessed simultaneously by multiple users. An online HELP facility guides the user through the MPE command set. MPE monitors and controls program input, compilation, execution, and output; arranges the order in which programs are executed; and dynamically allocates hardware and software resources as required.

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

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

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

Disk Caching, featured with all models except the Series 37, manages retrieval and replacement of disk "domains" in excess main memory. It locates and replaces these disk domains so that a significant portion of the references to disk storage can be resolved before actually having to physically access the disk. Disk Caching policies are integrated ▶

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into the MPE kernel, file system, and I/O system. The operator is able to use external commands to activate and deactivate caching on a disk-by-disk basis and to display general caching statistics.

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

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

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

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

MPE XL, the operating system utilized on the Series 930 and Series 950 processors, provides a superset of MPE V system functionality, while maintaining object code and source code compatibility with MPE V. Programs written for MPE V-based HP 3000s can be run as is on MPE XL-based systems, or can be recompiled using new optimizing compilers for MPE XL systems in order to obtain maximum performance on the 900 Series HP 3000 systems.

MPE XL delivers enhanced performance and system capacity through the exploitation of the 900 Series architecture and advanced software capabilities. File mapping, whereby virtual memory management hardware is used to decrease much of the software overhead associated with I/O operations, significantly increases performance for I/O-intensive commercial processing environments. System capacity is enhanced via support of 48-bit virtual addressing, which provides over 64,000 times the addressability of typical 32-bit systems.

MPE XL increases system availability via a concurrent backup facility, allowing system files to be backed up while still being accessed by users. Availability is also increased via enhanced system resiliency in the event of peripheral and subsystem failures, and via transaction management tools which allow applications developers to build more reliable applications that ensure data integrity and easier recovery in the event of failures.

System management is simplified via a simplified system configuration dialogue and automatic system table expansion when required. System management and ease of use have been further enhanced via a more flexible, powerful command interpreter, which allows simplified manipulation of files and control of session/job environments. Further, a window-oriented program debugger enhances programmer productivity.

DATA BASE MANAGEMENT SYSTEM: *TurboImage/V* is oriented toward general-purpose data base manage-

ment and operates in both interactive and batch environments.

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

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

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

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

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

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

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

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

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

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► or alternate key value, by logical record number, or in chronological order.

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

System Dictionary is for both MPE-V-based systems and MPE-XL-based systems and provides a central information resource, documenting data, programs, files, users, input forms, and network configuration. Features include entity-relationship model, programmatic access, Dictionary/V conversion utility, Image data base utilities, VPlus forms definition loader, and Cobol definition extractor. It also allows users to tailor the documentation structure of the dictionary to fit their needs.

HPSQL/V is a relational data base management system for general-purpose applications. It supports the Structured Query Language (SQL) as the Data Definition Language (DDL) and Data Manipulation Language (DML). SQL commands may be entered interactively via the Interactive Structured Query language facility (ISQL), or as commands embedded in Cobol or Pascal application programs. Higher performance is achieved via the use of a sophisticated query optimizer, which is invoked by source code preprocessors at program preparation time. In addition, HPSQL/V detects whether a change in the database structure has invalidated the access strategy for the new structure.

The system's capabilities include automatic roll-back recovery, roll-forward recovery, dual-logging, dynamic data restructuring, fast B-tree index access, automatic locking for data integrity, optional explicit locking, flexible security designation, transaction backout, and generic retrieval.

HPSQL/V applications are compatible with the relational database component of Allbase/XL.

Allbase/XL is the network and relational model data base management system for the 900 Series; it requires 8MB of memory. Under Allbase/XL, network model databases can be defined and accessed via the HPImage component of Allbase/XL, and relational databases (tables, indices, and views) may be defined and accessed via the HPSQL component.

Allbase/XL's capabilities are the same as for HPSQL/V listed above.

Applications developed on earlier Image/3000 or Turbo-Image/V data base management systems can access HP Image databases via the TurboWindow component.

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

COMMUNICATIONS: The *HP AdvanceNet* software provides capabilities in three broad areas: 1) workstation-to-HP system communications, 2) HP system-to-HP system communications, and 3) HP system-to-IBM mainframe communications. Network Services that comprise the HP AdvanceNet software products include Distributed Systems (DS) Network Services; Multipoint Terminal Support

(MTS) Service; Workstation Configurator; LAN/3000; NS/3000; and HP 3000-to-IBM communications products, which include SNA NRJE Network Remote Job Entry, SNA IMF Interactive Mainframe Facility, Multileaving Remote Job Entry, and RJE/Remote Job Entry.

Distributed Systems (DS) products are designed to be used in applications that involve transaction processing and are geographically or functionally dispersed. Any local system command may be executed remotely through an extension to that command. Many operating system intrinsics are extended in a similar fashion. DS products on the HP 3000 provide facilities for point-to-point connections between processors.

Communication lines may be switched, leased, or hardwired, and may be mixed throughout the network. Every DS Network Service operates transparently across each Network Link alternate. At least one Network Link—Point-to-Point Hardwired Link, Point-to-Point Modem Link, X.25 Network Link, or Satellite Network Link—is required.

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

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

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

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

- Provides a Workstation Configurator utility routine for an interactive, menu-driven interface to create, modify, and manipulate workstation-type files.

- Supports Advanced Terminal Processors and Asynchronous Data Communication Controller hardware.

- Provides a choice of three workstation flow control protocols—Enquiry/Acknowledge or Delay handshakes controlled by the software driver, or X-on/X-off mechanism controlled by the attached device.

- Supports block mode workstations.

- Allows special characters to be defined for system attention, backspace, cancel line, end-of-record, or subsystem break.

- Provides control settings for echo, line feed, backspace response, or parity. ►

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▶ • Provides a set of characters that can be defined to be stripped and ignored by the serial I/O driver.

• Provides printer control.

The *LAN/3000 Link* and the *LAN3000/XL Link* contain the hardware as well as the software required to connect an HP 3000 system to an IEEE 802.3 coaxial cable. The software components consist of transport protocols, network protocols, IEEE 802.2 logical link control, and IEEE 802.3 media access control. The transport protocol provides end-to-end connection-oriented services with flow control and multiplexing. The network protocol provides fragmentation/reassembly and internetting capability. The IEEE 802.2 and 802.3 protocols give every node on the coaxial cable equal access to the network and monitor the network, eliminating transmission collisions. Node management software is also included in the 3000 Link and provides a friendly user interface for the network management functions of configuration, tracing, and logging.

The *NS/3000* and *NS3000/XL* allow an HP 3000 system to communicate with up to 99 other HP 3000s running NS/3000 over an IEEE 802.3 local area network. Functions include file transfer, remote database access, interprocess communication, remote process management, and remote file and peripheral access.

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

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

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

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

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

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

HP 18300A X.25 is a network performance analyzer enabling the data center manager to detect network performance degradation.

HP SiteWire is a set of multivendor communications guidelines that provides planning, design, and implementation support for wiring manufacturing and engineering buildings as well as business offices.

HP Network Services for the Digital Equipment VAX provides HP-to-Digital Equipment Corporation computer communications in manufacturing, engineering, and office environments.

HP Convert/DCA performs two-way conversion between HP word processing formats and IBM Revisable Form Text Document Content Architecture (DCA) word processing formats.

