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# Hewlett-Packard HP 3000 Series

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**Product Summary****Editor's Note**

The HP 3000 Series 948 and 958 are the newest, high-performance members of the HP 3000 family of business computers. Based on HP Precision Architecture-RISC (PA-RISC) and VLSI CMOS circuit technology, the S948 and S958 deliver mainframe performance in a small integrated package.

**Description**

The HP 3000 Series is a compatible family of commercial data processing systems based on the RISC-based HP Precision Architecture. The HP 3000 Series is suited for online transaction processing and distributed processing. A wide range of manufacturing and service industries, as well as government and public service organizations, also use HP 3000s.

**Strengths**

Compatibility throughout the product line. An extensive library of applications software. Consistent support and service.

**Limitations**

Upgrading between product levels requires a box swap versus a board upgrade. Despite the hardware requirements, the growth potential within these levels is now very good.

**Competition**

Competition includes the Digital Equipment Corp.'s VAX Models, IBM AS/400 and RISC System/6000, NCR 3000 Series, and Prime 50 Series.

**Vendor**

Hewlett-Packard Co.  
Business Computing Systems  
19091 Pruneridge Avenue  
Cupertino, CA 95014  
(800) 752-0900

**Price**

\$10,950 to \$1,050,000

**GSA Schedule**

Yes.

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—By Dale Peacock  
Senior Associate Editor

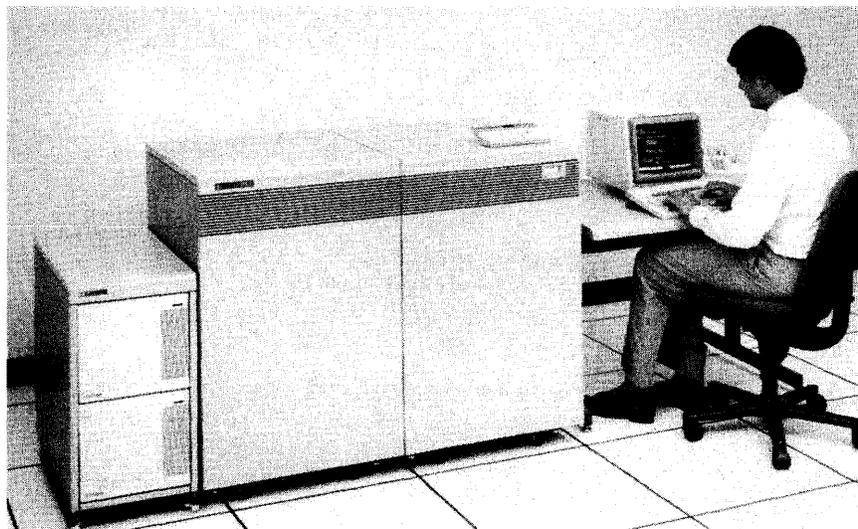
# Analysis

## Product Strategy

Since our last report, Hewlett-Packard has added two more processors to its HP 3000 Series line, forming the largest family of RISC-based superminicomputers available today. The performance of the HP 3000 Series now ranges from minicomputer at the low end to mainframe-equivalent at the high end. The Series facilitates entry-level into midrange computing and offers a growth path once a system is purchased. The HP 3000 family now comprises the Micro 3000LX, Micro 3000RX, Series 922LX, 922RX, 922, 932, 948, 950, 955, 958, 960, 980/100, and 980/200.

The Series 980/100 and 980/200 are HP's high performance superminicomputers. Based on HP's latest CMOS chip technology, the Series 980 systems offer more than twice the main memory and up to three times the performance of the Series 960. They provide extra computing power for very large scale online transaction processing (OLTP) while preserving compatibility. The Series 980/200 is a symmetric multiprocessor, made up of two 980/100 processors.

*The HP 3000 RISC-based family ranges from the Micro 3000LX and 3000RX at the low end and the 980/100 and 980/200 at the high end. The Series 950, pictured here, is field-upgradeable to the Series 980.*



A field upgrade for Series 950, 955, or 960 models allows customers to obtain a Series 980/100 or 980/200 without investing in a new platform. Included with the field upgrade is the exchange of CPU boards.

The Series 922LX, 922RX, 922, and 932 computers comprise the low-end family. Completely software-compatible with the entire HP 3000 product line, these systems also provide RISC-based computing. The 948 and 958 are simple board upgrades from the 920, 922, and 932 integrated systems.

Minicomputer models Micro 3000LX and Micro 3000RX are the entry point to non-RISC, very small-scale HP 3000 computing.

## The RISC Commitment

Since its introduction nearly 20 years ago, the HP 3000 Series has undergone many changes. Since 1986, Hewlett-Packard has embraced reduced instruction set computing (RISC) for its computer architecture. Hewlett-Packard Precision Architecture (HPPA) is a design technology based on RISC concepts and extensions.

Hewlett-Packard's latest RISC product announcements are the culmination of over six years' research and development of RISC-based systems. HP's early commitment to this new architecture has resulted in the company being among the first to develop an entire RISC-based superminicomputer product line.

## Company Profile Hewlett-Packard Co.

### **Corporate Headquarters:**

Hewlett-Packard Co.  
Business Computing Systems  
19091 Pruneridge Avenue  
Cupertino, CA 95014  
(800) 752-0900

### **In Canada:**

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(416) 678-9430  
European Operations  
Headquarters in Geneva,  
Switzerland.

### **Apollo Division:**

Apollo Computer, Inc.  
A subsidiary of Hewlett-Packard  
300 Apollo Drive  
Chelmsford, MA 01824  
(508) 256-6600

### **Officers:**

*Chairman:* David Packard  
*President and CEO:* John Young  
*CFO:* Robert Wayman  
*General Manager of Apollo Division:* David Perozek

### **Company Background**

*Year Founded:* 1939  
*No. Employees:* 94,000  
(includes Apollo employees)  
*No. Workstations Installed:*  
Approximately 220,000  
(includes Apollo workstations)

Hewlett-Packard is one of the largest industrial corporations in America. Headquartered in Palo Alto, CA, Hewlett-Packard plants are located in 25 U.S. cities, most of which are in California, Colorado, the Northeast, and the Pacific Northeast; international facilities are strategically located throughout the world. The company has over 300 sales and support offices in 100 countries worldwide.

### **Business Overview**

HP acquired Apollo Computer in April 1989, which made HP the market leader in technical workstations for a brief period.

The lead has been recaptured by Sun Microsystems because of HP's difficulty in reconciling two different workstation product lines; however, Hewlett-Packard is moving rapidly to correct that situation. The announcement of the 9000 Series 400 in June of 1990 was the first step in that direction. The acquisition of Apollo underscores the importance of the technical workstation market and HP's commitment to it. The company has been a leader in promoting open systems, and standards in both hardware and software.

Hewlett-Packard combined its traditional computer organization with the workstation end of the business last fall into the Computer Systems Organization. Other organizational changes also were made to give the responsible managers more direct control over technologies and sales activities. Hewlett-Packard has a reputation second to none for quality products and service. Over half of its revenues for the last five years

have come from international operations.

### **Financial Profile**

Revenue in fiscal year 1990 reached \$13.2 billion. Earnings were \$739 million, a decline of 11 percent from fiscal year 1989.

### **Management Statement**

"Our goal remains to improve our overall financial performance while building for the longer term. We will continue to focus on increasing our revenues and reducing expenses as a percentage of net revenue in fiscal 1991. While economic indicators aren't positive, particularly for the U.S., we were encouraged by signs of order strength during the last quarter of 1990. We believe that HP's strong global presence, combined with our leadership in standards-based computing, technical strength in all areas of its activity, and new management structure, put the company in an excellent position to improve its overall performance in 1991 and in the years ahead."

### **The RISC Advantage**

RISC-based computing offers benefits in price/performance and reliability over conventional or complex instruction set computing (CISC). RISC also allows for easier upgrades; simple CPU board swaps provide performance level boosts that previously required complete system box exchanges.

Such attributes help Hewlett-Packard deliver a more competitive system.

### **Vertical Markets**

Hewlett-Packard is expanding the role of the HP 3000 within the business organization. In addition to targeting the HP 3000 as a departmental data processing system, Hewlett-Packard is directing the HP 3000s toward "niches" or specific application tasks within an application environment. The departmental processor off-loads a single task or a group of tasks to the HP 3000. For example,

an HP 3000 could be used to run a field sales system or a customer support system while the remainder of the marketing system applications run on the central marketing system.

Hewlett-Packard also plans to grow the installed base of HP 3000s within the manufacturing sector by placing more emphasis on sales within the process manufacturing market.

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## Applications

Hewlett-Packard markets the HP 3000 Series for a variety of applications. The Series 900 is primarily used for online transaction processing and distributed processing in a wide range of manufacturing and service industries, in addition to government and public service organizations. HP also markets Series 900 computers for financial, administration, and office automation applications.

### Applications Software

To compete in its target markets, Hewlett-Packard ensures that applications software for the HP 3000 systems is readily available. The major source is alliances with independent software developers. To attract and retain independent software providers, Hewlett-Packard supports the marketing, technical, and business aspects of these alliances. The alliances give Series 900 customers access to the services of the independent software vendors (ISVs). After discovering a customer's application need, Hewlett-Packard helps the customer establish contact with the appropriate software vendors. In some cases, Hewlett-Packard will provide the customer with a third-party package directly.

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## Competitive Position

The HP 3000 product line competes most directly with Digital Equipment and IBM systems for the online transaction processing target markets.

HP's Micro 3000 minicomputers compete with Digital's Microvax 3100 and IBM's entry-level AS/400 computers. The Series 900 competes with Digital's VAX and IBM's high-level AS/400 computers and IBM's 3090/9000 mainframes.

The expanded HP 3000 product line enables Hewlett-Packard to compete more effectively. For

example, the Series 980/200 provides mainframe-level performance comparable to the large VAX 9000 and IBM 3090/9000 systems at a substantially lower price.

