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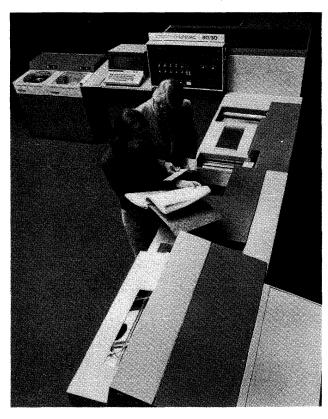
UNIVAC 90/30

The basic UNIVAC 90/30 configuration includes a processor with 32K bytes of MOS memory, CRT system console, 500-cpm card reader, 500-lpm printer, and two 8418 disk drives with a total capacity of 57.8 million bytes. Also shown here is an optional card punch.

MANAGEMENT SUMMARY

Introduced in June 1974, the UNIVAC 90/30 is the smallest member of the byte-oriented Series 90 product line. As in the case of the larger members of the Series 90 family, UNIVAC went all-out to attract new customers from competitive accounts with the 90/30, and indications are that this strategy has been very successful so far. Latest industry figures estimate that UNIVAC has sold between 1100 and 1300 of the 90/30 systems to date.

Targets for replacement by the 90/30, in addition to UNIVAC's own base of 9200 and 9300 accounts, include IBM 360/20 and 360/22 systems, disk-oriented versions of the IBM System/3 Model 10, 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 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 ▷

The smallest member of the UNIVAC Series 90 family, the 90/30 offers a broad range of configurations supported by the modular OS/3 operating system. Typical system rentals range from about $4,300 per month for an entry-level system to over $8,700 per month for a large 90/30 configuration.

CHARACTERISTICS

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

MODEL: UNIVAC 90/30.

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: From 32,768 to 524,288 bytes in 12 sizes: 32K, 49K, 65K, 98K, 131K, 163K, 196K, 262K, 327K, 393K, 458K, and 524K bytes.

CYCLE TIME: 0.6 microsecond per 2-byte access.

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. ▶

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▷ 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 $4,300 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 90/30 features metal oxide semiconductor (MOS) main memory. Memory sizes can range from 32,768 bytes to 524,288 bytes, with 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 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 90/30 offers the complete set of System/360 Model 50 nonprivileged instructions. The basic instruction repertoire for the 90/30 consists of 84 instructions, including complete arithmetic facilities for variable-length decimal 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.

The 90/30 is the smallest member of the expanding UNIVAC Series 90 product line. Series 90 central processors now compete across a broad range of price/performance, ranging from the IBM System/3 Model 10 level on the low end of the UNIVAC 90/30 configuration range to the IBM System/370 Model 148 level for the UNIVAC 90/70 and 90/80. Absent from the UNIVAC product line at present is an entry-level computer system, with rentals starting in the $1,000-per-month price range, that would appeal to first-time computer users.

For UNIVAC 9200/9300 users, however, 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. A 9480 central processing unit with an operator console and printer, multiplexer channel, selector channel, and 65,536 bytes of main memory rents for $4,536 per ▷

▶ **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 131K bytes of main storage, or for 2048-byte segments with more than 262K bytes of main storage.

RESERVED STORAGE: The first 640 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 nonprivileged 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.

Binary add/subtract (32 bits):	5.4
Multiply (32 bits)	39.6
Divide (32 bits)	65.4
Load (RX)	4.8
Store (RX)	5.4
Compare (RX)	5.4
Decimal add (2-address, 5-digit fields)	43.0
Decimal multiply (5-digit fields)	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 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. ▶

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▷ month on a one-year rental contract including maintenance. In contrast, a 90/30 central processor with an integrated peripheral channel, console and printer, writable control storage for 9200/9300 or IBM 360/20 emulation, and 65,536 bytes of MOS main memory rents for just $2,404 on a one-year lease including maintenance, and can be purchased for $94,776.

Users of UNIVAC 9200/9300 systems can upgrade to the new 90/30 system in one of two ways. For those who are willing to convert, UNIVAC is supplying a conversion utility package to translate data files to disk formats acceptable to the 90/30 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 is offering 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.

UNIVAC has ambitions for its new medium-scale system beyond that of upgrading the 9200/9300 systems, most of which are rapidly approaching obsolescence. The 90/30 also is definitely 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 Model 10 users, the 90/30 offers better performance and substantially greater growth capability at prices roughly equal to or somewhat below the competing IBM systems. For these accounts, the 90/30 offers an RPG II compiler, with features comparable to those of its IBM System/3 counterpart, 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.

In order to design a system that will appeal to such a wide variety of potential customers, UNIVAC has carefully taken into account the requirements of most users of small systems. Thus, although the resulting 90/30 blazes no new technological trails, it does incorporate capabilities that are unusual for a system of its size. ▷

▶ INPUT/OUTPUT CONTROL

I/O CHANNELS: The basic 90/30 Processor has an integrated disk adapter and an integrated peripheral channel for attachment of a CRT console, card reader, card punch, and line printer. A multiplexer channel with a maximum data transfer rate of 83K bytes per second and up to two selector channels with a maximum data transfer rate of 825K bytes per second are optional. The maximum aggregate system I/O data transfer rate is approximately 1.8 million bytes per second.

CONSOLE: The System Console consists of a keyboard with operator controls and a Uniscope 100 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 Console Printer operates at 30 characters per second and connects to the System Console.

The UNIVAC 90/30 "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 90/30 configuration contains integrated control units for two UNIVAC 8418 Disk Drives, a 500 card-per-minute card reader, a 75 to 160 card-per-minute card punch, a 500 line-per-minute printer, and a CRT System Console. The console is required for operation of the OS/3 operating system.

