

Hewlett-Packard HP 3000 Series



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Product Summary

Editor's Note

Hewlett-Packard significantly enhanced the performance range of the HP 3000 Series with the introduction of eight new systems. HP now boasts the largest family of RISC-based superminicomputers available today.

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. With an installed base of over 40,000 systems, they appear in a wide range of manufacturing and service industries, in addition to government and public service organizations.

Strengths

The primary advantage of the HP 3000 Series is the compatibility provided throughout the product line. The HP 3000 Series also offers an excellent upgrade path.

Limitations

There are now four distinct levels of processing power; upgrading between them requires a complete box swap versus a board upgrade. Otherwise, the growth potential within these levels is now very good.

Competition

The HP 3000 Series 900 competes directly with Digital Equipment Corporation's VAX Models and with the IBM AS/400. Other competition comes from the NCR Tower Series and Prime 50 Series computers.

Vendor

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

Price

Ranges from \$10,950 to \$1,195,000 for basic configurations.

GSA Schedule

Yes.

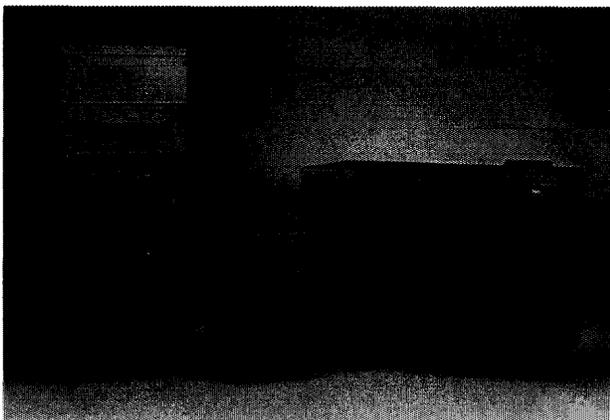
Analysis

Product Strategy

Since our last report, Hewlett-Packard has nearly doubled its HP 3000 Series line, forming the largest family of RISC-based superminicomputers available today. In the largest systems announcement in the company's history, Hewlett-Packard introduced eight new HP 3000 models. The performance of the HP 3000 Series now ranges from minicomputer at the low end to mainframe-equivalent at the high end. They facilitate entry into midrange computing and provide an impressive growth path once a system is purchased. The HP 3000 family now comprises the Micro 3000LX, Micro 3000RX, Micro 3000XE, Series 922LX, 922RX, 922, 932, 925, 935, 949, 950, 955, 960, 980/100, and 980/200.

Expanded High End

Positioned above the Series 960—the previous top of the line—the Series 980/100 and 980/200 are HP's new RISC-based 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



Pictured here is the new HP 3000 Series 949, Series 922, and Series 980/200. The HP 3000 family now comprises 16 models and provides a wide performance range.

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.

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.

New Low End

Hewlett-Packard has created a completely new low end to HP 3000 computing. The Series 922LX, 922RX, 922, and 932 computers comprise the new low-end family. Completely software-compatible with the entire HP 3000 product line, these systems bring the performance of RISC-based computing to the low end. Effectively replacing the non-RISC-based Series 52, 58, and 70 models, these new computers fill the performance gap at the low end.

The four new models are field upgradable.

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

The RISC Commitment

Since its introduction nearly twenty 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 five 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.

The RISC Advantage

RISC-based computing offers benefits in price/performance and reliability over conventional or complex instruction set computing (CISC). Furthermore, RISC allows the vendor to develop less expensive systems more quickly since the complex designs of the CISC systems are avoided.

Table 1. System Comparison

Model	Micro 3000LX	Micro 3000RX	Micro 3000XE	Series 922LX	Series 922RX
System Characteristics					
Date of introduction	April 1988	January 1990	November 1986	January 1990	January 1990
Operating system	MPE V	MPE V	MPE V	MPE XL	MPE XL
Architecture	CISC	CISC	RISC	RISC	RISC
Upgradable to	—	—	—	Series 922RX	Series 922
Relative Performance (based on Series 925 at 1.0)	0.3 -0.5	0.3 -0.5	0.3 -0.5	1.2	1.2
Memory					
Minimum capacity, bytes	2M	2M	2M	24M	32M
Maximum capacity, bytes	4M	4M	8M	64M	64M
Cache memory, bytes	None	None	128K	32K	32K
Minimum Disk Storage (bytes)	81M	152M	81M	670M	1.3G
Maximum Disk Storage (bytes)	304M	2.3G	5.4G	—	—
Number of Workstations	Up to 8	Up to 24	Up to 56	Up to 32	Up to 64
Communications Protocols	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25
Purchase Price (basic system) (\$)	10,950	17,950	21,000	35,000	65,000

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

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.

Continued Compatibility

Hewlett-Packard has made a very large investment to ensure that the Series 900 models remain program, file, and data compatible from the low-end to the high-end. The newest HP 3000 Series 900 models continue that commitment to compatibility.

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 has consistently upgraded the computing power of the HP 3000 line without sacrificing compatibility with HPPA-based or conventional predecessors.

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.

Table 1. System Comparison (Continued)

Model	Series 922	Series 932	Series 925	Series 935	Series 949
System Characteristics					
Date of introduction	January 1990	January 1990	April 1988	April 1988	January 1990
Operating system	MPE XL				
Upgradable to	Series 932	Not applicable	Series 935, 949	Series 949	Not applicable
Relative Performance (based on Series 925 at 1.0)	1.2	1.9	1.0	2.0	4.0
Memory					
Minimum capacity, bytes	32M	32M	32M	48M	64M
Maximum capacity, bytes	64M	64M	96M	96M	192M
Cache memory, bytes	32K	128K	16K	128K	640K
Maximum Disk Storage (bytes)	1.3G	1.3G	10G	20G	41.6G
Number of Workstations	152	240	152	240	400
Communications Protocols	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25
Purchase Price (basic system) (\$)	90,000	135,000	80,000	150,000	275,000

Competitive Position

The HP 3000 product line competes most directly with Digital Equipment Corporation 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 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 systems at a substantially lower price.

The Series 925 offers approximately the same performance as a comparably configured AS/400 Model 60 at one third the price and the Series 935 provides 2.5 times more MIPS than a comparably configured IBM 9370 Model 90.

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 85.5G bytes of mass storage, compared to only 27.1G bytes on the Series 955. The IBM 4381 Model 21 supports approximately 50G bytes of mass storage. 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 Tower and 10000 Series computers. Generally, when compared to these vendor's 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

Table 1. System Comparison (Continued)

Model	Series 950	Series 955	Series 960	Series 980/100	Series 980/200
System Characteristics					
Date of introduction	February 1986	April 1988	October 1989	January 1990	January 1990
Operating system	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
Memory					
Minimum capacity, bytes	64M	96M	128M	192M	256M
Maximum capacity, bytes	192M	256M	256M	512M	1G
Cache memory, bytes	128K	256K	1024M	—	—
Maximum Disk Storage (bytes)					
	85G	85G	85G	85.8G	85.8G
Number of Workstations					
	400	600	600	600+	600+
Communications Protocols					
	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25	IEEE 802.3 Ethernet, HP StarLAN, HP ASNL, NS/3000, APRA Services, SNA, BSC, OSI/X.25
Purchase Price (basic system) (\$)					
	305,000	385,000	485,000	775,000	1,195,000

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

automation sale. Hewlett-Packard now has the competitive advantage in the RISC-based mini-computer market; Digital and IBM will have to expand their RISC offerings from the technical workstation level to compete effectively.