HP OfficeConnect-to-PROFS allows HP DeskManager to support electronic mail exchange with any system running IBM's bisynchronous office-support mainframe software.

HP OfficeConnect-to-DISOSS works with HP LU 6.2 products to allow electronic mail exchange, filing, and automatic document conversion between an HP 3000 system running HP DeskManager and an IBM mainframe running DISOSS.

SNA Link/3270 enables HP Vectra and Portable Plus PCs remotely connected to an IBM mainframe to emulate an IBM 3270 display station.

Advancelink 2392 is a data communication and terminal emulation program enabling the HP Vectra Personal Computer to be integrated into the Personal Productivity Center.

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

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

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

FCopy/V performs general file copying tasks.

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

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

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

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

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

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

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

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

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

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

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

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

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

HP Access and HP Central are for workstations and MPE-V-based systems. They provide personal computer users the ability to select information from a combination of up to three databases simultaneously, and then automatically translate the results into any of a variety of PC file formats.

Business Report Writer/V is for MPE V-based systems, and allows report writing without numerous lines of programming code or complex report syntax. The system uses Dictionary/V or Applications Dictionary to verify data definitions, maintain documentation, and define access paths to the data.

TurboImage DBchange/V is an interactive utility allowing restructuring and capacity expansion of a TurboImage data base.

TurboImage Profiler/V aids the programmer and data base administrator in the design, fine-tuning, and maintenance of the TurboImage data base.

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

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

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

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

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

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

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

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

HPDraw is a graphics software subsystem for presentation text and figure design. Drawings can be plotted on paper or overhead transparencies, transformed into 33 mm slides, printed on an HP dot matrix printer, merged with a textual document for printing on an HP laser printer, or sent via HPDeskManager's electronic mail facility to other HP 3000 users. In addition, charts and graphs created with HPEasyChart, HPMap, and HP DSG/3000 can be integrated into HPDraw designs.

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

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

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

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

• HP Decision Support Graphics/3000 (DSG/3000)

• Autoplot

• Word

• Forms

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

PRICING

POLICY: The HP 3000 Series systems are available on a purchase or lease basis. The U.S. list price includes freight charges. Individual models are offered as a system processor unit and selected software, with extensive, separately priced peripheral and software options. Standard on each HP 3000 system is the Fundamental Operating Software, which includes MPE operating system, Edit/V text editor, FCopy/V file copying utility, Sort-Merge/V, TurboImage/V database management system, Query/V database inquiry language, KSAM/V keyed sequential access method, HP VPlus/V forms management software, and a facility for executing ▶

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compiled programs without the source language compiler on the system.

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

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

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

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

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

The HP 3000 is listed on the GSA vendor list.

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

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

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

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

Workstation Maintenance Service is provided for workstation products, such as personal computers, terminals, flexible disk drives, printers, and plotters. 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.

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

HP also provides a Pickup and Delivery Service that provides on-site pickup of the peripheral, with return within four days.

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

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

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

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

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

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

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

The *Response Center Support* plan includes a subset of the services available through Account Management Support, with all assistance from HP provided over the telephone. It is recommended that, with this plan, the user have sufficient experience with the HP system so that on-site assistance or other local attention will rarely, if ever, be needed. On-site assistance is available, if needed, on a time-and-materials basis. This plan also provides the support materials necessary to keep current on the changes and improvements in HP software.

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

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

- Additional system coverage—provides flexibility in structuring support for multiple systems by extending the central system coverage to additional systems.

- HP Trend System Performance Analysis plan—a year-long service that provides the customers with periodic reports on system usage overtime. HP Trend reports are an aid for high-level resource planning, as well as for balancing loads across multiple HP 3000s and across shifts, hours in the day, and days in the month. Performance statistics are collected on the customer's computer, and at specific, predetermined times are transmitted to the Response Center for analysis and report generation.

- Additional response center caller—with the Account Management or Response Center Support plans, only the system manager or designated alternate can call the Response Center. Each purchase of this option authorizes one additional response center caller, with no limit on the total number of calls allowed. Additional callers have the same benefits as the system manager, except for requesting on-site assistance, which remains the System Manager's responsibility.

- Off-hours emergency assistance—provides on-site emergency assistance outside normal business hours through a central dispatch center. An Account Management Support customer is charged a fixed fee for each call. A Response Center Support customer is charged a fixed fee per call, plus time-and-materials charges for on-site assistance.

- Software update installation assistance—provides installation assistance for each software update.

- Off-hours software update installation assistance—allows the installation of one software update by an HP support representative between 6 a.m. and 8 a.m. or between 5 p.m. and 9 p.m. on weekdays (excluding HP holidays) if a planned interruption of system operation during normal business hours is undesirable.

- Extended materials subscription—extends the software materials subscription to one additional system. It provides the right to make one copy of all central system support materials for use on one additional system.

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

In addition, Hewlett-Packard provides *Capacity Planning and Performance Analysis (HPCaplan)*. This allows the customer to plan for systems to support future business expansion by forecasting when to budget for additional computing power.

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

Along with the above mentioned software support features, Hewlett-Packard offers bundled financing for third-party

software configurations where the third-party software is no more than 50 percent of the list price of the HP equipment. This financing applies to software suppliers, software resellers, software OEMs acting as software suppliers, and selected OEMs.

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

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

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

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

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

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

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

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

TYPICAL CONFIGURATIONS: Sample configurations for the HP 3000 follow:

SERIES 52:

32552A—System Processor Unit with 4MB memory, 2 GICs, and Fundamental Operating System	$45,000
7936—307MB disk	13,250
7974A—1600 bpi tape system	14,000
2563A—300-lpm printer	5,780
2392A—3 display terminals	4,125
30018A—ADCC main (4 ports)	2,250
TOTAL PURCHASE PRICE	**$84,405**

SERIES 930:

32480A—System Processor Unit with 16MB memory, 2 I/O channels, LAN channel, MPE/XL Fundamental Operating System, Allbase/XL, System Dictionary/XL	$225,000
19472A—floating-point co-processor	10,000
7933XP—404MB disk drive	23,000
7978B—6,250-cpi tape subsystem with HP-IB interface	24,500
2392A—7 display terminals	10,325
2393A—5 graphic terminals	10,475
2566B—900-lpm printer	21,766
7440A—Colorpro 8-pen plotter	1,295
2934A—(3) 40/67/200-cps office printers	8,985
TOTAL PURCHASE PRICE	**$335,346**