Where HP used to be at a disadvantage, it now excels. Expandability was limited in the old HP 3000 product line when compared to the expansive lines from Digital and IBM. Now, the Series 980/200 can support up to 85.8G bytes of mass storage, compared to only 36.5G bytes on the Series 955. The current Series 900 performance range is broad enough to expand to meet almost any computing requirements.

The other primary competition for the HP 3000 Series comes from Data General's Eclipse MV Series; Wang Laboratories' VS Systems; Prime Computer's Prime 50 Series; and NCR's 3000 and 10000 Series computers. Generally, when compared to these vendors' offerings, the HP 3000s provide greater price/performance and stay competitive in configurability and functionality.

The new, expanded HP 3000 product line definitely puts Hewlett-Packard in a position to compete with Digital Equipment, IBM, and others for new corporate accounts or for the first-time automation sale. Hewlett-Packard now has the competitive advantage in the RISC-based mini-computer market; Digital Equipment and IBM will have to expand their RISC offerings to compete effectively.

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## Sales and Distribution

Minis and workstations are sold by the direct sales force. PC, printers, and other products are sold through dealers as well as the sales force.

Hewlett-Packard is increasing its direct and indirect sales channel size to increase its HP 3000 computers' market visibility. By adding more distributors, dealers, and value-added resellers to its network of existing resellers, Hewlett-Packard increases sales potential. The resellers give HP access to customers it cannot reach through its direct sales force.

### Future Enhancements

Hewlett-Packard is committed to enhancing its HP 3000 product line to accommodate the customer's growing power, functionality, and system expansion requirements.

The latest systems introduced improve the performance range of the entire HP 3000 product line and include the first multiprocessor version of a Series 900 superminicomputer. The Series 980/200 comprises two 980/100 processors.

According to Hewlett-Packard, RISC-based computing permits the development and delivery of new processor boards every 6 to 12 months.

One planned development is the eventual conversion of the *entire* HP 3000 product line to RISC-based HPPA architecture. This means the replacement of the Micro 3000 models at the entry point of the product line.

Hewlett-Packard has also developed some strategic business partnerships—most notably with Hitachi and Samsung—for the purpose of technology exchanges that will further enhance HP products. A joint marketing agreement has been signed by HP and Lotus Development Corp. that will bring Lotus 1-2-3 software to HP's environment. HP has also signed a five-year agreement with Informix Corp. to develop, market, and sell products.

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## Decision Points

### Strengths

#### Compatibility

One of the HP 3000 Series' primary advantages is the compatibility provided throughout the product line. The HP 3000 minicomputers and superminicomputers are object-code compatible with one another. The Series 900 computers' MPE XL operating system provides protection for software investments in system migrations and provides a measure of bottom-to-top software development and execution. Peripheral, communications, and software compatibility throughout the HP 3000 product line allow installations to grow with no need to invest in another vendor's computer architecture.

Hewlett-Packard upgrades the computing power of the HP 3000 line without sacrificing compatibility with HPPA-based or conventional predecessors.

MPE V-based applications and data can be moved to the Series 900 systems without modifications or recompilations. MPE XL is a functional superset of MPE V. The two versions are nearly

identical in terms of user interface, system management, accounting, and security. Investments in MPE V training are protected.

#### Upgrade Options

The latest additions to the HP 3000 family greatly improve upgradability within the product line. There are now three distinct groups within the HP 3000 Series: the entry-level Micro 3000 minicomputers; the low-end Series 922 and 932 models and the midrange Series 948 and 958; and the high-end Series 950, 955, 960, 980/100, and 980/200.

Within each group, field upgrades require only a CPU board swap. The system processing unit boxes must be exchanged when upgrading from the entry-level to the low-end Series and from the midrange to the high-end Series.

#### Software Availability

Through Hewlett-Packard's third-party vendor program, customers can obtain an abundance of packaged software programs written for HP 3000 computers. The program provides users with a wide range of solutions for a wide range of commercial computing disciplines. Customers have direct access to the application solutions through Hewlett-Packard's cooperative marketing efforts with third-party vendors.

Furthermore, for customers developing their own application systems, the development and maintenance tasks are reduced when programmers use HP products such as the Toolset program development set and the Business Report Writer report writing system. With these tools, programs are developed, installed, and serviced at a quicker pace than with traditional programming and system development methods.

#### Open Network Computing

All HP 3000 computers implement an "open network computing" philosophy to attract customers with a multivendor or multiple-architecture computer infrastructure. The HP 3000's communications and networking scheme provides the openness required in a departmental and distributed processing environment. Tools are available to:

- Communicate with Hewlett-Packard HP 1000 technical computing and realtime processing

systems and HP 9000 workstations and multiuser computers; and

- Communicate with non-Hewlett-Packard computers with proprietary and industry-standard architectures that are connected to IEEE 802.3 Ethernet or X.25 communications lines and implement the Department of Defense Advanced Research Projects Agency (ARPA) networking standards—i.e., the TCP/IP, FTP, Telnet, and SMTP protocols for file transfer, terminal login access, electronic mail, and remote command execution.

The HP 3000 systems also can communicate with IBM System/370-architecture mainframe and supermini host systems and can directly interface with DECnet-connected Digital Equipment Corp. computers.

### PC Integration

To further highlight the HP 3000 as a true departmental system, Hewlett-Packard touts the HP 3000's capabilities of supporting MS-DOS-based IBM PC and compatible microcomputers. PC integration tools such as AdvanceLink, Resource Sharing, and Information Access allow the microcomputers to access HP 3000 programs and data, and to use the HP 3000 as a resource server and a gateway to other systems within the network.

### Support Programs

Hewlett-Packard maintains a reputation for consistent customer and product support programs.

### Limitations

While field upgrade options have increased, several upgrades still require reinvestment in the system processing unit. Box swaps are required when moving from the Micro 3000 minicomputers to the Series 900 models; from a Series 932 to a Series 950; and from a Series 948 to a Series 960.

# Characteristics

## System Overview

The HP 3000 Series is a compatible family of commercial data processing systems based on the RISC-based HP Precision Architecture. The HP 3000 Series is suited for online transaction processing, distributed processing, and client-server environments.

The HP 3000 Series comprises the Micro 3000LX, Micro 3000RX, and Series 922LX, 922RX, 922, 932, 948, 950, 955, 958, 960, 980/100, and 980/200.

## Specifications

### Data Formats

**Basic Format:** 16-bit word for the conventional computers—i.e., the Micro 3000 minicomputers. A 32-bit word for the Hewlett-Packard HP Precision Architecture (HPPA)-based HP 3000 superminicomputers—i.e., the Series 900 Models.

**Fixed-Point Operand:** For the conventional HP 3000 computers, 16-bit operands can be used by logical or fixed-point arithmetic instructions to represent 16-bit integers. Double-integer, fixed-point formats provide 32 bits of value representation. Packed decimal instructions can be extended to 28 digits of precision. Logical operands are represented in positive integer format, while fixed-point operands are represented in twos complement format.

The Series 900 superminicomputers, implementing the HPPA, support 16-bit and 32-bit integers, either signed or unsigned. Signed integers are in twos complement form. Both packed and unpacked decimal data representations are supported. To help minimize processor complexity, halfword (16-bit) integers must be aligned at even byte addresses, and 32-bit integers must be aligned on a word boundary.

**Floating-Point Operand:** The conventional Micro 3000 systems include single-precision, 32-bit operands and extended-precision, 64-bit operands.

The Series 900 supports binary floating-point representation that conforms to the ANSI/IEEE 754-1985 standard. The computers perform floating-point arithmetic operations using single-precision (32-bit), double-precision (64-bit), and quadruple-precision (128-bit) floating-point formats.

**Table 1. System Comparison**

Model	Micro 3000LX	Micro 3000RX	Series 922LX	Series 922RX
<b>System Characteristics</b>				
Date of introduction	April 1988	January 1990	January 1990	January 1990
Operating system	MPE V	MPE V	MPE XL	MPE XL
Architecture	CISC	CISC	RISC	RISC
Upgradable to	Series 3000RX	Not applicable	Series 922RX	Series 922
Relative Performance (based on Series 925 at 1.0)	0.3 -0.5	0.3 -0.5	1.2	1.2
<b>Memory</b>				
Minimum capacity (bytes)	2M	2M	24M	32M
Maximum capacity (bytes)	4M	4M	64M	64M
Cache memory (bytes)	None	None	32K	32K
Minimum Disk Storage (bytes)	81M	152M	670M	1.3G
Maximum Disk Storage (bytes)	304M	2.3G	2.6G	2.6G
Number of Workstations	Up to 8	Up to 24	Up to 32	Up to 64
<b>Communications Protocols</b>				
	IEEE 802.3	IEEE 802.3	IEEE 802.3	IEEE 802.3
	Ethernet, HP	Ethernet, HP	Ethernet, HP	Ethernet, HP
	StarLAN, HP	StarLAN, HP	StarLAN, HP	StarLAN, HP
	ASNL, NS/3000,	ASNL, NS/3000,	ASNL, NS/3000,	ASNL, NS/3000,
	APRA Services,	APRA Services,	APRA Services,	APRA Services,
	SNA, BSC,	SNA, BSC,	SNA, BSC,	SNA, BSC,
	OSI/X.25	OSI/X.25	OSI/X.25	OSI/X.25
Purchase Price (basic system) (\$)	10,950	17,950	35,000	65,000

On the Series 900, the floating-point instructions can either be executed directly in hardware by a co-processor, or can be emulated in software. With a floating-point co-processor, floating-point calculations are performed while the CPU continues to execute in parallel.

**Instructions:** Conventional HP 3000 instructions are either 8, 16, or 32 bits in length. Except for the stack instructions, all conventional HP 3000 instructions are one-word types with 23 distinct formats for 13 different instruction groups. The 65 stack instructions, which are 8 bits long, can be packed two per word.