User Opinion

Datapro's 1989 Computer Users Survey included responses from 88 HP 3000 system users.

The respondents reported that their systems had been installed for an average of 27 months. Of the respondents, 66 percent purchased their systems from Hewlett-Packard; 25 percent rented or leased from Hewlett-Packard; and less than 10 percent leased from a third party.

Responses indicated that the HP 3000s are used within a variety of industries as multipurpose business systems as well as dedicated systems, further validating Hewlett-Packard's attempt to meet a wide range of application processing needs.

When asked about system operability and functionality, the respondents rated the HP 3000 systems consistently above average, with an overall satisfaction rating of 9.0 (on an scale from 1 to 10).

When asked if the system did what it was expected to do, 100 percent of the users stated that it did. Ninety-nine percent of the respondents would recommend the system to another user.

To supplement our survey findings, we telephoned two companies using HP 3000 computers.

The first company we contacted is a large manufacturing and retail business on the West Coast. This company has continued to upgrade its HP 3000 systems because its business has nearly tripled in the past five years. This company is presently using five HP 3000 Series 935 computers for inventory control and distribution. Included in the application set are order processing, customer billing, inventory control, purchasing, manufacturing planning and control, and data collection applications.

Table 2. Mass Storage

Model	HP 7935H/ HP 7935XP	HP 7957A	HP 7958A	HP 7958B
Type	Removable	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, megabytes	404	81	130	152
Average seek time (ms.)	24.0	29.0	29.0	—
Average rotational/relay time (ms.)	11.1	8.3	8.3	—
Average access time (ms.)	35.1	37.3	37.3	—
Data transfer rate (bytes/second)	1.06M	1.25M	1.25M	—
Supported by system models	All models except Micro 3000LX and Micro 3000RX	All models	All models	Micro 3000LX, Micro 3000RX, and Micro 3000XE
Purchase price (basic) (\$)	24,950/26,000	4,250	6,450	3,875
Comments	Attaches to the host via HP-IB. The HP 7935XP features a read/write cache; the HP 7935H does not.	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.

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This manufacturer upgraded to the Series 935 from the Series 70, and before that from the Series 37. The company cited low cost of ownership and continued product enhancements as the reason it chose to remain with the HP 3000 computers as the company grew. It also noted Hewlett-Packard's support programs. As the company expanded, it looked to HP for advice in expanding their computer systems, and were very pleased with the presented options.

To date, the manufacturer has not had any major problems with reliability or product support, and noted that as the business continues to grow they have no doubt they will remain with the HP 3000 product line. Not surprisingly, this manufacturer enthusiastically recommends the HP 3000 to prospective users.

The second company we contacted is a small health services organization in the Northeast. The company recently purchased a Micro 3000XE for general business administration functions. In the year since its purchase, the company has had no problems with the system. They noted that it was their first step to computerize office functions, and

the training and support provided by HP made the transition easier. In the year since its purchase, the company has considered expanding its computer system and, in light of the recent product announcements, had indicated an interest in the new Series 922 systems.

This firm admits not having experience with expansive computer systems but would recommend HP 3000 computers based on their satisfaction with the Micro 3000XE.

Sales and Distribution

Hewlett-Packard is embarking on an intensive marketing effort to expand the role of its HP 3000 computers within the business data processing market. By focusing on a wide range of target markets, Hewlett-Packard increases the sales potential for Series 900 superminicomputers.

The company is trying to place more HP 3000s within the service industry and government. Although Hewlett-Packard has installed HP 3000s in a variety of service sector industries

Table 2. Mass Storage (Continued)

Model	HP 335H	HP 670H, 670FL	HP 670XP	HP 1.34FL
Type	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	13.5	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) (\$)	5,275	8,075/8,375	9,575	15,575
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.

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

(i.e., banking, wholesale/distribution, and health care) and government offices (e.g., state government agencies and school district administrative offices), it has never concentrated on selling into these sectors.

Manufacturing Applications

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.

Business Applications

Hewlett-Packard is also 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.

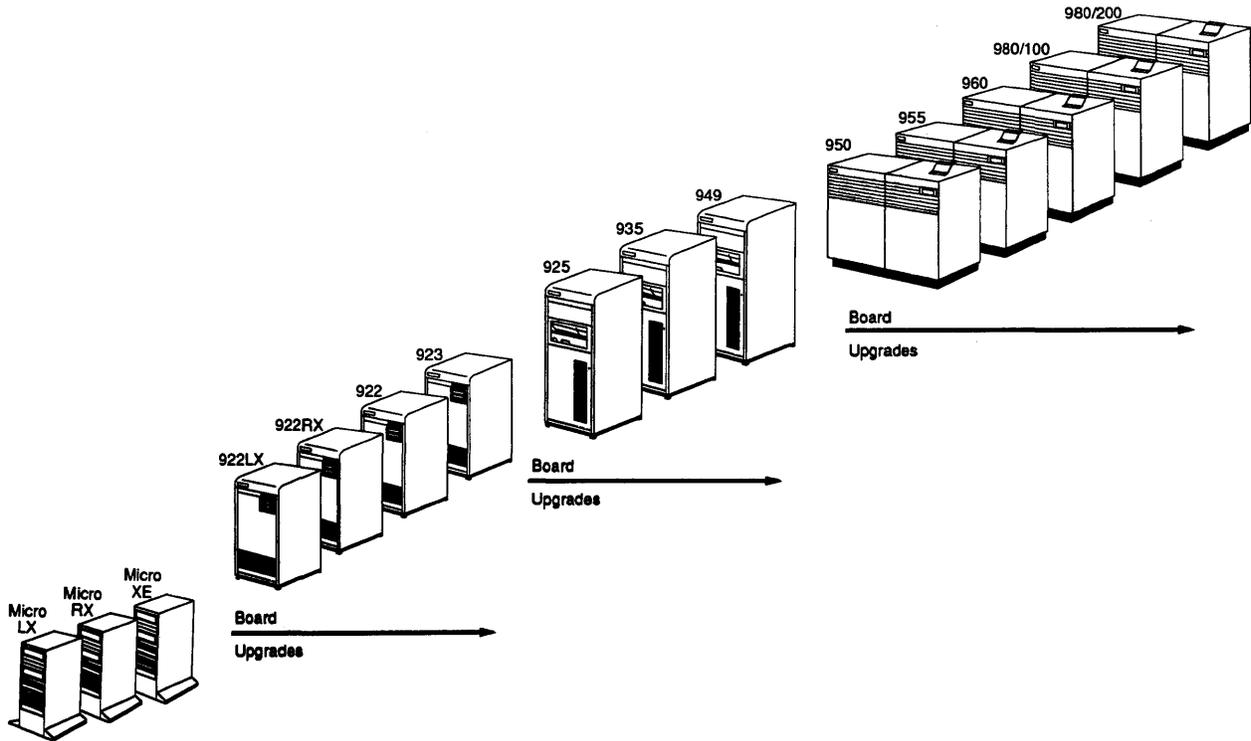
Software Availability

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.

