

Hewlett-Packard 3000 Series

MANAGEMENT SUMMARY

Hewlett-Packard totally updated their HP 3000 Distributed Mainframe Series with the impressive introduction of four new models. Increased processor speeds, 64K RAM memories, an improved operating system, and lower peripheral costs all contribute to the apparent strength of this product line. Hewlett-Packard's commitment to a single operating system guarantees complete program compatibility and field-upgradeable growth paths.

The Series 40, 40SX, and 44 utilize the same 16-bit microcoded processor. The Series 40 and 40SX are basically the same system with slight configuration differences. The Series 40SX is a bundled system intended for the small business environment. The 40SX basic configuration includes only 256K bytes of memory, rather than the Series 40 initial memory size of 512K bytes. Also, the Series 40SX includes either HP's 27- or 67-megabyte Winchester disk with integral cartridge tape. The Series 40 initial disk selection is left to the user. Both systems support eight disk drives, three communications lines and up to 56 terminals, of which 32 may be point-to-point.

The Series 44 starts with a minimum memory of one megabyte with expansion capability to four megabytes. The Series 44 doubles the number of disks supported to 16 and increases the number of communications lines to seven. A maximum of 96 terminals can be supported on a Series 44, only 64 of which may operate point-to-point. The Series 44 also may utilize the HP Advanced Terminal Processor (ATP) to provide communications capabilities while reducing system overhead via the ATP's own microprocessors.

The Series 64 is certainly the most powerful HP 3000 to date with a reported performance level of 1-million- ➤

Hewlett-Packard has again revamped the 3000 Series with four new models, each featuring increased performance while remaining within the traditional HP 3000 price range. The new top-of-the-line, the Series 64, provides 32-bit operation while retaining full software compatibility with other HP 3000s. The Series 44 doubles the throughput of the earlier Series III for nearly the same price. The Series 40 incorporates the same CPU as the Series 44 but with less expandability in order to be priced well under \$50,000. The Series 40SX teams a Series 40 processor with a 27-megabyte sealed disk and integrated cartridge tape backup unit.

MAIN MEMORY: 256K bytes to 8 megabytes.

DISK CAPACITY: 27 megabytes to 6.464 gigabytes.

WORKSTATIONS: Up to 56 on the Series 40 and 40SX, to 96 on the Series 44, to 143 (110 active) on the Series 64.

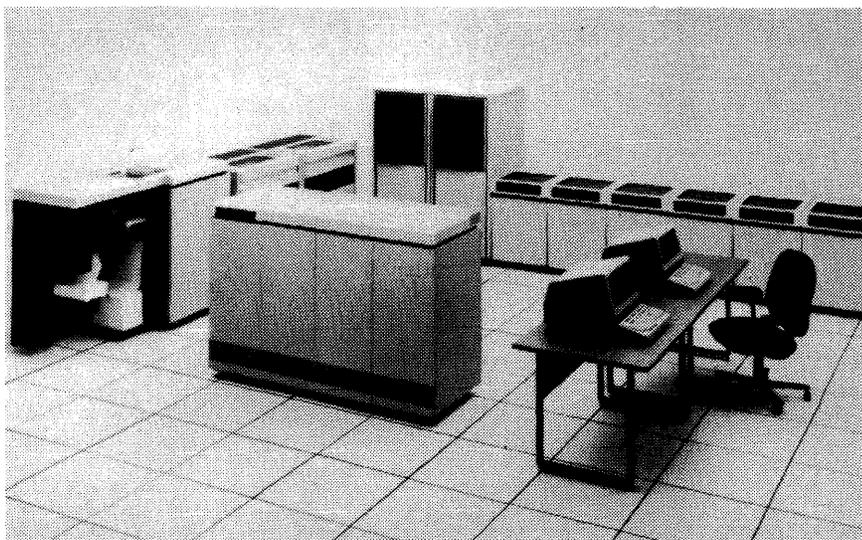
PRINTERS: 40 cps to 1000 lpm.

OTHER I/O: Magnetic tape, factory data collection terminals, graphics plotters, digitizers, and the intelligent page printer.

CHARACTERISTICS

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

Hewlett-Packard is one of the foremost manufacturers of sophisticated laboratory test equipment and specialized process control instrumentation. In addition to conventional laboratory equipment such as signal generators, oscilloscopes, and voltmeters, HP also manufactures more exotic ➤



The Series 64, as the top-of-the-line Series 3000, performs at the one-million-instructions-per-second level. The system offers many advantages of a 32-bit machine—a 32-bit data path, a 32-bit memory word, and dual arithmetic logic units—while maintaining full compatibility with existing HP software. The system shown here includes multiple disk units, two magnetic tape drives, two line printers, two workstations, and HP's laser printer.

Hewlett-Packard 3000 Series

▷ instructions-per-second. This system offers many 32-bit advantages—a 32-bit data bus, a 32-bit memory word, and dual arithmetic logic units capable of performing 32-bit arithmetic in a single cycle. The Series 64, however, maintains full compatibility with existing HP 3000s to protect the software investment of the installed base.

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

All of the HP 3000 utilize 64K RAM memory chips to provide maximum memory with a minimum of boards. The Series 64 adds an 8K byte cache memory to properly take advantage of its outstanding speed. The cache memory is said to have a 95 percent effective hit rate for memory accesses.

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

<u>Model</u>	<u>Performance Level</u>
Series 30	Base-line
Series III	1.5 to 2 times Series 30
Series 40/40SX	2.5 to 3 times Series 30
Series 44	2.5 to 3 times Series 30
Series 64	7 to 9 times Series 30

The Series 40, 40SX, and 44 models include an Inter-module Bus (IMB) to handle communications between the CPU, memory, and I/O modules. The CPU only releases control of the IMB upon request. The Series 64 has a Central System Bus (CSB) to perform the same general functions. The CSB features a 56 megabyte-per-second bandwidth and allows each module independent control of bus transfers. The Advanced Terminal Processor (ATP) is one of the independent microprocessor based modules accessing the CSB.

Hewlett-Packard offers a wide range of peripherals and mass storage devices for use on the HP 3000. Disk storage is available in sizes ranging from 19.6 megabytes to 404 megabytes per drive. One magnetic tape model features a ▷

▶ instruments such as gas chromatographs, digital thermometers, network analyzers, and spectrum analyzers. Related products include both digital and analog graphic recorders, analytic instrumentation systems, and medical electronic instrumentation systems. Other Hewlett-Packard products are hand-held and desk-top calculators, both programmable and nonprogrammable.

The Computer Groups organization includes the Computer Systems Division, which is responsible for the HP 3000 and the HP 250 small business computers; the General Systems Division, responsible for the HP 125 personal computer; the Data Systems Division, responsible for the HP 1000 line; the Desktop Computer System, which is responsible for the HP 9800 family; the Boise Division, which is responsible for system printers, the Data Terminals Division, responsible for display terminals, graphics terminals, and system consoles for the HP 250, 3000 and 1000 systems; the Vancouver Division, responsible for dot-matrix printers and printing terminals; the Disc Memory Division, responsible for disk drives; the Greeley Division, responsible for tape drives and Winchester and floppy disk drives, the Information Network Division responsible for languages, office software products, data base software products and data communications hardware and software products, the Manufacturing Systems Operation, responsible for manufacturing software, the Computer Support Division, the Systems Remarketing Operation and divisions in Grenoble, France and Boblingen, Germany.

Hewlett-Packard products are sold by 135 sales offices and distributorships in 70 countries and serviced to 160 offices in 37 countries. They are manufactured in 23 facilities in the U.S. and nine overseas (United Kingdom, Germany, France, Japan, and Malaysia). The company employs about 64,000 worldwide, with about 14,100 involved worldwide in computational products. Total sales for 1981 were 3.58 billion dollars.

MODELS: HP 3000 Series 40; HP 3000 Series 40SX; HP 3000 Series 44; HP 3000 Series 64.

DATE ANNOUNCED: HP 3000 Series 40: October 1981; HP 3000 Series 40SX: October 1981; HP 3000 Series 44: December 1980; HP 3000 Series 64: October 1981.

DATE OF FIRST DELIVERY: HP 3000 Series 40: November, 1981; HP 3000 Series 40SX: January 1982; HP 3000 Series 44: January 1981; HP 3000 Series 64: March 1982.

NUMBER INSTALLED TO DATE: Over 8000 total HP 3000s.

DATA FORMATS

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

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

FLOATING-POINT OPERANDS: Includes single-precision 32-bit (2-word) operands with signed 9-bit exponent and 22-bit positive fraction and extended-precision 64-bit (4-word) operands with signed 9-bit exponent and 55-bit positive fraction. In both single- and extended-precision formats, the exponent can range between -256 and +255, while an assumed ▶

Hewlett-Packard 3000 Series

PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION & SPEED	MANUFACTURER
MAGNETIC TAPE EQUIPMENT	All HP magnetic tape units accept 10½-inch reels, read and record on IBM/ANSI-compatible tape, and contain read-after-write features.	
7970B	9-track, 800 bpi, NRZI, 45 ips; 7970B-304 or -305 is the 1st drive, 7970B-300 or -302 the 2nd, 3rd or 4th drive; 36 KBS	Hewlett-Packard
7970E	9-track, 1600 bpi, phase encoded ips; 7970E-304 or -305 is the 1st drive, 7970E-300 or -302 the 2nd to 4th master drive, 7970E-301 or -303 the 2nd to 4th slave drive; 72 KBS	Hewlett-Packard
7976A	9-track, 1600 bpi; phase encoded, 6250 bpi; group encoded; 75 ips; burst transfer rate=120 KBS (1600 bpi) or 469 KBS (6250 bpi); streaming mode=110 KBS (1600 bpi) or 320 KBS (6250 bpi); auto load and auto thread features included. Maximum of 1 unit supported on series 40, 40SX, and 44, up to 2 on Series 64	STC
PRINTERS		
2601A	Daisywheel; letter quality; 40 cps; automatic proportional spacing; center and right justification, auto underline, shadow and bold print; bidirectional forms tractors; single or multipart forms	Diablo 630
2608A/S	Comb matrix, 5 x 7 dot matrix (5 x 9 for lower case in 128-char. set); S indicates remote print capability, two print densities, and enhanced forms handling	Hewlett-Packard
2631B/2631G	Dot matrix, 7 x 9, 136 positions, 128-character set, 10 characters per inch, 6 or 8 lines per inch, 1.2 to 15.75-inch paper, 8-channel VFU; 180 cps, may be used as remote spooled printer with RS-232-C interface. G suffix adds graphics capabilities with a line drawing character set, a high intensity print character set, and a Factory Data Collection Printer as option	Hewlett-Packard
2617A/2617A-001	Drum, 132 positions, 64/96-character sets, 10 characters per inch, 6 or 8 lines per inch, 4 to 16.8-inch paper, 12-channel VFU, OCR-B character font available; 600/436 lpm	Dataproducts 2260
2619A/2619A-001	Drum, 132 positions, 64/96-character sets, 10 characters per inch, OCR-B character font available, 6 or 8 lines per inch, 4 to 19-inch paper, 12-channel VFU; 1000/750 lpm	Dataprinter 1210
2680A	Intelligent Page Printer; laser printing, 45 11 x 8.5 inch pages per minute, up to 32 character fonts, up to 32 user defined forms	Hewlett-Packard
PRINTING TERMINALS		
2635B	Printing Terminal; 180 cps, automatic bidirectional printing, underline and display function modes, 16-channel computed VFU, EIA RS-232-C interface without modem control	Hewlett-Packard

➤ 6250 bits per inch, group-encoded unit for burst-speed backup operations. Printers vary from a 40 character per second letter quality printer to a 45 page per second Laser Page Printing System. The wide range of terminals available can allow the user to tailor each workstation according to its task.

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

The Multiprogramming Executive (MPE) operating system allows transaction processing, on-line program developments, data communications and batch processing. An on-line HELP command is one illustration of HP's user friendly software approach. The full ➤

➤ "one" is placed to the left of the binary point in the fraction. (The "one" is disregarded for floating-point zero.) All floating-point numbers are by definition normalized. The binary point is assumed to be between the exponent and fraction. Bit 0 of the first word is the sign bit; the exponent in bits 1 through 9 is biased by +256.

