NCR 9800 Systems

MANAGEMENT SUMMARY

UPDATE: *NCR introduced the faster 9800XP Application Processor (AP) in an attempt to make the 9800 Systems more attractive to users in the financial and banking industry. The dyadic 9800XP AP, which is based on the V-8595-II processor, increases processing power by more than two and a half times over the standard 9800 AP. NCR also doubled the basic memory capacity from 2 to 4 megabytes for both the 9800 AP and the Data Storage Processor (DSP) and added two additional input/output (I/O) slots to the DSP, for a total of four. NCR hopes these enhancements will convince users of the smaller V-8500 Systems to move into the 9800 architecture. The 9800 Systems' lack of processing power, its small main memory, and its incapable of connecting older peripherals are all addressed by the new releases.*

The 9800XP Processor provides the 9800 System with a more powerful AP to run software applications, such as large, single-thread jobs, that have not been converted to work efficiently on multiple 9800 APs. The XP operates under the Virtual Resource Executive/Extended (VRX/E) operating system and retains all its features, including virtual volumes, disk cache memory, and file mirroring and interleaving. It also permits the migration of existing V-8000 software and peripherals that cannot be converted directly to the 9800. Software applications include VRX Fortran and VRX Basic programs; large, complex Tran-Pro and/or Total applications; and third-party software that has not been rewritten to take advantage of the 9800 architecture. The hardware includes the 6780 Magnetic Ink Character Recognition (MICR) sorter, 621 Communications Multiplexer, and 6480 Laser Printer.

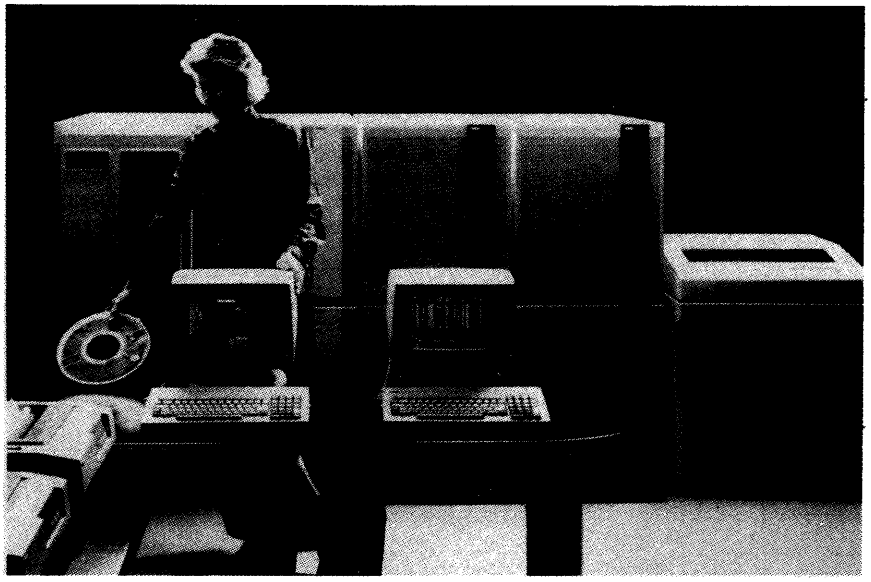
The 9800 Systems are a departure from the previous V-8000 System architecture. The 9800 uses a modular, incremental architecture based on multiple, loosely coupled, ➢

The NCR 9800 Systems are medium-scale computer systems for commercial data and transaction processing. The modular 9800 Systems consist of a series of function-specific processors. The incremental architecture is designed for on-line, high-volume transaction processing.

MODELS: 9811, 9821, 9822, 9832, 9842, 9863, 9884.
CONFIGURATION: The NCR 9800 Systems are available in several different configurations. Depending on the model, a system can contain from one to eight Application Processors and one to four Data Storage Processors. The Application Processors each have from 4 to 8 megabytes of memory; the Data Storage Processors each have 4 to 16 megabytes of memory. The new 9800XP processor has from 4 to 16 megabytes of memory.
COMPETITION: Digital Equipment VAX 8250; Honeywell Bull DPS 7000; IBM 4381 9370; Unisys A 1, A 4, A 6, and 2200/200 Series.
PRICE: Basic system prices range from $58,960 for the two-processor Model 9811 to $340,580 for the 12-processor Model 9884.

CHARACTERISTICS

MANUFACTURER: NCR Corporation, 1700 South Patterson Boulevard, Dayton, Ohio 45479. Telephone (513) 445-5000. In Canada: NCR Canada Limited, 117 Eglington Avenue East, Toronto, Ontario M4P 1J1. ➢



The NCR 9800 is an on-line transaction processing system, based on multiple function-specific processors. The 9842 model is a mid-range configuration consisting of four Application Processors and two Data Storage Processors. Each Application Processor can contain up to 8 megabytes of memory and each Data Storage Processor has a memory capacity of 16 megabytes.

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TABLE 1. SYSTEM COMPARISON

MODEL	9811	9821	9822	9832
SYSTEM CHARACTERISTICS				
Date announced	April 1986	April 1986	April 1986	April 1986
Date first delivered	First quarter 1987	First quarter 1987	First quarter 1987	First quarter 1987
Field upgradable to	9821	9822	9832	9842
Relative performance	1	2	2	3
Number of processors	1 AP, 1 DSP	2 APs, 1 DSP	2 APs, 2 DSPs	3 APs, 2 DSPs
Cycle time, nanoseconds	145	145	145	145
Word size, bits	32	32	32	32
Operating systems	VRX/E	VRX/E	VRX/E	VRX/E
MAIN MEMORY				
Type	64K MOS	64K MOS	64K MOS	64K MOS
Minimum capacity, bytes	4M	8M	8M	12M
Maximum capacity, bytes	8M	16M	16M	24M
Increment size, bytes	2 or 4M	2 or 4M	2 or 4M	2 or 4M
Cycle time, nanoseconds	120 AP, 145 DSP	120 AP, 145 DSP	120 AP, 145 DSP	120 AP, 145 DSP
BUFFER STORAGE				
Minimum capacity	4MB DSP	4MB DSP	4MB DSP	4MB DSP
Maximum capacity	16MB	16MB	16MB	16MB
Increment size	2 or 4MB	2 or 4MB	2 or 4MB	2 or 4MB
INPUT/OUTPUT CONTROL				
Number of channels:				
Byte multiplexer	Not applicable	Not applicable	Not applicable	Not applicable
Block multiplexer	Not applicable	Not applicable	Not applicable	Not applicable
Word	Not applicable	Not applicable	Not applicable	Not applicable
Other	11 to 18	18 to 32	22 to 36	29 to 50