The HPPA-based computers—Series 900—support a reduced number of instructions relative to conventional computers. For example, typical complex architectures use over 300 instructions, compared to 140 instructions provided with Series 900 computers. The reduced complexity allows instruction decoding and control circuitry to be simplified, resulting in higher performance.

All HPPA instructions are fixed-length, 32-bit instructions. A fixed-length instruction helps facilitate the simultaneous processing of multiple instructions, a capability known as instruction pipelining.

All HPPA instructions are also fixed format, which means that the instruction opcode and operand registers are always specified in the same place in the instruction. Fixed-format instructions allow instruction decoding and fetching of required operands to occur in parallel, thus increasing processing efficiency and performance.

Furthermore, the HPPA instruction set directly implements only simple functions to minimize processor complexity. The more complex functions, often directly

supported in the instruction sets of the conventional systems, are performed by a sequence of simple instructions generated by high-level language compilers.

With the HPPA architecture, data stored in memory is referenced via only Load and Store instructions. A relatively large number of central processor registers allows frequently required operands to be held in the central processor. The minimal number of accesses to cache and main memory increases performance.

The arithmetic and logical functions are limited to relatively simple functions with appropriate primitives provided for common operations. More complicated arithmetic and logical functions are implemented by executing a sequence of simple instructions.

**Internal Code:** ASCII.

#### **Main Storage**

**General:** The HP 3000 computers are virtual memory machines. Under the virtual memory allocation scheme of the conventional HP 3000 systems, each program is partitioned into as many as 63 segments. Each code segment can be up to 32K bytes long, and each data segment can be 64K bytes long. A program cannot be larger than 2M bytes.

Using 48- or 64-bit virtual addresses, the HPPA-based computers provide virtual address spaces of significant size. The virtual memory is organized as a set of linear spaces, with each space being 4G bytes long. Spaces are further divided into fixed-length, 2K-byte pages, each of which can hold either code, data, or both. A single data structure can be up to 4G bytes long.

**Table 1. System Comparison (Continued)**

Model	Series 922	Series 932	Series 948	Series 958
<b>System Characteristics</b>				
Date of introduction	January 1990	January 1990	December 1990	December 1990
Operating system	MPE XL	MPE XL	MPE XL	MPE XL
Upgradable to	Series 948, 958	Series 948, 958	Series 958	Not applicable
Relative Performance (based on Series 925 at 1.0)	1.2	1.9	3.7	5.5
<b>Memory</b>				
Minimum capacity (bytes)	32M	32M	64M	96M
Maximum capacity (bytes)	64M	64M	256M	256M
Cache memory (bytes)	32K	128K	512K	512K
Maximum Disk Storage (bytes)	1.3G	1.3G	34.8G	34.8G
Number of Workstations	152	240	400	600
<b>Communications Protocols</b>				
	IEEE 802.3	IEEE 802.3	IEEE 802.3	IEEE 802.3
	Ethernet, HP	Ethernet, HP	Ethernet, HP	Ethernet, HP
	StarLAN, HP	StarLAN, HP	StarLAN, HP	StarLAN, HP
	ASNL, NS/3000,	ASNL, NS/3000,	ASNL, NS/3000,	ASNL, NS/3000,
	APRA Services,	APRA Services,	APRA Services,	APRA Services,
	SNA, BSC,	SNA, BSC,	SNA, BSC,	SNA, BSC,
	OSI/X.25	OSI/X.25	OSI/X.25	OSI/X.25
Purchase Price (basic system) (\$)	75,000	89,500	120,000	245,000

Segments and pages are moved to and from main storage on an as-needed basis. Virtual memory segments and pages are transferred between main storage and disk storage under the control of the virtual memory manager in the MPE V and MPE XL operating systems.

**Capacity:** The Micro 3000RX and Micro 3000LX mini-computers accommodate either 2M or 4M bytes of main storage. The main storage resides on the system processor board along with the central processor and input/output (I/O) channel.

The Series 900 computers support between 32M bytes and 1G byte of main storage. Table 1 provides the memory capacities of specific models.

**Checking:** Error detection and correction circuitry detects and corrects single-bit errors. Multibit errors are detected and a high-priority interrupt is sent to the system software for appropriate action.

**Storage Protection:** The Micro 3000 systems have upper and lower address boundaries provided by certain registers that limit program access. A microprogram routinely checks for violations during execution (overlapped with operand fetch) and generates an interrupt if an unauthorized memory access attempt is made. Bounds violations may be classified under program transfer or reference, data reference, and stack overflow or underflow.

On the Series 900 computers, virtual memory access is protected by the buffer hardware in the central processor. The buffer supports protection mechanisms to ensure that the currently executing process can perform only authorized code, data, or I/O accesses. Included in the access checking mechanisms are four privilege levels. Protection parameters are associated with each page, and these parameters define the privilege level required to access that page, as well as the

types of accesses permitted. For each requested access, these privilege parameters are checked against the privilege level of the currently executing process, to ensure that the process has sufficient authorization to perform that access.

**Cache Memory:** The Series 900 superminicomputers each have a cache memory. The cache gives the central processors high-speed access to frequently used data and instructions. The cache improves system performance since fetching instructions and data in cache memory is faster than accessing instructions and data in main memory. Cache memory overcomes the discrepancy between the memory cycle speed and the faster data-access rate of the central processor.

#### Central Processor

**General:** The conventional HP 3000 computers use central processors that include a firmware-implemented instruction set; firmware-implemented, repetitive functions such as subroutine linkage, string processing, and buffer transfers; firmware-assisted software; bus control clock; and crystal clock dedicated to process execution measurements.

The central processor of the Micro 3000LX and Micro 3000RX is mostly contained on a single chip. The processor chip comprises the central processing unit (CPU); a control store containing the most frequently used microcode routines and boot code; a register file; a power supply monitor; and a miscellaneous maintenance block. The external support circuitry consists of the system clock generation circuitry, a maintenance panel interface, a power supply for the processor chip, and the additional control stores.

The Series 900 computers feature central processors that implement the HP Precision Architecture

**Table 1. System Comparison (Continued)**

Model	Series 950	Series 955	Series 960	Series 980/100	Series 980/200
<b>System Characteristics</b>					
Date of introduction	February 1986	April 1988	October 1989	January 1990	January 1990
Operating system	MPE XL	MPE XL	MPE XL	MPE XL	MPE XL
Upgradable to	Series 955, 960, 980/100, 980/200	Series 960, 980/100, 980/200	Series 980/100	Series 980/200	Not applicable
Relative Performance (based on Series 925 at 1.0)	2.2	3.3	4.4	7.5	up to 14
<b>Memory</b>					
Minimum capacity (bytes)	64M	96M	128M	192M	256M
Maximum capacity (bytes)	192M	256M	256M	512M	1G
Cache memory (bytes)	128K	256K	512K	1M	1M
Maximum Disk Storage (bytes)	27.4G	36.5G	85G	85.8G	85.8G
Number of Workstations	400	600	600	600+	600+
<b>Communications Protocols</b>					
	IEEE 802.3	IEEE 802.3	IEEE 802.3	IEEE 802.3	IEEE 802.3
	Ethernet, HP	Ethernet, HP	Ethernet, HP	Ethernet, HP	Ethernet, HP
	StarLAN, HP	StarLAN, HP	StarLAN, HP	StarLAN, HP	StarLAN, HP
	ASNL,	ASNL,	ASNL,	ASNL,	ASNL,
	NS/3000,	NS/3000,	NS/3000,	NS/3000,	NS/3000,
	APRA Services, SNA,	APRA Services, SNA,	APRA Services, SNA,	APRA Services, SNA,	APRA Services, SNA,
	BSC,	BSC,	BSC,	BSC,	BSC,
	OSI/X.25	OSI/X.25	OSI/X.25	OSI/X.25	OSI/X.25
Purchase Price (basic system) (\$)	305,000	385,000	485,000	675,000	1,050,000

(HPPA). Each processor embodies the basic principles of reduced instruction set computers (RISC).

The Series 900 central processors contain a CPU that comprises an instruction unit for instruction fetching and decoding; an execution unit for arithmetic, logic, and system control instruction execution; a floating-point co-processor, which performs floating-point arithmetic operations; a cache controller and cache; the translation lookaside buffer, which performs virtual-to-physical address translations; and a console and diagnostic control processor.

## Peripherals

### Input/Output (I/O) Control

The Micro 3000LX and the Micro 3000RX use the Synchronous Inter-Module Bus (SIMB) to carry communications between the central processor, main storage, and I/O channel controller. This SIMB resides on the processor board along with the central processor, main storage, and I/O channel controller. The on-board (central system) bus operates at 113 nanoseconds (ns).

The Micro 3000LX and Micro 3000RX use a backplane SIMB to interface peripherals and network interfaces with main storage and the central processor. This backplane bus operates at 226 nanoseconds. An SIMB interface on the processor board buffers data between the high-speed and low-speed SIMBs.

The Series 922LX, 922RX, 922, 932, 948, and 958 use the Precision Bus to communicate with the central processor, main storage, Channel Adapters, and a Programmable Serial Interface (PSI) card. The Precision

Bus is 32 bits wide, and runs synchronously with an 8MHz clock, supporting data transfer rates up to 20M bytes per second.

The Series 922, 932, 948, and 958 Channel I/O Bus Adapters provide the interface between the Precision Bus and the Channel I/O Bus (CIB).

Each CIB supports up to six cards for interfacing peripheral devices and local area networks. Each CIB provides a 16-bit-wide, bidirectional data path that runs synchronously with a 4MHz clock rate and has a data transfer rate of up to 5M bytes per second.

The Series 950, 955, 960, and 980 employ a three-tier bus structure for I/O throughput. The System Memory Bus (SMB) carries communications between the central processor, main storage, and I/O bus adapters. The SMB provides a 64-bit-wide data path and runs asynchronously with a 27.5MHz clock. It supports an average transfer rate of 100M bytes per second.