INSTRUCTIONS: The HP 3000 Series have an unusually rich and varied complement of instructions; all, except the stack operation instructions, are one-word types with 23 distinct formats for 13 different instruction groups. The 65 stack instructions can be packed two per word. In general, each instruction has a number of basic fields. Invariably, the first field is always four bits long and is used to define a specific operation code (for memory reference or loop control instructions) or one of four sub-opcode groups. All sub-opcode type instructions have an operation code extension field whose length and position in the instruction vary depending upon which of the four sub-opcode groups is specified. In some cases, a third operation code field (mini-opcode or special opcode) is used to extend the basic operation code. The rest of the 16-bit instruction is used for a variety of functions (count fields, bit positions, index specification, immediate operand, etc.) and is called the argument.

➤ **INTERNAL CODE: ASCII.**

Hewlett-Packard 3000 Series

PERIPHERALS/TERMINALS (Continued)

INTERACTIVE DISPLAYS

Features	2382A/ 2622A	2621B/ 2623A	2624B	2626A/W	2641A/ 2645A	2642A/ 2647A	2648A
Maximum data rate (bits per second)	9600	9600	9600	9600	9600	9600	9600
Memory Block or character mode	48 lines Std.	48 lines Char. mode only on 2621B/Std. on 2623A	Up to 32Kb Std.	119 lines Std.	4-12Kb Std.	Up to 9Kb Std.	8-12Kb Std.
Inverse video Underline, half-bright, blinking	Std. Std.	Std. Underline only on 2621B/Std. on 2625A	Std. Std.	Std. Underline and blinking	Std. Std./2645A requires 13231A dis- play opt.	Std. Std./2647A requires 13231A dis- play opt.	Std. 13231A
User-definable soft keys Option slots supplied	8 Std. None	8 Std. None	8 Std. None	8 Std. None	8 Std. 5/7	8 Std. 5 Std.; 4 with CTU/1	8 Std. 4
Character set supplied	128 Roman	128 Roman	128 Roman	128 Roman	64 Roman, 128 APL†/ 128 Roman*	128 Roman	128 Roman
Other	120 cps thermal printer opt. on 2622A	120 cps thermal printer opt. on 2621B/ Graphic printer opt. on 2623A	120 cps thermal printer opt.; extended edit checks	Dual ports; 4 windows/ workspaces; 120 cps thermal printer opt.		Flexible mini- disc on 2642A Graphics and Intelligence on 2647A	Graphics features
Lower case/displayable control codes	Std.	Std.	Std.	Std.	128 Roman/ Std. on 2645A	Std.	Std.
Integrated dual cartridge tapes	N/A	N/A	N/A	N/A	Opt. 007	Opt. 007/ Std. on 2647A	Opt. 007
Multipoint interface	N/A	N/A	13267A or 13268A or 13264A	13267A or 13268A or 13264A (for 2626A only)	Opt. 33/34	Opt. 33/34	Opt. 33/34
Math symbols, alternate character set	N/A/Opt. 204 on 2622A	N/A	Opt. 201	Opt. 201	13231A Opt. 201	Std./13231A Opt. 201 on 2647A	13231A Opt. 201
Large character, alternate character set	N/A	N/A	Opt. 201	Opt. 201 (only on 2626A version)	13231A Opt. 203	Std./13231A Opt. 203 on 2647A	13231A Opt. 203

KEY Std.—Standard with terminal, Opt.—Option ordered with terminal, Avail.—Order separate product, N/A—Not Avail, CTU—Cartridge Tape Unit

†APL 3000 is available only on the HP 3000 Series III. The 2641A is supported on the HP 3000 as a 2645A when used without APL 3000.

*Character sets for languages other than English are available on other models of these terminals.

➤ complement of language processors available include Basic, Cobol, Fortran, Pascal, RPG, and SPL. The majority of HP 3000 systems are used in Cobol applications.

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

The close parallels between the Fortran and Basic languages used on the smaller HP 1000 Series computers ➤

➤ MAIN STORAGE

STORAGE TYPE: NMOS utilizing 64K RAMs.

CYCLE TIME: The Series 40, 40SX, and 44 each have a cycle time of 430 nanoseconds for a 16-bit fetch and a read access time of 300 nanoseconds. The Series 64 includes an 8K byte cache memory to provide an average memory access time of 134 nanoseconds. The cycle time of 840 nanoseconds is for an 8-word block.

CAPACITY: The HP 3000 Series 40SX system starts with 256K bytes of memory. Additional memory is available in increments of 256K bytes or 1 megabyte, up to a maximum of 2 megabytes. The Series 40SX supports memory sizes of 256Kb, 512Kb, 756Kb, 1 mb, 1.5 mb and 2 mb. The Series 40 capacity ranges from 512K bytes to 2 megabytes, with memory increments of 256K bytes or 1 megabyte. Configurations supported on the Series 40 are 512Kb, 756Kb, ➤

Hewlett-Packard 3000 Series

PERIPHERALS/TERMINALS (Continued)

DEVICE	DESCRIPTION & SPEED	MANUFACTURER
DATA COLLECTION TERMINALS		
3075A	Desktop data capture terminal; 15 position numerical display, protected data field, 17 user-defined prompting lights, 10 special function keys, supported in point-to-point or asynchronous multi-point configurations	Hewlett-Packard
3076A	Wall mounted data capture terminal; see description for 3075A	Hewlett-Packard
	Options for the 3075A and 3076A models include: alphanumeric keyboard, alphanumeric display (24 positions), 5 inch CRT, multi-function reader, type V reader, alphanumeric printer, low cost bar code reader, magnetic stripe reader, RS-232-C interface, and 220/240V operation	
3077A	Time reporting terminal: large time display and type V badge reader, wall mounted, options include multifunction reader, alphanumeric display, and 220/240V operation	Hewlett-Packard
7260A	Optical mark reader: buffered serial output data, switchable baud rate, RS-232-C, up to 300 cards per minute; options include select hopper, encoder, bell, 220/240V operation, 50 Hz operation, and wider input hopper	Hewlett-Packard
PLOTTERS		
7220C/7220T	Multicolor graphics plotter, RS-232-C, optional 2K byte buffer, 11 x 17 inch maximum size for paper or overhead transparencies, auto pen changing; T indicates auto paper advance	Hewlett-Packard
7221C/7221T	Multicolor graphics plotter, RS-232-C, optional 1.8K byte buffer, 11 x 17 inch maximum size for paper or overhead transparencies; auto pen changing; T indicates auto paper advance	Hewlett-Packard
7225B	Graphics Plotter, single pen, HP-IB interface, 8 x 11.2 inches, .001 inch resolution, 10 inch/second velocity on each axis, must order Personality Module for I/O capability	Hewlett-Packard
7240A	Plotter/printer, thermal high-resolution plotting; 38 cps printer; RS-232-C	Hewlett-Packard
72458	Printer/Plotter; 7.4-inch by 16.4-foot bidirectional paper drive for long-axis plotting; better than 0.06-inch resolution; up to 10.1 inches per second pen velocity; 7 x 9 dot-matrix characters at 38 cps; 14 x 9 dot-matrix characters at 19 cps	Hewlett-Packard
7580A	Digital plotter; D size; 8 selectable pens; uses paper, velum, or polyester film	Hewlett-Packard
9872C/9872T	Digital plotter; 11 x 15.75 inches, eight program-selectable pens, multicolor, 14 inches per second; T indicates auto paper advance	Hewlett-Packard
DIGITIZER/GRAPHICS TABLET		
9874A	Tiltable glass platen, 15-character LED display, 16K bytes of read-only memory, rear projection of graphic images	Hewlett-Packard
9111A	Graphics tablet, single point or continuous line mode, 16 softkeys, resolution to 0.100mm (00394 inch)	Hewlett-Packard

➤ and their counterparts of the HP 3000 systems make it possible for users with these smaller systems to upgrade easily. (Even though conversion will be required, the standard portions of the languages will be unchanged, and only the discrepancies in language extensions and data format expressions will need to be resolved.)

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

HP is directing its applications development efforts towards two major market areas: manufacturing and office automation. Their Materials Management/3000 ➤

➤ 1 mb, 1.5 mb or 2 mb. The Series 44 capacity starts at 2 megabytes and goes to 8 megabytes in 1 megabyte increments. The Series 64 capacity starts at 2 megabytes and goes to 8 megabytes in 1 megabyte increments.

CHECKING: Automatic fault detection and correction memory is used in all current HP 3000 models. The word length transmitted over the intermodule bus is 16 bits. In the memory modules the word length is expanded to 39 bits; 32 data bits and 7 bits for the automatic fault detection and correction logic. This provides the system with the capability of detecting single bit and double bit errors and correcting single bit errors.

STORAGE PROTECTION: Upper and lower address boundaries, provided by certain registers, define the limits of authorized program access in main memory. The micro-program routinely checks for bounds violation during execution (overlapped with operand fetch) and generates an ➤

Hewlett-Packard 3000 Series

▷ and Production Management/3000 are intended for manufacturers of products assembled from discrete components. The Office Systems products provide a system-wide solution to individual employee word processing and decision support needs. A series of programming aids, RAPID/3000, is available to provide an improvement of two to ten times in programming speeds.

Customer services for the HP 3000 Series are extensive. They include pre-installation site planning, installation, several levels of training given both at users' sites and at HP, several levels of on-site hardware and software service, user program consultation both on-site and via toll-free telephone, reference manual updates, information newsletters, and an active user's group.

HP provides a Guaranteed Uptime Service which warrants that a system's uptime shall exceed 99 percent over any three months or the user will receive a one month credit toward his maintenance fee. The service provides continuous coverage and a four hour response within 100 miles of a service site. The mean-time-to-repair a Series 40, 40SX, or 44 is said to be one hour, and for the Series 64, is said to be two hours.

Maintenance is handled through 53 HP offices in the U.S., 9 in Canada, 18 in Central and South America, and 103 in Europe, Africa, Asia, and Australia. Both on-call and scheduled services are available. The Standard System Maintenance Service (SSMS) contract provides for typical four-hour response times within a 100-mile radius of a major metropolitan area. Prime-time coverage is provided in nine different time and day periods.

The HP 3000 systems are being marketed to five general classes of prospective users: small manufacturers with sales in the 10 to 100 million dollar range; medium-scale manufacturers in the 100 to 250 million dollar range; Fortune 500 or 1000 companies that wish to decentralize and have several applications in each location; educational institutions on both the college/university and secondary school levels; the OEM accounts and system houses with capabilities for applications software development. About 10 percent of the 300 Series systems being sold at present go to educational institutions. The main thrust of HP's marketing effort is toward distributed processing applications.

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

▶ interrupt if an unauthorized memory access attempt is made. Bounds violations may be classified under program transfer or reference, data reference, and stack overflow or underflow.

RESERVED STORAGE: The first eleven main memory locations are reserved for global system pointers used in the firmware implementation of virtual memory and variable-length program segmentation. Following this is a device reference table containing a set of four-word entries (one per device, maximum 125 entries) containing device interrupt vectors and the identity of the drivers for each device.

CENTRAL PROCESSOR

GENERAL: The HP 3000 Series processors are complex systems that include a firmware-implemented instruction set; firmware-implemented repetitive functions such as sub-routine linkage, string processing, and buffer transfers; firmware-assisted software; bus control clock; and crystal clock dedicated to process execution measurements.

The hardware processors consist of an arithmetic-logic unit, shifting network, and on the Series 40, 40SX, and 44, 72 specific purpose registers, 18 of which are user-accessible. The Series 64 CPU also contains 72 specific-purpose registers with 21 user-accessible.

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

The Series 40, 40SX, and 44 feature a Hewlett-Packard designed, microcoded, 16-bit processor using Schottky TTL technology. This technique provides high speed execution of instructions while maintaining machine instruction set flexibility. Each system is based on a modular design to allow independent elements to be interconnected through a central system bus structure. The independent elements consist of a CPU which controls memory via a memory controller, General I/O channels, DSN/Asynchronous Data Communication Controllers, and the bus system to allow communication between the I/O devices. The system also includes a console and a Control and Maintenance Processor (CMP).

The Series 64 CPU is a Hewlett-Packard designed, microcoded processor using high speed Emitter Coupled Logic (ECL) technology and a dual arithmetic logic unit (ALU). This provides the highest performance level achieved in an HP3000, one-million-instruction-per-second. The modular concept used in the Series 64 includes the following components: a CPU module with dual arithmetic logic units (ALUs), cache memory, main memory, Writable Control Store, I/O Adapters, General I/O channels, and DSN/Advanced Terminal Processors. Communications between modules is accomplished using a high speed Central System Bus and up to two Intermodule Busses. The Series 64 also includes a system console, system display panel, and a Diagnostic Control Unit (DCU).

Program code and data are maintained in strictly separate domains and cannot be intermixed except in "immediate" type data present in program instructions. This design was chosen so that all program code would be protected from alteration, thus permitting the development of re-entrant programs for multi-thread operation.