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EQUIPMENT PRICES

		Purchase Price ($)	Std. Month. Maint. ($)
SYSTEM PROCESSOR UNITS			
32535A	Micro 3000 System Processor Unit with 2MB main memory	12,000	34
015	200-240 VAC system operation	0	0
051	DUS software on 1600 bpi tape media	0	0
510	Expands memory to 4MB. Must order an ATP/M separately	4,000	7
32545A	Micro 3000XE System Processing Unit with 2MB main memory	29,500	70
015	200-240 VAC system operation	0	0
022	DUS software on cartridge tape media	0	0
051	DUS software on 1600 bpi tape media	0	0
510	Expands memory to 4MB	7,000	−13
32535E	Micro 3000 System Processing Unit with 2MB memory, 81MB disk drive, 67MB cartridge tape drive, 2392A console terminal, and ATP/M (8 terminal port controller)	21,350	103
001	Add-on ATP/M with Option 125	2,700	8
007	Add-on 7957A 81MB disk drive	5,200	35
008	Add-on 7958A 130MB disk drive	7,700	37
015	200-240 VAC system operaton	0	0
32535F	Micro 3000 System Processing Unit with 4MB memory, 130MB disk drive, 67MB cartridge tape drive, 2392 A console terminal, and ATP/M (8 terminal port controller)	26, 950	112
001	Add-on ATP/M with option 125	2,700	8
007	Add-on 7957A 81MB disk drive	5,200	35
008	Add-on 7958A 130MB disk drive	7,700	37
015	200-240 VAC system operation	0	0
32548B	HP 3000 Series 48 System Processor Unit (60 Hz)	75,000	327
015	220-240 V/50 Hz single-phase operation	0	0
022	Software on cartridge tape	0	0
410	Substitute MPE-V/E for MPE-V/P	0	−7
32548Z	Series 48 Media for MPE-V/E	0	0
022	Cartridge Tape Media	0	0
051	1600 bpi magnetic tape media	0	0
32552A	HP 3000 Series 52 System Processor Unit with 4MB memory	45,000	271
015	220-240V/50Hz single-phase operation	0	0
022	Software on cartridge tape media	0	0
502	Add-on 2MB memory	10,500	19
503	Add-on 4MB memory	18,000	38
32558A	HP 3000 Series 58 System Processor Unit (60 Hz) includes 4MB memory and DUS on 1600 bpi tape. Must order an ATP separately	75,000	304
34202AR	HP 3000 Series 58 system bundle. Includes S/58R, 4MB memory, 30018AR (ADCC main), 7933HR disk drive, 7974AR tape drive, and Touchscreen II console	77,500	—
401	7933R Disk drive	14,000	—
501	Additional 1MB memory	3,500	—
602	Upgrade from S/II or earlier CPU	2,000	—
603	Upgrade from S/III with 256KB	4,000	—
605	Upgrade from S/30, /33 with no memory	2,500	—
617	Upgrade from S/37 with no memory	5,000	—
618	Upgrade from S/37XE with no memory	8,000	—
32471A	HP 3000 Series 70 Processor Unit with 8MB memory. Must order an ATP separately	150,000	550
015	380V/50Hz three-phase operation	0	0
016	415V/50Hz three-phase operaton	0	0
250	Add expansion bay and 1MB	25,000	56
500	Add 4MB memory	28,000	50
501	Add 8MB memory	48,000	100
32480A	HP 3000 Series 930 preconfigured system with 16MB memory, MPE XL FOS, Allbase/XL, System Dictionary/XL	225,000	475
500	Add 8MB memory	32,000	0
32481A	HP 3000 Series 930 Processor Unit with 16MB memory (does not include software)	185,000	475
I/O EXPANSION			
19742A	Series 930 Floating-Point Co-processor	10,000	13
19744A	Series 930 third CIB adapter	15,000	45
2345A	Distributed Terminal Controller for connection of workstations to S/930 (includes AUI cable, MAU, and tap for connection to thick LAN cable)	7,100	36
241	Delete AUI, MAU, and tap	420	0
242	Delete UI, MAU, and tap, set unit for operation on ThinLAN	420	0
625	Provide 6 25-pin RS-232-C modem ports installed in the DTC	2,520	0
803	Provide 8 3-pin RS-232-C local ports installed in DTC	2,520	0
805	Provide 8 5-pin RS-422 ports installed in DTC	3,230	0

* Required for use on MPE-based systems. (Only one tape cartridge supported per system.)
** Series 64 or 68 systems shipped before March 1, 1984 require a DCU firmware upgrade to use 7974A or 7978A as system cold load device.
NA—Not applicable.
TBA—To be announced.

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

MEMORY EXPANSION

		Purchase Price ($)	Std. Month. Maint. ($)
30462A	2MB memory module for Micro 3000XE	8,500	24
30482A	4MB memory module for Micro 3000XE	17,000	11
19748A	8MB main memory for Series 930	48,000	35
30142A	1MB memory module for Series 68	12,000	75
30142AN	Return credit for Series 70 1MB memory module toward 30165A	−2,500	0
30165A	4MB Memory Module for Series 68	35,000	—
30165AN	Return credit for 4MB memory for Series 70	−12,000	—
30173A	2MB Memory Module for Series 42XP and 58	15,000	18
30173AN	Return credit for 2MB memory for Series 58	−4,000	—

MASS STORAGE

		Purchase Price ($)	Std. Month. Maint. ($)
7911P	28MB disk drive with cartridge tape drive and one controller with 1m HP-IB cable	13,750	57
001*	Adds dedicated controller for cartridge tape drive	1,840	25
140	Deletes cartridge tape drive	−3,570	−12
7912P	65MB disk drive with cartridge tape drive and one controller with 1m HP-IB cable	14,800	59
001*	Adds dedicated controller for cartridge tape drive	1,840	25
140	Deletes cartridge tape drive	−3,570	−12
7914CT	132MB disk with site-installed 9144A cartridge tape drive, both mounted in a 92211R mobile minirack cabinet	17,350	79
140	Deletes cartridge tape drive	−3,500	−14
7914P	132MB disk drive with integral 67MB tape cartridge	17,350	69
001*	Adds dedicated controller for cartridge tape drive	1,840	25
140	Deletes cartridge tape drive	−3,570	−14
7914R	132MB second disk drive for an installed 7914TD/ST that was ordered w/out the second disk drive	17,350	69
140	Deletes cartridge tape drive	−3,570	−15
7914ST	Mass Storage Subsystem consisting of 132MB 7914 disk drive and 7974A ½" magnetic tape drive mounted in a 56" high cabinet	27,500	154
002	Adds cartridge tape drive and second controller	5,410	40
114	Adds second 7914 (Option 140) disk drive	13,830	54
800	Dual-density operation; 800/1600 bpi	2,500	17
7925MR	Master 120MB Disk Drive (Remarketed)	10,560	125
102	HP-IB interface and 2m cable	1,000	4
7925SR	120MB Slave Disk Drive (Remarketed)	8,227	85
7933G	1.2GB Storage System, consists of three 7933H, 404MB disk drives, each with media, controller, power supply, and 1m HP-IB cable	64,000	270
7933H	404MB fixed media disk drive; standard operating voltage is 208 V w/1m HP-IB cable	21,500	94
7933HN	Return credit towards purchase of 7936H/37H	−4,000	—
7933XN	Return credit for 7933XP (applicable towards purchase of 7936H or 7937H)	4,500	—
7933XP	404MB fixed media disk drive with controller cache	23,000	84
7935G	1.2GB removable disk system; consists of three 7935H, 404MB disk drives, each with media, controller, power supply, and 1m HP-IB cable, shipped to single destinations	74,400	507
7935H	404MB removable media disk drive; standard operating voltage is 208 V, w/1m HP-IB cable	22,100	169
7935XP	404MB removable disk drive with controller cache	24,000	120
7936H	307MB fixed media disk drive with 100-120 V operation, 1m HP-IB cable. Cabinet required	13,500	42
7936XP	307MB fixed media drive with controller cache, 100-120 V operation, 1m HP-IB cable. Cabinet required	15,500	44
7937H	571MB fixed media disk drive with 100-120V operation, 1m HP-IB cable. Cabinet required	17,600	50
7937XP	571MB fixed media drive with controller cache, 100-120 V operation, 1m HP-IB cable. Cabinet required	19,600	52
7945A	55MB Disk Drive with 1-m HP-IB cable	6,000	50
550	Delete 1-m HP-IB cable	−85	—
7945AN	Return credit towards 7958A purchase	−1,000	—
7946AN	Return credit towards 7958A purchase	−3,000	0
7957A	81MB fixed disk drive	5,200	35
550	Delete 1m HP-IB cable	−85	—
7958A	130MB fixed disk drive	7,700	37
550	Delete 1m HP-IB cable	−85	—
9123D	Series 68 Console 3.5" Diskette Drive	715	8
9895A	Flexible Disk System	5,910	77
010	1.2MB single drive system with manual for HP 3000 hookup and use	−1,330	−36