Additional low-speed devices, including card readers, card punches, printers, a paper tape subsystem, an optical document reader, and the Uniservo 10 magnetic tape subsystem, can be connected through the optional multiplexer channel, which accommodates up to eight control units and eight subchannel addresses.

High-speed peripheral devices, such as Uniservo 12, 14, 16, or 20 Magnetic Tape Units or 8430 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 90/30 Processor 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 is approximately 1.8 million bytes per second.

MASS STORAGE

8418 DISK SUBSYSTEM: Removable disk pack storage that attaches to the 90/30 via the integrated disk adapter. The 8418 subsystem is available in two models: the ▶

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▷ Paramount among these is its unusual capability for expansion. Main memory on the 90/30 can be expanded from the basic 32,768 bytes to a maximum of 524,288 bytes, twice the amount currently available for the IBM System/3 Model 15.

I/O capabilities of the 90/30 also span an unusually wide range. The basic system with its Integrated Peripheral Channel can accommodate a CRT console, a 500 card-per-minute card reader, 500 line-per-minute printer, and an optional 75 to 160 card-per-minute card punch. An optional Integrated Disk Adapter permits attachment of a minimum of two Model 8418 Disk Drives with a combined storage capacity of 57.8 million bytes. Up to eight Model 8418 Disk Drives can be attached to the Integrated Disk Adapter for a total of over 463 million bytes of random-access storage. Communications capabilities 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 250 card-per-minute punches, 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 tape drives with transfer rates of up to 320,000 bytes per second and the new UNIVAC 8430 Disk Subsystem. The latter, a product of UNIVAC's recently acquired Information Storage Systems division, offers up to 16 IBM 3330-type disk storage drives per controller, for a total of 1.6 billion bytes of on-line random-access storage. Also available are a paper tape subsystem and an optical document reader.

Software for the UNIVAC 90/30 centers around OS/3, a new 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. ▷

▶ 8418-94 with a capacity of 57.9 million bytes per drive, and the 8418-92 with a capacity of 28.9 million bytes per drive. 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. 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: 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 comb-type access mechanism. Average head movement time is 27 milliseconds, average rotational delay is 8.33 milliseconds, and data transfer rate is 806,000 bytes per second.

From two to eight 8430 Disk Pack Drives can be attached to a 5039 Controller for a total of 800 million bytes of interchangeable disk pack storage. The Sixteen Drive Expansion Feature expands the capability of the 5039 Controller to up to 16 drives for a total of 1.6 billion bytes of on-line storage. The 8430 subsystem features a Command Retry facility and error correction coding circuitry.

INPUT/OUTPUT UNITS

UNISERVO 10 MAGNETIC TAPE UNIT: A low-speed tape drive that reads and records data on standard 1/2-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. ▶

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

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 will include 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, 1,024 bytes in systems with more than 131K bytes of main memory, or 2,048 bytes in systems with more than 262K 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 lessens 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, currently the second largest system in the UNIVAC Series 90 product line. Thus, an installation with a basic 90/30 configuration can avail itself of a vast growth potential in main memory, I/O capability, and ▷

▶ **UNISERVO 12 MAGNETIC TAPE UNIT:** A medium-speed tape drive that reads and records data on standard 1/2-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.

UNISERVO 14 MAGNETIC TAPE UNIT: A medium-speed tape drive that reads and records data on standard 1/2-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 1/2-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. ▶

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▷ 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.

UNIVAC is emphasizing the availability of industry-oriented software packages for the 90/30. Among these are off-the-shelf packages for manufacturing, newspaper production, banking, wholesaling, and retailing. In connection with announcing the availability of these programs for the 90/30 system, UNIVAC announced a "visible pricing" policy. In other words, some applications programs supplied by UNIVAC for the 90/30 are unbundled and available for monthly license fees ranging from $25 to $420 per month. The operating system, language processors, and all other software support are still supplied with the system at no additional charge.

Various configurations of the UNIVAC 90/30 will compete with IBM computers ranging from the System/3 Model 10 and Model 15 to the System/370 Model 115, 125, and small configurations of the Model 135. 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, twice the amount currently available with the System/3 Model 15 and 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 8430 Disk Drives for a total of 1.6 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 135, but is not available for the IBM System/3.

● 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, ▷

▶ UNISERVO 20 MAGNETIC TAPE UNIT: A high-speed tape drive that reads and records data on standard 1/2-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 in either mode. Includes a 2400-card input hopper and two 2000-card stackers. Multi-read error checking and validity checking are standard features. Includes an integrated control unit and attaches to a position on the optional multiplexer channel on 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.

0604 CARD PUNCH: A free-standing card punch that punches 80-column cards in row-by-row fashion at 250 cards per minute. Has a 1000-card input hopper and two 500-card output stackers. Punched cards are directed to one of the two stackers under program control. Punching is in card-image mode or compressed code translation. Contains an integrated controller and attaches to a position on the multiplexer channel.

0605 CARD PUNCH: An integrated card punch that attaches to a position on the integrated peripheral ▶

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▷ although OS/3 supports dynamic memory management, it does not now have a virtual storage operating system capability.

● UNIVAC prices for the 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 90/30, UNIVAC has designed a computer system that is geared to meet the requirements of a large number of small-system users for additional processing capability, communications-oriented applications, 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

Nine users of UNIVAC 90/30 systems responded to Datapro's 1976 survey of users of general-purpose computer systems. Each of these users had one system installed. All nine of the systems were engaged solely in business data processing, with four also performing some data communications functions. The maximum number of remote batch terminals in use on any one system was three, and the maximum number of interactive terminals reported was also three.