Firmware-assisted software includes the interrupt handler, cold-start loader, power-failure data-saving routines, ▶

Hewlett-Packard 3000 Series

▷ USER REACTION

Two hundred and six users of HP 3000 systems responded to the Datapro 1982 Computer System User Survey. The systems itemized included the earlier HP 3000 models as well as the current Series 40 and 44 systems. No Series 64 configurations were specifically mentioned by model number.

The majority of HP systems were purchased with 150 users reporting that fact. Only 22 users rent or lease from HP and 34 users lease from a third party firm. One hundred and thirty-eight users converted to the HP 3000 from another system while 67 respondents went directly to the HP 3000. Central processing installations generated the majority of our responses with 205 users reporting. Distributed processing sites only prompted 21 responses.

The systems described varied in memory size from two systems with 64K to 128K bytes of memory to three systems with eight megabytes of memory. The systems with between one and two megabytes of memory formed the largest group as 105 users fell into that range. Very few HP 3000 systems were reported as using diskette storage. In fact, 182 users have no diskette storage at all on their systems. Disk storage, however, ran the gamut from seven users with less than one megabyte of storage to sixteen reporting over 1200 megabytes of total disk storage. One hundred and twenty users reported having between 200 and 600 megabytes of disk storage. That size range was by far the most popular reported.

The IMAGE Data Base Management System is being used by 187 respondents. Five respondents are using an outside vendor package and one, a home-grown system. Only 13 respondents are not using a DBM system of some kind. Sixty-two users have integrated word processing functions on their system; 140 have not. Cobol was the favorite programming language with 129 users. Fortran came in a distant second with 27 users and RPG, third with 20 users. Applications programs came from a variety of sources: 169 respondents used in-house personnel, 110 used proprietary software, 77 used contract programming, and 76 used "packaged" programs from HP.

The HP 3000 systems are used in a variety of industries. They are listed in order by number of respondents: Manufacturing: 72 users; Education: 24 users; Retail/Wholesale: 18; Government: 15; Health Care/Medical: 11; Chemical/Petroleum: 11; and Banking/Finance/Securities: 6. The principal applications listed also varied considerably. They are again listed in order by number of respondents: Accounting/Billing: 167; Order Processing/Inventory control: 114; Payroll/Personnel: 113; Purchasing: 74; Sales/Distribution: 72; Manufacturing: 65; Mathematics/Statistics: 27; Engineering/Scientific: 25; and Education-Scheduling/Administration: 24.

The following table summarizes the ratings given by these HP 3000 users: ▷

▷ automatic restart routines, and front panel-initiated diagnostics. The basic microprogramming architecture is asynchronous and designed to facilitate a multiprogrammed, variable-length, code-segmentation, virtual-memory and mode of operation with extensive stack processing.

CONTROL STORAGE: Bipolar ROM (read-only memory) consisting of 12K 48-bit words for the Series 40, 40SX, and 44. The Series 64 utilizes 40K bytes of RAM (random-access memory) as its control storage. HP utilizes all of this space. Control storage is not directly accessible to the end user. Microinstruction cycle time is 105 nanoseconds for the Series 40, 40SX, and 44. The Series 64 microinstruction cycle time is 75 nanoseconds.

REGISTERS: There are 72 hardware registers on the HP 3000. Eighteen are accessible to the programmer on the Series 40, 40SX, and 44. Twenty-one registers are available for programmer use on the Series 64. 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 64 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 64), and the Index and Status registers.

The code segment group consists of the Program Base register (PB), which defines the program base of the code segment being executed; the Program Counter (P), which contains the 16-bit absolute address of the instruction being executed; the Program Limit register (PL), which defines the limit of the code segment being executed; and the Program Bank register (PBNK), which defines the bank of 64K words where the code segment resides (Series 40, 40SX, and 44). The Series 64, instead of the PBNK register, includes a BNKP register which performs the same function.

The stack pointer group is divided into the data segment group and the stack pointers. The data segment group includes the Data Base register (DB), used to define the data base of the current user's stack; the Q register, utilized to define the current stack master in the current data segment; the Data Limit register (DL), where the data limit of the current data segment is defined; and the Data Base Bank register (DBNK) which contains the location of the bank in which the stack or split stacks reside. DBNK is used in the Series 40, 40SX, and 44 machines. The Series 64 uses the BNKD register to perform this function. The stack pointers include the SM register, which defines the number of top-of-stack elements that are in CPU Stack registers; the Z register, whose function is to define the stack limit of the current user's stack; and the Stack Bank register (SBNK), used to define the 64K word bank in which the stack resides (Series 40, 40SX, and 44). The Series 64 uses the BNKS register to perform this function.

The Status register indicates the current status of the computer hardware, including whether the system is in user or privileged mode. The Switch register (SWCH) is a 16-bit register representing front panel switches used for bootstrapping and fault diagnosis on the Series 40, 40SX, and 44. A performance register (PERF) in the Series 64 is used by Hewlett-Packard to make electrical measurements to monitor performance.

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

Hewlett-Packard 3000 Series

	Excellent	Good	Fair	Poor	WA*
Ease of operation	139	61	5	0	3.7
Reliability of mainframe	172	33	0	1	3.8
Reliability of peripherals	119	77	6	2	3.5
Maintenance service:					
Responsiveness	100	90	15	0	3.4
Effectiveness	106	80	14	2	3.4
Technical support:					
Trouble-shooting	51	117	32	4	3.0
Education	7	118	33	7	2.2
Documentation	46	102	51	6	2.9
Manufacturer's software:					
Operating system	126	74	6	0	3.6
Compilers and assemblers	83	108	9	1	3.4
Applications programs	36	81	18	2	3.1
Ease of programming	88	103	9	1	3.4
Ease of conversion	59	99	16	4	3.2
Overall satisfaction	114	87	5	0	3.5

*Weighted Average on a scale of 4.0 for Excellent.

The HP 3000 users were quick to point out the significant advantages of their systems. One hundred and seventy-three users noted the ease with which their equipment can be expanded and reconfigured. One hundred and fifty users feel that the IMAGE data base language is both efficient and effective. One hundred and twenty-nine users are happy with their response time and eighty-six feel the HP productivity aids do help keep programming costs down. Seventy-three users feel their HP 3000 is power and energy efficient while seventy-four noted that programs and data from other systems were as compatible as the vendor promised. Fifty-seven users said that their equipment delivery and/or installation was ahead of schedule. Thirty five users were pleased that their terminals and peripherals from other systems were as compatible as promised. Twenty-three users felt that their systems costs were less than expected.

The significant problems encountered with the HP 3000 systems were few and far between. Nineteen respondents felt that the vendor did not provide all the promised software or support. Seventeen thought that the system costs exceeded their expected total. Sixteen noted that the

direct-indexed, indirect or indirect-indexed. Both word and byte addressing is relative to the Q-register (plus or minus), the DB-register (plus only) or the S-register (minus only). The S-register is a logical addition of the contents of the SM and SR registers. In addition, word addressing is relative to the P-register (plus or minus). Indirect addressing and indexing are both provided, individually or in combination. Up to 32K words (addresses) can be referenced by a memory reference instruction.

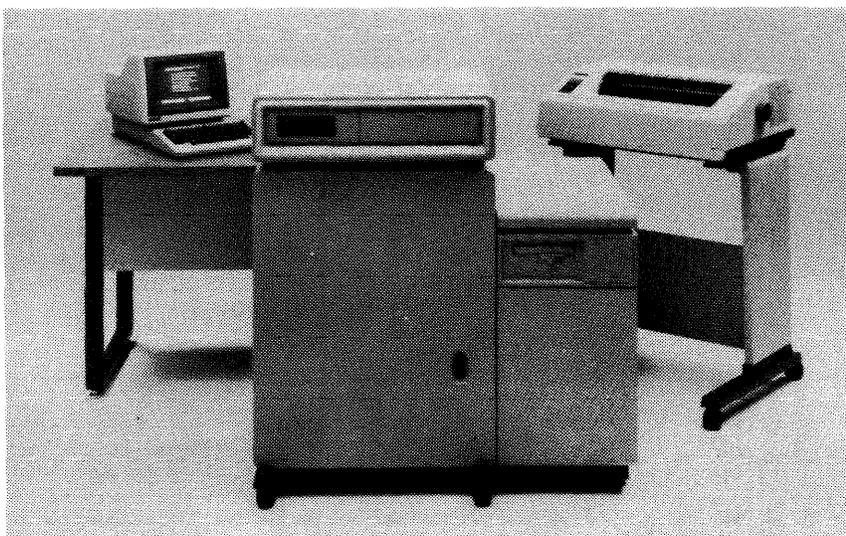
Double-word indexing is provided for two memory address instructions that automatically cause the index register contents to be incremented by two during development of the effective address.

INSTRUCTION REPERTOIRE: There are 216 machine instructions in the HP 3000 Series 64, 213 in the Series 44, and 212 in the Series 40 and 40SX. These are broken down into the following groupings: 65 stack op instructions, 17 shift instructions, 15 program control and special instructions (16 in the Series 44), 19 machine and I/O instructions (15 in the Series 40 and 44), 4 loop control instructions, 16 memory address instructions, 7 field and bit instructions, 13 branch instructions, 12 move instructions, 8 privileged instructions, 15 immediate instructions, and 7 register control instructions. Extended instructions includes 6 extended-precision floating point instructions and 12 decimal arithmetic instructions.

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

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

PHYSICAL SPECIFICATIONS: The Series 40 System Processing Unit (SPU) is housed in a standalone cabinet



The Series 40 is the first model in the HP3000 model line to break the \$50,000 (U.S. list) price barrier. Memory sizes range from 256K bytes to two megabytes. Up to 56 terminals may be configured on the Series 40, as well as up to eight disk drives.

Hewlett-Packard 3000 Series

➤ configuration proposed by the vendor was too small and that their equipment installation was late. Thirteen users added that their required software was delivered later than planned and ten users felt that vendor enhancements to the hardware and software were hard to keep up with.

None of these negatives seemed to affect our respondents plans for the coming year. One hundred and thirty-two users are planning expansion to their present hardware. One hundred and twelve users will be acquiring proprietary software from other manufacturers while 85 will be staying within HP for their additional software. Sixty-nine users plan to expand their data communications facilities and 43 want to add business graphics. Thirty-one users want to implement a distributed processing capability and 21 are planning on purchasing another HP 3000 system.

A review of the user ratings reflects the quality of the HP 3000 systems. The top rating went to the reliability of the mainframe, an assurance that HP's Guaranteed Uptime is no idle claim. Ease of operation ran a close second, also with an excellent rating. The lowest ratings were in the education and documentation areas. These are traditionally the weakest scores reported on most systems and it seems HP may have some room for improvement on an otherwise outstanding product.

The loyalty of the installed HP 3000 user base is impressive. Of our respondents, one hundred and seventy-nine users are not planning to replace their systems in 1982. Twenty-two are switching systems but will remain with HP. Only one user indicated plans to leave the HP fold and one user was undecided. In answer to the question "Did the computer system do what you expected," 195 users said yes, three said no, and eight were undecided. The final question, "Would you recommend this system to another user," 195 voted yes, two voted no, and there were still eight undecided.

Possibly the best summary to this review is a few actual user comments "The most reliable computer I've ever seen," "the finest hardware/software combination I've ever used," "system ran continuously 24 hours a day for seven days a week for nearly 18 months," "the operating system is a joy to use." Hewlett-Packard must have worked hard to deserve all of this praise and the HP 3000 users can only benefit from that effort.□

➤ inches (101.6cm) high, 24 inches (61 cm) wide, and 22.4 inches (56.9 cm) deep. The unit weighs 190 pounds (86 kg). The Series 40 requires a line voltage of 120 VAC at 60 Hz or 220 VAC at 50Hz and a line current 8.5A at 60 Hz or 4.5A at 50 Hz. Heat dissipation is 3000 BTUs per hour.

The Series 44 SPU is housed in a desk-style cabinet 28.5 inches (72.4 cm) high, 72.25 inches (183.5 cm) wide, and 31.25 inches (79.4 cm) deep. The unit weighs 240 pounds (109 Kg). The Series 44 requires a line voltage of 210 VAC at 60 Hz or 220 VAC at 50 Hz with a line current of 13.1A at 60 Hz or 12.4A at 50 Hz. The system dissipates 7380 BTUs per hour.