The Series 950, 955, 960, and 980 Central Bus Adapters (CTB Adapters) provide the interface between the SMB and the Central Buses (CTBs). The CTB Adapters act as agents for DMAs and direct I/O transfers between the Channel I/O Adapters and the central processor and main storage.

The high-end systems accommodate two standard CTB Adapters. Each CTB Adapter supports one Series 950, 955, 960, or 980 CTB.

The 32-bit CTB is the communication path between the CTB Adapters and the Channel I/O Adapters. In addition, the Series 950, 955, 960, and 980 CTBs directly support a programmable serial interface card, which interfaces data communications controllers to the

**Table 2. Mass Storage**

Model	HP 7957B	HP 7958B	HP 7959B
<b>Type</b>	Fixed	Fixed	Fixed
Controller model	Integrated	Integrated	Integrated
Drives per subsystem/controller	1/controller	1/controller	1/controller
Formatted capacity per drive (bytes)	81M	152M	304M
Average seek time (ms.)	29.0	29.0	—
Average rotational/relay time (ms.)	8.3	8.3	—
Average access time (ms.)	37.3	37.3	17.0
Data transfer rate (bytes/second)	1.25M	1.25M	1.25M
Supported by system models	All models	All models	Micro 3000LX, Micro 3000RX
Purchase price (basic) (\$)	3,225	3,875	5,675
Comments	Has a 5.25-inch form factor. Can be rack-mounted. Requires the HP-IB to communicate with the host.	Has a 5.25-inch form factor. Requires the HP-IB for connectivity	Has a 5.25-inch form factor. Requires the HP-IB for connectivity.

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

central processor and main storage. Each CTB runs synchronously with a 9.2MHz clock and supports a sustained data transfer rate of 20M bytes per second.

The Channel I/O Bus Adapters provide the interface between the CTB and the CIBs. Each Channel I/O Bus Adapter serves as a high-performance channel multiplexer providing full DMA for all CTB-attached peripheral and communications channels.

The Series 950, 955, 960, and 980 include two standard Channel I/O Bus Adapters. A third or fourth Channel I/O Bus Adapter is optional.

Each Channel I/O Bus Adapter supports one CIB. The CIB supports up to five cards for interfacing peripheral devices and local area networks. Each CIB transfers data at up to 5M bytes per second.

#### Other Peripherals

Disk drive, magnetic tape, system printer, and data communications options for the Micro 3000 series computers communicate with central processor and main storage via the *Peripheral Interface Controller (PIC)*. One PIC is used on the Micro 3000LX and Micro 3000RX.

The PIC is the hardware I/O channel that provides the interface necessary to control and communicate with mass storage, printers, and data communications devices. It interfaces with the SIMB and is controlled by standard I/O instructions or by the execution of channel programs. It consists of SIMB interface logic, PIC control logic, and a peripheral bus. Up to six devices can be connected to the PIC.

PIC interfaces with peripheral and communications devices via the *Hewlett-Packard Interface Bus (HP-IB)* peripheral bus. The HP-IB peripheral bus is Hewlett-Packard's implementation of the IEEE standard 488-1975 peripheral interface. HP-IB is an eight-bit-wide asynchronous bus that supports a sustained data transfer rate of 1M byte per second.

The 900 Series computers use the *HB-IB Channel* to interface disk drives, magnetic tape devices, and printers to the system. The HP-IB Channel consists of the HP-IB Interface Card and the HP-IB peripheral bus. The HP-IB Interface Card connects the HP-IB peripheral bus to the CIB and performs protocol translation so the HP-IB-based devices can communicate with the central processor and main storage. The HP-IB peripheral bus, as stated previously, transports commands and data transfers to and from the peripherals. Up to six devices can be connected to the peripheral bus.

As an option, the Series 900 computers can be configured with the *Hewlett-Packard Fiber Link (HP-FL) Channel*. It consists of an HP-FL interface controller and the HP-FL bus. The HP-FL interface controller connects the HP-FL bus to a CIB. The HP-FL bus—a fiber optic link—carries I/O commands and transfers to and from the peripherals. Up to eight disk drives can be connected to the link. The link has a 5M-byte-per-second bandwidth.

**Workstations:** Workstations are connected to the Micro 3000 computers via the *Advanced Terminal Processor Model M (ATP/M)*. The ATP/M workstation controller provides connectivity for up to eight (asynchronous) workstations (terminals, printers, and personal computers [PCs]) in a point-to-point local or remote configuration. The ATP/M allows workstations to transmit and receive in either character or block mode at speeds ranging up to 19.2K bits per second (bps). Local workstations are connected to the system via RS-232-C direct-connect ports, modem ports, or RS-422 direct-connect ports. Remote workstations can be connected via RS-232-C modem ports with full-duplex asynchronous modems or with HP 2334A statistical multiplexers and full-duplex synchronous modems.

**Table 2. Mass Storage (Continued)**

Model	C2200A	C2203A, C2201A	C2202A	C2204A
<b>Type</b>	Fixed	Fixed	Fixed	Fixed
Controller model	Integrated	Integrated	Integrated	Integrated
Drives per subsystem/controller	1/controller	1/controller	1/controller	1/controller
Formatted capacity per drive (bytes)	335M	670M	670M	1.34G
Average seek time (ms.)	17.0	17.0	17.0	17.0
Average rotational/relay time (ms.)	7.5	7.5	7.5	7.5
Average access time (ms.)	26.6	26.6	26.6	26.6
Data transfer rate (bytes/second)	2.5M	2.5M	2.5M	2.5M
Supported by system models	All models	All models	All models	All models
Purchase price (basic) (\$)	5,325	8,875/8,875	10,050	17,275
Comments	Attaches to host via HP-IB interface.	FL Model features fiber optic controller.	Features a cache HP-IB interface.	Attaches to host via HP-FL interface.

ATP/M communicates with the central processor and main storage of the Micro 3000 computers via the SIMB bus.

The *Distributed Terminal Controller (DTC)* for the Series 900 computers is an intelligent controller with microprocessors to handle workstation connection pre-processing and communications with the system. The DTC is compatible with the ATP.

The DTC supports up to 48 workstations in point-to-point local configuration, up to 36 workstations in a point-to-point remote configuration, or a combination of both. Workstations can perform data transfers in either a character or block mode at up to 19.2K bps. Furthermore, the DTC includes online diagnostics and a comprehensive configuration program.

The DTC connects local workstations via an interface board which contains eight ports that either support a RS-232-C or RS-422 cable. Remote workstations connect to the DTP via an interface board that contains six modem ports that support full-duplex modems. Up to six interface boards can be configured within the DTC.

The DTC attaches to the Series 900 supermini-computers using HP ThinLAN or HP ThickLAN networking cable. A LAN link residing on the CBI connects the Series 900 central processing complex to the cable where the DTC resides.

The *Terminal Server 8-Port (TS8)* connects a maximum of eight, asynchronous terminal I/O devices to one or more computer systems via an IEEE 802.3-specified Ethernet network. On the computer side, the TS8 allows the ATP, DTC, or asynchronous multiplexer to transmit data to and receive data from workstations connected to an IEEE 802.3-based TS8. The TS8s are controlled by a LAN manager running in an HP Vectra microcomputer.

Remote terminal I/O device connections can be made using the *HP 2334A Plus X.25 Multiplexer*. The multiplexer can be connected to a maximum of 16 devices. A second multiplexer is connected to the ATP, DTC, or TS8 ports. A X.25 link connects the two multiplexers.

The *HP Asynchronous Serial Network Link (HP ASNL)* provides a remote asynchronous connection for MPE V-based computers and HP Vectra, MS-DOS-based, and IBM PC and compatible microcomputers. The communication link is made through a standard ATP.

Besides using workstation controllers and hard-wired communications links, PCs can also connect to the HP 3000 computers via the *HP StarLAN* and *HP StarLAN-10* PC-based local area networks (LANs). Furthermore, Hewlett-Packard's IEEE 802.3-compatible *HP ThinLAN* or *ThickLAN* can be used for attaching personal computers to the HP 3000 computers.

The system-to-system communications on the Micro 3000 and conventional HP 3000 minicomputers are handled through *HP ThinLAN*, the *HP ASNL*, and the *Intelligent Network Processor (INP)*. The system-to-system communications on the HPPA-based HP 3000 superminicomputers are handled through *HP ThinLAN* and the *Programmable Serial Interface (PSI)*. Via an HP ThinLAN hub, nodes on HP ThinLAN can communicate with systems on Hewlett-Packard's *HP ThickLAN*—an IEEE 802.3 Ethernet that features thick coaxial cabling instead of thin.

## Software

### General

The HP 3000 Series supports the Multiprogramming Executive (MPE) operating system, of which there are two versions—the MPE V and the MPE XL. The Micro 3000LX and Micro 3000RX support the MPE V operating system. The MPE XL is supported on the Series 900 systems only.

### Operating System

Both MPE V and MPE XL enable the HP 3000 to perform transaction processing, timesharing, online program development, and data communications in interactive and batch modes concurrently. MPE monitors and controls program input, compilation, execution, and output; arranges the order in which programs are

**Table 3. Workstations**

Model	HP C1001	HP C1002	HP 2393A	HP 2397A	HP 3081A	Touch-screen II Terminal
<b>Display Parameters</b>						
Screen size	14 inches	14 inches	—	12 inches	—	—
Screen format	80 or 132 columns per line	80 or 132 columns per line	80 or 132 columns per line	—	—	24 lines, 80 columns per line
Screen type	Mono-chrome	Mono-chrome	Mono-chrome	Color	—	—
<b>Keyboard Parameters</b>						
Style	Detachable, low-profile, QWERTY	Detachable, low-profile, QWERTY	Detachable, low-profile, QWERTY	Detachable, low-profile, QWERTY	Detachable, low-profile, QWERTY	Detachable, low-profile, QWERTY
<b>Terminal Interface</b>						
	RS-232-C	RS-232-C	RS-232-C or RS-422	RS-232-C or RS-422	RS-232-C	RS-232-C
Purchase Price (basic) (\$)	895	1,150	2,430	3,810	935	2,868
Comments	A block-mode alphanumeric display terminal. Has an 8-page display memory.	A high-performance block-mode alphanumeric display terminal.	Graphics resolution is 512 x 390 or 640 x 400 pixels.	A graphics terminal with bit-mapped and line drawing graphics.	A data entry terminal packaged for the factory floor environment.	An intelligent workstation with advanced touch-screen technology.