Expanding Network of Resellers

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.

Figure 1.
The HP 3000 Family



The HP 3000 family simple board upgrades provide a growth path within each level of the HP 3000 Series 90.

Aggressive New Programs

Hewlett-Packard intends to exploit the strength of its new products with aggressive sales programs. The company is providing more market-specific and technical training to better prepare its sales representatives. HP is also now performing competitive benchmarking; Hewlett-Packard salespeople were previously instructed to avoid competitive benchmarks and analyses. Benchmark results are now being disclosed and used as sales tools. HP is now looking for its competitors to do the same.

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 six to twelve 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.

Support

According to Datapro's 1989 U.S. Computer User's Survey, Hewlett-Packard once again rated above Digital Equipment Corporation, IBM, Data General, Prime, and Wang in overall support satisfaction.

Table 3. Workstations

Model	HP 700/92	HP 700/94	HP 2393A	HP 2397A	HP 3081A	Touchscreen II Terminal
Display Parameters						
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	Monochrome	Monochrome	Monochrome	Color	—	—
Keyboard Parameters						
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
Terminal Interface						
Terminal Interface	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						
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 touchscreen technology.

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

HP maintains and enhances its award-winning customer and product support programs in order to keep existing customers and to attract new ones.

In addition to its HP TeamLine, HP ResponseLine, and HP BasicLine software support programs, Hewlett-Packard recently introduced a new four-level hardware support program. Both support programs offer customers a choice of support levels.

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. 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 four distinct groups within the HP 3000 Series: the entry-level minicomputers; the low-end Series 922 and 932 models; the midrange Series 925, 935, and 949; and the high-end Series 950, 955, 960, 980/100, and 980/200.

Within each group, field upgrades require only a CPU board swap. Figure 1 illustrates the upgrade paths of the HP 3000 Series. The system processing unit boxes must be exchanged when upgrading from one group to another, e.g. from a Series 932 to a Series 925.

Software Availability

Through Hewlett-Packard's third-party vendor program, customers can obtain an abundance of packaged software programs written for HP 3000

Table 4. Printers

Model	HP 2563B	HP 2564B	HP 2566B	HP 2567B
Type	Matrix line	Matrix line	Matrix line	Matrix line
Speed	300 lpm	600 lpm	900 lpm	1,200 lpm
Character formation	7 of 19 x 18 and 14 of 38 x 18 dot matrix	7 of 19 x 18 and 14 of 38 x 18 dot matrix	7 of 19 x 18 and 14 of 38 x 18 dot matrix	7 of 19 x 18 and 14 of 38 x 18 dot matrix
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 interface	RS-232-C, RS-422, or HP-IB interface	RS-232-C, RS-422, or HP-IB interface	RS-232-C, RS-422, or HP-IB interface
Graphics capability	Yes	Yes	Yes	Yes
Purchase price (basic) (\$)	7,990	13,250	24,950	32,000
Comments	Prints text and alphanumeric in draft or NLQ mode. Can do OCR and bar code printing. Supports 22 sets of types-tyles and fonts and 4 types of graphics.	Used as a data center or departmental printer. It prints draft- and NLQ-mode alphanumerics, OCR, bar code, and 4 types of graphics printing.	Used to accommodate high-volume printing at the data center or within the department. Features bar code and OCR printing capabilities.	A heavy-duty printer for high-volume printing. Has OCR and bar code printing capabilities.

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 Corporation 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.

Table 4. Printers (Continued)

Model	HP 2934	HP 2225	HP 2227	HP 2228
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) (\$)	2,995	495	799	599
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.

Support Programs

As stated earlier, Hewlett-Packard maintains award-winning 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 925; and from a Series 949 to a Series 950.

for online transaction processing and distributed processing. With an installed base of over 40,000 systems, they appear in a wide range of manufacturing and service industries, in addition to government and public service infrastructures.

The HP 3000 Series comprises the Micro 3000LX, Micro 3000RX, Micro 3000XE, and Series 922LX, 922RX, 922, 932, 925, 935, 949, 950, 955, 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

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

Table 4. Printers (Continued)

Model	HP 3630	HP 33440	HP 2684	HP 2680
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.

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.

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

Table 5. Cartridge and Magnetic Tape Equipment

Model	HP 7979A	HP 7980A	HP 9144A	HP 35401A	C1511A
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
Format					
Number of tracks	—	—	16	16	—
Recording density, bits per inch	1600	1600/6250	—	—	—
Recording mode	PE	PE/GCR	DC 600 HC	DC 600 HC	—
Characteristics					
Controller model	Integrated	Integrated	Integrated	Integrated	Integrated
Storage capacity, bytes	40M	40M/140M	67.1M	67.1M (on each cartridge)	1.3G
Tape speed, inches per second	125	125	60	60	—
Data transfer rate, units per second	200K bytes	781K bytes	35K bytes	35K bytes	183K bytes
Supported by system models	cept Micro 3000LX	All models except Micro 3000LX	All models	All models	All models
Purchase Price (basic) (\$)	13,400	23,200	2,600	8,150	7,500
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.

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

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.

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 minicomputers 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 Micro 3000XE comes with a 2M-byte main memory that can be expanded to 8M bytes in 2M- or 4M-byte increments.

The Series 900 computers support between 24M 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 Micro 3000XE minicomputer and 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, Micro 3000RX, and Micro 3000XE 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 central processor board of the Micro 3000XE contains a cache memory. The cache stores 128K bytes of frequently referenced instructions and data.

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

The instruction execution cycle times and instruction pipeline architecture for Series 900 computers are shown below:

	Central Processor	Specifications
Model	Clock Cycle (ns.)	Instruction Pipeline
Series 922/LX/RX	80	3-stage
Series 932	67	3-stage
Series 925	80	3-stage
Series 935	67	3-stage
Series 949	33	5-stage
Series 950	73	3-stage
Series 955	37	5-stage
Series 960	37	5-stage
Series 980/100,200	21	5-stage

Control Storage: The conventional HP 3000 computers are microcoded—the instructions in the instruction set are broken down into a series of microinstructions. The microinstructions perform the elementary operations of a machine instruction. One instruction consists of several microinstructions. The machine instruction cannot be executed until it has been transformed into a sequence of basic operations.

In addition to the instruction set, many system operations once programmed in software have been microcoded. These operations are requested by machine instructions that, in turn, execute multiple microinstructions.