The Series 64 SPU is housed in a standalone cabinet 48 inches (121.92 cm) high, 69 inches (175.26 cm) wide, and 26 inches

(66.04 cm) deep. The unit weighs 1100 pounds (500 kg). The system requires a line voltage of 200VAC, 3 phase at 60 Hz or 380 VAC, 3 phase at 50 Hz with a line current of 24A at 60 Hz or 13A at 50 Hz. Heat dissipation is 12000 BTUs per hour.

All HP 3000 models have a recommended operating temperature of 20°C to 25.5°C or 68°F to 78°F. The recommended operating relative humidity is 40 to 60 percent non-condensing.

INPUT/OUTPUT CONTROL

The Series 40 and 44 utilize an Intermodule Bus (IMB) to handle communications between the CPU, memory, and I/O modules. The CPU generates over 90 percent of the bus activity and has continuous access to the bus. The CPU relinquishes control to the I/O channels only on request. The IMB has separate address and data paths, each with handshake controls operating in a master/slave mode to transfer data. Any channel request will cause the CPU to relinquish control of the IMB so the request can be serviced.

The Series 64 Central System Bus (CSB) is the communication link between the CPU module, main memory module, and the I/O adapter modules. The CSB has a 56 megabyte per second overall bandwidth to allow support of multiple IMBs. No module has implied control of the CSB. Each operates independently except when necessary to transfer data or send commands. The initiating module asks for and receives control of the CSB. All transfers to and from memory are in eight word blocks.

The I/O adapter modules (IOA) are an interface between the Central System Bus and the Intermodule Busses to allow communication between the I/O system, main memory, and the CPU. Up to two Intermodule Busses are supported on the Series 64. The IOA synchronizes the slow speeds of the IMB to the Central System Bus. A 1024 byte buffer cache memory is included in each IOA to handle communications between the 16-bit IMB and the 32-bit CSB. To devices on the IMB, the IOA appears as memory responding to IMB requests generated by I/O controllers.

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

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

CONFIGURATION RULES

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

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

Hewlett-Packard 3000 Series

- Up to eight megabytes of main memory.
- Up to 6.464 billion bytes of on-line disk storage.
- Up to 143 multipoint terminals.
- Up to eight magnetic tape drives.
- Up to eight line printers.
- Up to two laser printer systems.

WORKSTATIONS: Up to 56 terminals may be configured on each Series 40 and 40SX system. Up to 55 of these may be multipoint terminals; all may operate at 9600 baud. The Series 44 increases the maximum number of terminals to 96, and 60 of these units may operate in a multipoint environment. The Series 64 is physically capable of configuring 143 multipoint terminals but software dictates that only 110 may be simultaneously active.

MASS STORAGE: The Series 40SX includes either a 27- or 64-megabyte Integrated Storage Unit with an integral Cartridge Tape Drive. A total of eight disk drives, including the unit packaged with each system, is supported on the Series 40SX. The Series 40 does not include any pre-packed disk unit as part of the basic configuration but, like the 40SX, does support a maximum of eight disk drives. The Series 44 and 64 increase the maximum number of disk drives supported per system to 16. All of the HP 3000s support only one Integrated Storage Unit per system. A second controller must be ordered to support the integral cartridge tape to prevent user-lockout during tape back-up operations. The disk units interface to the GIC; a dedicated GIC is required to support the integral cartridge tape unit on the Integrated Storage Unit.

MAGNETIC TAPE UNITS: The cartridge tape drive included with the Integrated Storage Unit is required as a system backup and for software updates on the Series 40SX. The cartridge tape is designed as a backup device for a maximum of 128 megabytes of disk capacity. When mass storage capacity exceeds 128 megabytes, additional magnetic tape drives must be added as the primary system backup. Each system can support both the HP 7970E 1600 bpi drive and the HP 7976A 1600/6250 drive. The Series 40 and 40SX systems can have a maximum of four tape drives with only one HP 7976A allowed. The Series 44 and 64 each handle up to eight magnetic tape drives with one HP 7976A supported on the Series 44 and two on the Series 64. The magnetic tape drives interface through the GIC.

PRINTERS: The HP 3000 supports up to two printers on the Series 40 and 40SX, four printers on the Series 44, and eight printers on the Series 64. These printers may be the 2608A dot matrix line printers (maximum of two on Series 44, four on Series 64) or the 2717A and 2619A line printers. Each HP 3000 system also supports a maximum of two 2680A Intelligent Page Printers in addition to those discussed above. All printers interface through the GIC; the 2608A dot matrix line printer cannot be interfaced to the same GIC used to interface high-speed peripherals.

MASS STORAGE

7906M/S DISK CARTRIDGE DRIVE: The 7906M is a 19.6-megabyte drive with 9.8 megabytes of fixed disk and 9.8 megabytes of removable cartridge storage. The 7906S is the add-on unit, also providing 19.6 megabytes of storage. It can be configured on the same controller as the 7920 and 7925 drives. Data is recorded on 800 tracks per cartridge or disk using 48 256-byte sectors per track. Track-to-track, average, and across-all-tracks head positioning times are 5, 25, and 45 milliseconds, respectively. The rotational speed and delay and the data transfer rate are also the same as those for the 7920 and 7925. The unit features a microprocessor based controller to provide error correction and automatic alternate track switching.

7911P AND 7912P INTEGRATED STORAGE UNITS: The 7911P and 7912P are standalone peripheral storage

systems with either a 27- or 64-megabyte fixed disk drive, an integral cartridge tape drive, a 67 megabyte tape cartridge, two intelligent controllers, and a power supply in a standalone cabinet. These units feature a 35.0 millisecond average access time and a 1 megabyte per second burst data transfer rate. Track-to-track seek time is 5 milliseconds and an average random seek is 26.7 milliseconds. The average data transfer rate is system dependent with a maximum of 983 kilobytes per second. The drive has a rotational speed of 3600 rpm and an average rotational delay of 8.3 milliseconds. The integral tape drive has a read/write tape speed of 60 inches per second and a search speed of 90 inches per second. The tape's maximum data transfer rate is 1 megabyte per second with burst transmission over the HP-IB. The average transfer rate over the internal data path is 35 kilobytes per second.

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

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

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

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

INPUT/OUTPUT UNITS

Refer to the Peripherals/Terminals table.

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

COMMUNICATIONS CONTROL

DSN/ASYNCHRONOUS DATA COMMUNICATIONS CONTROLLER (ADCC): The ADCC is used in the Series 40, 40SX, and 44 to provide modem connections for terminals or as an alternate way to direct connect terminals. One ADCC is required to connect the Control and Maintenance Processor. The channel performs essentially for terminals the

Hewlett-Packard 3000 Series

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

The ADCC does not have DMA facilities and so cannot control the IMB or memory. Terminals on the ADCC do not respond to a parallel poll. The ADCC must be directly controlled by the CPU through channel programs. Circuitry on the ADCC decodes address information and selects the proper device for each operation. Four full-duplex ports are provided on each Main ADCC, the Extender ADCC boards increase the capacity to eight full-duplex ports. Multiple ADCCs are supported on each system but, as the Main ADCC includes specific control circuitry, each Extender ADCC requires a Main ADCC to function. The Main ADCC supports full duplex operation only via Bell type 103, 212, and 202T modems; Extender ADCCs are required for European half duplex support. The Series 40 and 40SX support up to eight ADCC's and the Series 44 can handle up to 15 ADCCs.

DSN/ADVANCED TERMINAL PROCESSOR (ATP): The ATP provides an intelligent interface between terminals and the CPU for the Series 44 and 64 systems. The ATP supports data transfer rates up to 19,200 bits per second, handles character processing to eliminate CPU interrupts, and provides direct memory access of user data. RS-232-C and RS-422 support is provided for local terminal hook-ups, with distances to 50 or 4000 feet respectively. The Series 64 ATP adds full-duplex asynchronous modem support (Bell type 103, 202T, 212A, and CCITT V.24) to the list of features. The Series 44 is expandable from 12 to 60 terminals while the Series 64 extends the maximum to 96 terminals. Up to two subsystems are supported on the Series 64 to provide a maximum of 144 ports.

An ATP is composed of one System Interface Board (SIB) and from one to five Port controllers (Series 44) or one to eight Port contractors (Series 64). The SIB provides a hardware interface to the Intermodule Bus (IMB) and performs byte packing/unpacking and direct memory access of user data. Port Controllers provide the hardware interface to the terminal/workstation devices. The Port Controller handles all handshaking between the system and the terminal, all character echoing, speed sensing, and input character buffering. The ATP supports character or block transmission.

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

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

SYNCHRONOUS SINGLE LINE CONTROLLER: This is the hardware portion of HP's 2780/3780 emulator subsystem; it provides all IBM 2780 and 3780 capabilities, including

Bisync protocol compatibility, plus 22 optional capabilities available from batch and interactive terminals under MPE III. The controller uses half- or full-duplex operation over public telephone or leased lines to allow the HP 3000 systems to be linked via modems to other computers in an HP Distributed Systems Network. The HP 30055A offers compatibility with EIA RS-232-C, CCITT V.24, and Bell type 201, 208, or 209 modems. The controller has program-selectable parity (none, even, odd), program-selectable special character recognition, and program-selectable synchronous characters. Two-character buffering is standard. The unit operates at speeds up to 9600 bps. Software is provided separately.

HARD-WIRED SERIAL INTERFACE: This provides the hardware for an HP 3000 Series link via coaxial cable to other computers in an HP Distributed Systems Network for high-speed asynchronous, point-to-point data transfers. A transfer rate of up to 2.5 megabytes per second is offered over distances of up to 1000 feet, with half that speed at 2000 feet. The interface includes four software-selectable channels; programmable error detection; call-back or line monitoring timer; automatic hardware transmission of an acknowledge word (handshaking) without program interruption; and CRC generation, transmission, and processing. The CRC uses a 15th-degree polynomial. A pair of 75-ohm coaxial cables function as a unidirectional pair of transmission lines for fast turnaround. The cable is optically isolated at the receiving end, enabling long-distance transmission with a low probability of errors due to common-mode noise or ground-level shifting.

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

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

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

In a network of HP 3000s, any computer can at any time interchange information simultaneously with as many as seven others. Any number of 3000s can be interconnected via DSN/DS as long as no single system needs to interchange information at the same time with more than seven others.

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

Hewlett-Packard 3000 Series

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

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

HP has also implemented distributed system software on the HP 1000, thus allowing these systems to become a part of an intercomputer communications network. For example, an HP 1000 system supports its own interactive terminals, which then can also function as terminals to any HP 3000 in the network.

Using a coaxial cable, line speeds of up to 2.5 million bits per second can be achieved. Using common-carrier facilities, which may be either switched or leased lines, data can be transferred at up to 9600 bits per second, depending upon line conditioning and choice of modem. The 37230A Short Haul Modem provides synchronous transmission of data at rates of 2.4K, 4.8K, 9.6K, and 19.2K bps over short distances (from four to twenty-two miles) and is designed for half-duplex, full-duplex, and multidrop operation over local circuits.

Two types of products are available to meet the diverse requirements of HP to IBM distributed system communications. Batch communications are handled through the DSN/Remote Job Entry (DSN/RJE) and DSN/Multileaving Remote Job Entry (DSN/MRJE) products. The DSN/Interactive Mainframe Facility (DSN/IMF) provides interactive communications capabilities.

In the DSN/Remote Job Entry (DSN/RJE) package, the supplied software supports all significant IBM 2780/3780 capabilities on point-to-point lines at speeds up to 9600 bps, plus most optional capabilities such as EBCDIC and ASCII transparency, short-record truncation, and multi-record transmission. The package does not support the 2780 6-bit Transcode or the 3780 capabilities for reverse interrupt and conversational mode. Optional capabilities include blank compression, short record truncation, horizontal tabulation, 2780/3780 vertical format control, multirecord transmission, and print/punch component select.

The DSN/Multileaving Remote Job Entry (DSN/MRJE) software provides access to any remote host system utilizing HASP II, JES 2, JES 3, or ASP for multiple HP 3000 batch users.

The DSN/Interactive Mainframe Link (DSN/IMF) allows interactive communication between HP 3000 systems and IBM 360, 370, 303X, or 4300 host mainframe computers or plug-compatible host mainframes using IBM operating software. With DSN/IMP software, the HP 3000 appears to the host mainframe as a remote IBM 3271, 3274, or 3276 bisync (BSC) cluster control unit. DSN/IMF allows user-written application programs in high-level languages on the HP 3000 to communicate interactively with teleprocessing applications such as CICS and IMS DB/DC applications using standard access methods on the host mainframe. DSN/IMF requires an intelligent Network Processor hardware interface for the HP 3000.

