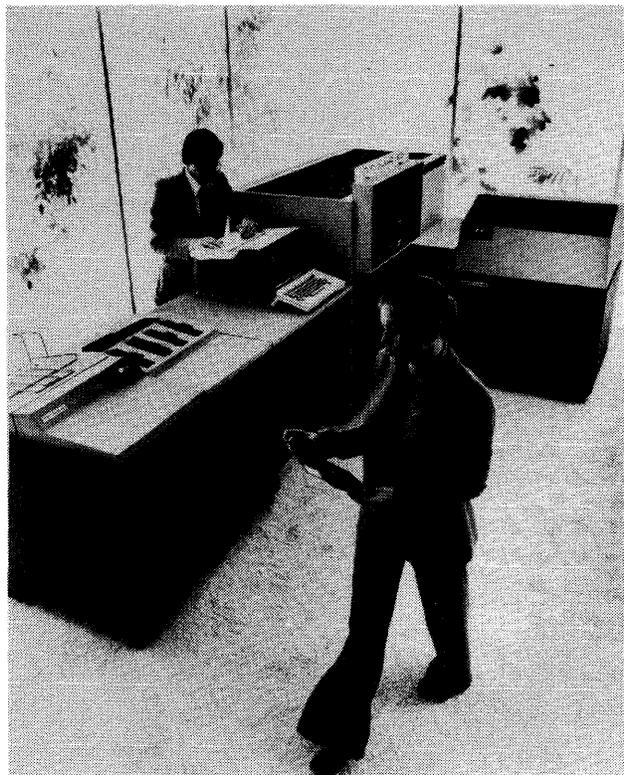# Univac 90/25 and 90/30

The Univac 90/25 is the entry-level member of the company's 90 Series computer family. The 90/25 is distinguished from the more powerful 90/30 system by a slower CPU and slower peripheral subsystems. The 90/25, however, runs under the same OS/3 operating system as the 90/30 and can be upgraded to 90/30 status. The resulting upgraded system is designated the 90/30B and can utilize both the slower 90/25 peripherals and the faster 90/30 peripherals.

MANAGEMENT SUMMARY

The Univac 90/25 and the closely related 90/30 and 90/30B systems make up the low end of the vendor's byte-oriented Series 90 product line. The 90/30 was introduced in June 1974 as an entry-level product to compete with IBM's System/3 and other vendors' System/3-competitive products. The 90/25 and 90/30B followed in February 1977, the 90/25 being offered as a new entry-level system with a lower price tag than the 90/30. The 90/25 is simply a lower-performance version of the 90/30 with reduced configurability. It can be upgraded to provide the same performance as the 90/30; and, as a bonus, the upgraded version, designated the 90/30B, can utilize all of the 90/30 peripheral subsystems *plus* a small group of low-speed peripherals that are offered specifically for the 90/25.

When the 90/30 was announced, Univac mounted an aggressive campaign both to attract new users and to convert competitive accounts with the 90/25 and 90/30, and the company has been quite successful in both areas. In February 1978, Univac announced that more than 2000 of the 90/25 and 90/30 systems had been sold. ▷

The Univac 90/30 systems, together with the lower-performance 90/25 entry system, offer an exceptionally broad performance range that spans those of several competing systems and often more than one competing product series. The 90/25 is upgradeable to 90/30 status, and both use the OS/3 operating system. Univac recently announced that more than 2000 of the 90/30 and 90/25 systems have been ordered.

CHARACTERISTICS

MANUFACTURER: Sperry Univac Division, Sperry Rand Corporation, P.O. Box 500, Blue Bell, Pennsylvania 19422. Telephone (215) 542-4011.

MODEL: Univac 90/25, 90/30, and 90/30B.

DATA FORMATS

BASIC UNIT: 8-bit byte. Each byte can represent 1 alphanumeric character, 2 decimal digits, or 8 binary bits. Two consecutive bytes form a 16-bit "halfword," four consecutive bytes form a 32-bit "word," and eight consecutive bytes form a 64-bit "doubleword."

FIXED-POINT OPERANDS: Can range from 1 to 16 bytes (1 to 31 digits plus sign) in decimal mode; 1 halfword (16 bits) or 1 word (32 bits) in binary mode. Certain operations use a doubleword (63-bit integer field plus sign) in binary mode.

FLOATING-POINT OPERANDS: Optional floating-point hardware provides for addition, subtraction, multiplication, division, loading, storing, and sign control of short or long format operands. The short format provides 24-bit precision and is represented by one word, which uses bit 0 for the sign, bits 1 through 7 for the exponent, and bits 8 through 31 for the fraction. Long format is represented with a doubleword which provides 56-bit precision; the long format is similar to the short format except that the fraction is contained in bit positions 8 through 63. A guard digit is carried by the hardware for intermediate "place holding" during addition/subtraction, multiplication, comparison, and halving.

INSTRUCTIONS: 2, 4 or 6 bytes in length, specifying 0, 1, or 2 main storage addresses, respectively.

INTERNAL CODE: EBCDIC or ASCII, depending upon setting of a mode bit in the program status word by certain processor instructions. The processor is sensitive to zone fields and edit control characters.

MAIN STORAGE

STORAGE TYPE: MOS (metal oxide semiconductor).

CAPACITY: For the 90/25, from 65,536 to 131,072 bytes in increments of 32,768 bytes. For the 90/30 and 90/30B, from 65,536 to 524,288 bytes in increments of 32,768 bytes up to 196,608 bytes and increments of 65,536 bytes up to the maximum of 524,288 bytes.

CYCLE TIME: For the 90/25, 600 nanoseconds per 2-byte access; for the 90/30 and 90/30B, 600 nanoseconds per 4-byte access. ▶

Univac 90/25 and 90/30

▷ Targets for replacement by the 90/30, in addition to Univac's own base of 9200 and 9300 accounts, included IBM 360/20 and 360/22 systems, disk-oriented versions of the IBM System/3 Model 10, Model 12, and Model 15, and the surprisingly large number of remaining IBM 1130 systems. In addition to these segments of the IBM customer base, Univac is eyeing users of the smaller members of the Honeywell Series 200, the NCR Century Series, and the Burroughs B 1700 and B 1800 Series as potential customers for the 90/30.

To achieve these goals, the 90/30 system is equipped with a variety of emulation and conversion aids and has potential growth capabilities that are unusually broad for a single central processor model. As a result, 90/30 systems span a wide price range, with rentals ranging from approximately $3,200 for a minimum configuration to over $17,000 per month for an expanded system. Deliveries began early in 1975.

Like the senior members of the Series 90 product line, the 90/25 and 90/30 feature metal oxide semiconductor (MOS) main memory. Memory sizes for the 90/30 can range from 65,536 bytes to 524,288 bytes, with a cycle time of 600 nanoseconds per four bytes. The 90/25 memory is expandable to a maximum of 131,072 bytes and has a cycle time of 600 nanoseconds per two bytes. Although the 90/30 is not totally dissimilar in design from the 90/60 and 90/70 central processors, it employs some architectural concepts that distinguish it from the larger Series 90 central processors. Among these is the use of integrated peripheral channels to interface both random-access and unit-record peripheral devices economically in small-scale 90/30 configurations. A multiplexer channel and up to two selector channels are optional, to expand the I/O device complement of larger 90/30 systems. However, like the two original members of the Series 90, the 90/30 employs a writable control storage for implementation of the basic instruction repertoire plus the optional instructions and emulation microcode, and relocation hardware for flexible main memory management.

The major difference between the 90/30 and the 90/25 is a 30-percent slower CPU, use of 16K memory chips, and modification of the integrated peripheral channel to permit connection of a floppy disk subsystem. At the same time the 90/25 was introduced, Univac announced that it was adding a new CPU to the 90/30 line, and that the same floppy disk subsystem offered with the 90/25 would also be available with the 90/30. The new 90/30B CPU offers 90/30 performance but enables the attachment of the lower-speed peripherals used with the 90/25 system. The 90/25 can be upgraded to a 90/30B system in the field without replacing the peripherals.

The 90/30 instruction repertoire surpasses the Univac 9400/9480 instruction set in the range of operations that can be performed. Like the Univac 90/60 and 90/70, the 90/25 and 90/30 offer the complete set of System/360 Model 50 nonprivileged instructions. The basic instruction repertoire consists of 84 instructions, including complete arithmetic facilities for variable-length decimal ▷

▶ CHECKING: Parity bit with each byte is generated during writing and checked during reading, with additional parity generation and checking provided on the channels and memory busses.

STORAGE PROTECTION: The optional Storage Protect feature utilizes 8 keys to provide read and/or write protection for 512-byte segments of main storage, or for 1024-byte segments in configurations with more than 128K bytes of main storage, or for 2048-byte segments with more than 256K bytes of main storage.

RESERVED STORAGE: The first 832 bytes of main storage are reserved to hold specific operating information accessed by the hardware and the supervisor.

CENTRAL PROCESSOR

REGISTERS: The programmer has access to sixteen 32-bit general registers that are used for indexing, base addressing, and as accumulators. (A second full set of 16 registers is used by the operating system.) Four double-word floating-point registers are standard.

Eight additional standard program relocation registers in low-order main storage serve as base registers for the program modules in main memory; one of these registers is reserved for the operating system. These program relocation registers act with other relocation hardware to facilitate the OS/3 rollout/rollin capability.

INDIRECT ADDRESSING: None.

CONTROL STORAGE: In addition to main storage, a fast writable control storage of 1K 82-bit words is available for the microprograms used to support the basic instruction set, microdiagnostics, and integrated emulation of Univac 9200/9300 and IBM 360/20 systems. An additional 1K of writable control storage is optional to supply the expanded instruction set, including floating-point operations. The cycle time is 600 nanoseconds per 82-bit word. Data is loaded into the writable control storage from a regular disk storage unit during the prep routine.

INSTRUCTION REPERTOIRE: 84 instructions in the basic instruction set, including decimal arithmetic, fixed-point binary arithmetic, code conversion, logical operations, packing, unpacking, editing, shifting, testing, and branching. An optional expanded instruction set adds 44 floating-point instructions plus 20 additional non-privileged instructions.

INSTRUCTION TIMES: All times are estimated and are given in microseconds. The times for binary instructions are for the register-to-indexed-storage (RX) formats. Operations involving the use of negative numbers require slightly longer execution times.

	90/25	90/30 & 90/30B
Binary add/subtract (32 bits)	5.4	5.4
Multiply (32 bits)	42.0	39.6
Divide (32 bits)	67.8	65.4
Load (RX)	5.4	4.8
Store (RX)	7.8	5.4
Compare (RX)	7.8	5.4
Decimal add (2-address, 5-digit fields)	39.0	43.0
Decimal multiply (5-digit fields)	39.9	39.9

EMULATION: Integrated emulation features are available for the IBM System/360 Model 20 and for the Univac 9200/9300 systems. Both the IBM 360/20 and the Univac 9200/9300 emulators operate as a "job" under control of ▶

Univac 90/25 and 90/30

CHARACTERISTICS OF THE 90/25 AND 90/30 SYSTEMS

	90/25	90/30B	90/30
PROCESSOR			
Relative performance	1.0	1.3	1.3
Instruction set	84 plus 64 opt.	84 plus 64 opt.	84 plus 64 opt.
MEMORY			
Type	MOS	MOS	MOS
Cycle time, nanoseconds	600	600	600
Bytes fetched per cycle	2	4	4
Minimum capacity, bytes	65,536	65,536	65,536
Maximum capacity, bytes	131,072	524,288	524,288
Increment size, bytes	32,768	32,768; 65,536	32,768; 65,536
I/O CONTROL			
Integrated peripheral channel	1 std.	1 std.	1 std.
Integrated disk adapter	1 std.	1 std.	1 std.
Multiplexer channel	1 opt.	1 opt.	1 opt.
Selector channel	No	2 opt.	2 opt.
Maximum aggregate I/O data transfer rate, bytes per second	83,000	1.8 million	1.8 million
PERIPHERAL AVAILABILITY			
Mass storage:			
Diskette	2 or 4	2 or 4	2 or 4
28.9/57.9 MB disks	Up to 2	Up to 8	Up to 8
33.1 MB disks	Up to 2	Up to 2	No
100 MB disks	No	2 to 16	2 to 16
200 MB disks	No	2 to 16	2 to 16
Magnetic tape units:			
20/40 KBS	Up to 8	Up to 8	Up to 8
68 KBS	No	Up to 16	Up to 16
48/96 KBS	No	Up to 8	Up to 8
192 KBS	No	Up to 16	Up to 16
320 KBS	No	Up to 16	Up to 16
Card equipment:			
300 cpm reader (int.)	Yes	Yes	No
600/1000 cpm reader	Yes	Yes	Yes
500 cpm reader	No	Yes	Yes
75-160 cpm punch (int.)	Yes	Yes	Yes
Printers:			
300 lpm (int.)	Yes	Yes	No
500 lpm (int.)	No	Yes	Yes
760/900 lpm	No	Yes	Yes
840/900/1200 lpm	No	Yes	Yes
800/1400/2000 lpm	No	Yes	Yes
Paper tape equipment:			
300 cps reader	No	Yes	Yes
110 cps punch	No	Yes	Yes
Communications	3 lines	12 to 24 lines	12 to 24 lines

▷ operands and binary arithmetic operations. Sixty-four additional instructions can be implemented as part of a micrologic expansion feature, including 44 optional floating-point instructions that are unavailable for the Univac 9200, 9300, and 9400/9480 central processors.