function-specific processors. A system contains at least two processors (one AP and one DSP), a dual-channel Interprocessor Bus (IB), and related peripheral components—all located in the same cabinet.

The system can be expanded by adding new processors. Up to eight APs and up to four DSPs can be combined for the high-end 9884 model. The AP manages low-speed peripherals and executes application programs. When two or more APs are present in a system, they are loosely coupled, with each AP using its own copy of the operating system software and running independently of the other APs in the system. The DSP controls input/output, data, and file management. Up to four strings of four fixed disk drives can be attached; together with the I/O cache, they create a globally accessible repository of data called the system memory.

All APs and DSPs are interconnected over the dual-channel Interprocessor Bus with an individual channel transfer speed of 3 megabytes per second. Each Interprocessor Bus channel is implemented as a star, with two IBs and star couplers in all 9800 models. Traffic is normally shared by the two Interprocessor Buses, but in the event of the failure of one bus, all APs and DSPs can communicate over the remaining IB.

Multiple-processor architecture provides fault tolerance, assuring a high availability of all computerized functions for business operations. Since fault tolerance is achieved with all system components actively contributing to processing the work load, no part of the system waits unproductively to provide backup in the event of component failure. To further ensure high system availability, the "file mirroring" feature assures that operation of critical applications can continue despite disk or Data Storage Processor failures. The system automatically maintains exact copies of selected files.

MODELS: NCR 9811, 9821, 9832, 9842, 9863, 9884.

DATA FORMATS

BASIC UNIT: 32-bit word plus 7 error-correcting bits.

FIXED-POINT OPERANDS: Can range from 1 to 256 bytes long in either decimal or binary mode.

FLOATING-POINT OPERANDS: Consist of a 7-bit exponent and a 24-bit fraction in the single-precision format and a 7-bit exponent and 56-bit fraction in the double-precision format.

INSTRUCTIONS: 16 or 32 bits in length, specifying one or two memory addresses, respectively.

INTERNAL CODE: Extended Binary-Coded Decimal Interchange Code (EBCDIC).

MAIN MEMORY

Each Application Processor (AP) can contain from 4 to 8 megabytes of memory, and each Data Storage Processor (DSP) can contain from 4 to 16 megabytes of memory. Memory access time on a 32-bit boundary is 360 nanoseconds for the AP, 450 nanoseconds for the DSP, and 320 nanoseconds for the new XP processor.

STORAGE TYPE: See Table 1.

CAPACITY: See Table 1 for capacities of individual models.

CYCLE TIME: See Table 1.

CHECKING: The Address Translation Chip performs error checking and error correction.

RESERVED STORAGE: Information not supplied by vendor.

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TABLE 1. SYSTEM COMPARISON (Continued)

MODEL	9842	9863	9884	9800XP
SYSTEM CHARACTERISTICS				
Date announced	April 1986	April 1986	April 1986	October 1987
Date first delivered	First quarter 1987	First quarter 1988	First quarter 1988	First quarter 1988
Field upgradable to	9863	9884	Not applicable	Not applicable
Relative performance	4	6	8	2.7*
Number of processors	4 APs, 2 DSPs	6 APs, 3 DSPs	8 APs, 4 DSPs	1 XP
Cycle time, nanoseconds	145	145	145	56
Word size, bits	32	32	32	32
Operating systems	VRX/E	VRX/E	VRX/E	VRX/E
MAIN MEMORY				
Type	64K MOS	64K MOS	64K MOS	64K MOS
Minimum capacity, bytes	16M	24M	32M	4M
Maximum capacity, bytes	32M	48M	64M	16M
Increment size, bytes	2 or 4M	2 or 4M	2 or 4M	4M
Cycle time, nanoseconds	120 AP, 145 DSP	120 AP, 145 DSP	120 AP, 145 DSP	145 DSP
BUFFER STORAGE				
Minimum capacity	4MB DSP	4MB DSP	4MB DSP	4MB DSP
Maximum capacity	16MB DSP	16MB DSP	16MB DSP	16MB DSP
Increment size	2 or 4MB	2 or 4MB	2 or 4MB	4MB
INPUT/OUTPUT CONTROL				
Number of channels:				
Byte multiplexer	Not applicable	Not applicable	Not applicable	Not applicable
Block multiplexer	Not applicable	Not applicable	Not applicable	Not applicable
Word	Not applicable	Not applicable	Not applicable	Not applicable
Other	36 to 64	54 to 96	72 to 128	22 to 36

**Relative performance rating based on one AP rated 1.*

The 9800 Systems' multiple, distributed architecture is well suited for on-line transaction processing (OLTP) applications. Airlines, travel agencies, banks, credit bureaus, brokerage houses, retailers, and the military are the primary users of transaction processing systems. To be truly reliable, an OLTP system must have fault tolerance. The multiprocessing hardware of the 9800 Systems provides just such continuous on-line operation by detecting and automatically correcting any system fault, without interrupting operations.