Unlike the conventional HP 3000s, the RISC-based HPPA systems do not rely on microcode to execute the instruction set. RISC designs eliminate microcode by implementing the instruction set directly in hardware. No intermediate translation step, therefore, exists from machine instructions to primitive, microcoded operations. The hardwired instructions drive the processor directly, without being decoded. By eliminating the steps for translating machine instructions into primitive, microcoded operations, instructions are executed faster.

Registers: The Micro 3000s have 256 registers; 18 of them are addressable by the programmer.

The Series 900 HPPA specifies register-intensive operation. Calculations are performed only between high-speed registers or between a register and a constant held in the instruction. There are 32 available 32-bit-wide, general-purpose registers for holding operands and results. There also are 32 control and status registers used for interrupt processing, virtual memory access protection, and other system functions. Eight space registers specify up to eight possibly different 4G-byte virtual spaces that can be used for a given operation; these registers can hold 16-bit or 32-bit space identifiers. Five of these space registers can be used directly by application programs. Two registers are used to point to the next instruction to be executed.

Addressing: On the HP 3000 conventional systems, only privileged instructions can use absolute addressing. All other addressing is performed using one of the six allowable, relative techniques. Two techniques apply

to code, while four apply to data. Except for privileged instructions (including I/O), all word addressing is direct, direct-indexed, indirect, or indirect-indexed.

HPPA provides 48-bit virtual addressing, which offers 4G bytes of virtual memory for each of the 65,536 linear spaces. The translation lookaside buffer converts the 48-bit virtual address into a 28-bit physical address; caches recently accessed virtual page translations; and implements page-level access protection.

HPPA also provides direct access to physical memory locations. Low-cost systems can provide only physical addressing if appropriate. The smallest addressable quantity is a byte.

Interrupts: The HP 3000 conventional systems' interrupt system provides for up to 105 external interrupts. There are 16 levels of interrupt masking, and each device is initially assigned to one of the 16 levels to fix priorities and permit masking under software control. Under microprogram control, context switching for an interrupt is performed, on average, in 21 microseconds. The interrupt routines operate on a common interrupt control stack to permit nesting of interrupt routines for multiple interrupts. 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 Series 900 systems define 25 interruptions, which are categorized in four groups based on their priorities. Central processor control registers provide information for vectoring to appropriate software interrupt handler routines, saving the current machine state when handling an interrupt, and restoring machine state after the interruption is handled.

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 Micro 3000XE uses a single SIMB to interconnect central processor, main storage, mass storage and data communications controller interfaces, terminal controllers, and local area network (LAN) interfaces. This single SIMB is the backplane of the computer into which all boards are plugged and is the main communication vehicle for transferring data between processor components.

The Series 922LX, 922RX, 922, and 932 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 and 932 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 925, 935, and 949 use the Central Bus (CTB) to interconnect the central processor, main storage, the I/O bus adapters, and a PSI card. The CTB is 32 bits wide. On the Series 925, the CTB runs synchronously with an 8MHz clock, supporting data transfer rates up to 20M bytes per second. The Series 935 and 949 CTB runs synchronously with a 10MHz clock and supports a data transfer rate of over 22M bytes per second.

The Series 925, 935, and 949 Channel I/O Bus Adapters provide the interface between the CTB and the CIBs. The Series 925, 935, and 949 all support two Channel I/O Adapters. Each adapter accommodates one CIB.

Each CIB supports up to seven 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 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 while up to three PICs are featured on the Micro 3000XE.

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.

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 preprocessing 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. *Discussions of these LANs can be found in the Communications section of this report.*

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. *Detailed descriptions of these system-to-system communications products are found in the Communications section of this report.*

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, Micro 3000RX, and Micro 3000XE 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 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, 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*.

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 *TurboImage/XL* and *HPSQL/XL*. *TurboImage/XL* is *TurboImage/V* optimized for the MPE XL environment and *HPSQL/XL* is an MPE XL version of *HPSQL/V*. *TurboImage/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 *TurboImage/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

Low-level networking is performed by software within products such as LAN3000 Link, HP ASNL, and products for X.25 network connectivity. Application-level networking is performed by packages such as Network Services 3000 (NS3000) and ARPA Services.

The *LAN3000 Link software* provides IEEE 802.2 and 802.3 Ethernet link control and media access control functions and contains the transport and interface programs required to connect a HP 3000 to an IEEE 802.3, coaxial cable-based, 10M bps Ethernet network. The transport-level protocols are based on the de facto, industry-standard Transmission Control Protocol/Internet Protocol (TCP/IP) communications set. The set of node management programs provides for online configuration, diagnostics, and logging.

The *HP Asynchronous Serial Network Link (HP ASNL)* system-to-system communication software provides all the programs for connecting two HP 3000 computers.

The *Point-to-Point Link software* provides the network connection programs to allow an HP 3000 to communicate with another remote HP 3000.

The *NS X.25 3000/V Link software* provides the network connection programs that allow HP 3000 computers to connect to private and public X.25 packet switched networks. It has code for link control and media access control functions and for the transport and interface functions.

The *Network Services 3000 (NS3000)* enables the HP 3000 computers to perform virtual terminal access, file transfer, remote file and peripheral access, remote database access, and network interprocess communications among themselves. NS3000 runs in conjunction with the LAN3000 Link and Point-to-Point Link, HP ASNL, and NS X.25 3000/V Link products.

The *Network File Transfer* protocol permits HP 3000, HP 1000, and HP 9000 computers to transfer files among themselves using the Hewlett-Packard-developed Network File Transfer (NFT) protocol set.

ARPA Services allows HP 3000 computers to communicate with computer systems that implement Department of Defense Advanced Research Projects Agency (ARPA) networking standards. ARPA Services runs in conjunction with the LAN3000 Link and Point-to-Point Link, HP ASNL, and NS X.25 3000/V Link products.

Network Management Tools include the following:

- *Integrated Network Console Support*—enables centralized management of multiple HP 3000 computers in a network.
- *NetCI*—allows an operator to execute commands on any HP 3000 remote system.
- *OPT/3000*—provides facilities for network performance management.
- *Network Configuration Management*—a menu-driven configuration utility.
- *LAN Node Diagnostic*—provides an online diagnostic tool for an HP 3000-based LAN.

For communications with Digital Equipment VAX computers, there is *Network Services/DEC VAX/VMS (NS/DEC VAX/VMS)*. This tool integrates Digital Equipment's VAX/VMS computers into the HP 3000 environment. It permits files to be transferred between HP 3000 and Digital Equipment VAX/VMS computers and allows bidirectional virtual services between HP 3000 and VAX/VMS computers.

For SNA communications, gateway and standalone solutions are available. The SNA standalone products are *SNA Interactive Mainframe Facility* for interactive communications, *SNA Network Remote Job Entry (NRJE)* for batch communications, and *HP LU6.2 Application Programming Interface* for program-to-program communications.

The SNA gateway products include *SNA Server* and *SNA Access*. *SNA Server* allows a single, MPE V-based system in a network to act as a transparent gateway for SNA IMF or SNA NRJE communication for all HP 3000 computers on a LAN. *SNA Access* allows a computer to transparently transmit input to, and receive output from, an IBM mainframe through the MPE V-based HP 3000 system with *SNA Server*.