One of these systems replaced an IBM System/3, one replaced an IBM System/360 Model 20, and two replaced IBM 1130's. One system replaced a UNIVAC Series 70 Model 35, and one a UNIVAC 9300. The remaining three systems were replacements for Honeywell 110, 115, and 200 systems. Main memory size for these 90/30 systems ranged from 65K to 196K bytes, with four of the systems having 98K bytes of main memory. The length of time these systems had been installed ranged from 3 to 14 months.

These users' ratings and their remarks on their experiences with the 90/30 can be summarized as follows:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	3	5	1	0	3.2
Reliability of mainframe	3	5	1	0	3.2
Reliability of peripherals	2	5	2	0	3.0
Maintenance service:					
Responsiveness	6	3	0	0	3.7
Effectiveness	3	4	2	0	3.1
Technical support	2	4	1	1	2.9
Manufacturer's software:					
Operating system	3	6	0	0	3.3
Compilers and assemblers	3	4	2	0	3.1
Application programs	1	5	2	0	2.9
Ease of programming	2	7	0	0	3.2
Ease of conversion	3	3	3	0	3.0
Overall satisfaction	2	6	1	0	3.1

*Weighted Average on a scale of 4.0 for Excellent.

▷ 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: 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.)

0770 PRINTERS: 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. The printers use a new horizontal print band technique. 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: An impact 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. ▶

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▷ All of these users expressed a high level of satisfaction with their 90/30's. When they were asked to cite principal strengths or disadvantages of the system, their comments were quite diverse, with no two users mentioning the same feature—either as a strength or a disadvantage.

On the positive side, specific features mentioned by these users were the system's multiprogramming capability, spooling facilities, sort/merge speed, ease of system generation, and processor speed. Also cited as strengths were the 90/30's price/performance, ease of operation, and "expandability."

On the negative side, one user was not happy with the RPG compiler, while another cited as a disadvantage the "lack of a floppy disk input reader." One user complained about UNIVAC's technical support, another said the documentation was "incomplete and incorrect," and a third cited "lack of maturity of operating software" as a disadvantage.

In summary, the 90/30 system looks good. The price is right, the capability and growth potential are there, and UNIVAC appears to be providing the support necessary to keep the users in a satisfied frame of mind. In view of the marketing success to date, the 90/30 may well become UNIVAC's biggest seller ever. The key to its ultimate success lies in UNIVAC's ability to continue to provide the necessary support. The market at which the 90/30 is aimed is such that virtually every installation means a conversion effort of some sort, and conversions require support personnel. As long as UNIVAC can provide the necessary conversion tools and manpower at a pace in keeping with the installation rate, the users are likely to stay happy and the 90/30 should continue to sell. □

► 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.

2703 OPTICAL DOCUMENT READER: Reads printed numeric data from individual documents ranging from 2.75 to 4.25 inches in height and 2.00 to 8.75 inches in length. Basic speed of 300 six-inch documents per minute can be increased to 600 dpm by an optional feature. Other options permit reading of vertical pencil marks and of standard 80-column punched cards. The Modulus-10 Check Digit option compares a computed modulus-10 check digit with a check digit printed on the document. Character set consists of the digits 0-9 and four special symbols, in either UNIVAC H-14, OCR-A, or OCR-B (ECMA) font. Has a 2000-document feed hopper and three 1000-document stackers. Connected via the multiplexer 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: 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.

SOFTWARE

OPERATING SYSTEM: OS/3 is a disk-oriented operating system specifically designed for the 90/30 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 90/30 system. 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 ►

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➤ 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 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.

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. Re-entrant 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 queueing 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 DCT 500, 1000, and 2000 Data Communications Terminals, the UNIVAC 1004 Card Processing System, the UNIVAC 9200/9300 systems, 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 queueing 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. ➤

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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 can be recompiled under OS/3 for execution on the 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.

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, application program scheduling, data management, system security, and recovery of files and messages. 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 statements. 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; a Sort/Merge program that can sort data files in IRAM format; 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, and disk data files to OS/3 formats. A UNIVAC-written program is available, run on a System/3, to transcribe source programs and 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 90/30 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 90/30 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 table below lists the 36/20 systems by peripheral orientation and memory size and the equivalent 90/30 systems required for emulation.

IBM 360/20 System to be Emulated	UNIVAC 90/30 System Required for Emulation	
	Minimum	Maximum
4K, 8K, 12K, 16K or 24K–Card	32K	49K
32K–Card	49K	65K

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IBM 360/20 System to be Emulated	UNIVAC 90/30 System Required for Emulation	
	Minimum	Maximum
12K or 16K—Disk	32K	65K
24K—Disk	49K	65K
32K—Disk	49K or 65K	65K
8K, 12K, 16K, 24K or 32K—Tape	32K	65K

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. The 9200/9300 system sizes and the required memory sizes for emulation on a 90/30 system are listed below:

UNIVAC 9200/9300 System to be Emulated	UNIVAC 90/30 System Required for Emulation	
	Minimum	Maximum
8K	32K	32K
12K—24K	32K	49K
32K	49K	65K

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

APPLICATION PROGRAMS: UNIVAC application software available for the 90/30 includes an advanced Pert Management Control System, Linear Programming, UNIS (bill of materials, inventory control, planning and scheduling), APT (automatically programmed tools), FIRST (on-line bank teller transaction processing), NEWSCOMP (on-line newspaper text editing and typesetting), LINCO III (typesetting and line justification), WIMS (Wholesale Inventory Management System), BEM (Basic Edit Monitor), BASIC (Beginner's All-Purpose Symbolic Instruction Code), EDT (a text editor), 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 90/30 BASIC SYSTEM: Consists of a 32K Processor, 500-cpm card reader, 75-160-cpm card punch, 500-lpm printer, integrated disk adapter, and 57.8 million bytes of disk storage. Monthly rental for a one-year lease is $3,230, and purchase price is $139,626. Monthly maintenance is $835.