COMPETITIVE POSITION

NCR Corporation is a well-established manufacturer of information systems. NCR's financial statement for 1987 listed a 25 percent increase in net income over 1986. NCR maintained a good cash flow position during 1987 and purchased nearly 11 million shares of company stock. However, the 9800 Systems were not part of the 1987 success story. Problems with the VRX/E operating system caused the general availability of the low-end systems to slip by several months. The two high-end six- and eight-processor models which were scheduled for delivery by the end of 1987 are still undergoing testing, and no new delivery data has been announced by the company.

The fault-tolerant OLTP market is a highly contested area, with almost all large vendors competing for a slice of the lucrative pie. The 9800 System will compete with the two dominant fault-tolerant vendors. Tandem's NonStop systems hold the largest share of the fault-tolerant market, with Stratus and its OEM partner, IBM, a distant second.

For more information on the Stratus and Tandem systems, please refer to Page M11-780-101, and Page M11-822-101, respectively, in Volume 2 of *Datapro Reports on Minicomputers.*

CENTRAL PROCESSORS

The 9800 System architecture consists of multiple, loosely coupled Application Processors and Data Storage Processors. They are interconnected in a network by a dual-channel Interprocessor Bus subsystem. The computer system size ranges from small, with one AP and one DSP, to large, with eight APs and four DSPs.

The AP is the main transaction processor for the 9800 System. The AP uses microcode for instruction execution; internal interrupt handling; and unit I/O operations from both the Interprocessor Bus and peripherals, including the system console. The AP supports all system I/O peripherals, other than the disks and magnetic tapes containing system memory.

The AP consists of the following components: the Processor Element (PE) Board, the System Bus Adapter/Star Coupler Board, the Writable Control Store Board, the Trace Board, the No-Match Assist Board, and the Memory Boards. The Processor Element (PE) Board contains a 32-bit processor-to-memory bus, maintenance registers, related logic circuits, and a 145-nanosecond VLSI chip set with five different chip types.

The Central Processor Chip (CPC) performs the microcode instructions supporting the operating system and all input/output (I/O) with a three-stage pipeline of access, interpret, and execute. The CPC includes the necessary register storage units, jump registers, and on-chip external register units. The NEAT Assist Chip (NAC) contains the 15 most commonly used NEAT index registers and instruction-related logic to perform 29 of the NEAT/VS object instructions. The Address Translation Chip (ATC) performs all of the virtual and real memory operations, including memory refreshing, error checking, and correction. The Extended Arithmetic Chip (EAC) performs most of the arithmetic calculations for the CPC, returning the results through the processor-to-memory bus. The System Interface Chip

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The 9800 Systems compete with the A 1, A 4, and A 6 Systems from Unisys in the banking and health care area, where both vendors have traditional strongholds. The 9800 Systems come with 4 to 32 megabytes of main memory and 11 to 72 channels and are rated at 1 to 8 million instructions per second (MIPS), depending on the number of processors in each configuration. The three Unisys A Systems each have 12 megabytes of memory and 8 to 24 Data Link Processors (DLPs) (Unisys uses DLPs in place of conventional channels) and are rated at 0.5 to 1.6 MIPS. Honeywell Bull is also well represented in the health care field. The DPS 7000 Models 10 through 50 have 4 to 8 megabytes of main memory, four to eight channels, and an approximate MIPS rating of 0.65 to 3.8. All these systems perform both OLTP and batch processing applications.

The Unisys 2200/200 Series is not a transaction processing system and only competes with the 9800 System in the general data processing area. The 2200/200 has 8 megabytes of main memory, from 7 to 14 channels, and a performance rating of 1.2 to 4.2 MIPS. The VAX 8250 system from Digital Equipment has 16 megabytes of main memory, two channels, and an estimated batch MIPS rating of 1.9; it is also a general-purpose data processing system.

IBM is present here, as it is in all market sectors, and the 9800 Systems have the IBM 4381 and 9370 as competitors. The main memory capacity of the IBM 4381 Model Groups 11 and 12 ranges from 4 to 8 megabytes; they have six channels and a performance rating of 1.5 to 2.8 MIPS. The 9370 Systems have from 4 to 18 megabytes of main memory and from 1 to 12 channels, with an approximate MIPS rating of 0.5 to 2.6. The IBM systems are designed to perform both OLTP and general data processing.

ADVANTAGES AND RESTRICTIONS

The 9800 Systems are compatible on the object level with the V-8500 and V-8600 Systems. The addition of the 9800XP processor will provide a more attractive migration path for V-8500 and V-8600 users, offering a better price/performance factor than these current systems. As with any of the other 9800 Systems, the VRX/E operating system for the XP is licensed at no charge. The SBA firmware, which is an additional cost for the V-8500, is included in the XP purchase price. The XP's annual maintenance charge also includes maintenance for the SBA; a separate maintenance fee is levied for the SBA on the V-8500.

The faster 9800XP processor, the increased main memory and I/O port capacity, plus fault tolerance, dynamic load balancing, and an IBM SQL/DS-compatible relational data base provide a definite incentive for users of the older V-8000 Systems to migrate to the 9800 Systems.

The addition of the faster 9800XP processor has alleviated the lack of processing power, which had been a problem for the 9800 Systems. However, release of the two

(SIC) provides the controller interface between the processor and all external I/O. The SIC is programmable to operate in either the Interprocessor Bus mode or the bit-serial mode.

The System Bus Adapter/Star Coupler Board is mounted on the PE Board. The System Bus Adapter (SBA) provides the circuits to transmit and receive the interprocessor communications. The Star Coupler circuitry receives, repowers, and retransmits these messages to all the processors on the bus. The Writable Control Store Board is also mounted on the PE Board; it contains 128K-bit RAM memory and stores the firmware microcode as an instruction storage unit. A 16K-bit PROM provides the initial power-on load boot and level 0 diagnostics firmware. The Trace Board is an optional feature to be mounted on the PE Board; it provides firmware control register tracing for unit servicing. The No-Match Assist Board operates in conjunction with the ATC to service the dynamic address translation, 16-entry associative memory register.