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

executed; and dynamically allocates hardware and software resources as required.

The MPE V internal system data structure supports up to 400 concurrent sessions. Virtual memory can be spread across multiple-system domain disks so that more and larger applications can run simultaneously on one system. The disk caching facility further improves I/O performance by using excess main memory to buffer reads and writes to disk subsystems. Internal file system management makes internal control block handling more efficient; all changes to the file system are transparent. The dispatcher-scheduler gives users more control over system work load. Disk access is queued on a priority basis to ensure better access to disk and memory resources.

The MPE V file system is a collection of routines in the system-segmented library. A user may open a file, obtain status information, read or write data, perform control functions, and close the file. File security is provided either through passwords to limit access or through file access modes and user restrictions.

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

The MPE V accounting facility ensures that information such as central processor time, connect time,

and disk file space is kept by user, group, and account. A report command allows extraction of this information for each logon group.

The command language, processed by the command interpreter, contains all the necessary commands to direct and control the system. Commands can be entered interactively through a session or through a batch job.

MPE V provides an online help facility to assist with command syntax or command usage. The help facility offers encyclopedic information on all MPE commands. Help can be requested on a certain command or on a general topic or task. Command definitions explain the command's operation and parameters. Accessing information by topics or tasks enables users to perform specific tasks without prior knowledge of commands.

**MPE XL** is the operating system used on the Series 900 computers. It provides a superset of MPE V system functionality, while maintaining object-code and source-code compatibility with MPE V systems. Programs written for MPE V-based computers can be run on MPE XL-based systems without modification, or can be recompiled using new optimizing compilers for MPE XL systems in order to obtain maximum performance on the Series 900 systems.

MPE XL delivers enhanced performance and system capacity by exploiting the Series 900 architecture and advanced software capabilities. File mapping,

**Table 4. Printers**

Model	HP 2563C	HP 2564C	HP 2566C	HP 2567C	HP C1602A
Type	Matrix line	Matrix line	Matrix line	Matrix line	Ink jet
Speed	300 lpm	600 lpm	900 lpm	1,200 lpm	167cps
Character formation	7 of 19 x 18 and 14 of 38 x 18 dot ma- trix	7 of 19 x 18 and 14 of 38 x 18 dot ma- trix	7 of 19 x 18 and 14 of 38 x 18 dot ma- trix	7 of 19 x 18 and 14 of 38 x 18 dot ma- trix	180 x 180 dpi
Horizontal character spacing (char./inch)	5.0, 10.0, 12.0, 13.3,15.0, 16.7	5.0, 10.0, 12.0, 13.3,15.0, 16.7	5.0, 10.0, 12.0, 13.3,15.0, 16.7	5.0, 10.0, 12.0, 13.3,15.0, 16.7	—
Controller/Interface	RS-232-C, RS-422, or HP-IB inter- face	RS-232-C, RS-422, or HP-IB inter- face	RS-232-C, RS-422, or HP-IB inter- face	RS-232-C, RS-422, or HP-IB inter- face	RS-232-C, RS-422, or HP-IB inter- face
Graphics capability	Yes	Yes	Yes	Yes	Yes
Purchase price (basic) (\$)	8,490	13,490	26,950	34,000	2,495
Comments	Prints text and alphanu- meric in draft or NLQ mode. Can do OCR and bar code printing. Sup- ports 22 sets of typestyles and fonts and 4 types of graphics.	Used as a data center or depart- mental print- er. It prints draft- and NLQ-mode alphanumer- ics, OCR, bar code, and 4 types of graphics printing.	Used to ac- commodate high-volume printing at the data cen- ter or within the depart- ment. Fea- tures bar code and OCR printing capabilities.	A heavy-duty printer for high-volume printing. Has OCR and bar code printing capabilities.	Used as a workstation printer

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

whereby virtual memory management hardware decreases much of the software overhead associated with I/O operations, significantly increases performance for I/O-intensive processing environments.

System capacity is enhanced via support of 48-bit virtual addressing, which provides over 65,000 times the addressability of typical 32-bit systems. The virtual memory is organized as a set of 65,536 linear spaces. Each space is 4G bytes long. Spaces are further divided into fixed-length, 2K-byte pages, each of which can hold either code, data, or both. A single data structure can be up to 4G bytes long.

MPE XL uses a demand-page virtual memory management scheme. Demand paging allows an increased number of processes to simultaneously reside in main storage, thus allowing more efficient central processor use.

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

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

#### **Database Management System (DBMS)**

Several data management systems are featured across the HP 3000 line of computers.

*TurboImage/V* runs on MPE V-based systems. This DBMS is oriented toward general-purpose database processing. It supports large, high-performance databases as well as those with less demanding requirements. Because it implements a two-level network structure with owner/member relationships, *TurboImage* provides fast access to complex relationships among data.

Security is provided at the database, data set, and data item levels using a class-type scheme with over 60 levels.

*Query/V*, *TurboImage DBchange/V*, and *TurboImage Profiler/V* are database support tools for *TurboImage/V*.

**Table 4. Printers (Continued)**

Model	HP 2934	HP 2225	HP 2227A	HP 2228A
Type	Matrix serial	Ink jet	Ink jet	Ink jet
Speed	200 cps	150 cps	192 cps	192 cps
Character formation	9 x 12 and 36 x 24 dot matrix	11 x 12 dot matrix	19 x 12 and 19 x 24 dot matrix	19 x 12 and 19 x 24 dot matrix
Horizontal character spacing (char./inch)	5.0, 10.0, 16.3	6.0, 10.7, 12.0, 21.3	5.0, 6.0, 10.0, 10.6, 12.0, 21.3	5.0, 6.0, 10.0, 10.6, 12.0, 21.3
Controller/Interface	RS-232-C, RS-422, or HP-IB interface	RS-232-C or HP-IB interface	RS-232-C or HP-IB interface	RS-232-C interface
Graphics capability	Yes; at 90 x 90 dpi	Yes; at 96 or 192 x 96 or 192 dpi	Yes; at 96 or 192 x 96 or 192 dpi	Yes; at 96 or 192 x 96 or 192 dpi
Purchase price (basic) (\$)	2,795	595	849	649
Comments	Used as either a departmental or workstation printer. Features a draft and NLQ mode. Also can do bar coding.	Used as a workstation printer. Features a draft and NLQ mode.	Used as a workstation printer. Features a draft and NLQ mode.	Used as a workstation printer. Features a draft and NLQ mode.

*HPSQL/V* is a relational database management system for general-purpose processing. *HPSQL/V* uses the de facto, industry-standard Structured Query Language (SQL) database language for the data definition language (DDL) and data manipulation language (DML).

*HPSQL/V* applications are compatible with Allbase/XL's relational database component.

*Allbase/XL* is the database management system for the Series 900. It includes *Turbolmage/XL* and *HPSQL/XL*. *Turbolmage/XL* is *Turbolmage/V* optimized for the MPE XL environment and *HPSQL/XL* is an MPE XL version of *HPSQL/V*. *Turbolmage/XL* is chosen when a network data model interface is required, and *HPSQL/XL* is selected when a relational model is needed.

*HP Visor/HP-UX* is available to users of the HP-SQL interface in Allbase/XL. It provides menu-driven tools to perform ad hoc queries and generate customized reports.

The *Keyed Sequential Access Method/V (KSAM/V)* runs under MPE V and under MPE XL in the compatibility mode. It allows users to create and maintain disk files whose records are accessed by the value of the key fields within the data records.

*Dictionary/V* is a MPE V-based data dictionary and directory that provides the means to control and coordinate an organization's data processing resources more efficiently. It consists of a *Turbolmage/V* database, a high-level user interface, and a set of utilities.

*System Dictionary* is a global dictionary for both MPE-V-based systems and MPE-XL-based systems.

#### Languages

All the HP 3000 computers are multilingual systems that support several high-level programming languages. Cobol II, Fortran-66, Fortran-77, Pascal, RPG, C, Basic, and Business Basic are offered throughout the product line. All implemented languages can call a subroutine

written in another language. Of equal importance is the facility provided by the file system for all languages to use a common file structure, providing uniform access to disk and tape.

#### Communications

##### Communications Control

Data communications capabilities of the HP 3000 Series are handled by a family of hardware and software communications products called HP AdvanceNet. All the HP 3000 Link products support industry-standard protocols

**General:** System-to-system communications can be conducted using *HP ThinLAN* or *HP ThickLAN*. Both local area networks (LANs) are Hewlett-Packard implementations of IEEE 802.3 Ethernet. *HP ThinLAN* uses thin coaxial cabling while *HP ThickLAN* uses thick coaxial cabling. Both networks contain the Carrier-Sense Multiple Access with Collision Detection protocol to control network access and the Defense Advanced Research Project Agency (DARPA)-recommended Transmission Control Protocol/Internet Protocol (TCP/IP) transport-level protocol. Up to 10M bits of data can be transmitted across the network per second.

The Series 900 systems are connected to the network through the LAN3000 Link intelligent controller. The LAN3000 Link contains the hardware and transport and interface software required to connect a HP 3000 computer to an IEEE 802.3-recommended cable. LAN3000 Link hardware components include the Local Area Network Interface Controller (LANIC)—a microprocessor-based communication controller that plugs into the HP 3000 backplane. It handles buffering, IEEE 802.2 and 802.3 protocols and error checking, and keeps track of network statistics.