UNIVAC 90/30 MEDIUM DISK SYSTEM: Consists of a 98K 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 $5,210, and purchase price is $209,160. Monthly maintenance is $1,218.

UNIVAC 90/30 LARGE SYSTEM: Consists of a 196K 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, auxiliary control, internal multiplexer channel, and 231.6 million bytes of disk storage. Monthly rental for a one-year lease is $7,297, and purchase price is $364,320. Monthly maintenance is $2,253.

SOFTWARE AND SUPPORT: With the exception of several industry-oriented applications packages, UNIVAC equipment prices include all of the UNIVAC software described 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 90/30 systems at significantly lower monthly rates. Under the 5-year "level-payment" agreement, the monthly equipment charge is 85% of the 1-year rental rate shown in the accompanying price list. Under a 5-year "reducing-payment" agreement, the monthly charge is 95% of the 1-year rental rate during the first year, 90% the second year, 85% the third year, 80% the fourth year, and 75% the fifth year. Maintenance is not discounted under these plans.■

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EQUIPMENT PRICES

	Purchase Price	Monthly Maintenance	Rental (1-year lease)*
90/30 PROCESSOR AND MAIN STORAGE			
3029-83 — 90/30 Processor (includes Integrated Peripheral Channel, 2 Interval Timers, CRT/ Keybord Operator Station, UNIVAC 9200/9300 Compatibility Mode, IBM 360/ 20 Compatibility Mode, and 32,768-byte Memory	70,632	349	1,635
3029-99 — 90/30 Processor; 49,152 bytes	76,680	432	1,975
3029-98 — 90/30 Processor; 65,536 bytes	82,728	475	2,275
3029-97 — 90/30 Processor; 98,304 bytes	93,528	518	2,575
3029-96 — 90/30 Processor; 131,072 bytes	104,328	553	2,855
3029-95 — 90/30 Processor; 163,840 bytes	114,048	568	3,135
3029-94 — 90/30 Processor; 196,608 bytes	123,768	623	3,090
3029-92 — 90/30 Processor; 262,144 bytes	143,208	658	3,685
3029-81 — 90/30 Processor; 327,680 bytes	160,488	713	4,170
3029-80 — 90/30 Processor; 393,216 bytes	177,768	768	4,655
3029-79 — 90/30 Processor; 458,752 bytes	195,048	823	5,140
3029-78 — 90/30 Processor; 524,288 bytes	212,328	678	5,625
STORAGE EXPANSION			
F1775-00 — Storage; 16,384 bytes (expands a 90/30 Processor from 32,768 to 49,152 bytes or from 49,152 bytes to 65,536 bytes of main storage)	6,048	24	170
F1907-01 — Storage; 32,768 bytes (expands main storage from 65,536 to 98,304 bytes)	10,800	43	300
F1775-95 — Storage; 32,768 bytes (expands main storage from 98,304 to 131,072 bytes)	10,800	43	300
7024-99 — Storage; 32,768 bytes (expands main storage from 131,072 to 163,840 bytes)	9,720	35	280
F1775-91 — Storage; 32,768 bytes (expands main storage from 163,840 to 196,608 bytes)	9,720	35	280
F1908-98 — Storage; 65,536 bytes (expands main stoage from 196,608 to 262,144 bytes)	19,440	70	550
F2319-98 — Storage; 65,536 bytes (expands main storage from 262,144 to 327,680 bytes)	17,280	55	485
F2318-97 — Storage; 65,536 bytes (expands main storage from 327,680 to 393,216 bytes, from 393,216 to 458,752 bytes, or from 458,752 to 524,288 bytes)	17,280	55	485
PROCESSOR FEATURES			
8541-84 — Console Printer; 30 cps	2,570	27	72
F1622-00 — Storage Protect; provides read/write protection for 512-byte blocks for processors with up to 131,072 byres of main memory and 1,024-byte blocks in processors with more than 131,072 bytes	648	NC	15
F1623-00 — Micrologic Expansion; adds 64 instructions, including 44 floating-point instructions and 20 non-privileged instructions	4,104	18	95
1921-00 — Channel Cabinet; provides interface for housing a multiplexer channel and two selector channels	8,424	37	195
F1618-00 — Selector Channel; requires 1921-00	7,344	37	170
F1620-00 — Multiplexer Channel; requires 1921-00	5,400	37	125
F2089-00 — Internal Multiplexer Channel	11,232	49	260
INTEGRATED PERIPHERAL SUBSYSTEMS			
0717-00 — Integrated Card Reader; 500 cpm	8,208	65	190
F1627-00 — 51-Column Feature; for 0717 Card Reader	1,512	10	35
F1627-01 — 66-Column Feature; for 0717 Card Reader	1,512	10	35
0605-00 — Integrated Card Punch; 75-160 cpm	8,856	82	205
F1617-00 — Punch Read Station; permits reading of 80-column cards on 0605 Card Punch	648	5	15
0773-99 — Integrated Printer; 120 print positions, 500 lpm	19,872	191	460
F1648-00 — 132 Print Positions; expands print positions from 120 to 132	1,728	10	40
F1648-01 — 144 Print Positions; expands print positions from 132 to 144	1,728	5	40
F1648-02 — 144 Print Positions; expands print positions from 120 to 144	3,456	16	80
F1649-00 — Expanded Character Set; permits use of print cartridges with more than 64 characters	1,944	8	45
F1647-00 — 48-Character Alpha-Numeric Business Set	1,296	NC	30
F1647-01 — 48-Character Alpha-Numeric Scientific Set	1,296	NC	30
F1647-02 — 63-Character Set; compatible with 9200/9300 integral printer	1,296	NC	30
F1647-03 — 48-Character Business Set; compatible with 0770 printer	1,296	NC	30
F1647-10 — Alpha-Numeric Character Set; contains 48 letters and a repeated 16 numeric characters for fast numeric printing	1,296	NC	30
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
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
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
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
F1650-01 — Print Cartridge; contains an 85-character ASCII subset	1,296	NC	30
F1650-02 — Print Cartridge; contains a 94-character ASCII graphic character set	1,296	NC	30
F1625-99 — 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	9,360	38	195
F1625-98 — Communications Adapter Expansion; expands the capability of C/A (F1625-99) to control up to 12 full-duplex or 24 half-duplex lines	9,360	38	195
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
F1826-01 — Synchronous Line Adapter; same as F1826-00 and provides reverse channel of up to 150 baud asynchronous; requires two ports	1,160	8	29
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