For Univac 9200/9300 users, the 90/30 offers approximately five times the raw processing power of the 9300, or approximately 1.2 times that of the Univac 9400/9480, at substantially reduced prices. Users of Univac 9200/9300 systems can upgrade to the 90/30 system in one of two ways. For those who are willing to convert, Univac supplies a conversion utility package to translate data ▷

▶ the OS/3 operating system and can be executed concurrently with 90/30 native-mode programs. Preliminary performance estimates indicate that the 90/30 can execute 360/20 programs with performance at least equal to that of a native-mode 360/20.

INPUT/OUTPUT CONTROL

I/O CHANNELS: The 90/25 processor includes an integrated peripheral channel (IPC) and an integrated disk adapter. An internal multiplexer channel is optional. The IPC is used to attach a CRT console, a floppy disk subsystem or a card reader, an integrated 75-to-160-cpm card punch, an integrated 300-lpm line printer, and a 3-line communications adapter. The integrated disk adapter controls two 8415 or 8418 disk pack drives and cannot be expanded. ▶

Univac 90/25 and 90/30

▷ files to disk formats acceptable to the OS/3 operating system and a source code analysis package that will pinpoint incompatible 9200/9300 assembly language instructions for modification. Source programs written in COBOL, FORTRAN, or RPG can generally be recompiled, with some modifications, and run under the 90/30 operating system. As an alternative, Univac offers a 9200/9300 emulation feature that will accept almost all 9200/9300 input media with the exception of data recorded on 8410 disk drives. Both the 9200/9300 programs and the original 9200/9300 supervisor are executed as a job under the OS/3 operating system.

The 90/30 is aimed at the IBM customer base, and, in particular, at those remaining System/360 Model 20 users that have not yet upgraded within the IBM product line. For these installations, the 90/30 offers an alternative to the currently somewhat limited growth path of the System/3 or the giant step to the System/370 Model 115. For System/360 Model 20 users, the Univac 90/30 offers integrated emulation for 360/20 programs under the OS/3 operating system. IBM 360/20 RPG II source programs can also be recompiled to run on the 90/30. For System/3 users, the 90/30 offers better performance and substantially greater growth capability at prices roughly equal to or somewhat below those of the competing IBM systems. For these accounts, the 90/30 offers a compatible RPG II compiler, sort, disk data management system, job control language, and 96-column card capabilities.

Conversion aids are also available for converting Honeywell Series 200 and NCR Century Series COBOL programs to 90/30 COBOL equivalents and for translating Honeywell Series 200 Easycoder programs to 90/30 COBOL, although the latter require more modifications in the area of I/O operations and register-to-register instructions.

The Univac 90/25 can be configured as a card or cardless system. The basic configuration using punched cards includes a central processor with 64K bytes of main memory (expandable to 98K or 128K bytes), an operator's console with a 1024-character CRT and typewriter-style keyboard, a 300-cpm card reader, a 300- or 500-lpm printer, and disk storage capacity of 33.1 million bytes. An optional 75-160-cpm card punch can also be attached. Disk capacity can be expanded to 115 million bytes. The cardless version of the system uses a diskette subsystem that has a data storage capacity of 243K bytes; the diskette subsystem replaces the punch card devices. All input/output devices are integrally attached to the central processor. The basic 90/25 card system, including the card punch, has a purchase price of $134,500. Monthly rental is about $3,600 including maintenance. An extended-term lease is available at about $3,200 per month. The cardless version of the system has a purchase price of $129,850 and rents for about $3,500 per month. The monthly rate under the extended-term lease is about $3,100 per month.

In addition to the integrated input/output devices, the 90/25 can also support a Uniservo 10 magnetic tape subsystem, an 80/96-column card reader, and a Univac ▷

▶ The optional multiplexer channel is used to attach a freestanding card reader and a Uniservo magnetic tape subsystem; it can handle up to three subsystems and has a maximum data transfer rate of 83,000 bytes per second.

The 90/30 and 90/30B processors include the same integrated peripheral channel as the 90/25 processor. The optional internal multiplexer channel has the same 83-KBS data transfer rate, but can attach up to eight subsystems. An external 83-KBS, eight-subsystem multiplexer channel can be added to the system in a two-channel cabinet in lieu of the internal multiplexer. The 90/30 and 90/30B processors can include one or two optional 8-subsystem selector channels with a maximum data transfer rate of 825 KBS. The maximum aggregate I/O data transfer rate is 1.8 million bytes per second.

CONSOLE: The system console consists of a keyboard with operator controls and a CRT display unit. The standard mode of operation provides for display of messages on the CRT screen. The screen images are rolled upward, with new display lines or operator input appearing on the bottom of the screen. Console management routines selectively delete messages not requiring responses from the top of the screen. Although messages and operator responses are normally output via a line printer, an optional console printer is also available. The 8541-84 console printer operates at 30 characters per second and connects to the system console.

The Univac "softscope" feature allows the system console to perform some functions of an oscilloscope to exercise the system hardware and to perform diagnostic testing of the integrated peripheral units.

CONFIGURATION RULES: The basic 90/25 configuration contains integrated control units for two 28.9- or 57.9-megabyte 8418 disk drives or two 33.1-megabyte 8415 disk drives, a 75-to-160-cpm integrated card punch, a floppy disk subsystem containing two or four drives, a 300-lpm integrated line printer, a 3-line communications adapter, and a CRT system console. One internal multiplexer channel can be added to the 90/25 for the attachment of one 600-cpm or 1000-cpm card reader and up to eight 40-KBS Uniservo 10 magnetic tape units.

The upgrade 90/30B system contains integrated control units for up to two 33.1-megabyte 8415 disk drives or up to eight 28.9- or 57.9-megabyte 8418 disk drives, a 75-to-160-cpm integrated card punch, a 300- or 500-cpm integrated card reader, a floppy disk subsystem, a 300- or 500-lpm integrated line printer, a 24-line communications adapter, and a CRT system console.

The 90/30 integrated control units are similar to those of the 90/30B but generally do not support all the lower-speed devices that can be employed on the upgrade system. The 90/30 integrated controls accommodate the same integrated card punch, floppy disk subsystem, and 24-line communications adapter, but support only the 500-cpm integrated card reader and the 500-lpm integrated line printer. The 90/30 integrated disk control supports four 28.9- or 57.9-megabyte 8418 disk pack drives and can be expanded through an optional adapter to include four additional 8418 drives.

Each of the three systems requires a system console, a card reader or a diskette drive, and a minimum of two disk drives. One 8415 disk drive appears to the OS/3 operating system as two physical drives and can be used to fulfill the requirement.

For the 90/30 and 90/30B, additional low-speed devices, including card readers, card punches, printers, a paper tape subsystem, and the Uniservo 10 or Uniservo 14 magnetic tape subsystems, can be connected through the optional multiplexer channel, which accommodates up to eight control units and eight subchannel addresses. ▶

Univac 90/25 and 90/30
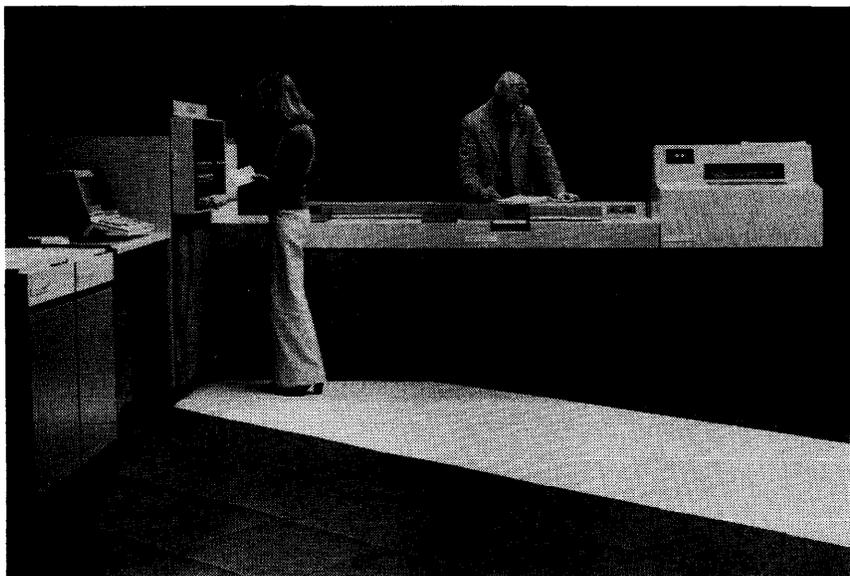
The Univac 90/30 was the smallest of the 90 Series computer systems until the February 1977 announcement of the 90/25. The 90/30 competes with IBM's System/3 Model 15 and System/370 Models 115 and 125 as well as other vendors' systems of equivalent performance. Main memory capacity starts at 64K bytes and can be expanded to 512K bytes. Disk storage can range from 29 million to over 3.2 billion bytes on-line.

▷ 9200/9300 channel adapter on its integrated multiplexer channel. The multiplexer channel operates at a maximum speed of 83K bytes/second.

Communications capability on the 90/25 is provided by the integrated communications adapter. The ICA supports three communications lines and is attached to the 90/25's integrated peripheral channel. The peripheral channel has a transfer rate of up to 50K bytes/second.

I/O capabilities of the 90/30 span a wide range. The basic system with its Integrated Peripheral Channel can accommodate a CRT console, a 500-card-per-minute card reader, a 500-line-per-minute printer, and an optional 75- to 160-card-per-minute card punch. An optional integrated disk adapter permits attachment of two Model 8415 or 8418 Disk Drives with a combined storage capacity of 66.2 or 115.6 million bytes. Up to eight Model 8418 Disk Drives can be attached to the integrated disk adapter for a total of over 462 million bytes of random-access storage. In addition, 100-megabyte Model 8430 Disk Pack Drives or 200-megabyte Model 8433 Disk Pack Drives can be added to 90/30 systems for a maximum subsystem capacity of 3.2 billion bytes.

Communications capabilities for 90/30 systems are provided by an integrated communications adapter that can control up to 24 half-duplex lines.

Many users of small-to-medium-sized computer systems express frustration with the limited capacity for expanding their I/O capabilities without first upgrading to larger central processor models. An important element of the 90/30 design is to prolong the life of the central processor by permitting extensive growth of its I/O processing and on-line storage capacities beyond those available with the integrated peripheral interfaces. An optional multiplexer channel allows connection of 1000-card-per-minute readers and printers with speeds of up to 2000 lines per minute. Two optional selector channels expand the system's range of peripheral devices to include magnetic ▷

▶ High-speed peripheral devices, such as Uniservo 12, 16, or 20 magnetic tape units or 8430/33 disk drives, must be connected to one of the optional selector channels. Up to eight control units can be connected to each channel.

An integrated communications adapter can handle up to 6 full-duplex or 12 half-duplex lines with aggregate speeds of up to 50K bytes per second. A communications adapter expansion feature expands the number of communications lines to 12 full-duplex or 24 half-duplex lines.

SIMULTANEOUS I/O OPERATIONS: Concurrently with computing, the 90/25 and 90/30 processors can control multiple I/O operations with a combined data rate of up to 50K bytes per second on the integrated peripheral channel, plus an 83KB data transfer rate on the multiplexer channel, one 625KB transfer on the integrated disk adapter, plus one I/O operation on each selector channel (one with a transfer rate of 825KB and the second with a somewhat degraded transfer rate when two selector channels are operating simultaneously). The maximum aggregate I/O data transfer rate for the 90/30 and the 90/30B is approximately 1.8 million bytes per second.