MAGNETIC TAPE SUBSYSTEMS

		Purchase Price ($)	Std. Month. Maint. ($)
7974A	1600 cpi/50-ips start/stop, 100-ips streaming, Streaming Magnetic Tape Subsystem with HP-IB interface**	14,000	100
131	Delete cabinet; add hardware for installation in existing 7974A cabinet	−500	0
800	Add 800 cpi NRZI format	2,500	16
7974AN	Return credit for 7974A tape drive	−3,000	—

Required for use on MPE-based systems. (Only one tape cartridge supported per system.)
**Series 64 or 68 systems shipped before March 1, 1984 require a DCU firmware upgrade to use 7974A or 7978A as system cold load device.*
NA—Not applicable.
TBA—To be announced.

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

MAGNETIC TAPE SUBSYSTEMS (Continued)

		Purchase Price ($)	Std. Month. Maint. ($)
2346A	Add-on DTC serial interface card. Provides 8 3-pin RS-232-C local ports	2,720	0
2346B	Add-on DTC serial interface card. Provices 8 5-pin RS-422 local ports	3,430	0
2346C	Add-on DTC serial interface card. Provides 6 25-pin RS-232-C modem ports	2,720	0
27113A	Series 930 HP-IB channel	1,900	4
30018A	Asynchronous Data Communications Controller (ADCC)—main	1,795	10
040	Series 52 internal cable	0	0
044	Series 58 internal cable	0	0
30018AN	Return credit for ADCC-Main	−250	0
30019A	Asynchronous Data Communications Controller (ADCC)—extender	1,795	10
040	Series 52 internal cable	0	0
044	Series 58 internal cable	0	0
30019AN	Return credit for ADCC-Extender	−250	0
30079A	General I/O Channel (GIC)	1,900	13
040	Series 52 cable	0	0
044	Series 48 internal cable	0	0
064	Series 70 cable	0	0
30079AN	Return credit for General I/O Channel	−400	0
30143A	Series 70 I/O Adapter Module (IMB)	10,100	36
550	Replace 5.2 V power supply	5,700	0
30143AN	Return credit for Series 70 I/O Adapter	−2000	—
	NOTE: Advanced Terminal Processor (DSN/ATP) consists of an SIB (30144A) and port controller		
40290A	ATP/M for Micro 3000 systems	2,700	8
103	RS-232-C 3-pin version, 7 direct, 1 modem	0	0
105	RS-422 5-pin version, 7 direct, 1 modem	0	0
125	RS-232-C 25-pin version, 4 direct, 4 modem	0	0
30144A	ATP System Interface Board (SIB)	3,175	15
30144AN	Return credit for ATP Interface Board	−800	—
30145A	ATP Direct Connect Port Controller; standard provides 12 RS-422 ports	6,590	28
001	Order once to provide 6X first I/O bay Junction Panel	−250	0
002	Replace Quantity 4 Type 422 ports with Quantity 4 Type 232 ports (need to order Quantity 3 to replace all 12 ports)	0	0
003	Order once to provide Series 70 second I/O bay Junction Panel	0	0
042	Series 52 cable for Direct Connect or Modem Expansion Package	0	0
048	Expansion package cable. Order only if 30145A is to be installed in Series 58	0	0
30145AN	Return credit for ATP Direct Connect Port Controller	−1,650	—
30155A	ATP Modem Port Controller	8,140	34
001	Order once to provide Series 70 first I/O bay Junction Panel	−250	0
003	Order once to provide Series 70 second I/O bay Junction Panel	0	0
042	Series 52 cable for Direct Connect or Modem Expansion Package	0	0
048	Series 58 cable for Direct Connect or Modem Expansion Package	0	0
30155AN	Return credit for ATP Modem Port Controller	−2,050	—
30173AR	2MB memory for Series 5X	10,500	19
30273A	Direct Connect Expansion Package; 12 RS-422 ports standard	7,510	43
001	Deletes SIB	−910	−15
002	Replaces 4 RS-422 ports with 4 RS-232-C ports	0	0
042	Series 52 cable	0	0
048	Series 58 cable	0	0
30273AN	Return credit for Direct Connect Expansion Package	−2,500	—
30274A	Modem Expansion Package; 12 RS-232-C ports standard	9,060	49
001	Deletes SIB	−910	−15
042	Series 52 cable	0	0
048	Series 58 cable	0	0
30274AN	Return credit for Modem Expansion package	−2,900	—
30276A	ATP for Meridian SL-1 Interface Port Controller, standard with 12 4-wire RS-422 port connections	8,140	33
001	Series 70 first I/O bay Junction Panel	0	0
003	Series 70 second I/O bay junction panel	0	0
004	10 port connections to Meridian SL-1 PBX, and 2 modem ports for system console connection and dial-in diagnostics	0	0
042	Series 52 cable	0	0
048	Series 58 cable	0	0
30276AN	Return credit for Meridian SL-1 ATP	−2,050	—
30277A	ATP for Meridian SL-1 Interface Expansion Package, standard with 12 4-wire RS-422 port connections	9,060	49
001	Deletes SIB	−910	—
30277AN	Return credit for Meridian Expansion Pack	−2,900	0

* Required for use on MPE-based systems. (Only one tape cartridge supported per system.)
** Series 64 or 68 systems shipped before March 1, 1984 require a DCU firmware upgrade to use 7974A or 7978A as system cold load device.
NA—Not applicable.
TBA—To be announced.