SOFTWARE

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

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

The latest version of the MPE operating system is said to provide a 50 percent improvement in performance over earlier MPE systems. Virtual memory can now be spread across multiple system domain disks so that more and larger applications can run simultaneously on one system. This reduces I/O contention on the system domain disk and improves system I/O performance. Internal file system management has been enhanced to make internal control block handling more efficient. All changes to the file system are transparent to the user. The dispatcher-scheduler gives users more control over system workload. Disk access is queued on a priority basis to insure better access to disk and memory resources. A TUNE command allows users to filter out long transactions, such as batch operations, to improve on-line performance during periods of heavy interactive load.

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

The MPE file system is a collection of routines in the system segmented library (SL). A user may open a file, obtain status information, read or write data, perform control functions, and close the file. File security is provided either through the use of passwords to limit access or through file access modes and user restrictions. File access modes are: Reading, Appending, Writing, Executing, Locking, or Save Files. User types are: Any user, Account member, Account Librarian, Group user, 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.

Features also include a local compression algorithm, memory allocation manager, and program dispatcher. The local compression algorithm functions to keep user segments tight ▶

Hewlett-Packard 3000 Series

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

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

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

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

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

LANGUAGES: All of the HP 3000 computers are multilingual systems that support six programming languages plus a data base management system. All implemented languages have the ability to call a subroutine written in another language. Of equal importance is the facility provided by the file system for all languages to utilize a common file structure, therefore, providing uniform access to disk and tape.

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

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

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

Language extensions implemented by HP include micro-coded instructions, pre-processor functions (provides statements which allow the programmer to equate a particular section of code or a file to an identifier), program debugging aids, access to subprograms, access to all MPE System Intrinsics, ACCEPT FREE option (allows a free

format for low-volume data entry), file locking capability, special registers, packed decimal, and multiple entry points to subprograms. Cobol II provides access to both sequential MPE and indexed sequential (KSAM) files through the use of ANSI Standard Cobol Input and Output operations and to IMAGE/3000, HP's data base management package, through the use of procedure libraries.

Cobol II requires an HP 3000 system with 256K bytes of memory and the current version of the MPE operating system.

Fortran is based on American National Standard Fortran, X3.9-1966, and is a full implementation of that standard. Described below are some of the Fortran language extensions implemented by HP.

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

Pascal/3000 is an implementation of the Hewlett-Packard Standard Pascal, introduced earlier for use on the HP 1000 Series. It is a super set of the proposed ANSI standard Pascal, and is a high-level, procedure-oriented language suitable for system software and large applications.

RPG is compatible to a high degree with RPG and RPG II as developed by IBM. Language extensions implemented by HP include parameters for external subroutine calls, an interface to the data base management system, three methods for runtime error options, a cross-reference error option, EBCDIC/ASCII automatic translation, input/output terminal files, and no requirements for calculation indicator repetition for duplicate conditioning indicators. Data can be processed in binary, packed and unpacked decimal, unpacked decimal with leading or trailing sign, and alphanumeric formats. RPG/3000 also provides automatic 2K- to 8K-byte program segmentation for a virtually unlimited-size RPG program.

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

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

IMAGE consists of three parts: a data base definition subsystem (DBDS), a data base management subsystem (DBMS), and a data base utility subsystem (DBUS). Typically, a data base manager would use DBDS to define the

Hewlett-Packard 3000 Series

► data base and DBUS to create and maintain the data base. The applications programmer, in writing his programs would use the data base management language (DBML), which operates on the data base using DBMS.

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

In serial access, IMAGE starts at the most recently accessed storage location for the data set and looks at all adjacent records sequentially until the desired entry (if it exists) is found. In chained access, entries have a common search item (key) value and are linked together through pointers to form a chain. Access is then merely retrieval of the next item in the current chain. 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 the chained access technique, pointers link one data set item to another. They are normally paired, where one pointer refers to the previous entry in a chain and the other pointer refers to the next entry in a chain. The last member of a chain contains a zero forward pointer. To add a new member in a chain, therefore, means only to change the forward pointer value. Up to sixteen different pointer pairs can be maintained for each data item; this permits each data item to be a member of sixteen different chains or access paths.

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.

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

Limiting parameters for IMAGE/3000 include the following. In each data base there can be a maximum of 255 data item names and 99 data sets; a single set cannot exceed the capacity of a disk drive. There may be up to sixteen characters per item or data set name. In each data entry there may be up to 127 data items. The maximum size of a data entry is 4094 bytes. A maximum of sixteen keys per detail data set and sixteen detail data sets per master data set is permitted. Each chain may have up to 65,535 entries. There may be six characters per data base name, eight characters per password, and 8,388,607 entries per data base.

Additional enhancements to IMAGE for the HP 3000 Series include thirty-two data extents; the capability for data sets to cross volume boundaries; DBFIND and DBGET without locking in access modes 1 and 5; the intrinsic DBEXPLAIN, which explains the result of a CALL; and the intrinsic DBERROR, which supplies an English-language message to an error code. The number of data extents is a constraint of the file system, not IMAGE.

QUERY/3000 uses such commands as FIND, REPORT, and UPDATE to locate, report, and update values in an IMAGE/3000 data base. Reporting of retrieved data can be formatted to include page titles, column headings, group subtotals, etc., if desired. All security provisions invoked through IMAGE are adhered to in QUERY. A command file can be utilized to store complex or often-used command sets on disk. For display purposes, nine data types may be converted and error-checked.

For the HP 3000 Series, QUERY/3000 has been enhanced with computation power for crossfooting. Ten registers have

been implemented for this purpose, using GROUP and TOTAL.

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

PROGRAMMING AIDS: HP's RAPID/3000 is a family of software programming tools consisting of four individual but integrated products. These are Dictionary/3000, Transact/3000, Inform/3000, and Report/3000. HP states that improvements of two to ten times in programming speed have been demonstrated with RAPID/3000.

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

Transact/3000 consists of a high-level programming language, a compiler, and an execute processor. It is specifically designed for interactive transaction-processing environments. It allows an entire interactive program to be summarized as a set of commands entered by the end-user. The command operations are then coded using Transact verbs. In an interactive environment, the processor executes the statements in each command as entered. Transact/3000 is self documenting and provides automatic error recovery. Separate verb categories are provided for data entry and retrieval, data base and file manipulation, program control, and data assignment.

Report/3000 is a command driven, non-procedural report writer designed for programmers and product specialists. Major features include formatting and control options, sub-item definition with full reporting and item control, and a compiled statement language for fast report execution. Report formats are available for tabular, list, or block output. Formats can be combined in the same report. Capabilities allow statistical reporting, such as totals, averages, counts, and minimum/maximum expressions. Ascending and descending sorts are available. New fields can be created to compute new values from existing data. Selection value criteria support both boolean and logical operands. No data management or access specifications are required as Transact/3000 fully utilizes the relational data dictionary.

Inform/3000 is an interactive inquiry and report generator for non-programmers. A variety of menus and questions guide the user through the report specification process. With proper passwords the user can access logically related groups of data through Dictionary/3000. The user selects the individual data elements to be included in the report; Inform/3000 formats the report with no user specification required. Detail information including subtotals, grand totals, break-points and sort order are user specified. Reports are available immediately either for previewing for running on a printer or terminal, or for saving for later use. Saved reports are stored as an MPE file with descriptive data in the dictionary.

UTILITIES: Several major utilities are included with each HP 3000. Edit/3000 is the HP text editor used to create, ►

Hewlett-Packard 3000 Series

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

VPLUS/3000 is a data entry and forms management software product to help users implement straight forward interactive data entry tasks and to facilitate development of more complex applications through the use of a high-level program interface. *VPLUS/3000* may be used as a stand-alone source data entry facility or as a front-end to transaction processing applications. Features include a Forms Design Facility, a Source Data Entry Facility, a Data Reformatting Facility, and a Program Interface.

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

The *On-Line Performance Tool/3000*, (*OPT/3000*), is an interactive performance measurement package for the system analyst. The user can isolate bottlenecks and improve performance by tracking CPU utilization, memory management activity, I/O traffic, program and process activity, and system table usage. Performance data is regularly updated and may be presented in the form of charts, graphic displays, or summary reports. HP offers a System Performance Training Course to teach users how to use the performance related data from *OPT/3000*. This training is required for each initial *OPT/3000* installation.

Flexible Diskcopy/3000 allows conversion of IBM 3741 format flexible disk data set files to HP 3000 disk files while translating EBCDIC code to ASCII. It can operate in either an interactive environment or in batch mode, and can convert either single or multiple data sets and volumes. A complete error, warning, and status message file is included to provide the user messages about program status, user prompts, and error conditions.

APPLICATIONS SOFTWARE: HP's application software is grouped into several major categories. They comprise the manufacturing application software, office systems software, HP Plus software, and an additional miscellaneous group.

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

Materials Management/3000 includes the following modules:

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

Production Management/3000 includes these modules:

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

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

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

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

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

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

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

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

HPMail operates from any terminal connected to an HP 3000. Working within HP's DSN capabilities, *HPMail* manages all message routing and data communications among multiple HP 3000 systems. Users only specify the name of their intended recipient; actual routing paths are invisible to the user. A general delivery feature provides a way to route messages to a number of locations for manual distribution.

HPMail includes a HELP facility to quickly answer any questions. If a sender requests acknowledgement of a message, it is sent automatically after the message is read. Users can send messages to offices that are closed, the

Hewlett-Packard 3000 Series

HARDWARE COMPARISON							
Feature	Series 30R	Series 33R	Series 40SX	Series IIIR	Series 40	Series 44	Series 64
Fault control memory	512Kb Std. 1MB max.	512Kb Std. 1Mb max.	256Kb Std. 2Mb max.	512Kb Std. 2Mb max.	512Kb Std. 2Mb max.	1Mb Std. 4Mb max.	2Mb Std. 8Mb max.
Max. disk drives	8 1.8Gb	8 1.8Gb	8 3.2Gb	8 7920/7925 2.58Gb	8 3.2Gb	16 4.2Gb	16 6.5Gb
Max. tape drives	Up to 4 1600 and 1600/ 6250 drives, max. one 1600/6250 unit	Up to 4 1600 and 1600/ 6250 drives, max. one 1600/6250 unit	Up to 4 1600 and 1600/ 6250 drives, max. two 1600/6250 units	Up to 8 800 or 1600 drives and one 1600/ 6250 unit	Up to 4 1600 and 1600/ 6250 drives, max. two 1600/6250 units	Up to 8 1600 and 1600/ 6250 drives, max. two 1600/6250 units	Up to 8 1600 and 1600/ 6250 drives, max. two 1600/6250 units
Max. line printers	2	2	2	4	2	4	8
Max. term.	48 (32 PT to PT)	48 (32 PT to PT)	56 (32 PT to PT)	96 (64 PT to PT)	56 (32 PT to PT)	96 (64 PT to PT)	144 (110 Simul- taneous sessions)
Communications lines	3	7	3	7	3	7	16

► electronic In Tray continues to receive messages for delivery as soon as the recipient signs on. An Out Tray and Pending Tray function is also provided. Other features include:

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

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

HP Plus is a marketing program which finds software written by independent software suppliers, qualifies the packages, and then markets them directly. Twenty-one user-qualified packages are now available through HP. Contact the local HP sales office for a current and complete listing of these packages.

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

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

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

PRICING

POLICY: The HP 3000 Series systems are available on a purchase or lease basis. Individual models are offered as a system processor unit, SPU (processor and selected software), with extensive separately priced peripheral and software options. Standard on each HP 3000 system is the Fundamental Operating Software which includes MPE-

operating system, EDIT/3000 text editor, FCOPY/3000 file copying utility, SORT-MERGE/3000, IMAGE/3000 data base management system. QUERY/3000 data base inquiry language, KSAM/3000 keyed sequential access method, HP VPLUS/3000 forms management software, and the facility to execute compiled programs without the source language compiler on the system.

Refurbished, previously owned, earlier model HP 3000 systems can be purchased through HP's new System Re-Marketing Operation. The HP 3000 Series 30R with 512K bytes of main memory, disk, tape and system console is priced at \$39,490. This system, when offered new, cost \$70,275. The Series 33R, in the same configuration, is priced at \$39,990 through resale rather than \$82,645 as new. The Series IIIR, until 1980 the top of the Series 3000 line, is now priced at \$70,245 as opposed to \$104,755 new. The configuration includes 512K bytes of memory, disk, tape, and system consoles. User upgrades are one source of equipment for resale, as are lease returns and internal capital equipment. Re-market products are refurbished, warranted, installed, and supported as new equipment. Sales channels are the same as for new products, as are discount schedules. All software products are compatible with these systems. A hardware comparison on page M11-472-616 positions these refurbished models in respect to HP's new product offerings.