Hewlett-Packard also provides interactive and batch communications products for the BSC-based IBM network. These products include:

- *Remote Job Entry (RJE)* for single-user remote job entry using the 2780/3780 BSC protocol;
- *Multileaved Remote Job Entry (MRJE)* for multiuser remote job entry using the HASP multileaving BSC protocol; and
- *IMF* for interactive communication using the 3270 BSC protocol.

Utilities

A number of add-on utility programs and systems is available. System management tools include:

- *On-Line Performance Tool/V (OPT/V)*, an interactive performance measurement package for the systems analyst.
- *Application Program Sampler/V (APS/V)*, an interactive performance measurement software product for tuning application programs.;MC

- *HP Security Monitor/V*, a security system that protects both system resources and sensitive data from unauthorized access.

Available application development tools included the following.

- *Virtuoso Code Generator*, a programmer's productivity tool for developing and maintaining large-scale business data processing applications.
- *Transact*, a fourth-generation language for transaction processing applications. Designed as a procedural language, *Transact* provides the functionality of a third-generation language, such as Cobol or Pascal, combined with a set of powerful, high-level constructs that can perform several functions with a single statement.
- *System Programming Language/V (SPL/V)*, a system programming language for MPE V-based HP 3000 computers that combines the efficiency of a machine-dependent language with the structure of a high-level programming language.
- *HP Toolset*, a productivity aid for designing and implementing Cobol II, Pascal, and Fortran 77 programs. It includes symbolic debuggers, full-screen editors, workspace file managers, and help facilities.
- *HP Symbolic Debugger*, a symbolic debugger that helps programmers locate and correct errors in C, Fortran 77, and Pascal.

Several major data management utilities are available for MPE V and MPE XL.

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

TurboStore/V eliminates the bottlenecks associated with disk-to-tape backups.

Copycat/V provides for disk-to-disk backup.

Turbolmage DBchange/V and *Turbolmage Profiler/V* are support tools for *Turbolmage/V*.

Silhouette is a software product that provides high availability by automatically duplicating the *Turbolmage* and *Image* databases on multiple HP 3000s over network links. This shadowing allows users to continue database applications during a hardware or software failure.

HP Visor, *Inform/V*, *Business Report Writer*, and *Report/V* are report and presentation utilities.

HP Visor is a terminal interface to *HPSQL/V* and the relational data model within *Allbase/XL*. It enables users to perform queries and generate reports without involving a programmer.

HP Inform/V is an interactive inquiry and report generation facility that works on *Turbolmage/V* databases, the *Turbolmage/V* database within *Allbase/XL*, *KSAM/V* files, MPE V files, and MPE XL files. It enables users to access data and generate reports without a programmer. *Inform/V* and a data dictionary work together to simplify data access.

Business Report Writer (BRW) is a high-performance report writing system for data processing professionals. It allows report writing without numerous lines of programming code or complex report syntax.

Personal Computer Integration and Support are provided through the following software packages:

- *Cooperative Services*: This development tool helps designers create cooperative processing applications between the HP 3000 computer and personal computers.
- *HP Information Access*: This information server permits personal computers to access data in the HP 3000 database or a database on the network and to upload data to the database. Data is accessed based on security provisions.
- *HP Resource Sharing*: This software package enables personal computers to store files on HP 3000-based disk storage devices and to use HP 3000 print services.
- *AdvanceMail*: This software enables personal computers to participate in the electronic mail network that operates on the host.
- *AdvanceLink*: This software lets personal computers emulate HP 3000 terminals so that HP 3000 applications can be accessed.

Office Automation

Hewlett-Packard's primary office system solution and professional support offering is *HP NewWave Office*. This system combines key office system and professional support applications with HP 3000 computers and personal computers. The personal computers and HP 3000s, with their respective software, are integrated into a single, centrally managed system. HP NewWave is a uniform user interface for host-based and personal computer applications that features icons, agents, menus, and windowing.

The HP NewWave Office software includes:

- HP DeskManager—provides electronic mail.
- HP NewWave Information Access—enables personal computers to retrieve from and send data to the host or network-based database.
- HP NewWave Office Shared Resource Services—enables personal computers to share HP 3000-attached peripherals.

Other Hewlett-Packard office system and professional support products include word and document processing, graphics, electronic mail, spelling checker, and spreadsheet packages.

Applications

Hewlett-Packard offers the following business automation applications for the HP 3000 computers:

- HP Manufacturing Management II—a manufacturing resource planning system.

- HP Maintenance Management—planning and control software for maintenance departments.
- HP FA—a financial accounting system.
- HP Payroll—a payroll processing system.
- HP FB—a financial budgeting system.

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.

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
Micro 3000XE	29.0	15.0	28.5	73
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 925	9.2	12.8	19.7	51
Series 935	9.2	12.8	19.7	51

Series 949	9.2	12.8	19.7	51
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

Environmental 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
Micro 3000XE	50-104	20-80	3,278
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 925	32-131	5-95	—
Series 935	32-131	15-95	2,034
Series 949	32-131	15-95	2,034
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	—
Micro 3000XE	120/240	6.0/4.0	—
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 925	120/240	8.0/5.3	—
Series 935	120/240	8.0/5.3	6.0
Series 949	120/240	8.0/5.3	6.0
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, Micro 3000RX, and Micro 3000XE minicomputers address entry-level information system requirements. The Micro 3000s come standard with MPE V fundamental operating software and TurboImage 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

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.

Unlike the other Micro 3000 minicomputers, the standard Micro 3000XE does not come in a full-size system configuration. The standard Micro 3000XE comes with a system cabinet housing the central processor and 2M bytes of main storage. Mass storage and terminal I/O device connectivity must be ordered separately; they are not provided by the base platform. Furthermore, programming languages, information management software tools, communications and networking software, office system software, and business automation software must be added.

A Micro 3000XE can be configured with the following:

- A maximum of 8M bytes of main storage: The standard 2M-byte main storage is expanded in 2M-byte increments.
- Up to 4.5G bytes of online mass storage.
- Up to four magnetic tape drives.
- A maximum of 56 workstation/terminal I/O device ports.
- Up to 56 hardwired display workstations.
- Four line and eight serial printers.
- One local area network interface.
- Three communications lines for system-to-system communications.
- A variety of programming languages, information management software tools, communications and networking software, office system software, and business automation software.

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.

The Series 900 models can be configured to the maximum memory, disk storage, and number of users listed in Table 1.

Expansion limits for magnetic tape drives and printers are shown below.

Expansion Limits: Series 900				
Model	Peripherals			
	No. of Magnetic Tape Drives	No. of Page Printers	No. of Line Printers	No. of Serial Printers
Series 922LX, RX	4	4	4	16
Series 922	4	4	4	16
Series 932	4	4	6	28
Series 925	4	4	4	8
Series 935	8	4	8	32
Series 949	8	4	8	48
Series 950, 955	8	4	8	32
Series 960	8	4	8	64
Series 980 /100/200	8	4	8	64+

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

A variety of disk storage devices can be configured on the HP 3000. Hewlett-Packard recently introduced the HP C2200 family of disk drives, effectively replacing several older models. These drives use 5¼-inch disk platters and thin-film media technology.