*Rental prices do not include equipment maintenance.

SEPTEMBER 1977

UNIVAC 90/30

IBM 360/20 System to be Emulated	UNIVAC 90/30 System Required for Emulation	
	Minimum	Maximum
12K or 16K—Disk	32K	65K
24K—Disk	49K	65K
32K—Disk	49K or 65K	65K
8K, 12K, 16K, 24K or 32K—Tape	32K	65K

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. The 9200/9300 system sizes and the required memory sizes for emulation on a 90/30 system are listed below:

UNIVAC 9200/9300 System to be Emulated	UNIVAC 90/30 System Required for Emulation	
	Minimum	Maximum
8K	32K	32K
12K—24K	32K	49K
32K	49K	65K

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

APPLICATION PROGRAMS: UNIVAC application software available for the 90/30 includes an advanced Pert Management Control System, Linear Programming, UNIS (bill of materials, inventory control, planning and scheduling), APT (automatically programmed tools), FIRST (on-line bank teller transaction processing), NEWSCOMP (on-line newspaper text editing and typesetting), LINCO III (typesetting and line justification), WIMS (Wholesale Inventory Management System), BEM (Basic Edit Monitor), BASIC (Beginner's All-Purpose Symbolic Instruction Code), EDT (a text editor), 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 90/30 BASIC SYSTEM: Consists of a 32K Processor, 500-cpm card reader, 75-160-cpm card punch,

500-lpm printer, integrated disk adapter, and 57.8 million bytes of disk storage. Monthly rental for a one-year lease is $4,296, and purchase price is $162,720. Monthly maintenance is $906.

UNIVAC 90/30 MEDIUM DISK SYSTEM: Consists of a 98K 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 $5,960, and purchase price is $231,840. Monthly maintenance is $1,130.

UNIVAC 90/30 LARGE SYSTEM: Consists of a 196K 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, auxiliary control, internal multiplexer channel, and 231.6 million bytes of disk storage. Monthly rental for a one-year lease is $8,714, and purchase price is $417,688. Monthly maintenance is $1,922.

SOFTWARE AND SUPPORT: With the exception of several industry-oriented applications packages, UNIVAC equipment prices include all of the UNIVAC software described 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 90/30 systems at significantly lower monthly rates. Under the 5-year "level-payment" agreement, the monthly equipment charge is 85% of the 1-year rental rate shown in the accompanying price list. Under a 5-year "reducing-payment" agreement, the monthly charge is 95% of the 1-year rental rate during the first year, 90% the second year, 85% the third year, 80% the fourth year, and 75% the fifth year. Maintenance is not discounted under these plans.■