Hewlett-Packard HP 3000 Series

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

MAGNETIC TAPE SUBSYSTEMS (Continued)

7978B	1600/6250 cpi, 75 ips Streaming Magnetic Tape Subsystem with HP-IB interface**	24,500	106
674	Return credit for 7974A tape drive	−1,000	NA
676	Return credit for 7976A tape drive	−6,800	—
9144A	¼″ cartridge tape drive	3,500	14
26074A	Installation Kit for mounting the 7970B/E in the bottom rack of a 7971A cabinet	460	0
26075A	Multiple System Access Selector (order cables separately)	725	6
30215AR	Magnetic Tape Controller; interfaces five through eight 7970B or 7970E magnetic tape drives with 300 level options (remarketed)	2,710	17
35491A	¼″ cartridge tape drive with auto changer	7,000	34

PRINTERS

2225	150-cps InkJet dot matrix printer, international character sets, raster graphics (HP-IB, Centronics, RS-232-C interfaces available)	495	—
2227A	160- /40-cps InkJet dot matrix printer with Centronics and RS-232-C interfaces standard	799	—
2563A	300-lpm printer	6,830	52
022	128KB Vector Graphics Board	1,570	0
023	512KB Vector Graphics Board	3,145	0
065	HP 3000 Graphics Support Software (36583A)	1,575	0
2564B	600-lpm printer with quiet cabinet, sound enclosure, passive paper stacker	12,445	94
022	128KB Vector Graphics Board	1,570	0
023	512KB Vector Graphics Board	3,175	0
024	Graphics option	2,120	—
2566B	900-lpm printer	21,766	209
2567B	1,200-lpm printer	28,050	233
	Options for 2566B and 2567B		
021	Enables higher compressed graphics	2,000	0
022	128KB Vector to Raster Conversion Board	1,570	0
023	512KB Vector to Raster Conversion Board	3,145	0
024	Graphics option	2,120	0
2603A	48-cps daisywheel printer, RS-232-C interface	1,495	42
2932A	200-cps transaction printer, graphics, and RS-232 interface standard. Includes national languages, line drawing, and math symbols (cable not included)	2,595	26
2934A	40-67-200-cps office printer; Courier/10 cartridge, graphics, and RS-232-C interface are standard; includes bar code printing, large character set, national languages, line drawing set, and math symbols (cable not included)	2,995	30
2680A	Intelligent Laser Page Printer; includes 125,000 rotations	85,400	607
060	Graphics/extended memory management	2,565	0
062	Variable Density Print	2,800	0
500	Forms Design Package	6,300	23
501	Graphics Package	7,300	26
505	Add-on 256KB memory module	4,550	6
520	1MB memory (Deletes std. 256KB memory)	5,100	26
521	1MB memory addition	9,000	34
525	Vacuum Paper Splice Option	1,550	0
2689A	45 ppm laser printer for IBM 43xx, 303x, 308x, or IBM PCM	99,950	733
062	Variable density print	2,550	0
505	256KB memory	4,500	0
525	Vacuum splice	1,025	0
26804B	2685 Laser Print Station (includes two 7945A disk drives, 9144 tape cartridge, and 2392A console terminal). Must be ordered with controller and printer option	19,560	126
337	Model 37XE controller	19,400	44
342	Model 42 controller	42,800	218
368	Model 68 controller	200,000	765
280	HP2680A Laser Printer	76,780	580
288	HP2688A Laser Printer	29,950	269
015	220 VAC 50 Hz	300	0
017	240 VAC 50 Hz	300	0
060	1680A Graphics Firmware upgrade	2,565	0
062	2680A Variable Density Print	2,550	0
094	Forms Design Workstations. 2628A graphics terminal, IFS and IDS/Forms software	10,100	26
095	Deletes 9144A tape cartridge	−3,400	−14
096	Deletes 2392A console terminal	−1,320	−12
097	Deletes two 7945A disk drives	−14,550	−100
098	Add 7914ST disk/tape	27,500	154
503	2680A Graphics Package. Consists of Options 060, 062, 520, 525, and 36583A	14,550	24
505	Adds 256KB memory to 2680A	4,550	6
520	Deletes standard 256KB memory from 2680 and replaces with 1024KB memory	5,100	24
521	Adds 1024KB memory to 2680A	9,000	34

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TBA—To be announced.

Hewlett-Packard HP 3000 Series

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

PRINTERS (Continued)

2686A	LaserJet Personal Laser Printer. Includes 4,000 pages/month, 150 V, 60 Hz	2,995	—
2686AU	LaserJet, 240 V, 50 Hz	3,150	—
2686AB	LaserJet, 220 V, 50 Hz	3,150	—
2686D 2	LaserJet 500+ (Plus) 115 V 8-ppm laser printer with dual 250 sheet input bins	4,995	—
2686DB	LaserJet 500+ 220 V 8-ppm laser printer with dual sheet input bins	5,150	—
2686DU	LaserJet 500+ 240 V 8-ppm laser printer with dual 250 sheet input bins	5,150	—
2687A	Desktop Laser Printer; includes 10,000 pages/month	9,300	151
2688A	Text and Graphics Laser Printer; includes 10,000 pages/month	29,950	269
040	Deletes IFS/3000 and graphics intrinsics	−4,000	0

GRAPHICS PLOTTERS AND DIGITIZERS

7440A	ColorPro 8-pen graphics plotter. Must order interface separately	1,295	—
7470A	Graphics Plotter; 2-pen, A-size	1,095	12
7475A	Graphics Plotter; 6-pen, B-size	1,895	13
7550A	Graphics Plotter, 8-pen, automatic sheetfeed, B-size, dual I/O; eavesdrop capability, along with HP-IB and RS-232-C interfaces	3,900	40
7570A	DraftPro 8-pen plotter	5,400	—
7580B	Drafting Plotter; D-size, dual I/O, eavesdrop capability, HP-IB and RS-232-C interfaces	9,900	96
7585B	Drafting Plotter; E-size, dual I/O, eavesdrop capability, HP-IB and RS-232-C interfaces	12,900	96
7586B	Drafting Plotter; E-size, roll feed, dual I/O	16,900	96
9111A	Graphics Tablet	2,275	16

INTERACTIVE DISPLAY TERMINALS

2392A	Display Terminal (available with Swedish, Norwegian, French, German, U.K., Spanish, Canadian-French, Canadian-English, Italian, Dutch, Finnish, Danish, Swiss-German, Swiss-French, Spanish-Latin, or Flemish character sets/keyboards at no additional charge)	1,375	6
092	Port 2: 25-pin RS-232-C interface	200	0
093	Port 2: 8-bit Parallel Centronics-type interface	200	0
160	Extended Memory; adds up to 4 pages of display memory	200	0
2393A	Graphics Terminal	2,095	5
046	Port 2: HP-IB interface	200	0
092	Port 2: 25-pin RS-232-C interface	200	0
093	Port 2: 8-bit Parallel Centronics interface	200	0
2394A	Data Entry Terminal (all 2392A options are available on this terminal except Option 160)	1,875	5
2386A	Color graphics terminal	3,295	6
2628A	HPWord Terminal (Swedish, Norwegian, German, U.K., Spanish, French, French-Canadian, Italian, Dutch, Finnish, and Danish character sets/keyboards available at no additional charge)	3,195	13
021	Port 1 Data Link	125	0
022	262X Pod Adapter	125	0
050	Integral Thermal Printer	1,210	8
061	Green CRT	50	0
062	Amber CRT	100	0
523	HP and TEK 4014 Graphics	640	0

DATA COLLECTION AND INDUSTRIAL TERMINALS

3081A	Industrial Workstation Terminal	890	8
004	Alphanumeric keyboard	115	0
052	Office Wand, 12 mil	160	5
053	Office Wand, 6 mil	160	5
054	Industrial Wand, 45 mil	290	8
055	Industrial Wand, 7 mil	290	8
056	Slot Reader, 6 mil	315	8
057	Slot Reader, 15 mil	315	8
92920A	Standard data comm cable for 3081A	475	0
92921A	Special data comm cable for 3081A	705	0
92922A	4-channel Adapter for 3081A	945	8
39800A	Programmable bar code reader with 2 RS-232-C ports and internal power supply	1,150	6
39801A	Bar code reader with 2 RS-232-C ports and internal power supply	965	6
45851A	Series 70 system console with Touchscreen II base system. Basic console configuration must include Touchscreen II, disk drive (9123D), cable (13242), and console communications software	2,560	20

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TBA—To be announced.