The new 9800XP is a dyadic, microprogrammed, register-to-register processor with an integrated SBA adapter. The XP processor is approximately 2.7 times as powerful as the standard 9800 AP. Through the SBA connection and the VRX/E operating system, the XP processor functions similar to a 9800 AP. The XP processor can be used as a large AP in 9800 System configurations to simplify large configurations.

The DSP hardware construction is similar to that of the AP and contains the same components. Exceptions are the addition of a time-of-day (TOD) clock circuit with battery backup (in place of the Star Coupler circuit on the SBA) and the absence of the No-Match Assist Board and the EAC chip. The DSP also contains an LLCS Control Module Board with two Console Line Modules and four terminal lines operating as a Console Interface Board to accommodate the system console and printer.

The DSP is the data file controller processor for system memory. It can support one to four bit-serial disk controllers with up to four fixed disk drives each for program library and data file storage. The data storage processor firmware runs object instructions, maintains the various task tables, provides call/return routines, services internal and external I/O interrupts including those of the Interprocessor Bus, and provides a unit interval timer facility and system time-of-day (TOD) clock. Under software control, the DSP maintains file queues and locks, as well as 1- or 3-megabyte cache memory for temporary file storage in local memory. The Data Storage Processor performs all memory addressing in realtime, with the majority of the operating system residing in that portion of local memory not dedicated to the cache. Overlays are called from disk virtual memory to provide software for exception conditions.

The Interprocessor Bus (IB) subsystem provides intelligent intersystem communications between processors through a dual-channel serial connection with broadcast capabilities. Each channel of the Interprocessor Bus subsystem, channel A and channel B, operates independently of the other. Both carry high-speed, bit-serial data between the various units of the system, operating in the full-duplex mode. The Interprocessor Bus subsystem is composed of two full-duplex, twisted-pair cables to each processor; one or two electrical Star Coupler Boards, each housed in separate Application Processors; and a system bus adapter board with I/O controller microcode and object code. A 6-megabyte bandwidth is achieved for the dual-channel bus through an individual channel transfer rate of 3 megabytes per second, transmitting at 24 megahertz.

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TABLE 2. MASS STORAGE

MODEL	6099-5113	6099-5213	6099-5413
Cabinets per subsystem	1	1	1
Disk packs/HDAs per cabinet	1	2	4
Capacity	415.2MB	830.4MB	1.6GB
Tracks/segments per drive unit	Not specified	Not specified	Not specified
Average seek time, msec.	20	20	20
Average access time, msec.	28.3	28.3	28.3
Average rotational delay, msec.	8.3	8.3	8.3
Data transfer rate	1.8MB	1.8MB	1.8MB
Controller model	Included	Included	Included
Comments	Can be stacked 2 high	Can be stacked 2 high	Can be stacked 2 high

high-end systems has been delayed, because of the operating system's problem in handling interprocessor communications in multiple-processor configurations. The shipment delays may have cost NCR some user confidence, not to mention prospective new customers.

USER REACTION

The first customer shipments of the 9800 Systems did not take place until the end of the first quarter of 1987. Therefore, Datapro could not contact users that had a system up and running. Prospective buyers of the 9800 Systems can consult "U.S. User Ratings of Mainframes" on Page 70C-000EB-101 for user experiences with the V-8500, V-8600, and V-8800 Systems. □

SPECIAL FEATURES: **The 9800 System departs from past NCR mainframe designs by using a modular, multiple-processor-based, incremental architecture, which offers system expansion by simply adding extra processors; up to eight APs and four DSPs can be configured. The combination of multiple APs and DSPs, the dual-channel Interprocessor Bus network, and the VRX/E operating system provides a system tolerant of single-point failures. Operational problems with either a channel of the bus or one of the processors in the network will not cause a system failure; production will continue in a degraded mode using the remaining resources.**

PHYSICAL SPECIFICATIONS: **The 9800 System's single cabinet containing two processors measures 29.3 inches in height, 22.0 inches in width, and 34.5 inches in depth; the weight is 200 pounds. The processor power supplies require a voltage of 120 to 125 V AC or 220 to 240 V AC at 50 to 60 hertz. A power loss of 100 milliseconds can be sustained. A computer room temperature range of 59 to 90 degrees Fahrenheit with a relative humidity of 30 to 60 percent is acceptable.**

CONFIGURATION RULES

The basic 9811 System consists of one AP with up to 8 megabytes of memory, one DSP with up to 16 megabytes of memory, up to 15 megabytes of cache, one console display terminal with keyboard, one console table, five cables, and two cabinets to accommodate future expansion. The 9811 System can be field upgraded to a 9821 System. System upgrades are accomplished with the addition of extra processors.

The high-end 9884 System consists of eight APs with up to 64 megabytes of memory, four DSPs each with up to 16 megabytes of memory, up to 15 megabytes of cache for each DSP, two console display terminals with keyboards, two console tables, 26 cables, and eight cabinets.

The 9800XP configuration includes one XP processor with integrated SBA, up to 16 megabytes of memory, two 9800 DSPs, a dual Interprocessor Bus, two console display terminals, one cabinet, and four cables.

The XP processor can also be connected to a 9832 or smaller system, using the integrated SBA for direct attachment to the 9800 dual Interprocessor Bus. A second DSP has to be added to the 9811 and 9821 Systems to handle the I/O activity expected with the addition of the XP. Presently, the XP can only be connected to these four low-end systems.

Peripheral and communications devices are not included in the 9800 Systems package, but have to be added before the system becomes operational. A minimum of one printer, one GCR tape drive, and one 415-megabyte disk drive are required.

INPUT/OUTPUT CONTROL

The input/output functions are handled by the Processor Element Board, a component of both the AP and the DSP. Three System Interface Chips (SICs) are mounted on the PE Board; one SIC is dedicated to high-speed, input/output multiplexing up to eight bit-serial links operating at up to 16 megabits per second. The second SIC multiplexes up to six low-speed I/O links operating at 1 megabits per second. The third SIC multiplexes the two Interprocessor Bus channels operating at 24 megabits per second. Bit-serial peripheral devices directly attached to each AP include disks, printers, magnetic tapes, integrated communications (LLCS), and communications front-end processors. Peripheral sharing between APs and DSPs is accomplished through the use of 6280 Electronic Switch units. The DSP can support one to four bit-serial disk controllers with up to four fixed disk drives each. Also supported are the magnetic tape drives used during system installation.