MASS STORAGE

8413 DISKETTE SUBSYSTEM: The floppy disk capability was added to the 90/30 systems in February 1977 with the announcement of the 90/25. It can be used in place of the system card reader. The 8413 Diskette Subsystem is attached to the integrated peripheral channel and includes two or four drives, each having a capacity of 242,994 bytes. Data is recorded on one side of IBM-compatible floppy disks with 73 tracks. Each track is divided into 26 sectors of 128 bytes each. Average head-positioning time is 260 milliseconds, and average rotational delay is 83.3 milliseconds. Data transfer rate is 31,248 bytes per second (360 rpm).

8415 DISK SUBSYSTEM: A free-standing disk unit with one removable disk cartridge and two fixed disks. The removable F1215-00 disk cartridge has two recording surfaces with a total storage capacity of 8.3 million bytes. The two fixed disks have three data recording surfaces and one servo track for head positioning, and have a storage capacity of 24.9 million bytes, thus providing a total capacity of 33.1 million bytes per drive. Data is organized into 40 sectors of 256 bytes on each of the tracks. The removable disk cartridge contains 404 tracks per surface, and the fixed disks each have 808 tracks per surface. Average head-positioning time is 33 milliseconds, and average rotational delay is 10.7 ▶

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▷ tape drives with transfer rates of up to 320,000 bytes per second and the Univac 8430/8433 Disk Subsystem. The latter, a product of Univac's Information Storage Systems division, offers up to 16 IBM 3330-type disk storage drives per controller, for a total of 3.2 billion bytes of on-line random-access storage. Also available is a paper tape subsystem.

Software for the Univac 90/30 centers around OS/3, an operating system designed specifically to maximize the modularity and growth potential of the 90/30 hardware. OS/3 features concurrent execution of up to seven user programs, including programs entered from remote terminals. In addition, each job step may also have one or more tasks which can be executed concurrently. OS/3's design relies heavily on transient routines and re-entrant coding for data management routines to achieve a high level of multiprogramming with a relatively small main memory overhead. The resident supervisor size is estimated to begin at 8K bytes for the minimum 90/30 configuration and supports multiprogramming of up to seven jobs plus multitasking. I/O spooling routines and the addition of optional I/O channels and faster peripheral devices naturally will enlarge the resident supervisor size.

Language processors for the 90/30 include COBOL, FORTRAN, RPG II, and an assembler.

The 90/25 runs under the same operating system as the 90/30, but has modified I/O control modules to accommodate the slower peripherals used with the 90/25.

Communications software is provided by the Integrated Communications Access Method, which supplies several levels of communications support ranging from device handlers for a wide variety of terminals to a message control program that offers message queueing, remote job entry, and an interface to IMS/90. The modular design of ICAM permits the user to tailor his communication software to his specific communications needs. Network configurations can be expanded by regenerating the Network Control Program, with no alteration of user programs required. Of particular interest to RPG users is a simplified remote I/O capability via an RPG II telecommunications interface. The 90/30 RPG II telecommunications feature includes software support for the IBM System/3, the IBM 360/20, and larger IBM System/360 computers with OS/360 or DOS BTAM binary synchronous communications support.

Univac is also offering IMS/90, an on-line information storage and retrieval system previously released with the 90/60 and 90/70 systems. IMS/90 permits users at remote terminals to retrieve and update records in files ordinarily used for batch processing through the use of UNIQUE, a user inquiry language that is easy to learn and use.

The OS/3 operating system is designed to fully utilize the 90/30's relocation hardware to allocate main memory to user programs. Each program is assigned a variable-length region composed of segments of either 512 bytes, ▷

▶ milliseconds (2800 rpm). Data transfer rate is 625,000 bytes per second.

The 8415 disk subsystem is available only in Univac 90/25 and 90/30B systems. In 90/25 systems, the F1621-01 integrated disk adapter provides the interface and control for up to two 8415 or 8418 drives (or one 8415 and one 8418 disk drive). In 90/30B systems, the F1621-02 integrated disk adapter provides the interface and control for two 8415 drives and two 8418 drives. The F1621-02 adapter can be expanded via the 2408-00 expansion to attach up to two additional 8418 drives. An all-8418 subsystem on a 90/30B can include up to eight drives.

Both the 90/25 and 90/30B systems require a minimum of two logical disk drives; this requirement can be satisfied with one 8415 drive or two 8418 drives.

8418 DISK SUBSYSTEM: A free-standing disk pack drive that attaches to the 90/25 or 90/30 systems via the integrated disk adapter. The drive is available in two models: the 8418-92, with a capacity of 28.9 million bytes per drive; and the 8418-94, with a capacity of 57.9 million bytes per drive. In 90/25 systems, one 8418 disk drive may be added to the 8415 subsystem. In 90/30B systems, up to four 8418 drives may be added to the 8415 subsystem. Four 8418 drives can also be substituted for two 8415 drives, providing an 8-drive maximum subsystem. In 90/30 systems, an 8418 subsystem can include from one to four disk drives in single-unit increments, or a maximum of eight disk drives with the 2408 integrated disk adapter expansion feature. Model 8418-92 and Model 8418-94 disk drives can be intermixed in any combination on the 90/30 integrated disk adapter.

The disk packs used with the 8418 subsystems have eight surfaces, of which seven are used for recording data and one is used as a positioning surface for a servo head. Each recording surface has 808 tracks for data and 7 spare tracks. The 8418-94 uses all 815 cylinders and has a capacity of 57,917,440 bytes per drive, while the 8481-92 uses only the outer 411 cylinders and has a capacity of 28,958,720 bytes per drive. Data tracks are divided into 40 sectors of 256 bytes. Both drives use a programmed servo offset technique to vary the accessor position for recovering from alignment inaccuracies and magnetic defects.

Average head positioning time for the 8418-94 is 33 milliseconds, and for the 8418-92 is 27 milliseconds. For both models, average rotational delay is 10.7 milliseconds and data transfer rate is 625,000 bytes per second.

8430 DISK SUBSYSTEM: The 8430 attaches to the selector channel of either 90/30B or 90/30 systems. It provides large-capacity random-access storage in interchangeable 11-disk packs with storage capacities comparable to the standard-density IBM 3330 disk storage subsystem. Each disk pack stores up to 100 million bytes of data. Up to 247,570 bytes (19 tracks) can be read or written at each position of the access mechanism. Average head movement time is 27 milliseconds, average rotational delay is 8.33 milliseconds (3600 rpm), and data transfer rate is 806,000 bytes per second.

The 8430 disk drives interface the selector channel through the 5039-97 disk drive control. Each 8430 subsystem must contain at least two drives and can be expanded to an eight-drive subsystem by adding additional drives. The subsystem can be further expanded to 16 drives (1.6 billion bytes) if the F2047 expansion feature is added. The 8430 subsystem features command retry facilities and error correction coding.

8433 DISK SUBSYSTEM: Provides random access to very large quantities of data stored on removable "double-density" 3330-type disk packs in 90/30 or 90/30B systems. Each industry-standard disk pack contains up to 200,036,560 bytes ▶

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1,024 bytes in systems with more than 128K bytes of main memory, or 2,048 bytes in systems with more than 256K bytes of main memory. In the event of excessive "checkerboarding" of memory, the supervisor provides automatic memory compaction services to relocate scattered memory segments into contiguous areas suitable for program scheduling. Univac claims that the dynamic memory management capabilities of the 90/30 processor lessen the need for the paging capabilities and associated CPU overhead of virtual storage operating systems.

Although current users of Univac 9400 and 9480 systems may be attracted to the price/performance of the new 90/30 system, the lack of compatibility between OS/3 and the OS/4 operating system released with the 9400 probably will act as a deterrent against user migration to the new system. OS/4 has been continued as a supported Univac software product, and 9400/9480 customers are being encouraged to upgrade to the 90/60 computer system and the VS/9 operating system.

A fully expanded 90/30 system overlaps the low end of the 90/60. Thus, an installation with a basic 90/30 configuration can avail itself of a vast growth potential in main memory, I/O capability, and software facilities before having to consider a move upward to a more powerful central processor and the VS/9 operating system. Since the two operating systems support identical compilers and the 90/30 assembly language is a compatible subset of the 90/60 and 90/70 assembly language, users can recompile programs to run under VS/9 with a minimum of effort, although the job control language will require modification to take advantage of the additional facilities provided by VS/9.

The OS/3 operating system, language processors, and all other software are supplied with the 90/25 and 90/30 systems at no additional charge.

Various configurations of the Univac 90/25 and 90/30 will compete with IBM computers ranging from the System/3 Models 10, 12, and 15 to the System/370 Model 115, 125, and small configurations of the Model 138. Computer users who are considering the acquisition of a small-to-medium-scale system might want to consider the following points before making a final selection:

● The Univac 90/30 system can be equipped with up to 524,288 bytes of main memory, equal to the maximum main memory size available with the System/370 Model 125-2.

● A Univac 90/30 system equipped with an optional selector channel can accommodate up to 16 Model 8433 Disk Drives for a total of 3.2 billion bytes of random-access storage per disk subsystem, considerably more than that available with the System/370 Model 125.

● An integrated emulation capability for the IBM System 360/20 is available for the Univac 90/30 and the IBM System/370 Models 115, 125, and 138, but is not available for the IBM System/3. ▷

of data organized in variable-length records. Each record can occupy an entire track and contain up to 13,030 bytes. There are 808 tracks (plus 7 spares) on each of the 19 recording surfaces. The average head positioning time is 30 milliseconds, and the average rotational delay is 8.3 milliseconds (3600 rpm). Data transfer rate is 806,000 bytes per second.

From two to eight 8433 Disk Pack Drives can be connected to a 5039 control unit for a total of 1.6 billion bytes per subsystem. The F2047 drive expansion feature expands the capability of the 5039 control unit to up to 16 drives, or 3.2 billion bytes. The 8433 and 8430 Disk Pack Drives can be intermixed on one 5039 control unit up to the maximum of 8 or 16 drives. The 8433 includes a command retry facility and error-correction coding circuitry.

INPUT/OUTPUT UNITS

UNISERVO 10 MAGNETIC TAPE UNIT: The only magnetic tape unit available for the 90/25, the Uniservo 10 is a low-speed tape drive that reads and records data on standard ½-inch tape in IBM-compatible phase-encoded or NRZI format. Available in both 9-track and 7-track versions. Tape speed is 25 inches per second, forward or backward. The standard 9-track version has a recording density of 1600 bpi (in phase-encoded mode) and a data transfer rate of 40,000 bytes per second; the optional dual density feature permits operation at 800 bpi (in NRZI mode) at a data transfer rate of 20,000 bytes per second. The optional 7-track version can operate at 200, 556, or 800 bpi, with corresponding data transfer rates of 5,000, 13,900, or 20,000 bytes per second.

The Uniservo 10 subsystem uses the 5045 control unit, which includes the controller and a housing for two magnetic tape units. A maximum of eight tape units can be attached to each 5045 control unit. Uniservo 10 tape drives can be connected to the 90/30 multiplexer channel. Features available with the 5045 include automatic loading of tapes housed in dustproof wraparound cartridges or standard tape reels and a dual-channel option that permits nonsimultaneous operation on two channels on a single central processor or shared operation between two central processors.

UNISERVO 12 MAGNETIC TAPE UNIT: A medium-speed tape drive that reads and records data on standard ½-inch tape in IBM-compatible phase-encoded or NRZI format. Available in both 9-track and 7-track versions. Tape speed is 42.7 inches per second, forward or backward. The standard 9-track version has a recording density of 1600 bpi (in phase-encoded mode) and a data rate of 68,320 bytes per second; the optional dual density feature permits operation at 800 bpi (in NRZI mode) at a data rate of 34,160 bytes per second—the same speed as the Uniservo VIC. The 7-track version can operate at 200, 556, or 800 bpi, with corresponding data rates of 8,540, 23,740, or 34,160 characters per second. The data conversion feature, for 7-track drives, converts each group of four 6-bit characters from tape into three 8-bit bytes in main storage, and vice versa.

From 1 to 16 Uniservo 12 tape units can be connected to a Uniservo 12 tape control, and up to 8 controls can in turn be connected to each Univac 90/30 selector channel. Optional features enable the tape control to be connected to two selector channels, permitting simultaneous read/read, read/write, or write/write tape operations, with bimodal (7- or 9-track) compatibility.

With addition of the Uniservo 16 capability option, any combination of up to sixteen Uniservo 12 and Uniservo 16 drives may be connected to the Uniservo 12 control. A Uniservo 12/16 control is also available which includes the Uniservo 16 capability as a standard feature. ▶

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● Average instruction execution times for the 90/30 are estimated to be more than 2.5 times as fast as those for the IBM System/3, and the 90/30 offers more I/O channels and nearly three times the aggregate I/O data transfer rate of the System/3.