**Table 4. Printers (Continued)**

Model	HP 3630A	HP 33440	HP 2684A	HP 2680A
Type	Ink jet	Laser	Laser	Laser
Speed	167 cps	8 ppm	20 ppm	45 ppm
Character formation	—	300 x 300 dpi	300 x 300 dpi	180 x 180 dpi
Horizontal character spacing (char./inch)	—	10.0, 16.7	10.0, 16.7	—
Controller/Interface	RS-232-C or HP-IB interface	RS-232-C or RS-422 interface	RS-232-C or RS-422 interface	HP-IB interface
Graphics capability	Yes; at 180 x 180 dpi	Yes; at 300 x 300 dpi	Yes; at 300 x 300 dpi	Yes
Purchase price (basic) (\$)	1,395	2,695	19,995	95,470
Comments	Used as a workstation printer.	Used as a departmental printer.	Used for departmental printing. Has 34 built-in fonts, 3 font cartridge slots, and font downloading capabilities.	A heavy-duty printer for high-volume printing. Supports up to 60 print styles. Can do multi-copy, continuous form, single-sheet, and label printing.

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

The *HP ThinLAN Hub* interconnects up to four separate HP ThinLAN segments. It also includes hardware for attaching up to four HP ThinLAN segments to an HP ThickLAN cable.

The *HP StarLAN* and *HP StarLAN-10* LANs connect HP Vectra, MS-DOS-based, IBM PC, and compatible microcomputers to the HP 3000. Both are Hewlett-Packard's implementation of the de facto, industry-standard StarLAN. Both Hewlett-Packard StarLAN products work over standard, unshielded, twisted-pair phone wire. While HP StarLAN supports 1M bps data transfer rates, HP StarLAN-10 operates at 10M bps.

The *Point-to-Point Link* provides the network connection to allow an HP 3000 to communicate with another remote HP 3000. It includes an Intelligent Network Processor (INP) or Programmable Serial Interface (PSI) communications/network processor and transport-level software. The link permits communications to occur over dial, leased line, X.21, and digital phone network modems. Data transmission rate is 19.2K bps when an RS-232-C interface supports the communication line and 64K bps when a CCITT V.35 interface is used.

The *NS X.25 3000/V Link* for MPE V-based computers provides the network connection to connect HP 3000 computers to private and public X.25 packet switched networks. It consists of the INP and the TCP/IP protocols.

Besides offering a microcomputer connection, the *HP Asynchronous Serial Network Link (HP ASNL)* provides a point-to-point link for connecting two HP 3000s.

The HP ASNL makes the connection through an ATP and includes all the software for a complete network connection.

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

The SNA Link can only be used to support the operation of Hewlett-Packard's BSC software products, which are described in this report's Communications subsection of the Software section.

The *BSC Link* provides the network connection to an IBM System/370-compatible mainframe using the bisynchronous protocol (BSC). The BSC Link connects to an IBM 37XX communications controller on the host through a pair of synchronous modems.

The BSC Link only supports operation of Hewlett-Packard's BSC software products, which are described in this report's Communications subsection of the Software section.

## Operating Environment

The following tables highlight the physical, environmental, and electrical specifications of the HP 3000 Series computers.

## Physical Specifications

Model (in.)	Height (in.)	Width (in.)	Depth (in.)	Weight (lb.)
Micro 3000LX	24.0	8.4	21.2	93
Micro 3000RX	24.0	8.4	21.2	93
Series 922LX	29.5	14.8	27.9	244
Series 922RX	29.5	14.8	27.9	244
Series 922	29.5	14.8	27.9	244
Series 932	29.5	14.8	27.9	244
Series 948	29.5	14.8	27.9	244
Series 958	29.5	14.8	27.9	244
Series 950	39.0	51.0	28.0	880
Series 955	39.0	51.0	28.0	880
Series 960	39.0	51.0	28.0	880
Series 980/100	39.0	51.0	28.0	880
Series 980/200	39.0	51.0	28.0	880

## Environment Specifications

Model	Operating Temp. (°F)	Operating Humidity (%)	Heat Dissipation (Btus/hr.)
Micro 3000LX	40-104	20-80	1,450
Micro 3000RX	40-104	20-80	1,450
Series 922LX	40-104	20-80	1,581
Series 922RX	40-104	20-80	1,581
Series 922	40-104	20-80	1,581
Series 932	40-104	20-80	1,581
Series 948	41-104	20-80	2,810
Series 958	41-104	20-80	2,810
Series 950	68-78	40-60	7,900
Series 955	68-78	40-60	7,900
Series 960	68-78	40-60	7,900
Series 980/100	68-78	40-60	7,900
Series 980/200	68-78	40-60	7,900

## Electrical Specifications

Model	Voltage	Amperage	Power Consumption (kVA)
Micro 3000LX	120/240	4.0/2.5	—
Micro 3000RX	120/240	4.0/2.5	—
Series 922LX	120/240	12.0/6.3	—
Series 922RX	120/240	12.0/6.3	—
Series 922	120/240	12.0/6.3	—
Series 932	120/240	12.0/6.3	—
Series 948	120/240	12.0/6.3	—
Series 958	120/240	12.0/6.3	—
Series 950	208/380/415	8.0/4.4/4.0	2.3
Series 955	208/380/415	8.0/4.4/4.0	2.3
Series 960	208/380/415	8.0/4.4/4.0	2.3
Series 980/100	208/380/415	8.0/4.4/4.0	2.3
Series 980/200	208/380/415	8.0/4.4/4.0	2.3

## Configuration Rules

*Minicomputers*

The Micro 3000LX and Micro 3000RX minicomputers address entry-level information system requirements. The Micro 3000s come standard with MPE V fundamental operating software and Turbolmage database management system. The standard hardware configurations are outlined below.

The standard Micro 3000LX contains:

- 2M bytes of main storage
- One 81M-byte fixed disk drive
- One cartridge tape drive
- Five terminal ports
- A system cabinet
- One terminal

The standard Micro 3000RX contains:

- 2M bytes of main storage
- One 152M-byte fixed disk drive
- One cartridge tape drive
- Eight terminal ports
- A system cabinet
- One terminal

**Table 5. Cartridge and Magnetic Tape Equipment**

Model	7979A	7980XC	9144A	35401A	C1511A	9145A
Type	0.5 inch reel-to-reel	0.5 inch reel-to-reel	0.25 inch cartridge	0.25 inch cartridge auto changer	Digital Data Storage (DDS) format tape	0.25 inch cartridge
Format						
Number of tracks	—	—	16	16	32	C1511A
Recording density	1600 bpi	1600/6250 bpi	—	—	—	256 bytes per frame
Recording mode	PE	PE/GCR	DC 600 HC	DC 600 HC	—	HCD 75
Characteristics						
Controller model	Integrated	Integrated	Integrated	Integrated	Integrated	Integrated
Storage capacity (bytes)	40M	40/140M	67.1M	67.1M (on each cartridge)	1.3G	132M
Tape speed (inches per second)	125	125	60	60	—	120
Data transfer rate (bytes per second)	200K	781K	35K	35K	183K	31K
Supported by system models	All models except Micro 3000LX	All models except Micro 3000LX	All models	All models	All models	All models
Purchase Price (basic) (\$)	13,400	29,000	2,860	9,300	7,500	4,460
Comments	Requires an HP-IB for connectivity.	Requires an HP-IB for connectivity.	Requires a HP-IB for connectivity.	Has an auto changer that accesses up to 8 cartridges from a removable magazine. An HP-IB interface is required to communicate with the host.	Requires a HP-IB for connectivity.	Requires a HP-IB for connectivity.

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

The Micro 3000LX and Micro 3000RX configurations can be expanded to include increased main storage, additional fixed disk storage, additional I/O ports, local area network interface, and communications lines.

A variety of programming languages, information management software tools, communications and networking software, office system software, and business automation software are also available.

#### **Superminicomputers**

The Series 900 superminicomputers implement the HP Precision Architecture. All Series 900 models come in a base system package that consists of a system cabinet with the central processor and standard main memory. In addition, each model comes with the MPE XL operating system, basic operating utilities, TurboImage database management system, and the System

Dictionary/XL dictionary. Mass storage and terminal I/O device connectivity options are not included.

In addition, the Series 900 models can also be configured with the following:

- One local area network interface for system-to-system communication
- One local area network interface for workstation and host system communications
- A variety of programming languages, information management software tools, communications and networking software, office system software, and business automation software.

**Auto Restart Feature**

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

**Mass Storage**

See Table 2 for specifications.

**Workstations**

See Table 3 for specifications.

**Printers**

See Table 4 for specifications.

**Cartridge and Magnetic Tape**

See Table 5 for specifications.

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**Pricing and Support****Policy**

The HP 3000 Series systems are available on a purchase basis. All HP 3000 computers come with system software as part of the basic configuration. The Micro 3000 products include the MPE V operating system, fundamental operating system utilities, and the TurboImage/V database management system. The standard Series 900 computers come with the MPE XL operating system, basic operating system utilities, TurboImage/XL database, and the System Dictionary/XL global dictionary.

Volume discounts are available for hardware. Customers purchasing multiple copies of the same applications software are offered price reductions.

**Documentation****CD-ROM Subscription Service**

HP LaserROM, an information service, speeds referencing and simplifies technical publication use. LaserROM uses compact disk read-only memory (CD-ROM) technology coupled with information retrieval software to deliver manuals, bulletins, catalogs, and other technical publications. Each HP LaserROM disk contains up to 200,000 pages of support information. The full-text retrieval software instantly pinpoints requested information. Customers have direct access to information and need not work with numerous physical manuals and publications.

**Service/Support**

In addition to its HP TeamLine, HP ResponseLine, and HP BasicLine software support programs, Hewlett-Packard offers SuccessLine, a hardware service program featuring four levels of support. SuccessLine provides choices in response time and coverage periods to meet specific service needs.