MASS STORAGE

For disk storage devices qualified on the 9800 Systems, see Table 2.

INPUT/OUTPUT UNITS

Tape drives and printers are covered in Table 3.

TERMINALS

For terminals supported on the 9800 Systems, refer to Table 4.

COMMUNICATIONS

The *Link Level Communications Subsystem (LLCS)* is the integrated communications controller for the 9800 Systems. A single link-level communications subsystem can

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TABLE 3. INPUT/OUTPUT UNITS

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed, Inches/Sec.	Transfer Rate, Bytes/Sec.
6373	9	1600	PE	75	40K to 120K
6373	9	6250	GCR	25, 75	156K to 469K
6376	9	1600	PE	200	320K
6376	9	6250	GCR	200	1.25M

Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
6411	120 cps	80	10	6 or 8	8½ x 11
6471	2,000 lpm	132	10	6 or 8	Industry std.
6455	33 cps	—	10	6 or 8	8½ x 11
6430	720 lpm	132	10	6 or 8	Industry std.
6470	1,000 lpm	132	10	6 or 8	Industry std.

support up to 18 lines of NCR ISO Async, Bisync, or Data Link Control (DLC) lines, or up to 36 lines for teletype (TTY)-compatible terminals. These lines are interfaced to a single, low-speed, bit-serial, 1-megabit serial line from the processor. The LLCS connects to an AP (up to six LLCSs per AP) through a low-speed link and handles an aggregate transmission rate of 120K bytes for all its lines. The XP cannot attach to an LLCS directly; connections can be made indirectly through an adjacent 9800 AP, a direct-attached 621 Communications Multiplexer, or a 721 Communications Processor.

The LLCS is housed in a communications module and consists of up to two subsystem control modules, 18 individual line interface boards, and its own power supply and cooling fan. The LLCS also includes five line module types and two features, including the console line module, the Base Mode Communications (BMC) line module, the DLC common carrier secondary line module, the teletype (TTY) line module, the X.25 line module, the backup interface feature, and the line status display feature.

The *621 Communications Multiplexer* is an on-line, low-speed multiplexer accommodating up to 15 lines. The 621 Multiplexer can be migrated from the older V-8000 Systems and works only with the XP processor.

The *5620 Communications Processor* is designed for local or remote network configurations requiring up to 32 duplex communications lines.

The *721 Communications Processor* serves as a front-end processor, as a remote communications concentrator, as a message switching system, or as a unit performing combinations of these functions, for up to 62 full-duplex or 95 half-duplex lines.

The *3650 Communications Processor* is designed for network configurations, at local or remote locations, requiring up to 128 duplex communications lines.

The *3690 Communications Processor* is a large-scale processor for complex and demanding networks. It can support up to 512 duplex communications lines for up to eight channel-attached processors in a local or remote configuration.

SOFTWARE

OPERATING SYSTEM: The *Virtual Resource Executive/ Extended (VRX/E)* operating system supports object code compatibility from the V-8500, V-8600, and V-8800 Systems. It maintains the same process and management disciplines as in the VRX. The VRX/E supports interactive and batch processing in a multiprocessing, multiprogramming environment. The VRX/E software automatically allocates virtual and actual memory depending on the requirements of each job. Errors are detected and automatic recovery is at the job level and at the system level. Other levels of error recovery designed for specific applications include the use of Criterion Access Method (CAM) routines and own-code intervention to recover NEATVS jobs and save telecommunications tables.

During system operations, the VRX/E operating system performs a number of tasks either automatically or in response to user direction. The VRX/E *File Catalog* serves as a central directory for all cataloged disk files in the system in either the interactive or batch mode. *File Interleaving* allows selected files to be split across multiple DSPs by the system, making more cache memory available to a given file and reducing I/O time. *File Sharing* permits most files to be accessed by more than one job at the same time. With the *Mirror File* feature, users can elect to duplicate certain critical files, and the software will keep a copy of the file physically separate from the original file to prevent the DSP or controller from denying access to the file in case of drive failure. *Job Scheduling* is accomplished automatically by the software, depending on the job's assigned priority and the peripheral and memory available.

Record Management System (RMS) is a component of the VRX/E operating system and executes in each AP. RMS is a file access method optimized for transaction processing applications, providing features such as commit and roll-back, index recovery, full file sharing at the record level between APs, and support for standard Cobol 74 I/O techniques. All RMS files must be represented in the centralized file catalog to be accessed from any AP. Jobs and application programs need not be concerned with the physical location of RMS files.

Virtual Volumes can be stored on disk units attached to DSPs. Virtual Volumes simulate real disk units and are used in the same manner, with each Virtual Volume representing a disk pack. However, the files stored in the volumes are not necessarily stored on the same physical disk. The amount of Virtual Volumes is limited to the total physical disk space available. Security measures are available to control the creation and deletion of Virtual Volumes as well as the recovery of the Virtual Volumes list entries.