UNIVAC 90/30

EQUIPMENT PRICES

		Purchase Price	Monthly Maintenance	Rental (1-year lease)*
90/30 PROCESSOR AND MAIN STORAGE				
3029-83	90/30 Processor (includes Integrated Peripheral Channel, 2 Interval Timers, CRT/ Keyboard Operator Station, UNIVAC 9200/9300 Compatibility Mode, IBM 360/ 20 Compatibility Mode, and 32,768-byte Memory	78,480	349	1,635
3029-99	90/30 Processor; 49,152 bytes	85,200	371	1,775
3029-98	90/30 Processor; 65,536 bytes	91,920	393	1,915
3029-97	90/30 Processor; 98,304 bytes	103,920	432	2,165
3029-96	90/30 Processor; 131,072 bytes	115,920	471	2,415
3029-95	90/30 Processor; 163,840 bytes	126,720	503	2,640
3029-94	90/30 Processor; 196,608 bytes	137,520	535	2,865
3029-92	90/30 Processor; 262,144 bytes	159,920	599	3,315
3029-81	90/30 Processor; 327,680 bytes	178,320	649	3,715
3029-80	90/30 Processor; 393,216 bytes	197,520	699	4,115
3029-79	90/30 Processor; 458,752 bytes	216,720	749	4,515
3029-78	90/30 Processor; 524,288 bytes	235,920	799	4,915
STORAGE EXPANSION				
F1775-00	Storage; 16,384 bytes (expands a 90/30 Processor from 32,768 to 49,152 bytes or from 49,152 bytes to 65,536 bytes of main storage)	6,720	22	140
F1907-01	Storage; 32,768 bytes (expands main storage from 65,536 to 98,304 bytes)	12,000	39	250
F1775-95	Storage; 32,768 bytes (expands main storage from 98,304 to 131,072 bytes)	12,000	39	250
7024-99	Storage; 32,768 bytes (expands main storage from 131,072 to 163,840 bytes)	10,800	32	225
F1775-91	Storage; 32,768 bytes (expands main storage from 163,840 to 196,608 bytes)	10,800	32	225
F1908-98	Storage; 65,536 bytes (expands main stoage from 196,608 to 262,144 bytes)	21,600	64	450
F2319-98	Storage; 65,536 bytes (expands main storage from 262,144 to 327,680 bytes)	19,200	50	400
F2318-97	Storage; 65,536 bytes (expands main storage from 327,680 to 393,216 bytes, from 393,216 to 458,752 bytes, or from 458,752 to 524,288 bytes)	19,200	50	400
PROCESSOR FEATURES				
8541-84	Console Printer; 30 cps	2,856	24	72
F1622-00	Storage Protect; provides read/write protection for 512-byte blocks for processors with up to 131,072 byres of main memory and 1,024-byte blocks in processors with more than 131,072 bytes	720	NC	15
F1623-00	Micrologic Expansion; adds 64 instructions, including 44 floating-point instructions and 20 non-privileged instructions	4,560	16	95
1921-00	Channel Cabinet; provides interface for housing a multiplexer channel and two selector channels	9,360	33	195
F1618-00	Selector Channel; requires 1921-00	8,160	33	170
F1620-00	Multiplexer Channel; requires 1921-00	6,000	33	125
F2089-00	Internal Multiplexer Channel	12,480	44	260
INTEGRATED PERIPHERAL SUBSYSTEMS				
0717-00	Integrated Card Reader; 500 cpm	9,120	60	190
F1627-00	51-Column Feature; for 0717 Card Reader	1,680	10	35
F1627-01	66-Column Feature; for 0717 Card Reader	1,680	10	35
0605-00	Integrated Card Punch; 75-160 cpm	9,840	75	205
F1617-00	Punch Read Station; permits reading of 80-column cards on 0605 Card Punch	720	5	15
0773-99	Integrated Printer; 120 print positions, 500 lpm	22,080	175	460
F1648-00	132 Print Positions; expands print positions from 120 to 132	1,920	10	40
F1648-01	144 Print Positions; expands print positions from 132 to 144	1,920	5	40
F1648-02	144 Print Positions; expands print positions from 120 to 144	3,840	15	80
F1649-00	Expanded Character Set; permits use of print cartridges with more than 64 characters	2,160	8	45
F1647-00	48-Character Alpha-Numeric Business Set	1,440	NC	30
F1647-01	48-Character Alpha-Numeric Scientific Set	1,440	NC	30
F1647-02	63-Character Set; compatible with 9200/9300 integral printer	1,440	NC	30
F1647-03	48-Character Business Set; compatible with 0770 printer	1,440	NC	30
F1647-10	Alpha-Numeric Character Set; contains 48 letters and a repeated 16 numeric characters for fast numeric printing	1,440	NC	30
F1647-11	Print Cartridge; contains a 63-character set with 13 H-14 characters used with the 2703 Optical Document Reader	1,440	NC	30
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	1,440	NC	30
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	1,440	NC	30
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	1,440	NC	30
F1650-01	Print Cartridge; contains an 85-character ASCII subset	1,440	NC	30
F1650-02	Print Cartridge; contains a 94-character ASCII graphic character set	1,440	NC	30
F1625-99	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	9,360	38	195
F1625-98	Communications Adapter Expansion; expands the capability of C/A (F1625-99) to control up to 12 full-duplex or 24 half-duplex lines	9,360	38	195
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	912	7	19
F1826-01	Synchronous Line Adapter; same as F1826-00 and provides reverse channel of up to 150 baud asynchronous; requires two ports	1,392	8	29
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	912	7	19