The new 335M-byte Model 335H is for smaller systems. The 670M-byte Models 670H, 670FL, and 670XP are suited for midrange systems storage requirements. For larger systems, Model 1.34FL provides 1.34G bytes of mass storage on sixteen platters.

These new models are compact in size; up to eight drives can be packaged in a single cabinet.

These new disk drives, like the others, offer a choice of either HP-IB or HP-FL interface with the host processor. HP-IB interface is available on Models 335H, 670H, and 670XL. HP-FL is available on Models 670FL and 1.34FL.

See Table 2 for the specifications of mass storage equipment.

Workstations

The HP 3000 Series computers accommodate alphanumeric terminals, graphics terminals, data entry terminals, and personal computers. The personal computers must be configured with the appropriate asynchronous terminal emulation equipment to access the applications running on the HP 3000 models.

See Table 3 for specifications on workstations for the HP 3000 Series.

Printers

A variety of printers is available for the HP 3000 Series. The matrix line printers handle text, numerics, OCR, bar code, and graphics character sets and offer maximum print speeds ranging from 300 to 1,200 lines per minute (lpm). The matrix serial printer runs at a maximum speed of 200 characters per second (cps). The ink jet printers provide nonimpact matrix printing at maximum speeds ranging from 150 to 192 cps. The laser printers output documents, images, and graphics at up to 45 pages per minute (ppm).

The matrix line printers and page printers are used at the data center or on a departmental processor. The matrix serial and ink jet printers address printing requirements on the small-scale (standalone or departmental) system and at the individual workstation. All printers connect to the host processor or workstation using an RS-232-C, RS-422, or HP-IB interface.

See Table 4 for printer specifications.

Cartridge and Magnetic Tape

Cartridge tape drives, cartridge tape auto changers, and open-reel tape drives provide for online storage backup, archival storage, data exchange, and software distribution. The cartridge tape drive places 67.1M bytes of data on each tape cartridge. The cartridge tape auto

changer accesses up to eight tape cartridges from a removable magazine. The open-reel tape drives use 0.5 inch media and read and write in either the 800, 1600, or 6250 bit-per-inch (bpi) mode at 75-, 100-, or 125 inches per second (ips). The HP-IB interface attaches magnetic tape drives to the host processor.

Hewlett-Packard recently introduced a new Digital Data Storage (DDS) backup tape drive. Based on Digital Audio Tape (DAT) technology, this cartridge tape drive can record up to 1.3G bytes of data on a tape smaller than a standard audio tape. This tape drive is ideal for unattended backup operations in entry-level systems. It can back up the full 1.3G bytes of data in 2 hours.

See Table 5 for specifications on magnetic tape equipment.

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

Hardware Support

On January 1, 1990, Hewlett-Packard instituted a new hardware service program called SuccessLine. SuccessLine features four levels of support, an expansion of the previous two levels. SuccessLine provides the flexibility to choose response time and coverage periods that 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.

HP TeamLine

This service provides premium software consulting and a comprehensive set of software maintenance services. Customers can access a team of HP engineers, which examines a customer's business goals, operating environment and applications, and recommends methods to improve system utilization. Consultations cover system performance, application design, operating procedures, and system administration. In addition, customers can receive assistance from HP consultants for system growth planning, personnel development, and implementing software updates.

As the highest level of HP's software support services, HP TeamLine gives customers an account-assigned consultant to ensure they have access to all the standard and contractual services needed to support their computer infrastructure. In addition, HP TeamLine provides all the software maintenance and support services included within HP ResponseLine and HP BasicLine. These services include unlimited telephone access to the remote support center, on-line access to an electronic database of HP product and support information, and on-site assistance for critical situations.

HP ResponseLine

HP ResponseLine provides problem resolution, user assistance, and software maintenance from the vendor's 32 worldwide response centers (remote support centers). Based on HP's proven telephone assistance and remote diagnostics systems, it includes extensions to existing problem resolution, user assistance, and software maintenance offerings.

Telephone consulting and remote diagnostics for software troubleshooting and user assistance are available 24 hours a day, 365 days a year to all customers

with account management or HP Response Level support. This availability is extremely beneficial to customers needing assistance beyond HP's normal business hours.

HP ResponseLine also provides all the maintenance and support of HP BasicLine, including software updates, documentation updates, subscription services, and on-line access to a database of HP product and support information.

HP BasicLine

HP BasicLine is aimed at customers who opt to support their own systems; it provides:

- Right to use software updates
- Documentation and related updates to reference information
- Product bulletins, newsletters, and periodicals
- On-line access to HP SupportLine

HP SupportLine

HP SupportLine is a remote, on-line information service that customers access via terminals and modems. Through this electronic service, customers can rapidly and easily access up-to-date information on product developments, get usage assistance, and resolve problems.

Multivendor Network Support

Supporting multivendor networks is complex. Customers must deal with an array of diverse equipment from multiple vendors, making network configuration and management time consuming, complicated, and expensive. To address the need for specialized customer support in the network environment, HP released its Network Support Program.

HP's Network Support Program helps customers plan, design, and install networks within heterogeneous environments. It also helps customers operate, administer, and program the network. Furthermore, it helps customers diagnosis network problems and contact the appropriate party responsible for service and repair. In some cases, HP will run the network remotely.

HP's Network Support Program addresses network planning, design, installation, and operations through seven services. Included are the following:

- **HP Network Consulting.** This assists customers analyze data communications requirements and create a detailed network design.
- **HP Wiretest.** This evaluates the suitability of existing twisted-pair cable for use with HP's Starlan local area network. Its objective is to enable customers to avoid additional wiring costs whenever possible.
- **HP Network Startup.** This helps customers plan and coordinate the configuration and installation of network components.
- **HP NetAssure.** This helps customers isolate problems to a specific component of all supported connections to the network, whether its HP's equipment

or another vendor's device. It also enables HP to directly work with the party responsible for service and repair if the failed device is not an HP model.

- **HP Network Operations.** This enables HP to remotely manage and operate a customer's HP private packet network. Through this service, HP monitors the network, detects faults, and resolves problems on a full- or part-time basis. Furthermore, HP can provide 24-hour technical support assistance through the HP Customer Network Center.
- **HP Customer Education Program.** This trains network manager and their programmers in network management, administrations, and programming.

The Network Support Program is modular and customizable. HP and customers select only those services required and tailor a support solution that meets specific needs. Although primarily designed for customers with multivendor equipment, it can be used to address an environment composed of homogeneous or heterogeneous HP computers.