● The 90/30 OS/3 operating system supports the concurrent execution of up to seven user jobs, in comparison with two user jobs for the IBM System/3 and up to five user programs for DOS/VS. However, although OS/3 supports dynamic memory management, it does not provide a virtual storage capability.

● Univac prices for the 90/25 and 90/30 are still largely bundled, with systems software, language processors, education, and a reasonable amount of technical support supplied at no extra charge. In addition, Univac offers unlimited use of all equipment and attractive discounts on rental prices for customers who select long-term lease contracts of five-year duration.

In the 90/25 and 90/30 systems, Univac offers a line of computers that is geared to meet the requirements of a large number of small-system users, especially with its extensive direct-access storage capacity and growth potential, at prices that make it an attractive competitor in the small-to-medium-scale computer marketplace.

USER REACTION

Datapro received responses from 14 users of the Univac 90/25 and 90/30 systems during the 1977 survey of general-purpose computer users. This group of 14 users collectively employed 16 systems consisting of fifteen 90/30's and one 90/25. The user population consisted of 10 small-to-medium-sized businesses, a mortgage lender, a police department, and 2 colleges. The average installed life of the 16 systems was about 15 months and ranged between 2 and 28 months. Five users had had their systems for 20 months or longer.

Memory included in the systems varied from the minimum 64K bytes to 384K bytes, averaging about 218K bytes per system. Ten of the 16 systems included 196K bytes or more. Disk storage capacity ranged from 60 megabytes to 342 megabytes and averaged slightly over 160 megabytes. Ten users indicated the use of magnetic tape subsystems on their 90/30's, six with a two-drive subsystem and four with a four-drive subsystem.

Only one remote batch terminal was attached to a system, but 13 users reported a collective total of 62 interactive terminals, ranging from 1 to 16 terminals on each system. Seven of those 13 users had four or more terminals on their systems.

The 16 systems were being used chiefly for business data processing and program development. Twelve of the 14 users reported business data processing as a principal application, and eight also listed program development. Other applications included scientific/ ▷

UNISERVO 14 MAGNETIC TAPE UNIT: A medium-speed tape drive that reads and records data on standard ½-inch tape in IBM-compatible phase-encoded or NRZI format. Available in both 9-track and 7-track versions. Tape speed is 60 inches per second, forward or backward. The standard 9-track version has a recording density of 1600 bpi (in phase-encoded mode) and a data transfer rate of 96,000 bytes per second; the optional dual density feature permits operation at 800 bpi (in NRZI mode) at a data transfer rate of 48,000 bytes per second.

The Uniservo 14 subsystem uses the 5045 control unit, which includes the controller and a housing for two magnetic tape units. A maximum of eight tape units can be attached to each 5045 control unit. Features available with the 5045 include automatic loading of tapes housed in dustproof cartridges or standard tape reels and a dual-channel option that permits nonsimultaneous operation on two channels on a single central processor or shared operation between two central processors.

UNISERVO 16 MAGNETIC TAPE UNIT: A high-speed tape drive that reads and records data on standard ½-inch tape in IBM-compatible phase-encoded or NRZI formats. Available in both 9-track and 7-track versions. Tape speed is 120 inches per second, forward or backward. The standard 9-track version has a recording density of 1600 bpi (in phase-encoded mode) and a data rate of 192,000 bytes per second; the optional dual density feature permits operation at 800 bpi (in NRZI mode) at a data rate of 96,000 bytes per second. The 7-track version operation at 200, 556, or 800 bpi, with corresponding data rates of 24,000, 66,720, or 96,000 characters per second.

From 1 to 16 Uniservo 12 and Uniservo 16 tape units can be connected to a Uniservo 12/16 control, or any combination of 1 to 16 Uniservo 12, 16, or 20 tape units can be connected to a Uniservo 20 control, and up to 8 tape controls can in turn be connected to each selector channel. Optional features enable the tape control to be connected to two selector channels, permitting simultaneous read/read, read/ write, or write/write tape operations.

UNISERVO 20 MAGNETIC TAPE UNIT: A high-speed tape drive that reads and records data on standard ½-inch tape in IBM-compatible formats. Available in a 9-track version only. Tape speed is 200 inches per second, forward or backward. The Uniservo 20 has a recording density of 1600 bpi (in phase-encoded mode) and a data rate of 320,000 bytes per second. Standard features include a power window, automatic tape threading, and a wrap-around cartridge.

From 1 to 16 nine-track, 800 or 1600 bpi Uniservo 12, 16, and/or 20 tape units can be connected in any combination to the Uniservo 20 control unit, and up to 8 tape controls can in turn be connected to each selector channel. With the 7-track capability and 9-track addition feature, Uniservo 12 and 16 tape units in the Uniservo 20 subsystem may be 7- or 9-track. Two or more control units may be used in the Uniservo 20 subsystem to provide simultaneous dual access for read/write, read/read, and write/write operations on any appropriately equipped Uniservo 16 or 20 tape units connected to the control units. Each control unit in a simultaneous dual access system has its own power supply and independent access path to provide increased reliability. Individual tapes cannot be switched off-line without removing all the tapes connected to that controller from service.

0716 CARD READER: A free-standing unit that reads 80-column cards serially by column at 1000 cards per minute. Reads in either card-image or translate mode; ASCII, EBCDIC, or compressed codes can be read. Includes a 2400-card input hopper and two 2000-card stackers. Multi-read error checking and validity checking are standard features. ▶

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▷ engineering (four users), data communications (four users), and data base management (three users). All 14 users indicated that some of their software was produced in-house, while six employed proprietary software packages and three used Univac-supplied software.

Twelve of the 14 users found Univac's lease terms more attractive than outright purchase, while the remaining two had opted to own their equipment.

The user responses from the survey are tabulated below, and the weighted averages of the previous year's user survey are also shown for comparative purposes.

	Excellent	Good	Fair	Poor	1977 WA*	1976 WA*
Ease of operation	7	6	2	0	3.4	3.2
Reliability of mainframe	8	5	0	2	3.3	3.2
Reliability of peripherals	5	6	2	2	2.9	3.0
Responsiveness of maintenance service	10	2	0	3	3.3	3.7
Effectiveness of maintenance service	6	7	0	2	3.1	3.1
Technical support	4	5	4	2	2.7	2.9
Operating system	10	3	2	0	3.5	3.3
Compilers and assemblers	6	9	0	0	3.4	3.1
Applications programs	3	6	3	0	3.0	2.9
Ease of programming	5	10	0	0	3.3	3.2
Ease of conversion	8	3	2	2	3.1	3.0
Overall satisfaction	8	5	0	2	3.3	3.1

*Weighted Average on a scale of 4.0 for Excellent.

The collective user responses gathered in this year's survey were, on the whole, slightly higher than those of the previous year, although none of the 12 survey categories varied more than four-tenths of a point from the previous year's ratings. Eight categories—ease of operation, mainframe reliability, operating system, compilers and assemblers, applications programs, ease of programming, ease of conversion, and overall satisfaction—showed an increase. The improvement would have been even greater were it not for one user who indicated early software and support problems.

On the other hand, three categories received ratings lower than those of the previous year. One, responsiveness of maintenance service, dropped four-tenths of a point, while the remaining two categories, reliability of peripherals and technical support, showed so little change that further mention is unwarranted. It is important to note that despite the drop, the 3.3 rating given to the category of maintenance service responsiveness in the latest survey was one of the highest earned by any mainframe vendor.

Comments from the users stressed the 90/30's reliability, expandability, and ease of operation as strong points and pointed specifically to Univac's OS/3 operating system, COBOL compiler, and IMS/90 information management system software as good performers. Only 5 of the 15 users provided negative comments (compared to 10 who made positive comments), and these showed no specific trend.

Perhaps the best indicator of the users' true feelings was the 3.3 rating they assigned to the category of overall ▷

▶ The unit includes an integrated control unit and attaches to a position on the optional multiplexer channel on a 90/25 or a 90/30 processor.

Two enhanced models of the 0716 card reader were announced in December 1975. Each of the new models reads both 80- and 96-column cards—the Model 0716-91 at the rate of 600 cards per minute, and the Model 0716-93 at the rate of 1000 cards per minute. The lower-speed unit can be field-upgraded to the higher-speed unit. Operators can switch between 80- and 96-column modes. The reader can accept 96-column cards from a data entry department or 80-column cards from either the 90/30 card punch or a terminal device such as the Univac DCT 1000 data communications terminal. The enhanced models of the 0716 card reader provide a single input hopper with a capacity of 2400 80-column or 2000 96-column cards. Each of two output stackers handles up to 2000 cards. An optional feature allows for handling 51- and 66-column short cards.

0717 INTEGRATED CARD READER: Attaches to a position on the integrated peripheral channel. Reads 80-column cards serially by column at a rate of 500 cards per minute. Can be equipped to read 51- or 66-column cards. Reads in either EBCDIC or card-image mode. Has a 2400-card feed hopper and a 2000-card stacker. Multi-read error checking and validity checking are standard features.

0719 CARD READER: This 300-cpm integrated unit is available only in 90/25 and 90/30B systems. The 0719 card reader employs two read stations and reads each column twice for improved accuracy. Each read station consists of one column of photo-sensitive sensors and light-emitting diodes. Like the faster 0716 card reader, the 0719 can read in either card image or translate mode. In card image mode, up to 160 six-bit characters can be recorded on a standard 80-column card. Three code sets are offered for use with the translate mode: 8-bit ASCII, 8-bit EBCDIC, and compressed code. The 0719 card reader can be modified to handle either 51- or 66-column short cards. The input and output hoppers each have a 100-card capacity.

0605 CARD PUNCH: An integrated card punch that attaches to a position on the integrated peripheral channel. Punches 80-column cards in column-by-column fashion at speeds of 75 to 160 cards per minute depending upon the number of columns punched per card. Contains a 700-card input hopper and a 700-card output stacker. Punches in EBCDIC or card-image mode. Can be equipped with a pre-punched read station, giving the unit read/punch capabilities.

0920 PAPER TAPE SUBSYSTEM: Includes the 1033 paper tape reader and the 1032 paper tape punch, forming a free-standing unit that reads and punches 5-, 6-, 7-, or 8-level tape at speeds of 300 and 110 characters per second, respectively. Spoolers are optional for both the reader and punch take-up. Attaches to a position on the multiplexer channel. (The 0921 Paper Tape Subsystem, which reads 5-, 6-, 7-, or 8-level tape at 2000 characters per second, is marketed for 90/30 systems outside the U.S.)

0768 PRINTER SUBSYSTEM: A drum-type printer available in three models: the 0768-00, which prints 49 contiguous characters at 1100 lpm and 63 characters at 900 lpm; the 0768-99, which prints 43 contiguous characters at 1600 lpm and 63 characters at 1200 lpm; and the 0768-02, which prints 87 contiguous characters at 1000 lpm and 94 characters at 840 lpm. The 0768 printer employs a conventional drum mechanism and has 132 print positions. Models 0768-00 and 0768-99 can have one of five fonts: EBCDIC, Modified ASCII, OCR A, Modified FORTRAN, or OCR B. The 0768-02 offers a choice of three ASCII fonts. The 0768-00 is upgradeable to the faster 0768-99 printer. The 0768 printers are offered only with the 90/30 and 90/30B systems and attach to the multiplexer channel. ▶

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satisfaction, up two-tenths of a point from last year and well above the composite weighted average calculated for that category for all mainframe vendors rated in Datapro's 1977 survey.□

0770 PRINTERS: These horizontal-band printers are offered in three models. Printing speeds for 48-character sets are 800 lines per minute for Model 0770-00, 1400 lines per minute for Model 0770-02, and 2000 lines per minute for Model 0770-04. The respective skipping speeds for these three models are 50, 75, and 100 inches per second. All can have character sets from 24 to 384 characters in size, and all have 132 print positions as standard. An optional feature for all models can increase the number of print positions to 160 without affecting the printing speed. All have a single-space print time of 8.75 milliseconds, line spacings that are operator-selectable at 6 or 8 lines per inch, and forms dimensions from 3 to 22 inches wide and up to 24 inches long. Their control units have a standard Series 90 interface.

The three 0770 Printers have the following features in common: all use interchangeable print band cartridges; all can identify the cartridge type under program interrogation to ensure that the operator has placed the proper band in the printer for that run; all use a program-loaded vertical format buffer in place of a paper tape format loop; and all have swing-out print carriages, easy ribbon replacement without rewinding, simplified line finding, lighted print areas, automatic print gap (forms thickness) adjustment, powered, program-controlled top covers, automatic power forms stackers, and enhanced acoustical covers to reduce operating noise.