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TABLE 4. TERMINALS

MODEL	4940	4902	4920
DISPLAY PARAMETERS			
Max. chars./screen	2,000, 3,300	2,000	2,000, 3,300
Screen size (lines x chars.)	25 x 80/132	25 x 80	25 x 80/132
Symbol formation	7 x 12 dot matrix	5 x 7 dot matrix	7 x 12 dot matrix
Character phosphor	Amber, green, white	Color	Amber, green, white
Total colors/no. simult. displayed	Not applicable	8	Not applicable
KEYBOARD PARAMETERS			
Style	Typewriter, numeric pad	Typewriter, numeric pad	Typewriter, numeric pad
Character/code set	128 ASCII	96 ASCII	128 ASCII
Detachable	Standard	Standard	Standard
Program function keys	16-32	8-16	12-24
OTHER FEATURES			
Buffer capacity	Not available	Not available	Not available
Tilt/swivel	Standard	Tilt	Standard
Graphics capability	Not available	11 Symbols	12 Symbols
TERMINAL INTERFACE	RS-232-C	RS-232-C	RS-232-C

The *Inter-Host Management Facility (IHMF)* is a group of software modules controlling all the interhost activities of a loosely coupled multiprocessor system. The two major capabilities provided by IHMF are *Shared System Storage*, permitting files stored on disk units connected to a DSP to be shared among the APs of the system, and *Instant Ready Operations*, which allows for duplicate application programs to be written to configure a mutual backup system. If either the active application or the Application Processor in which it is running fails, the duplicate *Instant Ready* application can automatically assume the processing responsibilities.

PROGRAMMING LANGUAGES: The high-level languages for the development of application programs supported by the 9800 System are VRX/E Cobol, NEATVS, C, and IVS Basic.

DATA BASE MANAGEMENT: The *NCR-Total* data base management system is a licensed software product running under the VRX/E operating system and is available in two versions. *Total Basic* is single threaded, with a copy of Total bound to each active task. *Total Central* is multithreaded and is located in its own job region. The structured *Data Base Definition Language* provides for the initial generation of a Total data base descriptor module and all subsequent modifications. The *Data Management Language* interfaces to the operating system and the application program for all communications with the Total data base. *File Sharing* under Total Basic uses file locks when an update to a data set is to occur. Total Central uses a combination of file sharing options and a record-locking facility to protect files to be updated. The Total *Logging Facilities* consist of Before-Image Logging, After-Image Logging (Total Central only), and a User-Written Logging Routine with two optional log commands, Mark-Log and Log-Quiet. The Total Basic Recovery System is parameter driven and identifies the data base and the data sets to be recovered. The Total Central Recovery System serves as a log file utility program and performs three different support functions: Log File Clear, Log File Report, and Log File Print. Before-Image Processing and After-Image Processing functions are also supported.

DATA MANAGEMENT: The *NCR-DMS* data management system for the VRX environment includes several software tools that provide resource control, system documentation, application development aids, and end-user information access.

The *DMS/Directory* is an integrated dictionary/directory that simplifies documentation and control of data bases, files, records, data elements, software, hardware, and networks. *DMS/Logical View* is a relational interface to data base files providing both a high-level view of data and independence of data files and data bases. The on-line inquiry and reporting tool *DMS/Query* is directory driven and provides an information retrieval system for the user. The *DMS/Reporter* is an off-line report writer for batch generation of large reports with extensive data manipulation and sorting. *DMS/Data Entry* is an on-line, source-data entry system for batch processing, allowing batches of data to be entered at the originating point of the transaction. *DMS/Tran-Pro III* is a transaction processing monitor for the on-line, realtime business processing environment designed for users with large high-volume network and data base requirements. Each of the NCR-DMS software tools is available separately and provides specific data management services.

DATA COMMUNICATIONS: The *System Telecommunications Access Method (STAM)* software includes a group of products for the design of flexible telecommunications networks. The *Local Environment Definition Processor (LEDP)* processes input statements defining queues, tasks, and end points in the communications network for an application program and produces a tables module.

The *Communications Access Interface Software (CAIS)* provides for the transfer of messages between the application program and the Link Communications Management (LCM) job. The *Network Definition Processor (NETDEF)* processes input statements defining links and terminals and produces a tables module. This module is then combined with the Link Communications Management software to create the LCM job. The *Link Communications Management* software (job) manages the use and status of the communications network for the system and also provides network monitoring and control functions for the system operator. The *Terminal Management System (TMS)* software runs as part of the LCM job and permits specified terminals within the network to dynamically access different jobs. The *Communications Backup Facility (CBF)* software provides for continuing link operation in case of an Application Processor, Link Communications Management job, or Control Module failure.

The *Basic Telecommunications Software* can be used instead of the STAM software. However, the basic software does not provide for access by any application to terminals connected to any Application Processor, or terminal switching between applications, nor does it provide the Communications Backup Facility. The *Network Description Language (NDL)* defines a communications network

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and the queue arrangement to be used by an on-line program. The NDL also defines the queue arrangement to be used with a multiple-task on-line program or with a multiple-task batch program. The *Network Description Language Processor (NDLP)* reads NDL statements, processes them, and creates an object module that contains a table defining the communications network. The *Message Control System (MCS)* is a software interface that permits a NEATVS or Cobol program to communicate with remote terminals. The *Low Level Interface (LLI)* is a group of software routines that permits a NEATVS program to communicate with remote terminals.

The *Telecommunications Access Method (TAM)* is a software interface that permits a Cobol or NEATVS application program to communicate within a network that includes an NCR Comten communications processor attached directly to an Application Processor.

The *Terminal Driver Software* includes a number of software modules that are stored in memory. Because of its modular design, additional capabilities can be added when new devices become available. Among the different terminal drivers available for the 9800 Systems are the *Teletype Telecommunications Driver (TTY TCD)* with the remote printer feature; the *Binary Synchronous Telecommunications Driver (BSC TCD)* operating with private and switched links; the *Polled CRT Telecommunications Driver (CRT TCD)* operating only with private four-wire links; the *Financial Terminals Telecommunications Driver*; the *Standard Message Format Telecommunications Driver (SMF TCD)*; and the *3270* and *NCR 721 Telecommunications Drivers.*

PROGRAM DEVELOPMENT: The *Mantis* application development system is a licensed software product that runs under the VRX/E operating system and can be implemented with DMS Tran-Pro. Mantis is available through a marketing agreement with Cincom Systems, Inc. For a description of Mantis, refer to Page SW15-153MY-101 in Volume 3 of this service.