Software products can also be purchased separately. See the Software Prices at the end of this report.

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

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

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

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

Maintenance is separately priced and offered through fifty-three U.S. offices, nine Canadian offices, and 121 international offices. The HP 3000 provides a Guaranteed Uptime Service which provides a money back guarantee that the uptime shall exceed 99 percent over any three consecutive months. The service provides continuous coverage, four hour ►

Hewlett-Packard 3000 Series

► response to all requests within 100 miles of an HP Service Office. If this service is ordered prior to installation, it will be provided during the warranty period for no additional charge.

HP's *Standard System Maintenance Series (SSMS)* provides same day response, typically within four hours of the request, at sites within 100 miles of a Service Office. Nine different coverage periods are available: 13, 16, or 24 hours per day and 5, 6, or 7 days per week. Preventive maintenance is scheduled regularly, as are Site Environmental Surveys. Installation services for HP products added to a system under SSMS are included at no extra charge.

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

HP also provides Product Support Services for workstation items, such as: terminals, small printers, and plotters. On-site service is available with next-day response for sites within the typical 100 mile service radius. Scheduled preventive maintenance for these products is either unnecessary or performed by the user. An approximate 50 percent savings can be had through the use of Field Repair Center (FRC) Service. This requires that defective units be shipped to the closest HP Repair Center Facility where HP will repair the units and reship them back to the user within three days of receipt.

The present software support policy for the HP 3000, which became effective in August 1979, contains the following qualifications:

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

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

Services that accompany software purchased under the support policy include phone-in consulting with an HP systems engineer (with an advertised four-hour response time) within a 100-mile radius of the HP sales office, software updates every three months, reference manual updates, software status bulletins every two weeks, and installation of

software at the customer site. The phone-in consulting service may also be used for customer application bugs and interpretation of HP documentation. Software bulletins and updates also offer an avenue for interpretation of HP documentation.

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

On-site consulting services by HP systems engineers are available to resolve software and documentation problems which cannot be solved using the phone-in service. If the problem reported is not associated with an HP software design error or system malfunction, the on-site services are considered outside the scope of HP's software and support agreement and subject to a time and materials charge. HP is not obligated to provide any on-site services for HP software products which the customer has modified. When on-site, the SE will help the customer to identify, verify, isolate, and work around problems caused by HP software. Assistance is available weekdays, excluding HP holidays, during HP working hours, at distances not more than 100 miles from the nearest HP office designated to provide on-site SE services. Support for facilities farther away can be provided at additional cost.

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

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

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

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

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

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

Hewlett-Packard 3000 Series

EQUIPMENT PRICES

Purchase Price Standard Monthly Maint.

► SYSTEM PROCESSOR UNITS

32440B	HP 3000 Series 44 System Processor Unit; 60 Hz; includes Central Processing Unit, System Clock, Control and Maintenance Processor (CMP), two General I/O Channels (GICs) for system disk and backup tape drive, 1 megabyte Fault Control Memory with controller, System Mainframe Cabinet with card cage and power supplies, 26 I/O slots and expansion for 4 megabytes of memory, and built-in Isolation Transformer	\$69,000	\$314
015	M01: Remote support service credit	0	-65
022	200-240V/50 Hz single-phase operation	0	0
32445A	Software on cartridge tape	0	0
32445A	HP 3000 Series 40 System Processor Unit; 60 Hz; includes Central Processing Unit, System Clock, Control and Maintenance Processor (CMP), two General I/O Channels (GICs) for system disk and backup tape drive, 512K bytes Fault Control Memory with controller, System Mainframe Cabinet with card cage and power supplies, 13 I/O slots and expansion for 2 megabytes of memory	38,900	250
	M01: Remote support service credit	0	-65
015	220/240V/50 Hz single-phase operation	0	0
022	Software on cartridge tape	0	0
507	Expands memory to 1024K bytes	10,000	16
32446A	HP 3000 Series 40SX System, same configuration as Series 40 System but includes 256K bytes of memory, one 7911P 27-megabyte Integrated Storage Unit with Cartridge Tape Drive	42,100	320
	M01: Remote support service credit	0	-65
012	Replace 7911P (27 megabyte) with 7912P (64 megabyte)	2,500	2
015	220/240V/50 Hz single-phase operation	0	0
051	Software on 1600 bpi magnetic tape	0	0
507	Expands memory to 1024K bytes	13,000	24
32460A	HP 3000 Series 64 System Processor Unit; 60 Hz; includes Central Processing Unit, System Clock, Diagnostic Control Unit (DCU), 2 General I/O Channels (GICs) for system disk and backup tape drive; 2 megabytes Fault Control Memory with controller, 8K bytes cache memory, System Mainframe Cabinet with card cage and power supplies, 24 I/O slots and expansion for 8 megabytes of memory, 40K bytes of Writable Control Store (WCS), and built-in Isolation Transformers	164,700	719
	M01: Remote support service credit	0	-65
015	380V/50 Hz three-phase operation	0	0
016	415V/50 Hz three-phase operation	0	0
35030A	Power Line Conditioner (Series 30 and 40)	1,050	5

REMARKETED SYSTEMS

32412CR	HP 3000 Series 33R System (re-marketed), 60 Hz, includes 512Kb memory, 2649E console, Fundamental Operating Software on 1600 bpi tape, must order all ADCCs and GICs separately	11,725	307
015	Adds 50 Hz operation	500	0
507	Expands memory to 1024Kb	6,000	40
920	7920M Master 50Mb disk drive (re-marketed) with HP-IB interface and 2M cable (60 Hz)	12,925	123
921	7920M Master 50Mb disk drive (re-marketed) with HP-IB interface and 2M cable (50 Hz)	12,925	123
925	7925M Master 120Mb disk drive (re-marketed) with HP-IB interface and 2M cable (60 Hz)	19,750	119
926	7925M Master 120Mb disk drive (re-marketed) with HP-IB interface and 2M cable (50 Hz)	19,750	119
970	7970E 1600 bpi tape drive HP-IB master in upright cabinet (110 VAC)	9,880	139
971	7970E 1600 bpi tape drive HP-IB master in upright cabinet (230 VAC)	9,880	139
32430CR	HP 3000 Series 30R System (re-marketed), 60 Hz, includes 512Kb memory, 2649E console, Fundamental Operating Software on 1600 bpi tape, must order all ADCCs and GICs separately	11,225	296
015	Adds 50 Hz operation	500	0
507	Expands memory to 1024Kb	6,000	40
920	7920M Master 50Mb disk drive (re-marketed) with HP-IB interface and 2M cable (60 Hz)	12,925	123
921	7920M Master 50Mb disk drive (re-marketed) with HP-IB interface and 2M cable (50 Hz)	12,925	123
925	7925M Master 120Mb disk drive (re-marketed) with HP-IB interface and 2M cable (60 Hz)	19,750	119
926	7925M Master 120Mb disk drive (re-marketed) with HP-IB interface and 2M cable (50 Hz)	19,750	119
970	7970E 1600 bpi tape drive HP-IB master in upright cabinet (110 VAC)	9,880	139
971	7979E 1600 bpi tape drive HP-IB master in upright cabinet (230 VAC)	9,880	139
32435BR	HP 3000 Series III R System (re-marketed) includes 512Kb memory, 1 ATC with Bell 103/202T/212 modem support and Fundamental Operating Software on 1600 bpi tape	33,000	498
008	Software on 800 bpi tape	0	0
015	Adds 50 Hz operation	500	0
507	Expands memory to 1024Kb	1,000	50
509	Expands memory to 1524KB	14,000	108
511	Expands memory to 2048Kb	21,000	158

I/O EXPANSION

30018A	Asynchronous Data Communications Controller (ADCC) Main	1,680	10
30019A	Asynchronous Data Communications Controller (ADCC) Extender	1,680	10
30079A	General I/O Channel (GIC)	1,890	13
39987A	HP 3000 Series 44 I/O Expansion Kit	8,930	26
30143A	I/O Adapter Module for Series 64	10,000	34
30144A	DSN/ATP System Interface Board (SIB)	3,120	15
30145A	DSN/ATP Direct Connect Port Controller	6,480	28
001	First port controller on Series 64	-250	0
002	Replace 4 RS-422 ports with 4 RS-232 ports	0	0
30155A	DSN/ATP Modem Port Controller	8,010	34
001	First Port Controller on Series 64	-250	0

Hewlett-Packard 3000 Series

EQUIPMENT PRICES

		Purchase Price	Standard Monthly Maint.
MEMORY			
30092A	512Kb memory module for Series 4x	10,500	16
30094A	Add-on Series 44 memory controller	1,575	11
30142A	1Mb memory module for Series 64	16,000	75
30161A	1Mb memory module for Series 4x	16,000	32
30171A	256Kb memory module for Series 40	5,250	8
MASS STORAGE			
7906M	Master, 20-megabyte cartridge disk drive, cartridge, controller, and low-profile cabinet	17,000	142
015	220V/50 Hz single-phase operation	0	0
102	HP-IB interface and 2M cable	1,175	4
7906S	Add-on 20-megabyte disk drive, includes drive, low-profile cabinet, 12940A cartridge, and cables; for use as second through eighth add-on drive	13,000	102
015	220V/50 Hz single-phase operation	0	0
7911P	27-megabyte sealed disk drive with integrated cartridge tape, controller, and cabinet, includes 67Mb tape cartridge	12,500	54
001	Adds second controller, required for MPE-based systems	1,800	24
015	220V/50 Hz single-phase operation	0	0
140	Deletes cartridge tape drive	-2,000	-11
7912P	64-megabyte sealed disk drive with integrated cartridge tape, controller, and cabinet; includes 67Mb tape cartridge	15,000	56
001	Adds second controller, required for MPE-based systems	1,800	24
015	220V/50 Hz single-phase operation	0	0
140	Deletes cartridge tape drive	-2,000	-11
7920M	Master 50-megabyte disk drive, pack, controller, and low-profile cabinet	19,000	119
015	220V/50 Hz, single-phase operation	0	0
102	HP-IB interface and 2-meter cable	1,175	4
7920S	Add-on 50-megabyte disk drive; includes drive, cabinet, 13394A disk pack, and cables; for use as second through eighth add-on drive	15,000	79
015	220V/50 Hz single-phase operation	0	0
7925M	Master 120-megabyte disk drive, pack, controller, and low-profile cabinet	22,050	115
015	220V/50 Hz single-phase operation	0	0
102	HP-IB interface and 2-meter cable	1,175	4
7925S	Add-on 120-megabyte disk drive, includes drive, cabinet, 13356A disk pack, and cables; for use as second through eighth add-on drive	17,850	75
015	220V/50 Hz single-phase operation	0	0
250	3029A controller upgrade; upgrades device controller board from 13037-60004 to 13037-60024	525	0
7925T	Add-on 240-megabyte disk storage system	31,450	150
015	220V/50 Hz single-phase operation	0	0
7933H	404Mb fixed media disk drive, includes drive, controller, low-profile cabinet, and HP-IB cable	26,150	80
9895A	Flexible disk system	6,830	65
001	50 Hz operation	0	0
010	Single drive system (1.2Mb)	-1,840	-25
333	HP-IB 2M cable	79	0
MAGNETIC TAPE EQUIPMENT			
30215A	Additional magnetic tape controller for Series III	2,835	17
7971A	Magnetic tape drive subsystem in upright cabinet	10,000	0
The following options apply to the Series 30, 33, 40, and 44:			
330	7970E slave	1,900	93
333	Two 7970E slaves	12,300	183
340	7970E Master HP-IB	5,000	139
343	One 7970E HP-IB master and one 7970E slave	14,300	229
344	Two 7970E HP-IB masters	16,400	275
The following options apply to the Series III:			
410	7970B add-on unit	2,000	89
411	Two 7970B add-on units	12,600	175
420	7970E master add-on	3,700	100
422	Two 7970E master add-ons	14,400	197
423	One 7970E master and slave, add-ons	13,300	190
430	7970E slave	1,900	93
433	Two 7970E slaves	12,300	183
470	7970E master, initial unit	3,500	100
472	Two 7970E masters, initial units	14,200	197
473	One 7970E master unit and one 7970E slave	13,200	190
480	7970B, initial unit	1,900	89
481	Two 7970B initial units	12,500	175
482	One 7970B initial unit and one 7970E master add-on	13,300	186
7970B	800 bpi 45 ips tape drive	8,260	86
015	230V operation	0	0
320	Option for add-on drives in lo-boy cabinet	3,740	3
324	Option for first drive on 30215A controlled in lo-boy cabinet	3,640	3
330	Option for add-on drives without cabinet	9,360	0
334	Option for first drive on 30215A controller without cabinet	9,600	0