0773 INTEGRATED PRINTER: Prints 120 columns of data at speeds of 500 lines per minute with a 48-character set and 400 lines per minute with a 64-character set. An optional feature provides 132 or 144 print positions. The type medium consists of a flexible, horizontally moving metallic band containing etched characters. Character sets range from a 48-character business set to a special 256-character set, the latter having a nominal print speed of 114 lines per minute. Single-space print time is 8.75 milliseconds, line spacings are operator-selectable at 6 or 8 lines per inch, and forms dimensions range from 3 to 18.75 inches wide and 1 to 24 inches long. The 0773 Printer attaches to a position on the integrated peripheral channel.

0776 PRINTER SUBSYSTEM: A horizontal-band printer subsystem that offers a choice of two line speeds: the Model 0776-00 prints a 48-character set at 760 lines per minute, and the Model 0776-02 at 940 lines per minute. Skipping speed for both models is 22 inches per second. Vertical spacing is operator-selectable at either 6 or 8 lines per inch. Both models can have character sets ranging from 24 to 384 characters in size, and both have 136 print positions as standard equipment. The 0776 printers have a single-space print time of 14.2 milliseconds and accommodate forms ranging from 4 to 18.75 inches wide and up to 24 inches long.

Printing is accomplished by the use of etched characters on a continuous metal band that travels horizontally across the paper. Each metal band contains 384 characters, which are usually grouped in repeating arrays. For example, a 48-character set array is repeated eight times on the band. The expanded character set control feature allows the use of character sets that contain more than 64 characters. This feature makes it possible to print upper/lower case text or to improve throughput in certain applications by designing character set arrays in which heavy-usage characters appear more frequently. The cartridge type can be identified under program interrogation to ensure that the operator has placed the proper band in the printer.

The 0776 Printer Subsystems also feature a program-loaded vertical format buffer in place of a paper tape format loop, swing-out print carriages, easy ribbon replacement without rewinding, simplified line finding, lighted print areas, automatic print gap (forms thickness) adjustment, powered, program-controlled top covers, automatic power forms stackers, and enhanced acoustical covers to reduce operating noise.

0778 INTEGRATED PRINTER: A horizontal-band printer offered only with the 90/25 and 90/30B systems. For the 90/30B, both a 300- and a 500-lpm model are offered, but only the 300-lpm version is available with the 90/25. The 0778 printer employs a band mechanism similar to that of the 0776 printer. The 0778 has 120 print positions, expandable to 132 positions. Both models can have 48-, 64-, 96- or 128-character sets. Print rate for the 48-character set is 300 lpm on the 0778-00 printer and 500 lpm on the 0778-02. Skipping speed for both models is 15 inches per second. As with the 0776 printer, the character sets are repeated on the print band. The 128- and 96-character sets are repeated once, the 64-character set is repeated three times, and the 48-character set is repeated four times. The maximum number of characters in a single set is 256. The 0778 printers attach to the 90/25 and 90/30 processors through the integrated peripheral channel.

90/30 CHANNEL ADAPTER: Permits Univac 9200/9200 II and 9300/9300 II systems to be directly connected to 90/30 systems via their respective multiplexer channels. Each attachable processor can function as an I/O subsystem providing peripheral capabilities.

COMMUNICATIONS CONTROLS

INTEGRATED COMMUNICATIONS ADAPTER (90/30 AND 90/30B): Controls message discipline for either 6 full-duplex or 12 half-duplex lines or, with an expansion feature, for either 12 full-duplex or 24 half-duplex lines. Contains the communications adapter interface, a communications multiplexer module, and line adapters can accommodate synchronous, asynchronous, wideband, auto-dial, asynchronous relay, TWX, and Telex communications lines. The integrated communications adapter is mounted in the console stand, and attaches to a special port on the integrated peripheral channel.

INTEGRATED COMMUNICATIONS ADAPTER (90/25): Controls a maximum of three lines, one of which can be full-duplex. Connects to the 90/25's integrated peripheral channel, which has a maximum data transfer rate of 50,000 bytes per second. An appropriate line adapter is required for each line.

2521 CHANNEL TRANSFER SWITCH: An electronic "crossbar" arrangement that permits peripheral subsystems to be electrically connected to one of eight CPU's. Individual peripheral subsystems can be manually switched to any one of the CPU's, permitting the reconfiguration of systems to meet varying processing requirements. The basic 2521 consists of a 2 x 1 switch that permits one subsystem to be switched between two CPU's. It is housed in a separate cabinet that has power and physical space for a maximum 4 x 8 configuration. This 2 x 1 configuration can be expanded in two ways; through the addition of up to three F2600-00 subsystem links that expand the switch to 2 x 4, and through the addition of a F2602-00 CPU link that expands the switch to a 4 x 1 configuration. The 2 x 4 switch permits four subsystems to be switched between two CPU's, while the 4 x 1 switch permits one subsystem to be switched between four CPU's. One F2602-00 CPU link can be added to the basic 2521 switch, expanding it to a 4 x 1 configuration. Both F2600-00 subsystem links and F2602-00 CPU links can be added to provide a maximum of four CPU links and four subsystem links. ►

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▶ The switch cabinet includes space and power for a duplicate 4 x 4 configuration that can be interconnected to form a single 4 x 8 switch.

Two independent 2 x 2 switches can also be configured in the cabinet, using the F2601-01 expansion module plus one F2600-00 subsystem link for each switch. However, each one of the F2601-01 expansion modules precludes the addition of one F2602-00 CPU link. Thus, if the maximum of two independent 2 x 2 switches are implemented, the basic channel transfer switch is limited to a maximum 2 x 8 switch.

SOFTWARE

OPERATING SYSTEM: OS/3 is a disk-oriented operating system specifically designed for the 90/30 and 90/25 hardware. The operating system has been designed in a modular fashion in order to provide support for the wide span of configurations available with the 90/25 and 90/30 systems. Processing capabilities of the system at its highest level of implementation include concurrent execution of up to 7 jobs, each of which in turn is capable of initiating up to 255 subtasks. Communications processing capabilities include inquiry/response, transaction processing, and remote job entry. The minimum OS/3 Supervisor requires 8,192 bytes of storage and supports seven levels of multiprogramming, multitasking, and the minimum complement of integrated peripherals.

The OS/3 Supervisor resides in main memory and consists of the system modules that perform storage management, task management, I/O control timer service, program management, system recovery, spooling control, record and file protection, program error handling, and diagnostic and debugging aids. Basic resources controlled by the supervisor include main storage for job residence, processing time for program execution, and the queuing and initiation of I/O commands and processing of I/O completion interrupts. Four types of spooling routines are available under OS/3: input readers, a supervisor printer/punch spooling cooperative (SPOOLIN), card-to-disk readers (SPOOLOUT), and output printer/punch writers. Input readers and output writers can interface with remote subsystems, accepting data files and providing output services identical with those supported for locally submitted programs. The Task Switcher component of the Supervisor is implemented in microcode and determines the order in which the various tasks are allocated central processing time. Every job step submitted to OS/3 is established as a primary task. Each job step, in turn, has the capability of initiating a theoretical maximum of 255 tasks. Dispatching priority among tasks is specified by the user in a system switch list. Diagnostic debugging aids provided by the Supervisor include a system Monitor Mode that accumulates information on branch and interrupt activities, main storage snapshots and dumps, system error messages, and program checkpoint/restarts.

The OS/3 Job Control routines control the scheduling and initiation of job steps according to the availability of system resources. Other functions include the suspension and cancellation of jobs, restarting of jobs, and termination of jobs. Jobs submitted to the system are queued for initiation by a scheduling priority designated by the user. Scheduling priority can be specified as normal priority, high priority, or preemptive priority (used for urgent jobs that require immediate scheduling and execution). The main storage requirements for a job can be calculated automatically by OS/3 if all job steps associated with the job reside in a load library. The user also can specify a minimum memory requirement for execution of all job steps within a job and a maximum memory allocation that will enable a job to be processed more efficiently. Main memory is allocated in contiguous "regions" to each job step in increments of 512, 1024, or 2048 bytes. Peripheral devices are allocated for each job and are released under control of a job control

STORAGE REQUIREMENTS FOR 90/25 AND 90/30 SOFTWARE

	Main Memory	
	Minimum	Typical
OS/3	8KB	20KB
COBOL	23KB	23KB
Basic	46KB	46KB
Extended	46KB	46KB
FORTRAN		
Basic	23KB	23KB
Extended	54KB	54KB
FORTRAN IV (small)	66KB	66KB
FORTRAN IV (large)	100KB	100KB
BASIC	37KB	*
Assembler	19KB	19KB
RPG	9KB	32KB
Information Management System/90	42KB	64KB
Information Collection System/90	20KB	20KB
NCR Conversion Aids		
NEAT/3 to COBOL	96KB	96KB
NCR Data File Converter	64KB	64KB
Honeywell H-100 Series Conversion Aids		
APS to OS/3 Assembler	60KB	60KB
COBOL to COBOL	50KB	50KB
H-100 Data File Converter	64KB	64KB
Honeywell H-200 Series Conversion Aids		
Easycoder to COBOL	75KB	75KB
COBOL to COBOL	62KB	62KB
H-200 Data File Converter	64KB	64KB
IBM 360/20 Emulator		
Univac 9200/9300 Emulator		
UNIS		
Master Data Processor	98KB	98KB
Inventory Management Module	98KB	98KB
Production Planning and Scheduling and Work Order Management	98KB	98KB
Note: Only one UNIS module can be resident at any time.		
FIRST		
Time Deposits	100KB	293KB
Loans	100KB	293KB
Accounting Control System		
Accounts Payable	49KB	49KB
Accounts Receivable	49KB	49KB
General Ledger	49KB	49KB
Payroll	49KB	49KB
Basic Edit Monitor (BEM)	16KB	*
Text Editor (EDT)	6KB	*
Remote Spool Processor (RSP)	6KB	*
* Dependent upon number of users, files, etc.		

statement at the termination of a job step. Automatic volume recognition is supported.

Jobs are initiated on a first-in, first-initiated basis until available resources are insufficient to satisfy the requirements of an encountered job. Succeeding priority levels are then searched for a job that can be accommodated within the available resources. Jobs that require more resources than are currently available remain in the job queues of their respective priority levels until sufficient resources become available. ▶

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The Job Control routines utilize a simulated day clock for providing job accounting entries. Job Control sequences that are frequently used can be added to the system catalog in the form of procedures. These procedures can be called from the catalog for inclusion in a control stream. The system file catalog permits files to be identified by file name and is automatically updated to reflect the current stature of generations of files. Passwords are used to protect files from unauthorized use.

Data Management provides a convenient interface between user programs and hardware-oriented I/O controls performed by the supervisor. Four access methods are available: the sequential access method (SAM), the direct access method (DAM), the indexed sequential access method (ISAM), and the system access technique (SAT). SAT is used only by the OS/3 system routines to support library and work files and to access all direct-access files. Reentrant logical I/O control modules provide for record blocking and unblocking, I/O buffering, data validation, and label processing. The OS/3 Data Management routines are designed to provide a high degree of compatibility with Univac 9200/9300, IBM 360/20, and IBM DOS systems. Names and functions of macroinstructions are the same as those of the other byte-oriented systems, and the spellings of keyword parameters used in these systems are accepted to provide compatibility.

The Integrated Communications Access Method (ICAM) is a modular component of OS/3 that provides three levels of communications support. The highest level of support provides a Message Control Program (MCP) that enables the user to communicate with the network by means of GET and PUT macroinstructions. A single Message Control Program can provide concurrent support for multiple user message processing programs that use a variety of terminals and line types. It provides the facilities for initiation and control of message flow, line control, buffering, code translation, data compression and decompression, and error detection. In addition to the assembly language macroinstruction interface, the MCP provides a communications interface for programs written in OS/3 RPG II, and for IMS/90. A remote job entry capability permits jobs to be submitted from a variety of remote terminal devices. Optional facilities available with the MCP include message queuing, multiple destination routing, an activity scheduling routine with an optional priority suspension and scheduling capability, checkpoint/restart, creation of journal files, and operational statistics accumulation.

The Remote Device Handler (RDH) Interface provides a communications capability for small systems with a limited degree of device independence. At this level, the user program communicates directly with the remote device handlers. Message queuing on disk and network buffering are not supported.

The Channel Control Routine (CCR) Interface permits user programs to interface with a communications facility at the physical input/output level. The primary purpose of this level is to permit users to write specialized Message Control Programs without having to modify the OS/3 interfaces.