The *Software Development Environment (SDE)* provides a set of development tools, including a uniform command language; an on-line Help facility; and an integrated, interactive self-instruction course. Using the interactive SDE command language, application software developers can perform tasks that previously required the coding of single-use, throwaway programs and job control and can also track and control changes in programs and data sets through simple, on-line documentation utilities. Developers can generate test programs and data automating the quality assurance process and integrating it into the development cycle.

UTILITIES: The following utility routines are offered for the 9800 Systems: data-related copy, print, and sort; interactive file-related copy, print, compare, backup, and delete; magnetic media initializers, system maintenance, and program debug; and CAM file handling, time-ordered index CAM file handling, and program development.

OTHER SOFTWARE: *Multi-Tran (MT)* is a transaction processing monitor for the 9800 System architecture. MT supports transaction distribution and load leveling and also offers walk-through screen menus, security and validation checking, debugging tools, and utilities. Multi-Tran consists of a Terminal Manager Job (TMJ) and an Applications Manager Job (AMJ). The AMJ is a multithreaded monitor serving multiple terminals. Multi-Tran provides an interface and support for the DBSR/SQL data base management system as well as direct access to the Record Management System. The DBSR/SQL relational query/update access system provides an SQL/DS IBM-compatible interface. The DBSR kernel, which contains the relational table management, can be linked with a Multi-Tran AMJ or to any user application.

PRICING AND SUPPORT

POLICY: NCR offers the 9800 Systems for purchase only. The basic maintenance charge covers maintenance of the equipment between 8 a.m. and 5 p.m., Monday through Friday. Charges for maintenance coverage beyond this period are calculated by adding a percentage premium to the basic maintenance rates.

SUPPORT: Remote hardware support includes any local on-site hardware support that is necessary. A software maintenance contract is mandatory for VRX/E system software products when a customer contracts for remote hardware support. The 9800XP configuration cannot be supported through the current hardware remote support program. A 9800 AP with LLCS is required for 9800 remote support. NCR's software maintenance plan has a toll-free number to call for assistance. If the problem cannot be resolved over the phone, on-site fault isolation activity and software updates are supplied at the current hourly rate.

EDUCATION: All educational services are separately priced.

TYPICAL CONFIGURATION: The following configurations illustrate a typical low-end and a typical high-end 9800 System. The quoted prices include all necessary hardware components, but no software.

9811 System:

One Application Processor with 4M-byte memory, one Data Storage Processor with 4M-byte memory, one system console, and two cabinets	$58,960
2 6543 415M-byte fixed disk drives and controller	44,260
1 6373 tape drive and controller 180M-byte GCR	25,990
1 LLCS communications module with 8 TTY lines	8,475
1 6280 serial switch	4,740
1 6471 2,000-lpm printer	39,500
10 4920 workstations	9,950
TOTAL PURCHASE PRICE:	$191,875

9884 System:

Eight Application Processors with 32M bytes of memory, four Data Storage Processors with 16M bytes of memory, two system consoles, and eight cabinets	$ 340,580
8 6543 415M-byte fixed disk drives and four controllers	177,040
8 6376 tape drives and controller 180M-byte GCR	211,840
4 LLCS communications modules with 24 TTY lines each	65,400
2 6280 serial switches	9,480
4 6471 2,000-lpm line printers	158,000
96 4920 workstations	95,520
TOTAL PURCHASE PRICE:	$1,057,860