Hewlett-Packard HP 3000 Series

		Purchase Price ($)	Std. Month. Maint. ($)
DATA COMMUNICATION			
28645A	ThinLAN HUB multiport repeater for IEEE 802.3 LANs. Includes 30241A MAU and 5-m AUI cable	2,950	—
241	Deletes 30241A MAU and 5-m AUI cable	−500	—
30240A	OfficeShare LAN/3000 Link. Select one option	0	0
TBA	For Micro3000 and Micro3000XE	TBA	TBA
499	For Series 58	7,000	32
500	For Series 70	7,000	32
30242A	LAN/3000 Link. Select one option	0	0
TBA	For Micro 3000 and Micro 3000XE	TBA	TBA
400	For Series 58	7,000	32
500	For Series 70	7,000	32
30246A	SNA Link. For use with 30245A or 30247A. Select one option	0	0
TBA	For Micro 3000 and Micro 3000 XE	TBA	TBA
4—	For Series 58 through 70	8,650	55
30251A	BSC Link. For use with 30248A, 30249A, or 30250A. Select one option	0	0
TBA	For Micro 3000 and Micro 3000XE	TBA	TBA
4—	For Series 58 through 70	5,750	55
30270A	Point-to-Point Hardwired Link. Requires 32185A. Select one option	0	0
TBA	For Micro 3000 and Micro 3000XE	TBA	TBA
4—	For Series 58 through 70	5,750	55
30271A	Point-to-Point Modem Link. Requires 32185A. Select one option	0	0
TBA	For Micro 3000 and Micro 3000XE	TBA	TBA
4—	For Series 58 through 70	5,750	55
32026A	MTS Data Link Connection. Requires 32025A MTS Service. Select one option	0	0
TBA	For Micro 3000 and Micro 3000XE	TBA	TBA
4—	For Series 58 through 70	5,845	67
32027A	MTS Synchronous Modem Link. Requires 32025A MTS Service. Select one option	0	0
TBA	For Micro 3000 and Micro 3000XE	TBA	TBA
4—	For Series 58 through 70	5,000	55
32028A	MTS IBM 3270 Device Link. Requires 32025A MTS Service. Select one option	0	0
TBA	For Micro 3000 and Micro 3000XE	TBA	TBA
4—	For Series 58 through 70	5,040	55
32187A	X.25 Network Link. Requires 32185A Network Services unless used solely for X.25 terminal I/O. Select one option	0	0
TBA	For Micro 3000 and Micro 3000XE	TBA	TBA
4—	For Series 58 through 70	7,560	55
32188A	Satellite Network Link. Requires 32185A Network Services. Select one option	0	0
TBA	For Series 3000 or 3000XE	TBA	TBA
400	For Series 58 through 70	20,160	55
2333A	MTS Cluster Controller	2,000	17
021	Data link host adapter	225	0
022	RS-232-C host adapter	225	0
122	4-port RS-232-C Interface	700	0
2334A	HP Statistical Multiplexer	1,800	16
100	Initial configuration by HP AEO/CEO	350	0
122	4-port direct connect interface	750	0
123	4-port modem control interface	850	0
30288A	Digital Multiplexed Interface (DMI) for Series 58 and 70	9,100	36
39301A	Fiber optics multiplexer	2,500	18
40250A	4-Port Terminal Serial Interface for 2333A	820	0
40251A	Second Host System Adapter for 2333A	550	0
40260A	4-Port Serial Interface Card for 1334A	870	0
40261A	Additional 4-port modem control interface for installed 2334A	980	0

UPGRADE PRODUCTS

Micro 3000XE

30545A	Series 37 to Micro 3000XE field upgrade	8,500	45
015	200-250 VAC system operation	0	0
022	DUS software on cartridge tape media	0	0
051	DUS software on 1600 bpi tape media	0	0
250	I/O extender box for Series 37	8,000	5
502	Adds 2MB memory	7,000	24
503	Adds 4MB memory	14,000	11
32545AH	Upgrade to Micro 3000XE with 2MB memory	29,500	70
015	200-240 VAC system operation	0	0
022	DUS software on cartridge tape media	0	0
051	DUS software on 1600 bpi tape media	0	0
250	I/O extender box for Series 37A	8,000	5
510	Expands memory to 4MB	7,000	−13

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TBA—To be announced.

Hewlett-Packard HP 3000 Series

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

Series 52

30552C	Upgrade for Series 39/40/42 to Series 52	32,500	243
042	Price adjustment for disk cache	−2,500	—
196	Delete 4MB memory	−10,000	—
502	Add-on 2MB memory	10,500	18
503	Add-on 4MB memory	18,000	38
32552AH	Upgrade to Series 52	41,200	243
502	Add-on 2MB memory	10,500	19
503	Add-on 3MB memory	18,000	38
617	Upgrade from Series 37	−4,000	0
618	Upgrade from Series 37XE	−7,000	0

Series 58

32558AH	Upgrade to Series 58 with 4MB memory	71,200	276
614	Upgrade from Series 39 with no memory	−8,000	13
615	Upgrade from Series 42 with no memory	−13,500	26
617	Upgrade from Series 37 with no memory	−5,000	26
618	Upgrade from Series 37XE with no memory	−8,000	26
30558C	Series 48 to Series 58 Upgrade with new SPU and 4MB memory	32,500	31
048	Price adjustment for disk caching customers (48s)	−2,500	0

Series 70

30444A	Series 68A to Series 70 field upgrade with no memory	30,000	−117
250	Add expansion bay and 1MB memory	25,000	78
400	Add 4MB memory	28,000	50
501	Add 8MB memory	48,000	100
550	Replace 5.2 V power supplies	5,700	0
30444B	Series 68B/C to Series 70 field upgrade with no memory	30,000	−117
250	Add expansion bay and 1MB memory	25,000	56
500	Add 4MB memory	28,000	50
501	Add 8MB memory	48,000	0
32471AH	Upgrade to Series 70 with 8MB memory	146,200	522
250	Add expansion bay and 1MB	25,000	56
500	Add 4MB memory	28,000	50
501	Add 8MB memory	48,000	100
614	Upgrade from Series 39 with no memory	−11,650	14
615	Upgrade from Series 42 with no memory	−15,000	28
615	Upgrade from Series 48 with 1MB memory	−19,000	28
617	Upgrade from Series 37 with no memory	−6,000	0
618	Upgrade from Series 37XE with no memory	−11,500	0
619	Upgrade from Series 42XP or 52 with 2MB memory	−34,000	28
621	Upgrade from Series 39HP with no memory	−13,800	0
622	Upgrade from Series 58 with 2MB memory	−46,000	28

Series 930

32480AH	Series 930 preconfigured system upgrade with 16MB memory, MPE XL FOS, Allbase/XL, System Dictionary/XL, and manuals	225,000	475
500	Add 8MB memory	32,000	—
614	Upgrade from Series 39 with no memory	−11,650	0
615	Upgrade from Series 42 with no memory	−15,000	0
616	Upgrade from Series 48 with 1MB memory	−19,000	0
617	Upgrade from Series 37 with no memory	−6,000	0
618	Upgrade from Series 37XE with no memory	−11,000	0
619	Upgrade from Series 42XP or 52 with 2MB memory	−34,000	0
621	Upgrade from Series 39HP with no memory	−13,800	0
622	Upgrade from Series 58 with 2MB memory	−56,000	0
624	Upgrade from Series 68 with 2MB memory	−62,000	0
625	Upgrade from Series 68 with 4MB memory	−77,000	0
626	Upgrade from Series 68 with 8MB memory	−96,000	0
627	Upgrade from Series 70 with 2MB memory	−96,000	0
628	Upgrade from Series 70 with 4MB memory	−101,000	0
629	Upgrade from Series 70 with 8MB memory	−120,000	0

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NA—Not applicable.
TBA—To be announced.