Remote Device Handlers are available to interface with the Uniscope 100 and 200 display terminals, the UTS 400 and UTS 700 intelligent terminals, the DCT 500, 1000, and 2000 Data Communications Terminals, the Univac 1004 Card Processing System, the Univac 9200/9300 systems, the IBM 3741 and 2780, and Teletype Model 28, 33, 35, 37, and 38 terminals. Binary synchronous communications procedures are also supported to simulate the IBM 2780.

Main memory requirements for ICAM depend on the level of communications support implemented. Mini ICAM requires a minimum of 5,700 bytes of storage, plus an average of 4,000 bytes per device handler. Midi ICAM requires a minimum of 8,400 bytes, plus memory for handlers and message queuing in memory. Maxi ICAM requires a minimum of 11,000 bytes of main storage, plus memory for handlers and buffers to support disk and main memory message queuing.

COBOL: Univac offers two COBOL compilers for use under OS/3. Basic COBOL requires a system with 32K bytes of main storage and includes the minimum American National Standard COBOL language facilities (i.e., Level 1 of the Nucleus, Sequential Access, Segmentation, Random Access, and Library modules and Level 2 of the Table Handling module). Extended COBOL requires a system with at least 65K bytes of main storage and includes the following facilities of ANS COBOL: Level 2 of the Nucleus, Sequential Access, Random Access, Sort, Segmentation, and Library modules, and Level 3 of the Table Handling module.

FORTRAN: The OS/3 FORTRAN compiler implements a subset of American National Standard FORTRAN 3.9-1966. It is also a compatible superset of IBM DOS/360 FORTRAN F. In addition, there are more than 20 useful language extensions, such as direct-access I/O statements and the ability to handle arrays of up to 7 dimensions. The compiler occupies 54,000 bytes of main memory.

A subset of FORTRAN IV is also provided to offer compatibility with the FORTRAN available with the IBM 1130 and System/3 computers. It includes the logical IF statement and a large mathematical library, but not such features as COMPLEX arithmetic and LOGICAL data types, and requires 18,000 bytes of main storage.

ASSEMBLER: The OS/3 Assembler is a logical extension of the assemblers used with the Univac 9200/9300 Series systems and supports the capabilities of the IBM 360/20 Assembler. Consequently, programs written for the 9200/9300 and the 360/20 can be assembled and executed under OS/3 with no modification.

The Assembler requires a minimum of 15,000 bytes of main memory. If more than the minimum amount of main memory is available, the Assembler will expand to occupy the additional storage by extending its table areas and creating larger input and output buffers to lessen assembly times.

The OS/3 Assembler features a conditional assembly facility that allows one source program to produce several object program versions by excluding or including specified lines of code and altering the values used to determine the source of assembly.

REPORT PROGRAM GENERATOR: OS/3 RPG II is an extended version of the Univac 9200/9300 RPG. Enhancements include a communications interface, access to the system console through programmed operations, a DEBUG operation code to aid the user in source-level debugging, and more than 10 other new features and modifications. Univac 9200/9300 RPG programs written for card, tape, or disk systems and RPG source code programs for the IBM 360/20 or System/3 can be recompiled under OS/3 for execution on the 90/25 or 90/30. OS/3 RPG II offers the same features as the RPG compilers available for the IBM System/3 and IBM System/360 DOS.

OS/3 RPG II, interfacing with the Message Control Program of OS/3 ICAM, can access the following terminals: Uniscope 100 and 200, 1004 Card Processor System, DCT 500, DCT 1000, DCT 2000, Univac 9300, IBM System/3, IBM 360/20, IBM System/360 operating under OS or DOS BTAM Binary Synchronous Communications support, and various teletypewriter models. Minimum main storage requirement is 16,000 bytes.

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CONVERSATIONAL BASIC: Provides language syntax and functions that are compatible with Dartmouth BASIC. The BASIC compiler operates under control of the Basic Editor Monitor (BEM), which is a program product used for interactive programming.

INFORMATION MANAGEMENT SYSTEM (IMS/90): Provides OS/3 users with an on-line information storage and retrieval capability utilizing the Message Control program and the Data Management handlers for standard file access methods. After initiating a dialog with IMS/90, passwords are used to control access to restricted information. A free-form query/update language, supported by either CRT or hardcopy terminal devices, permits users to retrieve and display information from files, generate and display lists of qualified data, and add, delete, or change files. The defined record management capabilities permit a new record to be created from selected portions of multiple files. IMS/90 also facilitates applications programming by providing communications interfacing, applications program scheduling, data management, system security, and recovery of files and messages. The minimum main memory requirement for IMS/90 is about 40K bytes, which includes the user-terminal language processor called UNIQUE.

UTILITY ROUTINES: The OS/3 Sort/Merge program is a subroutine or a stand-alone program capable of using disk and/or tape files. It can sort fixed or variable-length records in ascending or descending sequence, with the capability to include user-code. Sort keys can use characters, signed or unsigned binary, decimal, floating-point, EBCDIC characters in ASCII sequence, and ASCII numeric key field formats. Up to 255 noncontiguous key fields can be specified, using shared input devices. The COBOL SORT verb generates a linkage to the Sort/Merge utility program, and the stand-alone Sort routine provides exits to COBOL.

A Linkage Editor combines object modules produced by the COBOL, FORTRAN, RPG, or Assembly language translators into "load modules" which are suitable for loading and execution under operating system control.

Other available utility programs include data transcription routines, comprehensive data utilities to copy data from any input device to any output device, a gang punch/reproduce program, a snapshot dump, a terminal (postmortem) dump, and tape and disk listing routines.

OS/3 also supports a set of diagnostic routines that can be executed concurrently with user jobs. These programs provide testing of both the central processor and peripheral subsystems. The central complex diagnostic programs are free-standing programs that run independently of the OS/3 supervisor. For integrated peripherals, a "softscope" feature permits the system console to be used as an oscilloscope for exercising integrated peripheral subsystems. Peripheral subsystem test programs can be run under OS/3 and accept parameters from the operating system to select the tests to be run and the environment under which the tests are to function.

CONVERSION AIDS: A COBOL-to-COBOL converter translates Honeywell Series 200 D Level COBOL or NCR Century Series COBOL source programs into equivalent OS/3 COBOL source statement. A conversion utility package translates Univac 9200/9300 and IBM System/360 Model 20 tape and disk files to 90/30 tape and disk formats and provides source code analysis of 9200/9300 and 360/20 assembly-language programs to aid in conversion.

A number of aids are also available for conversion from the IBM System/3 to the Univac 90/30, including the Indexed Random Access Method (IRAM), which is functionally equivalent to the System/3 disk data management method; a compatible RPG II programming language and Sort/

Merge program; and an Operations Control Language (OCL) processor that enables the user to use System/3 OCL statements and procedures for job control. In addition, Univac has established procedures and written programs for converting IBM System/3 source programs, OCL procedures from an IBM 5444 disk to magnetic tape. This tape is then run into the OS/3 Librarian routine for transcription onto a Univac disk in OS/3 format. For data transcription, an IBM System/3 routine is used to copy the files from either a 5444 or 5445 disk to magnetic tape. An OS/3 data utility routine is then used to transcribe the file onto a disk in an OS/3-acceptable format.

EMULATORS: The IBM 360/20 emulator uses microprogramming in combination with OS/3 software to execute programs written for 360/20 systems. The 360/20 emulator functions as a job under the OS/3 operating system. All 360/20 instructions are executed by microprogrammed routines with the exception of I/O instructions and supervisor-related functions, which are executed by software routines.

The Univac 9200/9300 emulator operates as a job under control of OS/3 and executes both the 9200/9300 program and the supervisor with which it was originally run.

In all cases, the 90/25 or 90/30 system must include appropriate counterparts of the peripheral devices in the system being emulated.

APPLICATION PROGRAMS: Univac application software available for the 90/25 and 90/30 includes UNIS (bill of materials, inventory control, planning and scheduling), FIRST (on-line bank teller transaction processing), BEM (Basic Editor Monitor), BASIC (Beginner's All-Purpose Symbolic Instruction Code), EDT (a text editor), RSP (a remote spool processor), ICS/90 (an on-line information collection system), and an Accounting Control System (Accounts Payable, Accounts Receivable, General Ledger, and Payroll).

PRICING

EQUIPMENT: All necessary control units and adapters are included in the indicated prices for the following configurations, and the quoted one-year rental prices include equipment maintenance.

UNIVAC 90/25 BASIC SYSTEM: Consists of a 64K processor, 300-cpm integrated card reader, 75-160-cpm card punch, console printer, 300-lpm integrated printer, integrated disk adapter and two 28.9-million-byte 8418 disk drives. Monthly rental for a one-year lease is $3,243, and purchase price is $136,319. Monthly maintenance is $970.

UNIVAC 90/30 MEDIUM DISK SYSTEM: Consists of a 96K processor, storage protection, micrologic expansion, 500-cpm card reader, 500-lpm printer, print position expansion (132 characters), integrated disk adapter, 75-160-cpm card punch, and 173.7 million bytes of disk storage. Monthly rental for a one-year lease is $4,490, and purchase price is $189,216. Monthly maintenance is $974.

UNIVAC 90/30 LARGE SYSTEM: Consists of a 192K processor, storage protection, micrologic expansion, four Uniservo 10 tape drives and control, 75-160-cpm card punch, 1000-cpm card reader, 1400-lpm printer, integrated disk adapter, internal multiplexer channel, and 231.6 million bytes of disk storage. Monthly rental for a one-year lease is $8,726, and purchase price is $378,750. Monthly maintenance is $1,975.

SOFTWARE AND SUPPORT: With the exception of several industry-oriented applications packages, Univac equipment prices include all of the Univac software described ▶

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➤ in this report and all normal educational courses and professional assistance.

CONTRACT TERMS: The standard Univac use and service agreements allow unlimited use of the equipment (exclusive of the time required for remedial and preventive maintenance). There are no extra-use charges. The basic maintenance charge covers maintenance of the equipment for nine

consecutive hours a day, Monday through Friday. Extended periods of maintenance are available at extra cost.

LONG-TERM LEASES: In addition to the basic 1-year agreement, Univac offers an extended-term 5-year lease for 90/25 and 90/30 systems at significantly lower monthly rates. Under the 5-year agreement, the monthly equipment charge is about 85 percent of the 1-year rental rate.■

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
PROCESSORS AND MEMORY					
3029-73	90/25 Processor; includes 64K bytes of main memory, two timers, one integrated peripheral channel, relocation registers, CRT/console unit, 9200/9300 compatibility mode, and IBM 360/20 compatibility mode; requires printer, diskette subsystem or card reader, and one integrated disk attachment with one 8415 or two 8418 disk drives	$66,096	$385	$1,530	$1,300
F2748-99	90/25 to 90/30B Conversion; F2593-00 expansion feature required if 8413-00 diskette subsystem is present	16,632	47	385	330
F2748-98	90/25 to 90/30B Conversion; same as F2748-99 conversion but for 98K system	13,176	40	355	259
F2748-97	90/25 to 90/30B Conversion; same as F2748-99 conversion but for 131K system	9,720	33	325	188
3029-83	90/30 Processor; includes 32K bytes of main memory, two timers, one integrated peripheral channel, relocation registers, CRT/console unit, 9200/9300 compatibility mode, and IBM compatibility mode; requires disk storage subsystem, card reader, and printer	70,632	384	1,635	1,390
3029-71	90/30B Processor; includes 64K bytes of main memory, two timers, one integrated peripheral channel, relocation registers, CRT/console unit, 9200/9300 compatibility mode, and IBM compatibility mode; requires printer, diskette subsystem or card reader, and one integrated disk attachment with one 8415-00 or two 8418-00 disk drives	82,728	432	1,915	1,630
Memory Expansion for 90/25:					
F2748-00	Memory expansion; 32K bytes; maximum two per processor	14,256	50	330	281
Memory Expansion for 90/30:					
F2748-91	Memory expansion; 32K bytes; expands 90/30 from 32K to 64K bytes	12,096	48	340	240
Memory Expansion for 90/30 and 90/30B:					
F2748-92	Memory expansion; 32K bytes; expands 90/30B processor from 64K to 96K bytes or from 96K to 128K bytes	10,800	43	300	210
F2748-01	Memory expansion; 32K bytes; expands processor from 128K to 160K bytes	9,720	35	280	190
F2748-96	Memory expansion; 32K bytes; expands processor from 160K to 192K bytes	9,720	35	280	190
F2748-95	Memory expansion; 64K bytes; expands processor from 192K to 256K bytes	19,440	70	550	385
F2748-94	Memory expansion; 64K bytes; expands processor from 256K to 320K bytes or from 384K to 458K bytes	17,280	55	485	340
F2748-93	Memory expansion; 64K bytes; expands processor from 320K to 384K bytes or from 458K to 512K bytes	17,280	55	485	340
PROCESSOR FEATURES					
8541-84	Console Printer; 30 characters per second; for use with all systems; connects to integrated peripheral channel	2,570	27	72	61
F1622-00	Storage Protect; adds two instructions	648	—	15	13
F1623-01	Micrologic Expansion; adds 64 instructions and four 64-bit registers	4,104	18	95	80
1921-00	Channel Cabinet for 90/30; provides interface for housing multiplexer channel and up to two selector channels	8,424	37	195	166
F1618-00	Selector Channel for 1921-00 channel cabinet; maximum two per system	7,344	37	170	145
F2089-00	Integrated Multiplexer Channel; three active subchannels; maximum one per system	11,232	49	260	221
F1620-00	External Multiplexer Channel; for use in 1921-00 channel cabinet; maximum one per system; precludes use of internal multiplexer channel	5,400	37	125	106
INTEGRATED PERIPHERAL SUBSYSTEMS FOR 90/25					
0719-93	Card Reader; attaches to integrated peripheral controller; 300 cpm	6,093	35	141	120
F2324-00	Short Card Feature; 51-column cards	1,512	10	35	30
F2324-01	Short Card Feature; 66-column cards	1,512	10	35	30
0605-00	Card Punch; attaches to integrated peripheral controller; 75-160 cpm	8,856	82	205	175
F1617-00	Punch/Read Station; permits reading of 80-column cards on 0605 card punch	648	5	15	13
0788-00	Printer; 48 characters at 300 lpm; requires F2507 print cartridge	13,824	175	320	272
F2386-00	Expands number of print positions for 0778-00 printer to 136	1,728	10	40	34
F1649-00	Expander; required for use of print cartridges with more than 64-character array	1,944	8	45	38