* Rental prices do not include equipment maintenance.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maintenance	Rental (1-year lease)*
INTEGRATED PERIPHERAL SUBSYSTEMS (Continued)				
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	720	6	15
F1828-01	Asynchronous Line Adapter; same as F1828-00 and provides reverse channel of up to 5 baud	912	7	19
F1828-02	Asynchronous Line Adapter; same as F1828-00 and provides reverse channel of up to 150 baud asynchronous; requires 2 ports	1,104	8	23
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	720	6	15
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	1,104	8	23
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	1,104	8	23
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	720	6	15
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	720	6	15
F1834-00	Wideband Line Adapter; same as F1839-01 except conforms to CCITT-V35	1,104	8	23
F1835-00	TWX Line Adapter; provides an interface to the USA TWX network	720	6	15
F1836-00	Telex Line Adapter; provides an interface to the USA WU Telex network	720	6	15
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
MASS STORAGE				
F1621-00	Integrated Disk Adapter (provides interface and control for up to four 8416 and/or 8418 Disk Drives)	12,000	50	250
F1769-01	Corner Transition (allows the disk configuration to make a right-angle turn)	1,350	—	45
2048-00	IDA Expansion (expands capability of IDA to control up to eight 8416 and/or 8418 Disk Drives)	8,160	30	170
8418-92	Disk Storage Drive; 28.9 million bytes	14,880	75	310
8418-94	Disk Storage Drive; 57.9 million bytes	22,080	85	460
F1216-02	Disk Pack	500	—	25
F2198-00	Disk Storage Upgrade (converts 8418-92 to an 8418-94)	7,200	10	150
5024-02**	8414 Control; controls up to eight type 8414 Disk Drives to a maximum capacity of 233,408,000 bytes of removable storage; includes File Scan and Record Overflow (not software-supported)	28,560	110	595
F1343-02**	8411 Capability; permits 8411 Disk Drives to be connected to a 5024-02 Control; a maximum of eight drives (any combination of 8411 and/or 8414 drives) may be connected	2,064	11	43
8414-92**	Disk Storage; consists of two 8414 Disk Drives; each drive provides direct access storage using a removable disk pack, feature F1214-00	42,528	157	886
8414-94**	Disk Storage; same as 8414-92 except consists of four disk drives	79,920	316	1,665
8414-96**	Disk Storage; same as 8414-92 except consists of six disk drives	112,128	474	2,336
8414-98**	Disk Storage; same as 8414-92 except consists of eight disk drives	139,104	631	2,898
8414-85**	Disk Drive; provides single disk drive for configuration expansion	21,312	80	444
F1214-00**	Disk Pack; provides up to 29.17 million bytes of removable storage for 8414 Disk Drive	382	—	22
8411-00**	Disk Drive; provides direct access to a maximum storage of 7.25 million bytes using removable disk pack F1211-00	21,552	97	449
F1211-00**	Disk Pack; provides 7.25 million bytes of removable storage for 8411-00	347	—	17
5039-00	8430 Control; controls up to eight type 8430 Disk Storage Drives with direct access to 800 million 8-bit bytes, via selector channel	57,600	327	1,200
8430-00	Disk Storage; provides a single disk drive using removable disk pack, feature F1230-00	24,960	142	520
F2047-00	16 Drive Expansion; provides the capability to attach up to sixteen 8430 Disk Drives to the 5039 Control	7,680	44	160
F1230-00	Disk Pack; provides up to 100 million bytes of removable storage for type 8430 Disk Drive	750	—	40
INPUT/OUTPUT UNITS				
5045-00	Uniservo 10 Control; consists of control and cabinet space for 2 Uniservo 10 Magnetic Tape Units	12,192	64	254
5045-02	Auxiliary Cabinet; for 1 or 2 additional Uniservo 10 Magnetic Tape Units	1,296	5	27
F1028-92	7-Track NRZI Native Mode; adds 7-track NRZI native mode conversion to F0826-00	3,654	10	82
F1753-99	7-Track NRZI Native Mode; permits 7-track tapes to be added to 5045-00 Control	5,760	17	120
F2143-00	Converts a 5045-00 Control to a 5045-99 Control for attaching Uniservo 14 Magnetic Tape Units	8,976	46	187
0870-00	Uniservo 10 9-Track PE Magnetic Tape Unit	11,376	61	237
0870-01	Uniservo 10 9-Track PE and NRZI Magnetic Tape Unit	12,576	67	262
0870-02	Uniservo 10 7-Track NRZI Magnetic Tape Unit	11,376	61	237
F2193-00	Dual Density; adds 9-track NRZI to Uniservo 10 PE Magnetic Tape Unit	1,200	6	25
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	110	551

*Rental prices do not include equipment maintenance.
**Subject to availability.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maintenance	Rental (1-year lease)*
INPUT/OUTPUT UNITS (Continued)				
5017-00	Universo 12/16 Control; controls up to sixteen 9-track, phase encoded, 1600-bpi, non-simultaneous Uniservo 12 and/or 16 tape units	28,560	121	595
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	18	92
F1131-99	Uniservo 16 Capability; permits the use of Uniservo 16 tape units on type 5017-99 Control	2,112	11	44
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
F1029-00	Simultaneous Operation; provides a second control module for simultaneous operation; appropriate features must also be added to the Uniservo 12 masters and Uniservo 16 tape units; used only with 5017-00	18,960	85	395
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	18	120
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	18	120
F1028-96	9-Track Addition; adds 9-track NRZI to F0823-99	4,176	11	87
F1028-95	7-Track Addition; adds 7-track NRZI plus data conversion to F0826-00	4,176	11	87
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	131	382
0861-01	Uniservo 12 Slave; 9-track phase-encoded, same characteristics as 0861-00	14,688	90	306
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	131	332
0861-05	Uniservo 12 Slave; 7-track NRZI tape unit; same characteristics as 0861-04	13,056	90	272
F0934-99	Simultaneous Feature; for 9-track phase encoded simultaneous operation; required in each master (0861-00)	4,080	19	85
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
F0934-98	Simultaneous Operation; required in each master (0861-04) to achieve 7-track NRZI simultaneous opeation	4,080	19	85
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	11	56
5045-99	Uniservo 14 Control; includes control and cabinet space for 2 Uniservo 14 Magnetic Tape Units	21,168	110	441
5045-02	Auxiliary Cabinet; for 1 or 2 additional Uniservo 14 Magnetic Tape Units	1,296	5	27
F1028-92	Adds 7-track NRZI native mode plus data conversion to F0826-00	3,654	10	82
F1753-99	Provides capability to add 7-track tape units to 5045-99 control	5,760	17	120
0870-03	Uniservo 14 9-track PE Magnetic Tape Unit	16,080	86	335
0870-05	Uniservo 14 7-track NRZI Magnetic Tape Unit	14,880	80	310
F2194-00	Dual Density; adds 9-track NRZI to Uniservo 14 PE Magnetic Tape Unit; requires F0826-00 in control	1,200	6	25
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
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	126	459
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	126	459
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
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
5034-00	Uniservo 20 Control; controls up to sixteen 9-track, phase encoded, 1600-bpi, nonsimultaneous 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	104	765
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	17	113
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 featues; F0823-98 may not be present	6,552	23	133
F1028-98	9-Track Addition; adds 9-track NRZI capability to F0823-99	5,544	17	113
F1028-97	7-Track Addition; adds 7-track capability and data conversion to F0826-99	4,536	10	92
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	144	577
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	10	51

*Rental prices do not include equipment maintenance.