Hewlett-Packard HP 3000 Series

SOFTWARE PRICES

		Purchase Price ($)
OPERATING SYSTEM		
—	Multiprogramming Executive (MPE)	NC
DATABASE MANAGEMENT		
—	Image/3000	NC
—	Query/3000	NC
—	KSAM/3000	NC
LANGUAGES		
	One SPU option must be ordered with each of the following languages.	
31500A	Cobol II/XL Compiler. Supported on MPE XL-based systems in Native mode.	0
430	First copy for Series 930	8,500
31500R	Right to copy Cobol II/XL Compiler	0
430	RTC for Series 930	5,950
31501A	HP Fortran 77/XL Compiler. Supported on MPE XL-based systems in Native mode.	0
430	First copy for Series 930	7,000
31501R	Right to copy HP Fortran 77/XL Compiler	0
430	RTC for Series 930	4,900
31502A	HP Pascal/XL Compiler. Supported on MPE XL-based systems in Native Mode.	0
430	First copy for Series 930	7,000
31502R	Right to copy HP Pascal/XL. Prior purchase of 31502A required.	0
430	RTC for Series 930	4,900
32100A	SPL/V Compiler. Supported on MPE V-based systems and in Compatibility mode on MPE XL-based systems .	0
300	Basic/RPG/300 return credit	−1,575
301	SL/300 return credit	−2,100
320	First copy for Series 52 through 70	2,725
430	First copy for Series 930	2,725
32100R	Right to copy SPL/V Compiler. Prior purchase of 32100A required	0
300	Basic/RPG/300 return credit	−630
301	SL/300 return credit	−840
320	RTC for Series 52 through 70	1,910
430	RTC for Series 930	1,900
32102B	Fortran 66/V Compiler. Supported on MPE V-based systems.	0
300	Basic/RPG/300 return credit	−1,575
301	SL/300 return credit	−2,050
320	First copy for Series 52 through 70	2,050
32102R	Right to copy 32102B. Purchase of 32102B required	0
300	Basic/RPG/300 return credit	−630
301	SL/300 return credit	−840
320	RTC for Series 52 through 70	1,435
32104A	RPG/V Compiler. Supported on MPE V-based systems and in Compatibility mode on MPE XL-based systems	0
300	Basic/RPG/300 return credit	−1,575
301	SL/300 return credit	−2,100
430	First copy for Series 930	3,000
32104R	Right to copy RPG/V Compiler. Prior purchase of 32014A required	0
300	Basic/RPG/3000 return credit	−630
301	SL/300 return credit	−840
320	RTC for Series 52 through 70	2,100
430	RTC for Series 930	2,100
32106A	Pascal/V Compiler. Supported on MPE V-based systems.	0
300	Basic/RPG/300 return credit	−1,575
301	SL/300 return credit	−2,100
320	First copy for Series 52 through 70	5,000
32106R	Right to copy Pascal/V Compiler. Purchase of 32106A required	0
300	Basic/RPG/300 return credit	−630
301	SL/300 return credit	−840
320	RTC for Series 52 through 70	3,500
32111A	Basic/V Interpreter and Compiler. Supported on MPE V-based systems	0
300	Basic/RPG/300 return credit	−1,575
301	SL/300 return credit	−2,050
320	First copy for Series 52 through 70	2,050
32111R	Right to copy Basic/V Interpreter/Compiler. Purchase of 32111A required	0
300	Basic/RPG/300 return credit	−630
301	SL/300 return credit	−840
320	RTC for Series 52 through 70	1,435
32115A	Business Basic/V. Supported on MPE V-based systems and in Compatibility mode on MPE XL-based systems	0

NC—No charge.

Hewlett-Packard HP 3000 Series

		Purchase Price ($)

LANGUAGES (Continued)

300	Basic/3000 return credit	−1,000
301	Basic/250 return credit	−1,000
320	First copy for Series 52 through 70	5,500
430	First copy for Series 930	5,500
32115R	Right to copy Business Basic/V. Purchase of 32115A required	0
300	Basic/3000 return credit	−500
301	Basic/250 return credit	−500
320	RTC for Series 52 through 70	3,850
426	Upgrade Series 52 through 70 to Series 930	0
430	RTC for Series 930	3,850
32116A	Fortran 77/V Compiler. Supported on MPE V-based systems	0
301	Fortran 66/3000 return credit	−1,000
320	First copy for Series 52 through 70	5,000
32116R	Right to copy Fortran 77/V. Purchase of 32116A required	0
301	Fortran 66/3000 return credit	−500
320	RTC for Series 52 through 70	3,500
32213R	Right to copy Cobol/V Compiler. Purchase of 32213C required.	0
320	First copy for Series 52 through 70	875
32233A	Cobol II/V Compiler. Supported on MPE V-based systems	0
300	Basic/RPG/300 return credit	−1,575
301	SL/300 return credit	−2,100
320	First copy for Series 52 through 70	6,500
32233R	Right to copy Cobol II/V. Purchase of 32233A required	0
300	Basic/RPG/300 return credit	−630
301	SL/300 return credit	−840

COMMUNICATIONS

30239	Workstation Configuration	0
320	For Series 52 through 70	3,500
30245	SNA NRJE Network Remote Job Entry. Requires 30246A Link	0
320	For Series 52 through 70	5,300
30247	SNA IMF Interactive M/F Facility. Requires 30246A SNA Link	0
320	For Series 52 through 70	8,050
30248	RJE Remote Job Entry. Requires 30251A BSC Link	0
320	For Series 52 through 70	2,950
30249	MRJE Multileaving Remote Job Entry. Requires 30251A BSC Link	0
320	For Series 52 through 70	5,050
30250	IMF Interactive Mainframe Facility. Requires 30251A BSC Link	0
320	For Series 52 through 70	8,050
30252	LU 6.2 Base	0
320	For Series 52 through 70	8,000
30254	SNA Server. Requires 30246A SNA Link, 30242A LAN3000/V Link, 32344 NS/3000/V, and 30247 SNA IMF or 30245 SNA NRJE.	0
320	For Series 52 through 70	1,000
30255	SNA Server Access/V. Requires 30242A LAN 3000/V Link and 32344A NS/3000/V	0
320	For Series 52 through 70	1,000
30256	SNA Server Access/XL. Requires 36921A LAN3000/XL Link and 36920 NS/3000/XL	0
430	For Series 930	1,200
32025	MTS Multipoint Terminal Support Service. Requires 32026A, 32027A, or 32028A	0
320	For Series 52 through 70	2,200
32185	DS Network Services	0
320	For Series 52 through 70	5,500
32344	HP Network Services (NS/3000). Requires 30240A or 30242A Link	0
320	For Series 52 through 70	5,500
36920	NS3000/XL Network Services for MPE XL-based systems	0
426	Upgrade from 32344A, Option 320	3,750
430	For Series 930	7,500

UTILITIES

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

INFORMATION MANAGEMENT TOOLS

19550A	Copycat/3000	3,000
19550R	Right to copy 19550A	2,100
30302A	Silhouette/3000	22,000
30302M	Right to copy 30302A	9,000

NC—No charge.