* Rental price does not include maintenance.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
INTEGRATED PERIPHERAL SUBSYSTEMS FOR 90/25 (Continued)					
F2507-00	48-Character Alpha-Numeric Business Set	1,296	NC	30	26
F2507-01	48-Character Alpha-Numeric Scientific Set	1,296	NC	30	26
F2507-02	63-Character Set; compatible with 9200/9300 integral printer	1,296	NC	30	26
F2507-03	48-Character Business Set; compatible with 0770 printer	1,296	NC	30	26
F2507-10	Alpha-Numeric Character Set; contains 48 letters and 16 repeated numeric characters for fast numeric printing	1,296	NC	30	26
F2507-11	Print Cartridge; contains a 63-character set with 13 H-14 characters used with the 2703 optical document reader	1,296	NC	30	26
F2507-12	Print Cartridge; contains a 63-character set with 13 OCR-B ISO numerics; all other characters are font style OCR-B, ECMA 11	1,296	NC	30	26
F2507-13	Print Cartridge; contains a 63-character set with 13 OCR-B, ECMA 11 numerics for use with the 2703 optical document reader	1,296	NC	30	26
F2507-14	Print Cartridge; contains a 62-character set with a 13-character OCR-A numeric set for use with the 2703 optical document reader; all other characters are font style OCR-B, ECMA 11	1,296	NC	30	26
F2510-01	Print Cartridge; contains an 85-character ASCII subset	1,296	NC	30	26
F2510-02	Print Cartridge; contains a 94-character ASCII graphic character set	1,296	NC	30	26
INTEGRATED PERIPHERAL SUBSYSTEMS FOR 90/30 AND 90/30B					
0717-00	Card Reader; 500 cpm	8,208	65	190	160
F1627-00	Short Card Feature; 51-column cards	1,512	10	35	30
F1627-01	Short Card Feature; 66-column cards	1,512	10	35	30
0605-00	Card Punch; 75-160 cpm	8,856	82	205	175
F1617-00	Punch/Read Station	648	5	15	13
INTEGRATED PERIPHERAL SUBSYSTEMS FOR 90/30					
0773-99	Printer; 48-characters at 500 lpm; requires F1647 or F1650 print cartridge	19,872	191	460	390
F1648-00	132-Position Expansion for 0773-99 printer	1,728	10	40	34
F1648-01	144-Position Expansion for 0773-99 printer; expands from 132 to 144 print positions	1,728	5	40	34
F1648-02	144-Position Expansion for 0773-99 printer; expands from 120 to 144 print positions	3,456	16	80	68
F1649-00	Expander; required for use of print cartridges with more than 64-character array	1,944	8	45	38
F1647-00	48-Character Alpha-Numeric Business Set	1,296	NC	30	26
F1647-01	48-Character Alpha-Numeric Scientific Set	1,296	NC	30	26
F1647-02	63-Character Set; compatible with 9200/9300 integral printer	1,296	NC	30	26
F1647-03	48-Character Business Set; compatible with 0770 printer	1,296	NC	30	26
F1647-10	Alpha-Numeric Character Set; contains 48 letters and a repeated 16 numeric characters for fast numeric printing	1,296	NC	30	26
F1647-11	Print Cartridge; contains a 63-character set with 13 H-14 characters used with the 2703 optical document reader	1,296	NC	30	26
F1647-12	Print Cartridge; contains a 63-character set with 13 OCR-B ISO numerics; all other characters are font style OCR-B, ECMA 11	1,296	NC	30	26
F1647-13	Print Cartridge; contains a 63-character set with 13 OCR-B, ECMA 11 numerics for use with the 2703 optical document reader; all other characters are font style OCR-B, ECMA 11	1,296	NC	30	26
F1647-14	Print Cartridge; contains a 62-character set with a 13-character OCR-A numeric set for use with the 2703 optical document reader; all other characters are font style OCR-B, ECMA 11	1,296	NC	30	26
F1650-01	Print Cartridge; contains an 85-character ASCII subset	1,296	NC	30	26
F1650-02	Print Cartridge; contains a 94-character ASCII graphic character set	1,296	NC	30	26
MASS STORAGE					
1621-01	Integrated Disk Adapter; provides interface and control for up to two 8415 disk drives, or one 8415 and one 8418 disk drive, or two 8418 drives	10,800	55	250	210
F1769-01	Integrated Disk Adapter Corner Transition	1,215	—	45	40
8413-00	Dual Diskette; requires F1624-00 interface and F2121-02 expander if communications adapter is present; F1625-97/99 interface and F2593 feature required for 90/30 system	10,800	50	250	212
F2653-00	Diskette Dual Expansion for expanding 8413-00 dual diskette by addition of two read/write diskette drives; maximum four drives per system	3,546	15	82	70
8415-00	Disk Drive; single-spindle, 33.1 megabytes; requires 1621-01 adapter	14,040	85	325	276
F1215-00	Disk Cartridge for 8415 disk drive; 8.3 megabytes of removable storage	153	—	10	8
F1624-00	Diskette/Communications Adapter Interface; required to connect 8413 diskette subsystem or F1625-02 communications adapter to a 90/30B system	216	—	5	4
F2121-02	Diskette/Communications Adapter Interface Expander; required to connect the 8413 diskette and F1625-02 communications adapter when both are present	1,080	5	25	20
8418-92	Disk Drive; 28.9 megabytes	13,392	82	310	265
8418-94	Disk Drive; 57.8 megabytes	19,872	93	460	390
F1216-02	Disk Pack for 8418 disk drives	450	—	25	21
F2198-00	Disk Storage Upgrade; converts 8418-92 to 8418-94	6,480	11	150	125

* Rental price does not include maintenance.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
MASS STORAGE (Continued)					
5039-97	8430/8433 Control; controls up to eight type 8430/8433 Disk Storage Drives, with direct access to 800/1600 million bytes, via selector channel	57,600	327	1,385	900
8430-99	Disk Storage; provides 100 megabytes using removable disk pack	24,960	128	600	390
8433-99	Disk Storage; provides 200 megabytes using removable disk pack				
F2047-00	16 Drive Expansion; provides the capability to attach up to sixteen 8430/8433 Disk Drives to the 5039 Control	7,680	40	185	120
F1230-00	Disk Pack; provides up to 100 or 200 million bytes of removable storage for type 8430 or 8433 Disk Drive	750	—	46	30
F2046	Dual Channel Feature for 8430/8433 disk drives	4,080	16	85	72
INPUT/OUTPUT UNITS					
5045-00	Uniservo 10 Control; consists of control and cabinet space for 2 Uniservo 10 Magnetic Tape Units	12,192	70	254	205
5045-02	Auxiliary Cabinet; for 1 or 2 additional Uniservo 10 Magnetic Tape Units	1,296	5	27	22
F1028-92	7-Track NRZI Native Mode; adds 7-track NRZI native mode conversion to F0826-00	3,654	10	82	66
F1753-99	7-Track NRZI Native Mode; permits 7-track tapes to be added to 5045-00 Control	5,760	18	120	100
F2143-00	Converts a 5045-00 Control to a 5045-99 Control for attaching Uniservo 14 Magnetic Tape Units	8,976	50	187	145
0870-00	Uniservo 10 9-Track PE Magnetic Tape Unit	11,376	66	237	190
0870-01	Uniservo 10 9-Track PE and NRZI Magnetic Tape Unit	12,576	73	262	210
0870-02	Uniservo 10 7-Track NRZI Magnetic Tape Unit	11,376	66	237	190
F2193-00	Dual Density; adds 9-track NRZI to Uniservo 10 PE Magnetic Tape Unit	1,200	6	25	20
F2193-02	Converts Uniservo 10 7-track NRZI Magnetic Tape Unit to 9-track PE Magnetic Tape Unit	—	—	—	—
5017-99	Uniservo 12 Control; controls up to sixteen 9-track, phase encoded, 1600-bpi, non-simultaneous Uniservo 12 tape units	26,448	124	605	440
5017-00	Uniservo 12/16 Control; controls up to sixteen 9-track, phase encoded, 1600-bpi, non-simultaneous Uniservo 12 and/or 16 tape units	28,560	136	655	476
F0825-00	Dual Channel; permits non-simultaneous operation on two selector channels for one processor or one selector channel on each of two 90/30 Processors	4,416	21	92	74
F1131-99	Uniservo 16 Capability; permits the use of Uniservo 16 tape units on type 5017-99 Control	2,112	11	44	37
F1029-99	Simultaneous Operation; provides a second control module for R/R, R/W, W/R, W/W simultaneous operation; simultaneous W/W operation on two Uniservo 12's is available through separate masters; appropriate features must also be added to the Uniservo 12 masters; used only with 5017-99	16,896	73	352	300
F1029-00	Simultaneous Operation; provides a second control module for simultaneous operation; appropriate features must also be added to the Uniservo 12 masters and Universo 16 tape units; used only with 5017-00	18,960	85	395	335
F0823-99	7-Track NRZI; provides the capability of adding 7-track tape units to type 5017-00 or -99 Control or 5045-00 Control	5,760	21	120	100
F0826-00	9-Track NRZI; enables read or write operation in 9-track NRZI mode at a density of 800 bpi; in addition to the 9-track phase encoded 1600 bpi; appropriate features must also be added to the Uniservo 12 masters and Uniservo 16 tape units	5,760	21	120	100
F1028-96	9-Track Addition; adds 9-track NRZI to F0823-99	4,176	13	87	70
F1028-95	7-Track Addition; adds 7-track NRZI plus data conversion to F0826-00	4,176	13	87	70
0861-00	Uniservo 12 Master; 9-track phase encoded master tape unit and logic to handle up to three slave tape units (0861-01); transfer rate is 68,320 bytes per second at a recording density of 1600 bpi; reads forward and backward; for non-simultaneous operation	18,336	147	382	325
0861-01	Uniservo 12 Slave; 9-track phase-encoded, same characteristics as 0861-00	14,688	101	306	260
0861-04	Uniservo 12 Master; 7-track NRZI master tape unit and logic to handle up to three slave tape units (0861-05); transfer rate 8,540, 23,741, and 34,160 characters per second at recording densities of 200, 556, and 800 bpi; reads forward and backward; for non-simultaneous operation	15,936	147	332	280
0861-05	Uniservo 12 Slave; 7-track NRZI tape unit; same characteristics as 0861-04	13,056	101	272	230
F0934-99	Simultaneous Feature; for 9-track phase encoded simultaneous operation; required in each master (0861-00)	4,080	19	85	75
F0934-01	Simultaneous Feature; required in each master (0861-00) in addition to F0934-99 and F0935-00 to achieve phase encoded and 7- and 9-track NRZI simultaneous operation	4,608	19	96	80
F0934-98	Simultaneous Operation; required in each master (0861-04) to achieve 7-track NRZI simultaneous operation	4,080	19	85	75
F0935-00	Dual Density; required in each master (0861-00) to provide the ability to read or write 7/9-track NRZI tapes in addition to phase encoded tapes at 1600 bpi	2,688	13	56	48
5045-99	Uniservo 14 Control; includes control and cabinet space for 2 Uniservo 14 Magnetic Tape Units	21,168	120	441	355
5045-02	Auxiliary Cabinet; for 1 or 2 additional Uniservo 14 Magnetic Tape Units	1,296	5	27	22

* Rental price does not include maintenance.