**Priority Plus Support** offers maximum coverage 24 hours a day for critical applications.

**Priority Support** offers maximum coverage during normal business hours.

**Next Day Support** offers next-day response during normal business hours.

**Scheduled Support** is the lowest cost support level and offers scheduled weekly visits to your location.

For additional information on the SuccessLine services, contact your HP representative.

**Software Support**

HP increased the level of software service and support for the HP 3000 Series 900 superminicomputers with the release of its HP TeamLine, HP ResponseLine, and HP BasicLine. These new software support services effectively replace existing support services, adding more problem resolution, software maintenance, and usage assistance.

**Custom Support**

The Custom Support Plan (CSP) is an extension to the Account Management Support plan for users requiring additional personalized assistance. It allows the incorporation of any software support service Hewlett-Packard offers into an annual plan developed by the user and the Hewlett-Packard account support representative.

**Consulting Services**

Hewlett-Packard provides a set of consulting services. Standard services include FastLane 3000, HP Capacity Planning and Performance Analysis (HP Caplan), and HP Snapshot.

The *FastLane 3000* service helps the installation move from an MPE V-based system to an MPE XL-based Series 900 computer. It consists of system planning and application migration planning.

*Capacity Planning and Performance Analysis (HP Caplan)* helps the customer plan for system expansion and budget for additional computing power. Hewlett-Packard system engineers perform capacity planning and performance analysis and recommend changes.

The *HP Snapshot* service helps customers identify performance bottlenecks and their causes and recommends a strategy for corrective action. The Hewlett-Packard specialist uses advanced capacity planning software tools to perform this analysis and to understand the profile of the system usage.

**Training**

Training courses are available at an educational center or at the customer site. A full range of courses is offered to meet the need to manage, operate, and develop applications. Typical topics include system introduction,

management, operations, application and systems programming, database administration, and data communications.

**Equipment Prices**

		<b>Purchase Price (\$)</b>	<b>Std. Month. Maint. (\$)</b>
<b>Basic System Packages: Micro 3000</b>			
32520A	Micro 3000LX with 2M bytes of main storage, 81M-byte fixed disk drive, cartridge tape drive, one terminal, MPE V FOS†, and Turboimage/V database	10,950	99
32543A	Micro 3000RX with 2M bytes of main storage, 152M-byte fixed disk drive, cartridge tape drive, one terminal, MPE V FOS†, and Turboimage/V database	17,950	109
<b>Basic System Packages: HP 3000 Series 900</b>			
A1027A	HP 3000 Series 922LX with 24M bytes of main storage, MPE XL FOS†, Turboimage, SQL, and System Dictionary/XL	35,000	180
A1046A	HP 3000 Series 922RX with 32M bytes of main storage, MPE XL FOS†, Turboimage, SQL, and System Dictionary/XL	65,000	250
A1033A	HP 3000 Series 922 with 32M bytes of main storage, MPE XL FOS†, Turboimage, SQL, and System Dictionary/XL	75,000	300
A1041B	HP 3000 Series 932 with 32M bytes of main storage, MPE XL FOS†, Turboimage, SQL, and System Dictionary/XL	89,500	400
A1700A	HP 3000 Series 948 with 64M bytes of main storage, 2 5.25-inch 670M bytes, integrated disk, integrated tape backup, 700/92 console, 2 CIO—HPIB, 1 CIO-TurboLAN, 1 Access Port, 1 MUX for console connect, 1 Precision Bus adapter, 1 CIB Adapter, MPE/XL, TurboIMAGE, ALLBASE/XL	120,000	—
32490B	HP 3000 Series 950 with 64M bytes of main storage, MPE XL FOS†, Turboimage/XL, SQL, and System Dictionary/XL	305,000	724
A1109A	HP 3000 Series 955 with 96M bytes of main storage, MPE XL FOS†, Turboimage/XL, SQL, and System Dictionary/XL	385,000	850
A1701A	HP 3000 Series 958 with 96M bytes of main storage, 2 5.25-inch 670M bytes, integrated disk, integrated tape backup, 700/92 console, 2 CIO—HPIB, 1 CIO-TurboLAN, 1 Access Port, 1 MUX for console connect, 1 Precision Bus adapter, 1 CIB Adapter, MPE/XL, TurboIMAGE, ALLBASE/XL	245,000	—
A1130A	HP 3000 Series 960 with 128M bytes of main storage, MPE XL FOS†, Turboimage/XL, SQL, and System Dictionary/XL	485,000	850
A1134A	HP 3000 Series 980/100 with 192M bytes of main storage, MPE XL FOS (1) Turboimage/XL, SQL, and System Dictionary/XL	675,000	1,700
A1149A	HP 3000 Series 980/200 with 256M bytes of main storage, MPE XL FOS (1) Turboimage/XL, SQL, and System Dictionary/XL	1,050,000	2,500
<b>Memory Expansion</b>			
30535A	2- to 4M-byte memory upgrade for Micro 3000LX and Micro 3000RX	4,000	—
A1010A	8M-byte add-on memory option for Series 925, 935, and 949	10,000	—
A1623A	32M-byte memory for Series 925LX, 925, 935, 948, 949, and 958	48,000	—
A1037A	16M-byte ECC RAM for Series 925, 935, 948, 949, and 958	20,000	—
A1103A	Memory Controller for Series 950, 955, and 960	12,000	—
A1104A	16M-byte add-on memory option for Series 950, 955, and 960	23,900	—
A1152A	64M-byte memory for Series 980/100 and 980/200	95,600	—
A1436A	16M-byte memory for Series 920, 922LX, 922RX, 922, and 932	20,000	—
A1437A	32M-byte memory for Series 920, 922LX, 922RX, 922, and 932	40,000	—
<b>I/O Expansion</b>			
19742A	Series 900 Floating-Point Co-processor	10,000	15
19744D	Series 900 Channel Adapter	15,000	—
2345A	DTC for MPE XL-based systems	7,440	38
2346A	Add-on DTC serial interface card; provides eight RS-232-C local ports	3,190	—
2346B	Add-on DTC serial interface card; provides eight RS-422 local ports	4,015	—
2346C	Add-on DTC serial interface card; provides six RS-232-C modem ports	3,190	—

(1) Fundamental Operating Software.

		Purchase Price (\$)	Std. Month. Maint. (\$)
<b>I/O Expansion (Continued)</b>			
27113A	Series 930 HP-IB channel	2,140	4
27115A	Fiber Optic interface for Series 900	5,970	5
40290A	ATP/M for Micro 3000 systems	4,010	8
A1017A	Display Controller Interface	2,500	4
A1065A	Series 935 Expansion Bay	11,000	12
A1101A	Channel Adapter for 95X	15,750	15
2340A	DTC Controller	4,850	—
<b>Field Upgrades for Basic System Packages</b>			
30543A	Upgrade Micro 3000GX to Micro 3000RX	8,000	8
A1711B-840	HP 3000 Series 920-to-Series 922LX	12,500	—
A1175B-840	HP 3000 Series 920-to-Series 922RX	38,100	—
A1175B-841	HP 3000 Series 922LX-to-Series 922RX	25,500	46
A1177B-840	HP 3000 Series 920-to-Series 922	38,100	—
A1177B-841	HP 3000 Series 922LX-to-Series 922	35,600	96
A1177B-842	HP 3000 Series 922RX-to-Series 922	20,000	50
A1176C-840	HP 3000 Series 920-to-Series 932	67,600	—
A1176C-841	HP 3000 Series 922LX-to-Series 932	55,100	196
A1176C-842	HP 3000 Series 922RX-to-Series 932	39,500	150
A1176C-843	HP 3000 Series 922-to-Series 932	29,500	100
A1117A	HP 3000 Series 950-to-Series 955 field upgrade package	160,000	132
A1132A	HP 3000 Series 950-to-Series 960 field upgrade package	250,000	126
A1133A	HP 3000 Series 955-to-Series 960 field upgrade package	125,000	—
A1137A-871	HP 3000 Series 950-to-Series 980/100	550,000	976
A1137A-872	HP 3000 Series 955-to-Series 980/100	450,000	850
A1137A-873	HP 3000 Series 960-to-Series 980/100	350,000	850
A1138A-874	HP 3000 Series 900/100-to-Series 980/200	375,000	800
<b>Mass Storage</b>			
7957B	81M-byte Winchester disk drive with integral controller and HP-IB interface	3,225	23
7958B	152M-byte Winchester disk drive in a small desktop package	3,875	25
7959B	304M-byte fixed disk drive	5,675	28
C2200A	Model HP335H 335M-byte fixed disk drive	5,325	16
C2203A	Model HP670H 670M-byte fixed disk drive	8,875	24
C2201A	Model HP670FL 670M-byte fixed disk drive	8,875	24
C2202A	Model 670XP 670M-byte fixed disk drive	10,050	24
C2204A	Model HP1.34FL 1.34G-byte fixed disk drive	17,275	36
<b>Magnetic Tape Equipment</b>			
35401A	¼-inch Cartridge Autochanger Tape Subsystem	9,300	43
7979A	1600 bpi/125 ips streaming magnetic tape subsystem	13,400	46
7980A	1600/6250 bpi/125 ips streaming magnetic tape subsystem	23,200	46
7980XC	1600/6250/6250XC bpi/125 ips streaming magnetic tape subsystem w/HP-IB	29,000	46
9144A	¼-inch cartridge tape drive (67M bytes)	2,860	20
9145A	¼-inch cartridge tape drive (133M bytes)	4,460	20
C1511A	Model 1300H 1.3G-byte Digital Data Storage (DDS) format tape drive	7,500	37
<b>Printers</b>			
2562C	420-lpm line printer	5,500	56
2563C	420-lpm matrix line printer with quietized cabinet	8,490	65
2564C	840-lpm matrix line printer with quietized cabinet	13,490	104
2566C	1200-lpm matrix line printer	26,950	243
2567C	1600-lpm matrix line printer	34,000	260
2934A	200-cps matrix serial printer	2,795	30
2225	150-cps inkjet dot matrix printer	595	7
2227A	192-cps inkjet printer that accommodates paper widths up to 14 inches	849	7
2228A	192-cps inkjet printer that accommodates 8.5 by 11 inch paper	649	7
3630A	PaintJet Color Graphics Printer	1,395	10
33440	8-ppm laser printer	2,695	54
33449A	8-ppm LaserJet Series III	2,395	45
2684A	20-ppm LaserJet 2000	19,995	398
2680A	45-ppm intelligent laser printer	95,470	1,210
C1602A	PaintJet XL	2,495	12
C1613A	PaintWriter XL	2,995	—