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

		Purchase Price (\$)	Std. Month. Maint. (\$)
Basic System Packages: Micro 3000			
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
32545A	Micro 3000XE with 2M bytes of main storage, MPE V FOS†, and TurboImage/V database	21,000	68
Basic System Packages: HP 3000 Series 900			
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	90,000	300
A1041A	HP 3000 Series 932 with 32M bytes of main storage, MPE XL FOS†, TurboImage, SQL, and System Dictionary/XL	135,000	400
A1007A	HP 3000 Series 925 with 32M bytes of main storage, MPE XL FOS†, TurboImage/XL, SQL, and System Dictionary/XL	80,000	265
A1060A	HP 3000 Series 935 with 48M bytes of main storage, MPE XL FOS†, TurboImage/XL, SQL, and System Dictionary/XL	150,000	515
A1600A	HP 3000 Series 949 with 64M bytes of main storage, MPE XL FOS†, TurboImage/XL, SQL, and System Dictionary/XL	275,000	620
32490B	HP 3000 Series 950 with 64M bytes of main storage, MPE XL FOS†, TurboImage/XL, SQL, and System Dictionary/XL	305,000	724

		Purchase Price (\$)	Std. Month. Maint. (\$)
A1109A	HP 3000 Series 955 with 96M bytes of main storage, MPE XL FOS†, TurboImage/XL, SQL, and System Dictionary/XL	385,000	850
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†, TurboImage/XL, SQL, and System Dictionary/XL	775,000	1,700
A1149A	HP 3000 Series 980/200 with 256M bytes of main storage, MPE XL FOS†, TurboImage/XL, SQL, and System Dictionary/XL	1,195,000	2,500
Memory Expansion			
30535A	2-4M byte memory upgrade for Micro 3000LX and Micro 3000RX	4,000	0
30482A	4M-byte memory module for Micro 3000XE	10,500	0
A1010A	8M-byte add-on memory option for Series 925	10,000	0
A1623A	32M-byte memory for Series 925LX, 925, 935, and 949	48,000	0
A1037A	16M-byte ECC RAM for Series 925 and 935	20,000	0
A1103A	Memory Controller for Series 950, 955, and 960	12,000	0
A1104A	16M-byte add-on memory option for Series 950, 955	23,900	0
A1152A	64M-byte memory for Series 980/100 and 980/200	95,600	0
I/O Expansion			
19742A	Series 900 Floating-Point Co-processor	10,000	15
19744D	Series 900 Channel Adapter	15,000	0
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	0
2346B	Add-on DTC serial interface card; provides eight RS-422 local ports	4,015	0
2346C	Add-on DTC serial interface card; provides six RS-232-C modem ports	3,190	0
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
30144A	ATP System Interface Board	3,890	17
30145A	Direct-connect port controller for ATP	8,070	32
30155A	Modem-connect port controller for ATP	9,980	39
30273A	Expansion package for direct connection on ATP	8,939	49
30274A	Modem-connect expansion package for ATP	10,775	56
Field Upgrades for Basic System Packages			
30521A	Micro 3000LX port upgrade (5 to 8)	1,500	—
30522A	Micro 3000RX port upgrade (8 to 16)	2,500	—
30528A	Micro 3000RX port upgrade (16 to 24)	5,000	—
30535A	Upgrade Micro 3000GX to Micro 3000RX	8,000	—
A1016A	Upgrade to a HP 3000 Series 925 system processor from Series 925LX system processor	—	—
A1062	Upgrade to a HP 3000 Series 935 system processor	70,000	55
A1117A	HP 3000 Series 950-to-Series 955 field upgrade package	180,000	—
A1132A	HP 3000 Series 950-to-Series 960 field upgrade package	250,000	—
A1133A	HP 3000 Series 955-to-Series 960 field upgrade package	125,000	—
Mass Storage			
7935H	404M-byte removable disk drive with integrated controller and HP-IB interface	24,950	137
7935XP	404M-byte removable disk drive with integrated controller, cache, and HP-IB interface	26,000	127
7957A	81M-byte Winchester disk drive with integral controller and HP-IB interface	4,250	33
7958A	130M-byte Winchester disk drive with integral controller and HP-IB interface	6,450	33
7958B	152M-byte Winchester disk drive in a small desktop package	3,875	25
—	Model HP335H 335M-byte fixed disk drive	5,275	—
—	Model HP670H 670M-byte fixed disk drive	8,075	—
—	Model HP670FL 670M-byte fixed disk drive	8,375	—
—	Model 670XP 670M-byte fixed disk drive	9,575	—
—	Model HP1.34FL 1.34G-byte fixed disk drive	15,575	—
Magnetic Tape Equipment			
35401A	¼-inch Cartridge Autochanger Tape Subsystem	8,150	43
7979A	1600 cpi/125 ips streaming magnetic tape subsystem	13,400	46
7980A	1600/6250 cpi/125 ips streaming magnetic tape subsystem	23,200	46
9144A	¼-inch cartridge tape drive (67M bytes)	2,600	20
9145A	¼-inch cartridge tape drive (133M bytes)	4,055	20
C1511A	Model 1300H 1.3G-byte Digital Data Storage (DDS) format tape drive	7,500	0

		Purchase Price (\$)	Std. Month. Maint. (\$)
Printers			
2562C	420-lpm line printer	5,500	56
2563B	300-lpm matrix line printer with quietized cabinet	7,990	62
2564B	600-lpm matrix line printer with quietized cabinet	13,250	99
2566B	900-lpm matrix line printer	24,950	230
2567B	1,200-lpm matrix line printer	32,000	245
2934A	200-cps matrix serial printer	2,995	30
2225	150 cps inkjet dot matrix printer	495	7
2227A	192 cps inkjet printer that accommodates paper widths up to 14inches	799	7
2228A	192 cps inkjet printer that accommodates 8.5 x 11 inch paper	599	7
3630A	PaintJet Color Graphics Printer	1,395	10
33440	8-ppm laser printer	2,695	54
2684A	20-ppm LaserJet 2000	19,995	398
2680A	45-ppm intelligent laser printer	95,470	1,210
Terminals and Workstations			
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
45851A	HP Touchscreen II Base System	2,868	20
Data Comm Network Links			
24405A	NS X.25 3000/V Network Link for Micro 3000 models	4,665	30
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
32003A	Asynchronous Serial Network Link for Micro 3000 models	750	0
28647A	HP StarLAN Bridge	5,150	21
28663A	HP StarLAN Hub	2,495	12
36923A	ThinLAN Network Link		
310	For Series 922LX	5,820	—
315	For Series 922RX	6,200	—
320	For Series 922, 932	7,640	—
325	For Series 925LX, 925	7,640	—
330	For Series 935	8,090	27
335	For Series 949	9,040	—
340	For Series 950, 955, 960	9,990	27
350	For Series 980	12,450	—
2335A	X.25 statistical multiplexer	1,650	20

†Fundamental Operating Software.