**Hewlett-Packard 3000 Series
EQUIPMENT PRICES**

		Purchase Price	Standard Monthly Maint.
7970E	1600 bpi 45 ips tape drive	9,980	97
015	230V operation	0	0
320	Option for 2nd, 3rd, and 4th master drive in lo-boy cabinet	3,720	3
321	Option for 1st, 2nd, and 3rd slave drive in lo-boy cabinet	1,920	-7
324	Option for first master drive on a 30215A controller in lo-boy cabinet	3,520	3
330	Option for 2nd, 3rd, and 4th master drive without cabinet	11,300	—
331	Option for 1st, 2nd, and 3rd slave drive without cabinet	10,275	—
421	Specifies slave drive in lo-boy cabinet	1,920	3
426	Specifies HP-IB master drive in lo-boy cabinet	5,020	42
431	Specifies slave drive without cabinet	10,275	0
436	Specifies HP-IB master drive without cabinet	12,250	0
7976A	1600/6250 bpi magnetic tape drive, 1600 bpi phase-encoded or 6250 bpi group encoded	52,250	586
010	For operation at altitudes from 2500-6500 feet	0	0
011	50 Hz operation	1,800	0
26075A	Multiple System Access Selector	550	0
PRINTERS/PLOTTERS			
26069A	2617/19A Line Printer Interface for Series 3X, 4X, and 64	2,415	22
30290A	Line Printer Controller for Series III	1,340	6
2601A	40 cps daisy wheel printer	3,950	67
26010A	Bidirectional forms tractor for 2601A	550	0
2608A	400-lpm dot matrix printer, 128-character ASCII set with 1 to 69 print hours/month	10,400	109
U02	With 70 to 130 print hours/month	0	+26
U03	With 131 to 360 print hours/month	0	+106
001	Language option	160	0
002	Substitution option	160	0
110	Sound cover	240	0
333	HP-IB interface and 2-meter cable for Series 3X	1,000	0
340	HP-IB interface and 2-meter cable for Series 40	1,000	0
344	HP-IB interface and 2-meter cable for Series 44	1,000	0
364	HP-IB interface and 2-meter cable for Series 64	1,000	0
26085	2608A with remote print capability, two print densities, and enhanced forms handling	10,900	—
2617A	Line printer, 136 positions, 64 characters, 600-lpm; with 1 to 50 print hours/month	18,110	253
U02	With 51 to 100 print hours/month	0	+63
U03	With 101 to 150 print hours/month	0	+184
001	96-character set; 436 lpm	1,945	0
002	64-character set with OCR-B font	0	0
003	96-character set with OCR-B font	1,945	0
015	230V/50 Hz single-phase operation	0	0
2619A	Line printer, 136 positions, 64 characters, 1000 lpm, 1 to 66 print hours/month	25,730	363
U02	With 67 to 99 print hours/month	0	+173
U03	With 100 to 132 print hours/month	0	+389
001	96 character set; 750 lpm	1,420	0
002	64 character set with OCR-B font	685	0
003	96 character set with OCR-B font	2,100	0
015	230V/50 Hz single-phase operation	0	0
016	100V/50 Hz single-phase operation	0	0
017	230V/60 Hz single-phase operation	0	0
One of the following options must be ordered for 2617A/19A:			
300	HP 3000 Series II and III interface	1,000	0
301	Series 30 HP-IB interface and cable*	2,470	22
302	Series 33 HP-IB interface and cable*	2,470	22
340	Series 40 HP-IB interface and cable*	2,470	20
344	Series 44 HP-IB interface and cable*	2,470	20
364	Series 64 HP-IB interface and cable*	2,470	20
2631B	Dot matrix printer, 180 cps, 136 positions	3,900	39
016	100V operation	0	0
017	240V operation	0	0
019	US ASCII character set	0	0
020	US ASCII high density character set	0	0
046	Replaces standard interface with HP-IB	50	0
050	Parallel differential interface	-65	0
051	RS-232- Edge connector	65	N/A
240	Provides terminal board, cable for 264x terminals	105	0
250	Added 2M HP-IB cable	125	0
331	RS-232-C Remote spooled printer capability (with 3.8M cable)	0	0
2631G	Graphics printer	4,900	45
011	Line drawing character set	150	0
012	High density print character set	150	0
200	Factory data printer	600	-9
The following options apply to the 2631B and 2631G:			
001	Swedish/Finnish character set	150	0
002	Norwegian/Danish character set	150	0
003	French character set	150	0
004	German character set	150	0
005	United Kingdom character set	150	0

*Includes 26069A interface

Hewlett-Packard 3000 Series EQUIPMENT PRICES

		Purchase Price	Standard Monthly Maint.
006	Spanish character set		
007	Cyrillic character set	150	0
008	Katakana character set	150	0
009	Extended Roman character set	150	0
010	Math character set	150	0
015	220V/50 Hz operation	0	0
26090A	Sound abatement cover for 2631B or 2635B	105	N/A
26097A	Pedestal stand with casters for 2631B or 2635B, includes paper catcher	343	N/A
2680A	Intelligent page printer, 45-pages per minute, 32 character fonts, includes 125,000 rotations	86,500	789
U02	125,001 to 200,000 rotations	—	+575
U03	200,001 to 275,000 rotations	—	+1,025
U04	275,001 to 350,000 rotations	—	+1,500
015	208-240V/50 Hz operation	0	0
099	Replaces 8M cable with 2M cable	0	0
300	Series III cable, documentation	5,500	0
301	Series 30 cable, documentation	5,500	0
302	Series 33 cable, documentation	5,500	0
340	Series 40 cable, documentation	5,500	0
344	Series 44 cable, documentation	5,500	0
364	Series 64 cable, documentation	5,500	0
505	Add-on 256K byte memory module	5,250	6
26080A	Add-on 256K byte memory module for 2680A	5,250	6
26804A	2685 Model 40 Print Station, includes 125,000 rotations	160,000	1,266
U02	125,001 to 200,000 rotations	—	+525
U03	200,001 to 275,000 rotations	—	+1,025
U04	275,001 to 350,000 rotations	—	+1,500
015	220V/50 Hz single-phase operation	3,030	0
017	240V/50 Hz single-phase operation	3,030	0
030	Adds Cobol/II compiler	2,050	0
031	Adds Fortran compiler	2,050	0
040	Deletes 64Mb disk and adds 404Mb disk (U.S. 120V/60 Hz)	14,500	44
042	Expands disk capacity to 404Mb (U.S. and Canadian 240V/60 Hz)	14,500	44
050	Expands disk capacity to 120Mb (120V/60 Hz)	10,225	15
051	Expands disk capacity to 120Mb (120V/50 Hz)	10,225	15
7220C	Graphics plotter, multicolor, 11 x 17 inch maximum paper size	5,800	61
001	Expanded buffer memory, 2K bytes	225	0
7220T	Graphics plotter, 7220C features with automatic paper advance	7,900	70
001	Expanded buffer memory, 2K bytes	225	0
7221C	Graphics plotter, multicolor, 11 x 17 inch maximum paper size	5,800	61
001	Expanded buffer memory, 1928 bytes	225	0
7221T	Graphics plotter, 7221C features with automatic paper advance	7,900	70
001	Expanded buffer memory, 1928 bytes	225	0
7225B	Graphics plotter, 8 x 11¼ inch maximum paper size, manual pen changing, requires personality module	2,750	41
003	220V/50 Hz operation	0	0
17601A	HP-IB Personality module for 7225B graphics printer	750	0
17604A	RS-232-C Personality module for 7225B graphics printer	900	0
7240A	RS-232-C Plotter/printer, thermal printing, 38 cps	6,600	64
7245B	RS-232-C Plotter/printer, thermal printing, 38 cps, interfaced to 2647A/48A graphics terminal	6,600	64
7470A	Graphics plotter	1,550	2c
001	RS/232-C interface	0	0
002	HP-IB interface	0	0
016	Dual 100 cable	100	0
7580A	Drafting plotter, multicolor, 24.5 x 46.85 inch maximum paper size	15,950	108
001	RS-232-C interface	0	0
002	HP-IB interface	0	0
9872C	Graphics plotter, features of 7220C interfaced to 2647A/48A graphics terminals	5,800	61
9872T	Graphics plotter, features of 7220T interfaced to 2647A/48A graphics terminals	7,900	70
DIGITIZERS			
9111A	Graphics tablet, 16 softkeys	2,050	16
9874A	Digitizer (Basic Monthly Maint. is shown rather than Standard Monthly Maint.)	12,000	54
TERMINALS			
2382A	Office Display Terminal	1,700	26
001	Swedish/Finnish character set/keyboard	80	0
002	Norwegian/Danish character set/keyboard	80	0
003	French character set/keyboard	80	0
004	German character set/keyboard	80	0
005	United Kingdom character set/keyboard	80	0
006	Spanish character set/keyboard	80	0
013	240V/50 Hz operation	0	0
014	100V/60 Hz operation	0	0
015	220V/50 Hz operation	0	0
016	100V/50 Hz operation	0	0
202	Line drawing character set	80	0
2621B	Character mode terminal	1,595	17
010	U.S. ASCII set/keyboard with national character set firmware	105	0
015	230V/50 Hz operation	0	0
050	Integral thermal printer	0	0

Hewlett-Packard 3000 Series

EQUIPMENT PRICES

		Purchase Price	Standard Monthly Maint.
061	Green CRT	50	0
100	U.S. ASCII Extended keyboard	150	0
101	Finnish/Swedish Extended keyboard	150	0
102	Dannish/Norwegian Extended keyboard	150	0
103	French Extended keyboard	150	0
104	German Extended keyboard	150	0
105	United Kingdom Extended keyboard	150	0
106	Spanish Extended keyboard	150	0
110	U.S. ASCII Extended keyboard with national character set firmware	150	0
2622A	Block mode terminal	2,175	30
202	Line drawing character set	105	0
061	Green CRT	50	0
2623A	Graphics terminal	3,750	34
202	Line drawing character set	105	0
061	Green CRT	50	0
2624B	Data entry terminal	3,000	33
160	Additional display memory	210	0
201	Math and large character set	105	0
061	Green CRT	50	0
The following options apply to the 2621B, 2622A, 2623A, 2624A and 2624A, except as noted:			
001	Finnish/Swedish character set and keyboard	105	0
002	Danish/Norwegian character set and keyboard	105	0
003	French character set and keyboard	105	0
004	German character set and keyboard	105	0
005	United Kingdom character set and keyboard	105	0
006	Spanish character set and keyboard	105	0
013	240V/50 Hz operation, (except 2621 P/B)	0	0
014	100V/60 Hz operation, (except 2621 P/B)	0	0
015	220V/50 Hz operation, (except 2621 P/B)	0	0
016	100V/50 Hz operation, (except 2621 P/B)	0	0
050	Integrated forms copy thermal printer	1,210	16
090	Delete pedestal and fan	0	0
204	Roman extended character set (2622A/23A only)	105	0
2626A	Display station, 110V/60 Hz	4,350	41
061	Green CRT	50	0
090	Delete pedestal and fan	0	0
201	Math and large character set (included with language options)	265	0
2626W	Word processing station	4,950	55
The following options apply to the 2626A and 2626W:			
001	Finnish/Swedish character set and keyboard	265	0
002	Danish/Norwegian character set and keyboard	265	0
003	French character set and keyboard	265	0
004	German character set and keyboard	265	0
005	United Kingdom character set and keyboard	265	0
006	Spanish character set and keyboard	265	0
013	240V/50 Hz operation	0	0
014	100V/60 Hz operation	0	0
015	220V/50 Hz operation	0	0
016	100V/50 Hz operation	0	0
050	Integral terminal printer	1,210	16
061	Green CRT	50	0
2641A	APL Display Station	5,800	34
201	Math character set	105	0
202	Line drawing set	160	0
203	Large character set	160	0
2642A	Display station with flexible mini disk	7,500	69
005	United Kingdom character set	0	0
070	Replace mini floppy with dual cartridge tape	-250	-70
072	Second flexible mini disk	1,050	28
096	Shared peripheral interface	735	0
964	Series 64 console	700	0
2645A	Display station	4,550	34
008	Expands memory to 8K bytes	315	0
009	Expands memory to 12K bytes	525	0
015	220V/50 Hz	0	0
061	Device support firmware	180	0
2645N	Danish/Norwegian display station	4,850	33
015	220V/50 Hz operation	0	0
2645R	Arabic display station	5,700	44
201	Math character set	105	0
202	Line drawing set	160	0
203	Large character set	160	0
2645S	Swedish/Finnish display station	4,850	33
015	220V/50 Hz operation	0	0
2647A	Intelligent graphics terminal	9,950	92
031	Delete standard communications interface	-79	0
096	Shared peripheral interface	735	0