		<b>Purchase Price (\$)</b>	<b>Std. Month. Maint. (\$)</b>
<b>Terminals and Workstations</b>			
C1001	HP 700/92 alphanumeric display terminal	895	7
C1002	HP 700/94 alphanumeric display terminal	1,150	7
2393A	HP 2393A graphics terminal	2,430	11
2397A	HP 2397A color graphics terminal	3,810	14
3081A	HP 3081 industrial data entry terminal	935	9
3082B	HP Industrial Touch Terminal	3,475	12
45851A	HP Touchscreen II Base System	2,868	20
<b>Data Comm Network Links</b>			
24405A	NS X.25 3000/V Network Link for Micro 3000 models	4,665	30
27212A	StarLAN Hub	1,455	20
27213A	HP 10:10 LAN Bridge	4,999	—
28684A	Ethertwist Hub	1,899	—
28685A	Ethertwist MAU	159	—
30251A	BSC Link for Micro 3000 models	4,985	30
30246A	SNA Link for Micro 3000 models	5,730	30
30284A	NS Point-to-Point Link for Micro 3000 models	3,270	30
36923A	ThinLAN Network Link		
310	For Series 922LX	6,820	—
315	For Series 922RX	7,200	—
320	For Series 922, 932	8,640	—
325	For Series 925LX, 925	7,640	—
330	For Series 935	8,800	27
335	For Series 949	9,040	30
340	For Series 950, 955, 960	9,990	33
350	For Series 980	12,450	41
2335A	X.25 statistical multiplexer	1,650	20

## Software Prices

		<b>Purchase Price (\$)</b>
<b>Operating System</b>		
—	MPE V fundamental operating software; includes the MPE V operating system, file copy and sort/merge utilities, an interactive screen manager, and a text editor. Supported on the Micro 3000 Family	bundled
—	MPE/XL fundamental operating software; includes the MPE/XL operating system, file copy and sort/merge utilities, an interactive screen manager, and a text editor. Supported on Series 900 superminicomputers	bundled
32651A	Fundamental Operating System (FOS); includes the MPE/XL operating system, VPLUS/V, KSAM, tools, and utilities	
418	For Series 920	10,000
419	For Series 922LX	10,000
421	For Series 922RX	20,000
422	For Series 922	30,000
432	For Series 932	35,000
450	For Series 950	60,000
455	For Series 955	60,000
460	For Series 960	60,000
480	For Series 980/100	120,000
482	For Series 980/200	120,000

		Purchase Price (\$)
<b>Programming Languages</b>		
31500	Cobol II/XL Compiler	
310	For Series 920 and 922LX	2,485
315	For Series 922RX	4,660
320	For Series 925, 925LX, 922, and 932	6,210
330	For Series 935 and 948	11,200
340	For Series 950, 955, 958, and 960	16,350
350	For Series 980/100	23,100
31501	Fortran-77/XL Compiler	
310	For Series 920 and 922LX	1,910
315	For Series 922RX	3,580
320	For Series 925, 925LX, 922, and 932	4,800
330	For Series 935 and 948	8,600
340	For Series 950, 955, 958, and 960	12,600
350	For Series 980/100	17,805
31502	Pascal/XL Compiler	
310	For Series 920 and 922LX	1,190
315	For Series 922RX	3,580
320	For Series 925, 925LX, 922, and 932	4,800
330	For Series 935 and 948	8,600
340	For Series 950, 955, 958, and 960	12,600
350	For Series 980/100	17,805
31506	C/XL Compiler	
310	For Series 920 and 922LX	2,000
315	For Series 922RX	3,750
320	For Series 925, 925LX, 922, and 932	5,000
330	For Series 935 and 948	8,750
340	For Series 950, 955, 958, and 960	13,200
350	For Series 980/100	18,450
32100	SPL/V Compiler	
310	For Micro Family and Series 920 and 922LX	760
315	For Series 922RX	1,425
320	For Series 925, 925LX, 922, and 932	1,900
330	For Series 935 and 948	3,420
340	For Series 950, 955, 958, and 960	5,225
350	For Series 980/100	7,410
32102B	Fortran 66/V Compiler	
310	For Micro Family and Series 920 and 922LX	600
315	For Series 922RX	1,125
320	For Series 925, 925LX, 922, and 932	1,500
330	For Series 935 and 948	2,700
340	For Series 950, 955, 958, and 960	4,125
350	For Series 980/100	5,850
32104	RPG/V Compiler	
310	For Micro Family and Series 922 and 922LX	840
315	For Series 922RX	1,575
320	For Series 925, 925LX, 922, and 932	2,100
330	For Series 935 and 948	3,780
340	For Series 950, 955, 958, and 960	5,775
350	For Series 980/100	8,190
32106	Pascal/V Compiler	
310	For Micro Family and Series 922 and 922LX	1,660
315	For Series 922RX	3,115
320	For Series 925, 925LX, 922, and 932	4,150
330	For Series 935 and 948	7,470
340	For Series 950, 955, 958, and 960	11,415
350	For Series 980/100	16,185
32111	Basic/V Interpreter and Compiler	
310	For Micro 3000s and Series 920 and 922LX	1,050
315	For Series 922RX	2,000
320	For Series 922 and 932	2,550
330	For Series 948	4,600
340	For Series 950, 955, 958, and 960	6,850
350	For Series 980/100	9,670
32115	Business Basic/V	
310	For Micro Family and Series 920 and 922LX	2,050
315	For Series 922RX	3,788
320	For Series 925, 925LX, 922, and 932	5,050
330	For Series 935 and 948	9,100

		<b>Purchase Price (\$)</b>
<b>Programming Languages (Continued)</b>		
340	For Series 950, 955, 958, and 960	12,650
350	For Series 980/100	17,940
32116	Fortran-77/V	
310	For Micro Family and Series 922 and 922LX	1,660
315	For Series 922RX	3,115
320	For Series 925, 925LX, 922, and 932	4,150
330	For Series 935 and 948	7,470
340	For Series 950, 955, and 960	11,415
350	For Series 980/100	16,185
32233	Cobol II/V Compiler	
310	For Micro Family Series 922 and 922LX	2,160
315	For Series 922RX	4,050
320	For Series 925, 925LX, 922, and 932	5,400
330	For Series 935 and 948	9,720
340	For Series 950, 955, 958, and 960	14,850
350	For Series 980/100	21,060
<b>Information Management Tools</b>		
32244	Dictionary/V Data Dictionary	
310	For Micro 3000 Family	1,290
315	For Series 922RX	2,410
320	For Series 922, 925, 925LX, and 932	3,215
330	For Series 935 and 948	5,790
340	For Series 950, 955, 958, and 960	8,840
350	For Series 980/100	12,540
32246	HP Inform/V Inquiry and Report Generator	
310	For Micro 3000 Family and Series 920 and 922LX	2,050
315	For Series 922RX	3,650
320	For Series 925LX, 925, 922, and 932	5,050
330	For Series 935 and 948	9,050
340	For Series 950, 955, 958, and 960	13,550
350	For Series 980/100	19,450
32247	Transact/V	
310	For Micro 3000 Family and Series 920 and 922LX	1,700
320	For Series 925 and 925LX	4,200
330	For Series 935 and 948	7,500
340	For Series 950 and 955	7,500
32256	System Dictionary/XL	
310	For Series 922LX	1,518
315	For Micro Family and Series 922 and 922RX	2,846
320	For Series 925LX, 925, 922, and 932	3,795
330	For Series 935 and 948	6,831
340	For Series 950, 955, 958, and 960	10,436
350	For Series 980/100	14,801
32257	System Dictionary Cobol Definition Extractor/XL	
310	For Micro Family and Series 920 and 922LX	470
315	For Series 922RX	880
320	For Series 925LX, 925, 922, and 932	1,170
330	For Series 935 and 948	2,105
340	For Series 950, 955, 958, and 960	3,220
350	For Series 980/100	4,635
35360	Business Report Writer/XL	
310	For Micro Family and Series 920 and 922LX	4,750
315	For Series 922RX	7,850
320	For Series 925LX, 925, 922, and 932	11,050
330	For Series 935 and 948	15,650
340	For Series 950, 955, 958, and 960	23,450
350	For Series 980/100	33,250
36044	Toolset/XL Development Environment	
310	For Series 920 and 922LX	1,400
315	For Series 922RX	2,625
320	For Series 925LX, 925, 922, and 932	3,500
330	For Series 935 and 948	6,300
340	For Series 950, 955, 958, and 960	9,625
350	For Series 980/100	13,650
32350	Toolset/V Program Development Environment	

		<b>Purchase Price (\$)</b>
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<b>Information Management Tools (Continued)</b>		
310	For Micro 3000 Family	1,400
36215	SQL/V	
310	For Micro 3000 Family and Series 920 and 922LX	4,600
36913A	Database Tools/V (Turbolmage database restructuring and performance tuning package)	
310	For Micro 3000 Family and Series 920 and 922LX	1,900
36914	Turbolmage Profiler/V	
310	For Micro 3000 Family and Series 920 and 922LX	1,000
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