Software Prices

		Purchase Price (\$)
Operating System		
—	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 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 Series 900 superminicomputers.	bundled
Programming languages		
31500	Cobol II/XL Compiler	
310	For Series 922LX	2,485
315	For Series 922RX	4,660
320	For Series 925, 925LX, 922, and 932	6,210
330	For Series 935	11,200

		Purchase Price (\$)
335	For Series 949	13,975
340	For Series 950, 955, and 960	16,350
350	For Series 980/100	23,100
31501	Fortran 77/XL Compiler	
310	For Series 922LX	1,910
315	For Series 922RX	3,580
320	For Series 925, 925LX, 922, and 932	4,800
330	For Series 935	8,600
335	For Series 949	10,740
340	For Series 950, 955, and 960	12,600
350	For Series 980/100	23,100
31502	Pascal/XL Compiler	
310	For Series 922LX	1,910
315	For Series 922RX	3,580
320	For Series 925, 925LX, 922, and 932	4,800
330	For Series 935	8,600
335	For Series 949	10,740
340	For Series 950, 955, and 960	12,600
350	For Series 980/100	17,805
31506	C/XL Compiler	
310	For Series 922LX	1,660
315	For Series 922RX	3,115
320	For Series 925, 925LX, 922, and 932	4,150
330	For Series 935	7,470
340	For Series 950, 955, and 960	11,415
350	For Series 980/100	16,185
32100	SPL/V Compiler	
310	For Micro 3000 Family	1,000
32100	SPL/XL Compiler	
310	For Series 922LX	1,000
315	For Series 922RX	1,425
320	For Series 925, 925LX, 922, and 932	1,900
330	For Series 935	3,420
335	For Series 949	4,275
340	For Series 950, 955, and 960	5,225
350	For Series 980/100	7,410
32101	Fortran 66/V Compiler	
310	For Micro 3000 Family	1,000
32101	Fortran 66/XL Compiler	
310	For Series 922LX	1,000
315	For Series 922RX	1,125
320	For Series 925, 925LX, 922, and 932	1,500
330	For Series 935	2,700
335	For Series 949	3,375
340	For Series 950, 955, and 960	4,125
350	For Series 980/100	5,850
32104	RPG/V Compiler	
310	For Micro 3000 Family	1,000
32104	RPG/XL Compiler	
310	For Series 922LX	1,000
315	For Series 922RX	1,575
320	For Series 925, 925LX, 922, and 932	2,100
330	For Series 935	3,780
335	For Series 949	4,725
340	For Series 950, 955, and 960	5,775
350	For Series 980/100	8,190
32106	Pascal/V Compiler	
310	For Micro 3000 Family	1,000
32106	Pascal/XL Compiler	
310	For Series 922LX	1,000
315	For Series 922RX	3,115
320	For Series 925, 925LX, 922, and 932	4,150
330	For Series 935	7,470
335	For Series 949	9,340
340	For Series 950, 955, and 960	11,415
350	For Series 980/100	16,185
32115	Business Basic/V	
310	For Micro 3000 Family	2,750
32115	Business Basic/XL	
310	For Series 922LX	2,750

		Purchase Price (\$)
315	For Series 922RX	3,788
320	For Series 925, 925LX, 922, and 932	5,050
330	For Series 935	9,100
335	For Series 949	10,870
340	For Series 950, 955, and 960	12,650
350	For Series 980/100	17,940
32116	Fortran 77/V	
310	For Micro 3000 Family	2,500
32116	Fortran 77/XL	
310	For Series 922LX	2,500
315	For Series 922RX	3,115
320	For Series 925, 925LX, 922, and 932	4,150
330	For Series 935	7,470
335	For Series 949	9,340
340	For Series 950, 955, and 960	11,415
350	For Series 980/100	16,185
32233	Cobol II/V Compiler	
310	For Micro 3000 Family	3,250
32233	Cobol II/V Compiler	
310	For Series 922LX	3,250
315	For Series 922RX	4,050
320	For Series 925, 925LX, 922, and 932	5,400
330	For Series 935	9,720
335	For Series 949	12,150
340	For Series 950, 955, and 960	14,850
350	For Series 980/100	21,060
Information Management Tools		
19550	Copycat/3000	0
310	For Micro 3000 Family	850
30302	Silhouette/3000	0
310	For Micro 3000 Family	8,800
320	For Series 925 and 925LX	22,000
330	For Series 935	39,600
340	For Series 950 and 955	45,000
32180	APS/3000 Application Program Sampler	0
310	For Micro 3000 Family	1,000
32238	OPT/3000 Online Performance Tool	0
310	For Micro 3000 Family	1,800
32244	Dictionary/V Data Dictionary	0
310	For Micro 3000 Family	2,310
320	For Series 925 and 925LX	3,215
330	For Series 935	5,780
340	For Series 950 and 955	7,070
32246	HP Inform/V Inquiry and Report Generator	0
310	For Micro 3000 Family and Series 922LX	2,000
315	For Series 922RX	3,650
320	For Series 925LX, 925, 922, and 932	5,050
330	For Series 935	9,050
335	For Series 949	11,350
340	For Series 950, 955, and 960	13,550
350	For Series 980/100	19,450
32247	Transact/V	0
310	For Micro 3000 Family	1,700
320	For Series 925 and 925LX	4,200
330	For Series 935	7,500
340	For Series 950 and 955	7,500
32256	System Dictionary/XL	0
310	For Series 922LX	2,730
315	For Series 922RX	2,846
320	For Series 925LX, 925, 922, and 932	3,795
330	For Series 935	6,831
335	For Series 949	8,539
340	For Series 950, 955, and 960	10,436
350	For Series 980/100	14,801
32257	System Dictionary Cobol Definition Extractor/XL	0
310	For Series 922LX	1,050
315	For Series 922RX	880
320	For Series 925LX, 925, 922, and 932	1,170
330	For Series 935	2,105

		Purchase Price (\$)
335	For Series 949	2,635
340	For Series 950, 955, and 960	3,220
350	For Series 980/100	4,635
35360	Business Report Writer/XL	0
310	For Series 922LX	3,700
315	For Series 922RX	7,850
320	For Series 925LX, 925, 922, and 932	11,050
330	For Series 935	15,650
335	For Series 949	19,550
340	For Series 950, 955, and 960	23,450
350	For Series 980/100	33,300
36044	Toolset/XL Development Environment	0
310	For Series 922LX	1,400
315	For Series 922RX	2,625
320	For Series 925LX, 925, 922, and 932	3,500
330	For Series 935	6,300
335	For Series 949	7,875
340	For Series 950, 955, and 960	9,625
350	For Series 980/100	13,650
32350	Toolset/V Program Development Environment	0
310	For Micro 3000 Family	1,400
36044	Toolset/XL Program Development Environment.	0
310	For Series 922LX	1,400
315	For Series 922RX	2,625
320	For Series 925, 925LX, 922, and 932	3,500
330	For Series 935	6,300
335	For Series 949	7,875
340	For Series 950, 955, and 960	9,625
350	For Series 980/100	13,650
36215	SQL/V	0
310	For Micro 3000 Family	4,600
36913A	Database Tools/V (Turbolmage database restructuring and performance tuning package)	0
310	For Micro 3000 Family	1,900
36014	Turbolmage Profiler/V	0
310	For Micro 3000 Family	1,000