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EQUIPMENT PRICES

INPUT/OUTPUT UNITS (Continued)

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
F1028-92	Adds 7-track NRZI native mode plus data conversion to F0826-00	3,654	10	82	66
F1753-99	Provides capability to add 7-track tape units to 5045-99 control	5,760	18	120	100
0870-03	Uniservo 14 9-track PE Magnetic Tape Unit	14,880	87	310	250
0870-04	Uniservo 14 9-track PE and NRZI Magnetic Tape Unit	16,080	94	335	270
0870-05	Uniservo 14 7-track NRZI Magnetic Tape Unit	14,880	87	310	250
F2194-00	Dual Density; adds 9-track NRZI to Uniservo 14 PE Magnetic Tape Unit; requires F0826-00 in control	1,200	6	25	20
F2194-02	Converts 0870-05 7-track NRZI Magnetic Tape Unit to 9-track PE	—	—	—	—
F2194-03	Converts 0870-05 7-track NRZI Magnetic Tape Unit into 9-track PE and NRZI	1,200	6	25	20
0862-00	Uniservo 16; 9-track phase encoded tape unit; transfer rate 192,000 bytes per second at a recording density of 1600 bpi; reads forward and backward	22,032	139	505	370
0862-02	Uniservo 16; 7-track NRZI tape unit; transfer rate 24,000, 66,700, and 96,000 characters per second at recording densities of 200, 556, and 800 bpi; reads forward and backward	22,032	139	505	370
F0936-99	Simultaneous Feature; provides for simultaneous operation when added to 0862-00 or -02; a second control unit or equivalent is required	914	NC	21	17
F0937-00	Dual Density; provides 0862-00 with the ability to read or write 9-track NRZI tape at 800 bpi in addition to phase encoded at 1600 bpi	2,284	NC	51	40
5034-00	Uniservo 20 Control; controls up to sixteen 9-track, phase encoded, 1600-bpi, non-simultaneous Uniservo 20's or a mixture of up to 16 Uniservo 20's, Uniservo 16's, and Uniservo 12's, provided at least one Uniservo 20 is present	36,720	120	840	610
F0823-98	9-Track Capability; provides the capability of adding 7-track NRZI Uniservo 16 and Uniservo 12 tape units to type 5034 control; includes data conversion; F0826-99 may not be present	5,544	20	113	90
F0826-99	9-Track NRZI; enables read or write operations in 9-track NRZI mode at a density of 800 bpi; in addition to the 9-track, phase encoded, 1600 bpi on Uniservo 16 and Uniservo 12 tape units with appropriate added features; F0823-98 may not be present	6,552	27	133	105
F1028-98	9-Track Addition; adds 9-track NRZI capability to F0823-99	5,544	20	113	90
F1028-97	7-Track Addition; adds 7-track capability and data conversion to F0826-99	4,536	12	92	75
0864-00	Uniservo 20; 9-track phase encoded tape unit; transfer rate 320,000 bytes per second at a recording density of 1600 bpi; reads forward and backward	27,696	166	635	460
F1510-00	Dual Access; provides for dual access and simultaneous R/R, R/W, W/R, W/W operation when added to two or more Uniservo 20's; requires two 5034-00 control units	2,448	12	51	41
0716-91	Card Reader and Control; 80- or 96-column, 600 cpm reader	18,187	113	421	360
0716-93	Card Reader and Control; 80- or 96-column, 1000 cpm reader	21,168	161	490	415
0716-99	Card Reader and Control; 80-column, 1000 cpm reader	15,504	121	323	275
F1487-00	Short Card, 51-column; for 9716	1,968	13	41	30
F1487-01	Short Card, 66-column; for 0716	1,968	13	41	30
F1488-00	Validity Check	816	NC	17	13
F1498-00	Alternate Stacker Fill	528	NC	11	8
F1530-99	Dual Translate; adds ASCII translator to translate mode	1,104	5	23	17
0768-00	Printer and Control; prints 49 contiguous characters at 1100 lpm and 63 characters at 900 lpm; 132 print positions	50,928	471	1,061	900
0768-99	Printer and Control; prints 43 contiguous characters at 1600 lpm and 63 characters at 1200 lpm; 132 print positions	63,216	582	1,317	1,120
F1071-00	1600/1200 LPM Rate; converts type 0768-00 to a type 0768-99	12,240	112	255	215
F1820-00	Stacking/Acoustical Aid; provides additional sound suppression to type 0768-00/-99 Printers; also provides power-driven assistance to form stacking	528	NC	11	9
0768-02	Printer and Control; prints 97 contiguous characters at 1000 lpm, 94 characters at 840 lpm, and 2000 lpm for a duplicated 14-character set (10 numerics plus 4 specials)	58,320	529	1,215	1,035
F1522-00	Print Code Expansion; provides for conversion of the 0768-02 to provide for a 103-character set	252	NC	5	4
0770-00	Printer and Control; prints 48-characters at 800 lpm; 132 print positions, 50 ips	56,304	268	1,173	940
0770-02	Printer and Control; same as 0770-00 except 1400 lpm and 75 ips	64,896	351	1,352	1,080
0770-04	Printer and Control; same as 0770-00 except 2000 lpm and 100 ips	86,686	447	2,220	1,445
F1533-00	160 Print Position; expands 132 print positions to 160	4,416	19	92	74
F1534-00	Expanded Character Set Control; provides control for print cartridges with other than 48-character sets	2,880	5	60	48
F1536-00	Print Cartridge; 43-character alphanumeric business set	462	NC	22	18
F1536-01	Print Cartridge; 48-character alphanumeric scientific set	462	NC	22	18
F1537-00	Print Cartridge; 94-character ASCII set; requires F1534-00	462	NC	22	18
F1537-03	Print Cartridge; 68-character OCR-B; requires F1534-00	462	NC	22	18
F1537-04	Print Cartridge; OCR H-14 universal; requires F1534-00	462	NC	22	18
F1537-05	Print Cartridge; 58-character set for COBOL, FORTRAN, and business; requires F1534-00	462	NC	22	18
F1537-06	Print Cartridge; 177-character international set; requires F1534-00	462	NC	22	18
F1537-09	Print Cartridge; 24-character numeric and special symbols for high-speed numeric printer; requires F1534-00	462	NC	22	18

* Rental price does not include maintenance.

Univac 90/25 and 90/30

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
INPUT/OUTPUT UNITS (Continued)					
F1537-11	Print Cartridge; universal OCR-A character set; requires F1534-00	462	NC	22	18
F1537-12	Print Cartridge; universal OCR-B (ECMA 11); requires F1534-00	462	NC	22	18
F1537-13	Print Cartridge; universal 77L	462	NC	22	18
0776-00	Printer and Control; prints 48-characters at 760-lpm; 136 print positions	40,800	200	850	680
0776-02	Printer and Control; prints 48-characters at 940 lpm; 136 print positions	46,080	240	960	770
F2245-00	Expanded Character Set Control; provides for print bands with other than 48-character sets for 0776 printers	2,160	5	45	36
F2217-00	Field conversion; converts 0776-00 printer to 0776-02 printer	5,280	40	110	90
F2216-XX	Print band for 0776 printers	1,440	—	30	24
0920-02	Paper Tape Control	9,408	38	196	170
F1033-02	Paper Tape Reader	1,968	21	41	35
F1032-02	Paper Tape Punch	6,864	30	143	120
F1034-00	Reader Spooler	1,968	5	43	37
F1035-00	Punch Take-Up Spooler	816	5	17	15
COMMUNICATIONS EQUIPMENT					
F1625-02	Communications Adapter for 90/25; provides three lines, one of which can be full duplex; requires F18XX line adapter	8,208	38	190	161
F1625-97	Communications Adapter; controls and coordinates the transfer of data from up to 6 full-duplex or 12 half-duplex communication lines; expandable to 12 full-duplex or 24 half-duplex lines; each line requires a line adapter	8,424	38	195	165
F1625-96	Communications Adapter Expansion; expands the capability of C/A (F1625-99) to control up to 12 full-duplex or 24 half-duplex lines	8,424	38	195	165
F1826-00	Synchronous Line Adapter; provides a full-duplex or 24 half-duplex interface to synchronous data sets conforming to RS-232 and CCITT; compatible with MIL 188C low-level interface electrical characteristics	760	7	19	16
F1826-01	Synchronous Line Adapter; same as F1826-00 and provides reverse channel of up to 150 bps asynchronous; requires two ports	1,160	8	29	25
F1827-00	Synchronous Line Adapter; same as F1826-00 except permits exact compliance with the MIL 188C low-level interface; control line polarity is RS-232	760	7	19	16
F1828-00	Asynchronous Line Adapter; provides a full-duplex or half-duplex interface to asynchronous data sets conforming to RS-232 and CCITT; compatible with MIL 188C low level interface electrical characteristics	600	6	15	13
F1828-01	Asynchronous Line Adapter; same as F1828-00 and provides reverse channel of up to 5 bps	760	7	19	16
F1828-02	Asynchronous Line Adapter; same as F1828-00 and provides reverse channel of up to 150 bps asynchronous; requires 2 ports	920	8	23	20
F1829-00	Asynchronous Line Adapter; same as F1828-00 except permits exact compliance with the MIL 188C low-level interface; control line polarity is RS-232	600	6	15	13
F1830-00	Wideband Line Adapter; provides a synchronous full-duplex interface to an AT&T 300 Series data set operating at 40.8K bits per second with 56K bps top speed	920	8	23	20
F1830-01	Wideband Line Adapter; provides a synchronous full-duplex interface to an AT&T 300 Series data set at 50K bps; includes auto-answering capability	920	8	23	20
F1831-00	Dial Adapter; provides the interface to both rotary and Touch-Tone auto dialing units; requires a line adapter location for each dialing unit	600	6	15	13
F1832-00	Asynchronous Relay Line Adapter; provides an asynchronous full-duplex interface optionally compatible with either 20-75 MA neutral or 10-40 MA polar telegraph lines	600	6	15	13
F1834-00	Wideband Line Adapter; same as F1839-01 except conforms to CCITT-V35	920	8	23	20
F1835-00	TWX Line Adapter; provides an interface to the USA TWX network	600	6	15	13
F1836-00	Telex Line Adapter; provides an interface to the USA WU Telex network	600	6	15	13
F1837-00	Active Line Indicator; provides a display panel to display line activity on up to 12 communication lines; two permitted if F1625-98 is present	336	2	7	6
2521-00	Basic Channel Transfer Switch; 2x1 configuration; includes cabinet with physical space and power for 4x8 configuration	18,750	58	442	380
F2600-00	Expansion Module; expands 2521-00 2x1 switch into a 2x2 configuration; maximum of 3 per 2521-00 switch	555	—	13	10
F2601-00	Expansion Module; 2x1 configuration; forms base for second 2x4 channels switch; requires F2100-00 modules to expand to 2x4 switch	9,930	32	234	175
F2601-01	Independent 2x1 Module; expandable to 2x2 configuration through one F2601-00; precludes addition of one F2602-00 expansion module; maximum of two per 2521-00 switch	9,930	32	234	175
F2602-00	Expansion Module; expands 2x1 basic configuration to a 4x1 configuration by adding links for two CPU's; requires one 2603-00 for each CPU-subsystem crosspoint	6,755	24	159	120
F2603-00	Crosspoint Module; connects one subsystem to each CPU link in F2602-00 expansion module; maximum of 3 per F2602-00 module	555	—	13	10

* Rental price does not include maintenance.

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SOFTWARE PRICES

	Monthly Rental
OS/3	NC
OS/3 BASIC	$ 60
OS/3 Remote Spool Processor	50
OS/3 Basic Edit Monitor	75
OS/3 Text Editor	50
ICS/90	80
Newscomp:	
Basic Newscomp	100
Editing Control	100
Classified Ads	100
UNIS:	
Master Data Processor	75
Inventory Management	75
Product Planning & Scheduling and Work Order Management	125
FIRST:	
Time Deposits	420
Loans	165
Accounting Control System:	
Accounts Payable	25
Accounts Receivable	25
General Ledger	25
Payroll	30