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UNIVAC 90/30

EQUIPMENT PRICES

		Purchase Price	Monthly Maintenance	Rental (1-year lease)*

INPUT/OUTPUT UNITS (Continued)

		Purchase Price	Monthly Maintenance	Rental (1-year lease)*
0604-99	Card Punch and Control; 80-column, 250 cpm row punch	22,234	117	463
F0875-00	Read/Punch; permits prepunch reading of 80-column cards	7,152	61	149
0716-91	Card Reader and Control; 80- or 96-column, 600 cpm reader	20,208	102	421
0716-93	Card Reader and Control; 80- or 96-column, 1000 cpm reader	23,520	146	490
0716-99	Card Reader and Control; 80-column, 1000 cpm reader	15,504	110	323
F1487-00	Short Card, 51-Column; for 9716	1,968	11	41
F1487-01	Short Card, 66-Column, for 0716	1,963	11	41
F1488-00	Validity Check	816	NC	17
F1498-00	Alternate Stacker Fill	528	NC	11
F1530-99	Dual Translate; adds ASCII translator to translate mode	1,104	5	23
0768-00	Printer and Control; prints 49 contiguous characters at 1100 lpm and 63 characters at 900 lpm; 132 print positions	50,928	409	1,061
0768-99	Printer and Control; prints 43 contiguous characters at 1600 lpm and 63 characters at 1200 lpm; 132 print positions	63,216	506	1,317
F1071-00	1600/1200 LPM Rate; converts type 0768-00 to a type 0768-99	12,240	97	255
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
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	460	1,215
F1522-00	Print Code Expansion; provides for conversion of the 0768-02 to provide for a 103-character set	252	NC	5
0770-00	Printer and Control; prints 48-characters at 800 lpm; 132 print positions, 50 ips	56,304	255	1,173
0770-02	Printer and Control; same as 0770-00 except 1400 lpm and 75 ips	64,896	334	1,352
0770-04	Printer and Control; same as 0770-00 except 2000 lpm and 100 ips	86,686	425	1,806
F1533-00	160 Print Position; expands 132 print positions to 160	4,416	18	92
F1534-00	Expanded Character Set Control; provides control for print cartridges with other than 48-character sets	2,880	5	60
F1536-00	Print Cartridge; 43-character alphanumeric business set	462	NC	22
F1536-01	Print Cartridge; 48-character alphanumeric scientific set	462	NC	22
F1537-00	Print Cartridge; 94-character ASCII set; requires F1534-00	462	NC	22
F1537-03	Print Cartridge; 68-character OCR-B; requires F1534-00	462	NC	22
F1537-04	Print Cartridge; OCR H-14 universal; requires F1534-00	462	NC	22
F1537-05	Print Cartridge; 58-character set for COBOL, FORTRAN, and business; requires F1534-00	462	NC	22
F1537-06	Print Cartridge; 177-character international set; requires F1534-00	462	NC	22
F1537-09	Print Cartridge; 24-character numeric and special symbols for high-speed numeric printer; requires F1534-00	462	NC	22
F1537-11	Print Cartridge; universal OCR-A character set; requires F1534-00	462	NC	22
F1537-12	Print Cartridge; universal OCR-B (ECMA 11); requires F1534-00	462	NC	22
F1537-13	Print Cartridge; universal 77L	462	NC	22
0776-00	Printer and Control; prints 48-characters at 760 lpm; 136 print positions; 22 ips	40,800	200	850
0776-02	Printer and Control; prints 48-characters at 940 lpm; 136 print positions, 22 ips	46,080	240	960
F2245-00	Expanded Character Set Control; provides control for print bands with other than 48-character sets for 0776 printers	2,160	5	45
F2217-00	Field conversion; converts 0776-00 printer to 0776-02 printer	5,280	40	110
F2216-XX	Print band for 0776 printers	1,440	—	30
2703-00	Optical Document Reader	47,664	228	993
F1108-00	600-dpm Speed Upgrade, for 6-inch documents	12,000	39	250
F1163-00	Modulus 10 Check Digit	1,104	5	23
F1106-00	Mark Read—EBCDIC	9,204	45	188
F1106-01	Mark Read—ASCII	9,024	45	188
F1149-00	Punch Card Read; requires F1106-00 or -01	3,024	11	63
F1154-00	Validity Check; requires F1106-00 or -01	528	NC	11
0920-02	Paper Tape Control	9,408	34	196
F1033-02	Paper Tape Reader	1,968	19	41
F1032-02	Paper Tape Punch	6,864	27	143
F1034-00	Reader Spooler	1,968	5	43
F1035-00	Punch Take-Up Spooler	816	5	17

*Rental prices do not include equipment maintenance.

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APPLICATION PACKAGES

	Monthly License Fee
UNIS:	
Master Data Processing	75
Inventory Management Module	75
Planning—Infinite	75
Planning—Finite	100
Work Order Processing	25
NEWSCOMP:	
LINCO	100
Editor	100
Classified Ads	100
PROFITS:	
Time Deposits	420
Loans	165
ACCOUNTING CONTROL SYSTEM:	
Accounts Payable	25
Accounts Receivable	25
General Ledger	25
Payroll	30
BASIC EDIT MONITOR (BEM)	75
BEGINNERS ALL PURPOSE SYMBOLIC INSTRUCTION CODE (BASIC)	60
TEXT EDITOR (EDT)	50