Hewlett-Packard 3000 Series

EQUIPMENT PRICES

		Purchase Price	Standard Monthly Maint.
13268A	Asynchronous Multipoint terminal interface for daisy chained 2626A terminals	395	3
011	Synchronous Multipoint Interface	0	0
37230A	Short-haul modem	1,190	7
301	Rackmount adapter	30	0
302	Dual rackmount	50	0
13265A	300 bps modem pod for 262x terminals	495	2
30037A	Asynchronous Repeater	1,190	7
015	230V operation	0	0
35016A	Remote support modem	1,100	17
39301A	Fiber Optic Multiplexer	2,500	18
001	Recessed rack mount hardware	30	0
033	Delete communications interface; add synchronous multipoint communications capability; includes monitor mode	265	0
034	Delete communications interface; add synchronous multipoint communications capability; includes monitor mode	290	0
054	Video output interface (except 2641A and 2642A/N/R/S)	160	0
2635B	180 cps printing terminal	4,300	41
001	Finnish/Swedish keyboard	100	0
002	Danish/Norwegian keyboard	100	0
003	French keyboard	100	0
004	German keyboard	100	0
005	United Kingdom keyboard	100	0
006	Spanish keyboard	100	0
015	220V/50 Hz operation	100	0
051	RS-232 edge connector	0	0
068	Ribbon kit	60	N/A
715	Additional service documentation	25	N/A
26090A	Sound abatement cover to 2631B or 2635B	105	N/A
26097A	Pedestal stand with casters for 2631B or 2635B, includes paper catcher	343	0

DATA COLLECTION TERMINALS

3075A	Desk top data capture terminal	2,710	15
3076A	Wall mounted data capture terminal	3,195	15
92904A	Wall mount cradle for 3076A/3077A	505	6
The following options apply to 3075A/3076A:			
004	Alphanumeric keyboard	270	0
005	Alphanumeric display	570	1
006	5-inch CRT	985	4
007	Multifunction reader	985	8
008	Type V badge reader	570	5
009	Alphanumeric printer	570	5
010	Low-cost bar code reader	640	3
011	Auxiliary HP-IB port	805	0
012	Magnetic stripe reader	690	3
013	RS-232-C auxiliary interface	570	1
015	220V/240V operation	0	0
021	Delete reference manual	-50	0
054	Low resolution industrial bar code reader	1,030	4
055	High resolution industrial bar code reader	1,030	4
3077A	Time reporting terminal	3,605	21
001	Replace Type V reader with multifunction reader	460	2
002	Replace Type V reader with magnetic stripe reader	115	0
005	Alphanumeric display	635	1
015	220V/240V operation	0	0
021	Delete reference manual	-50	0
7260A	Optical mark reader	8,450	133
002	Select hopper	460	0
003	Encoder	580	0
004	Bell	63	0
005	200V/240V operation	0	0
006	50 Hz operation	0	0
007	Wider input hopper for turn-around document	230	0
045	Provides operation with desk top computers	23	0
300	Adds operating documentation for HP 3000	11	N/A
13231A	Display enhancements (except 2642A)	395	0
201	Math symbols alternate character set	105	0
203	Large character alternate character set	160	0
13234A	Terminal 4K memory module (except 2642A)	315	0
13261A	Device support firmware	180	0
13296A	Shared peripheral interface for 2647/48A graphics terminals	735	0

COMMUNICATIONS

3074A	Data link adapter	715	11
3074M	Data link adapter (for asynchronous modem configurations)	820	6
13260C	Asynchronous Multipoint Communications Interface for 264x terminals	455	0
13260D	Synchronous Multipoint Communications Interface for 264x terminals	475	0
13264A	Data link adapter for 2626A/2624B terminal	350	—
13267A	Asynchronous Multipoint Interface for first 2626A terminal	395	2
011	Synchronous Multipoint Interface	0	0

**Hewlett-Packard 3000 Series
EQUIPMENT PRICES**

		<u>Purchase Price</u>	<u>Standard Monthly Maint.</u>
▶ 2648A	Graphics terminal	7,100	41
096	Shared peripheral interface	735	0
2649E	System/maintenance console for Series 30 or Series 33	7,250	53
015	230V/50 Hz operation	0	0
The following options and products apply to 2641A, 2642A, 2645A/N/R/S, 2647A and 2648A except as noted:			
003	Display enhancements (except 2641A/42A, 2645N/R/S)	265	0
004	Display enhancements with math and large character sets (except 2641A/42A, 2645N/R/S)	525	0
007	Integrated dual cartridge tapes (standard on 2647A; except 2642A)	1,400	12
015	230V/50 Hz (except 2645A/N/R/S)	0	0
016	115V/50 Hz (except 2641A)	0	0
210	100V/50 Hz single-phase operation	0	0
212	120V/60 Hz single-phase operation	0	0
222	220V/50 Hz single-phase operation	0	0
224	240V/50 Hz single-phase operation	0	0
30010A	Intelligent Network Processor (INP) for Series III	4,725	43
001	New I/O card cage backplane	395	N/A
30020B	Intelligent Network Processor (INP) for Series 4x or 64	4,200	33
30055A	Synchronous single line controller	2,100	19
001	Replaces synchronous cable with asynchronous cable for hardwired operation	0	0

SOFTWARE PRICES

LANGUAGES		<u>Price</u>
32233A	Cobol II/3000 Compiler	\$4,075
300	Basic/RPG/300 return credit	-1,575
301	SL/300 return credit	-2,100
32233R/M	Right to copy 32233A, with/without sublicense	2,050
300	Basic/RPG/300 return credit	-630
301	SL/300 return credit	-840
32213C	Cobol/3000 Compiler	1,725
32213R/M	Right to copy 32213C, with/without sublicense	875
32104A	RPG/3000 Compiler	3,000
300	Basic/RPG/300 return credit	-1,575
301	SL/300 return credit	-2,100
32104R/M	Right to copy 32104A, with/without sublicense	1,500
300	Basic/RPG/300 return credit	-630
301	SL/300 return credit	-840
32102B	Fortran/3000 Compiler	2,050
300	Basic/RPG/300 return credit	-1,575
301	SL/300 return credit	-2,051
32102R/M	Right to copy 32102B, with/without sublicense	1,025
300	Basic/RPG/300 return credit	-630
301	SL/300 return credit	-840
32111A	Basic/3000 Interpreter and Compiler	2,050
300	Basic/RPG/300 return credit	-1,575
301	SL/300 return credit	-2,050
32111R/M	Right to copy 32111A, with/without sublicense	1,025
300	Basic/RPG/300 return credit	-840
301	SL/300 return credit	-630
32105A	APL/3000 Language Subsystem	6,750
32105R/M	Right to copy 32105A, with/without sublicense	3,375
32106A	Pascal/3000 Compiler	5,000
300	Basic/RPG/300 return credit	-1,575
301	SL/300 return credit	-2,100
32106R/M	Right to copy, with/without sublicense	2,500
300	Basic/RPG/300 return credit	-630
301	SL/300 return credit	-840
32100A	SPL/3000 Compiler	2,725
300	Basic/RPG/300 return credit	-1,575
301	SL/300 return credit	-2,100
32100R/M	Right to copy 32100A, with/without sublicense	1,375
300	Basic/RPG/300 return credit	-630
301	SL/300 return credit	-840

DATA COMMUNICATIONS

30130E	DSN/RJE Remote Job Entry	1,350
300	31447A RJE/300 credit	-525
30130R/M	Right to copy 30130E, with/without sublicense	950
300	31447R RJE/300 credit	-105
32190A	DSN/DS Distributed Systems Software	5,000
300	31447A RJE/300 credit	-525
32190R/M	Right to copy, with/without sublicense	3,500
300	31447R RJE/300 credit	-105
32192A	DSN/MRJE Multileaving Remote Job Entry	2,520
300	31447A RJE/300 credit	-525

Hewlett-Packard 3000 Series

SOFTWARE PRICES

		<u>Price</u>
32192R/M	Right to copy 32192A, with/without sublicense	1,775
300	31447A RJE/300 credit	-105
32229A	DSN/IMF Interactive Mainframe Facility	7,000
300	31447A RJE/300 credit	-525
32229R/M	Right to copy 32229A, with/without sublicense	4,900
300	31447A RJE/300 credit	-105
32193A	DSN/MTS Multipoint Terminal Support	1,350
32193R/M	Right to copy 32193A, with/without sublicense	950
PROGRAMMER PRODUCTIVITY TOOLS		
32244A	Dictionary/3000 Relational Data Dictionary	5,000
32244R/M	Right to copy 32244A, with/without sublicense	2,500
32245A	Report/3000 Report Writer	5,000
32245R/M	Right to copy 32245A, with/without sublicense	2,500
32247A	Transact/3000 Transaction Processing Language and Processor	6,000
32247R/M	Right to copy 32247A, with/without sublicense	3,000
32248A	Programmer productivity package (Report/3000, Dictionary/3000, Transact/3000)	13,000
32248R/M	Right to copy 32248A, with/without sublicense	6,500
32449A	RAPID/3000 Processor, execute only for Transact/3000, and Report/3000 programs	3,500
OFFICE SYSTEMS SOFTWARE		
32120A	HPWORD Word Processing (available in German version)	5,000
32120R/M	Right to copy 32120A, with/without sublicense	3,500
32246A	INFORM/3000 User Report Generator	6,000
32246R/M	Right to copy 32246A, with/without sublicense	4,200
32250A	HP DSG/3000 Decisions Support Graphics	6,300
32250R/M	Right to copy 32250A, with/without sublicense	4,400
36576A	HPSLATE Screen based word processing	3,000
36576R/M	Right to copy 36576A, with/without sublicense	2,100
36578A	TDP/3000 Text and document processor	6,300
36578R/M	Right to copy 36578A, with/without sublicense	4,400
36580A	IFS/3000 Interactive Formatting System	2,500
36580R/M	Right to copy 36580A, with/without sublicense	1,750
36581A	IDS/3000 Interactive Design System	4,000
36581R/M	Right to copy 36581A, with/without sublicense	2,800
MANUFACTURING APPLICATIONS SOFTWARE		
32260A	Materials Management/3000, available in German, Spanish, French, Dutch, Katakana, Norwegian, Swedish, British, Finnish, and Italian language versions	31,500
32260R/M	Right to copy 32260A, with/without sublicense	22,050
32270A	Production Management/3000, available in British and German versions	31,500
32270R/M	Right to copy 32270A, with/without sublicense	22,050
FINANCIAL SYSTEMS APPLICATION SOFTWARE		
32285A	General Ledger/3000	7,000
32285R/M	Right to copy 32285A, with/without sublicense	4,900
32286A	Accounts Payable/3000	7,000
32286R/M	Right to copy 32286A, with/without sublicense	4,900
32287A	Accounts Receivable/3000	7,000
32287R/M	Right to copy 32287A, with/without sublicense	4,900
32292A	General Ledger/3000 Source code*	3,000
32293A	Accounts Payable/3000 Source code*	3,000
32294A	Accounts Receivable/3000 Source code*	3,000
ADDITIONAL APPLICATIONS SOFTWARE		
32199A	Flexible Disk copy/3000	685
32199R	Right to copy 32199A	275
32205B	Scientific Library	410
32205R/M	Right to copy 32205B, with/without sublicense	200
32238A	OPT/3000 On-line performance tool	6,400
32238M	Right to copy 32238A without sublicense	2,200
32900B	SIS/3000 Student Information System	3,780
32900R	Right to copy 32900B	2,650
32902A	CIS/3000 College Information System	6,300
32902R	Right to copy 32902A	4,400
HP PLUS SOFTWARE		
32251JA	Insight	7,500
001	Adds custom programming hooks	2,000
32251JR	Right to copy 32251JA with sublicense	3,750
011	Adds custom programming hooks	1,000
32252JA	Protos	7,500
32252JR/M	Right to copy 32252JA with/without sublicense	3,750
32253JA	Skipper	1,500
32253JR/M	Right to copy 32253JA with/without sublicense	750

*Requires concurrent purchase of object code. ■