Hewlett-Packard HP 3000 Series

INFORMATION MANAGEMENT TOOLS (Continued)

31503A	Cobol II Developer's Package	0
320	First copy for Series 52 through 70	8,000
430	First copy for Series 930	12,400
31503R	Right to copy Cobol II Developer's Package	0
320	For Series 52 through 70	5,600
430	For Series 930	8,680
31504A	Fortran 77 Developer's Package	0
430	First copy for Series 930	11,200
31504R	Right to copy Fortran 77 Developer's Package	0
430	For Series 930	7,840
31505A	Pascal Developer's Package	0
320	First copy for Series 52 through 70	8,000
430	First copy for Series 930	11,200
31505R	Right to copy Pascal Developer's Package	0
320	For Series 52 through 70	5,600
430	For Series 930	7,840
32180A	APS/3000 Application Program Sampler	0
320	First copy for Series 52 through 70	2,000
32180R	Right to copy APS/3000 Application Program Sampler	0
320	For Series 52 through 70	1,400
32238A	OPT/3000 Online Performance Tool	0
320	First copy for Series 52 through 70	6,400
32238M	Right to copy 32238A	0
320	For Series 52 through 70	
32244A	Dictionary/3000 Data Dictionary	0
320	First copy for Series 52 through 70	5,500
430	First copy for Series 930	5,500
32244R	Right to copy 32244A	0
320	For Series 52 through 70	3,850
430	For Series 930	3,850
32245A	Report/V General-Purpose Report Writer. Supported on MPE V-based systems and in Compability mode on MPE XL-based systems	0
320	First copy for systems up through Model 70	5,000
430	First copy for Series 930	5,000
32245R	Right to copy 32245A	0
	RTC for systems up through Series 70	3,500
430	RTC for Series 930	3,500
32246A	HP Inform/V Inquiry and Report Generator. Requires Dictionary/V. Supported on MPE V-based systems and in Compability mode on MPE XL-based systems	0
320	First copy for systems up through Series 70	6,000
430	First copy for Series 930	6,000
32246R/M	Right to copy 32246A	0
320	RTC for systems up through Series 70	4,200
430	RTC for Series 930	4,200
32247A	Transact/V. Supported on MPE V-based systems and in Compatibility mode on MPE XL-based systems	0
320	First copy for systems up through Series 70	6,000
430	First copy for Series 930	6,000
32247R	Right to copy 32247A	0
320	RTC for systems up through Series 70	4,200
430	RTC for Series 930	4,200
32248A	Programmer productivity package (Report/3000, Dictionary/3000, Transact/3000) Supported on MPE V-based systems and in Compability mode on MPE XL-based systems	13,000
32248R	Right to copy 32248A	9,100
32449A	Rapid/V Processor (execute only for Transact/3000 and Report/3000). Supported on MPE V-based systems and in Compatibility mode on MPE-XL-based systems	500
32254A	Dictionary/V Extensible Data Dictionary	0
320	First copy for Series 52 through 70	6,500
32254R	Right to copy Dictionary/V Extensible Data Dictionary	0
320	RTE for Series 52 through 70	4,550
32255A	System Dictionary Cobol Definition Extractor/V	0
320	First copy for Series 52 through 70	2,000
32255R	Right to copy 32255A	0
320	RTC for Series 52 through 70	1,400
32256A	System Dictionary/XL Extensible Data Dictionary	0
430	First copy for Series 930	9,750
32256R	Right to copy 32256A	0
430	RTC for Series 930	6,825
32257A	System Dictionary Cobol Definition Extractor/XL	0
430	First copy for Series 930	3,000
32257R	Right to copy 32257A	0
430	RTC for Series 930	2,100
32258A	HP Report Writer Package (Report/V, Inform/V, Dictionary/V). Supported on MPE V-based systems and in Compatibility mode on MPE XL-based systems	13,000
32258R	Right to copy 32258A	9,100
32350A	Toolset/V Program Development System. Supported on MPE V-based systems	0
320	First copy for Series 52 through 70	5,000

NC—No charge.

Hewlett-Packard HP 3000 Series

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		Purchase Price ($)
INFORMATION MANAGEMENT TOOLS (Continued)		
32350R	Right to copy 32350A	3,500
36020A	TurboImage DBchange/V. Supported on MPE V-based systems and in Compatibility mode on MPE XL-based systems	0
320	First copy for Series 52 through 70	5,000
430	First copy for Series 930	5,000
36020R	Right to copy 36020A	0
320	RTC for Series 52 through 70	3,500
430	RTC for Series 930	3,500
36044A	Toolset/XL Program Development Environment. Supported on MPE XL-based systems	0
430	First copy for Series 930	7,000
36044R	Right to copy 36044A	0
430	RTC for Series 930	4,900
36070A	Business Report Writer/V. Supported on MPE V-based systems and in Compatibility mode on MPE XL-based systems	0
320	First copy for Series 52 through 70	8,000
430	First copy for Series 930	8,000
36070R	Right to copy 36070A	0
320	RTC for Series 52 through 70	5,600
430	RTC for Series 930	5,600
36215A	SQL/V. Supported on MPE V-based systems	0
320	First copy for Series 52 through 70	15,000
36215R	Right to copy 36215A	0
320	RTC for Series 52 through 70	10,500
36216A	Allbase/XL. Supported on MPE XL-based systems in Native mode	0
430	First copy for Series 930	30,000
36216R	Right to copy 36216A	0
430	RTC for Series 930	21,000
36913A	Data base Tools/V TurboImage data base restructuring and performance tuning package. Supported on MPE V-based systems and in Compability mode on MPE XL- based systems	0
320	First copy for Series 52 through 70	6,800
430	First copy for Series 930	6,800
36913R	Right to copy 36913A	0
320	RTC for Series 52 through 70	4,800
430	RTC for Series 930	4,800
36014A	TurboImage Profiler/V. Supported on MPE V-based systems and in Compatibility mode on MPE XL-based systems	0
320	First copy for Series 52 through 70	3,500
430	First copy for Series 930	3,500
36914R	Right to copy 36914A	0
320	RTC for Series 52 through 70	2,450
430	RTC for Series 930	2,450
99940A	Transform/3000 Tools and Utilities	2,000
99941A	Procmon, menu processor that interprets IBM S/34/36 procedure files to run under MPE	0
320	First copy for Series 52 through 70	2,000
99941R	Right to copy 99941A	0
320	RTC for Series 52 through 70	1,000

NC—No charge. ■