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EQUIPMENT PRICES

		Purchase Price ($)	Annual Maint. ($)	One-Year Rental* ($)
PROCESSOR AND MAIN MEMORY				
9811-0000-0404	System includes 1 Application Processor with 4MB memory, 1 Data Storage Processor with 4MB memory, 1 system console CRT with table, 2 cabinets, and 5 cables	58,960	3,541	NA
9821-0000-0404	System includes 2 Application Processors with 4MB memory each, 1 Data Storage Processor with 4MB memory, 1 system console CRT with table, 2 cabinets, and 7 cables	86,490	5,741	NA
9822-0000-0404	System includes 2 Application Processors with 4MB memory each, 2 Data Storage Processors with 4MB memory each, 2 system console CRTs, 10 cables, and 3 cabinets	116,740	6,282	NA
9832-0000-0404	System includes 3 Application Processors with 4MB memory each, 2 Data Storage Processors with 4MB memory each, 2 system console CRTs, 12 cables, and 4 cabinets	145,610	8,482	NA
9842-0000-0404	System includes 4 Application Processors with 4MB memory each, 2 Data Storage Processors with 4MB memory each, 2 system console CRTs, 14 cables, and 4 cabinets	173,160	10,682	NA
9863-0000-0404	System includes 6 Application Processors with 4MB memory each, 3 Data Storage Processors with 4MB memory each, 2 system console CRTs, 20 cables, and 6 cabinets	256,870	15,432	NA
9884-0000-0404	System includes 8 Application Processors with 4MB memory each, 4 Data Storage Processors with 4MB memory each, 2 system console CRTs, 26 cables, and 8 cabinets	340,580	20,182	NA
9800-GXP0-0000	System includes 1 XP Processor with 4MB memory, 1 System Bus Adapter, XP Firmware, 2 system console CRTs, and 4 cables	132,500	11,100	NA
SYSTEM AND MEMORY UPGRADES				
9811-9821-AP04	System Upgrade; 9811 to 9822, 1 additional Application Processor with 4MB memory, and 2 cables	27,530	2,200	NA
9821-9822-DS04	System Upgrade; 9821 to 9822, 1 additional Data Storage Processor with 4MB memory, 1 cabinet, 1 console CRT, and 3 cables	30,250	541	NA
9822-9832-0404	System Upgrade; 9822 to 9832, 1 additional Application Processor with 4MB memory, 1 cabinet, and 2 cables	28,870	2,200	NA
9832-9842-0404	System Upgrade; 9832 to 9842, 1 additional Application Processor with 4MB memory, and 2 cables	27,550	2,200	NA
9842-9863-0404	System Upgrade: 9842 to 9863, 2 additional Application Processors with 4MB memory, 1 additional Data Storage Processor with 4MB memory, 2 cabinets, and 6 cables	83,710	4,750	NA
9863-9884-0404	System Upgrade; 9863 to 9884, 2 additional Application Processors with 4MB memory, 1 additional Data Storage Processor with 4MB memory, 2 cabinets, and 6 cables	83,710	4,750	NA
9800-AP02-0004	Memory Upgrade; 2MB to 4MB for the Application Processor	8,425	400	NA
9800-AP04-0008	Memory Upgrade; 4MB to 8MB for the Application Processor	11,800	800	NA
9800-AP06-0008	Memory Upgrade; 6MB to 8MB for the Application Processor	8,425	400	NA
9800-DS02-0004	Memory Upgrade; 2MB to 4MB for the Data Storage Processor	8,425	400	NA
9800-DS04-0006	Memory Upgrade; 4MB to 6MB for the Data Storage Processor	8,425	400	NA
9800-DS04-0008	Memory Upgrade; 4MB to 8MB for the Data Storage Processor	11,800	800	NA
9800-DS06-0008	Memory Upgrade; 6MB to 8MB for the Data Storage Processor	8,425	400	NA
9800-DS08-0010	Memory Upgrade; 8MB to 10MB for the Data Storage Processor	8,425	400	NA
9800-DS08-0012	Memory Upgrade; 8MB to 12MB for the Data Storage Processor	11,800	800	NA
9800-DS10-0012	Memory Upgrade;10MB to 12MB for the Data Storage Processor	8,425	400	NA
9800-DS12-0014	Memory Upgrade; 12MB to 14MB for the Data Storage Processor	8,425	400	NA
9800-DS12-0016	Memory Upgrade; 12MB to 16MB for the Data Storage Processor	11,800	800	NA
9800-DS14-0016	Memory Upgrade; 14MB to 16MB for the Data Storage Processor	8,425	400	NA
5640-P801-0000	Memory Upgrade; 4MB to 8MB for the XP Processor	30,000	4,566	NA
5640-P802-0000	Memory Upgrade; 8MB to 12MB for the XP Processor, requires left-hand plenum	30,000	4,566	NA
5640-P803-0000	Memory Upgrade; 12MB to 16MB for the XP Processor	30,000	4,566	NA
5640-P980-0000	Left Hand Plenum; required to install 8 to 12MB memory upgrade	5,200	NC	NA
SYSTEM OPTIONS				
1003-A101-0000	System Cabinet; may contain any two of the following: Application Processor, Data Storage Processor, LLCS Communications Module, 6280-0403 Switch Module	1,310	NC	NA
98X1-0000-0000	4920 Visual Display Terminal Console with cable	1,160	191	NA
98X2-0000-0000	6411-8521 Printer Console; 80 columns, 180 cps, with cable	1,060	89	NA
98X3-0000-0000	Console Table	1,660	NC	NA
9800-P001-0000	Four additional high-speed BSL Links for the Application Processor	1,050	150	NA
9800-P002-0000	Three additional low-speed BSL Links for the Application Processor	525	100	NA
0658-P003-0000	DSP Kit; 2 additional DSP links for disk controllers	1,050	150	NA

**Includes maintenance.*
NA—Not available.
NC—No charge.

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		Purchase Price ($)	Annual Maint. ($)	One-Year Rental* ($)
0658-P005-0001	Disk Latch Down Kit; required when utilizing 658 disk drive on DSP	42	NC	NA
9800-MBBU-0000	Battery Backup Kit; provides memory backup for DSPs, 2.9 hours for 4MB	2,100	200	NA
3460-K980-0000	Interface Kit; 9800 to Tower, requires VRX/E and Union Tower software	7,000	895	NA
5600-0558-0000	Channel Control Processor; includes a Dynamic Channel Director interface; I/O Linc Controller and common trunks will not interface to the Dynamic Channel Director, only to the Channel Control Processor	9,000	700	NA
5600-P785-0000	Loosely Coupled MP Kit; required for Dynamic Channel Director attachment	555	NC	NA
5640-P740-0000	Common Trunk; low speed, trunks, I/O Link Adapters, Channel Control Processors, Channel I/O Links, and System Bus Adapters combined cannot exceed eight	3,562	184	NA
5640-P741-0000	Common Trunk; medium speed, requires a low-speed trunk also be on the system	5,380	267	NA
5640-P743-0000	I/O Link Control Kit	7,710	282	NA
MASS STORAGE				
6099-5113-7190	Disk Subsystem; includes 1 (6543) 415.2MB fixed disk unit, 1 SIA-SCSI buffered controller, 1 cabinet, and 1 BSL cable; 3 additional 6543 disk units can be added	29,035	1,296	1,390
6099-5213-7170	Disk Subsystem; includes 2 (6543) 415.2MB fixed disk units, 1 SIA-SCSI buffered controller, 1 cabinet, and 1 BSL cable; 2 additional 6543 disk units can be added	44,260	1,788	2,105
6099-5413-7190	Disk Subsystem; includes 4 (6543) 415.2MB fixed disk units, 1 SIA-SCSI buffered controller, 1 cabinet, and 1 BSL cable	80,095	3,276	3,810
6543-7404-6690	Add-On Fixed Disk Unit; 415.2MB, cables and mounting hardware included	19,000	660	865
6999-0003-0000	Stacking Kit; allows the stacking of 2 disk subsystems, hardware included	350	NC	NA
6280-0403-6090	ELCS Switch Module; includes 4 2x2 link of channel switches	4,740	126	206
1003-A101-0000	Accessory Cabinet; supports a maximum of 2 switching modules	1,310	NC	55
MAGNETIC TAPE UNITS				
6376-0201-6590	Magnetic Tape Subsystem; 200 ips, PE/GCR, includes 1 controller	49,510	5,050	2,505
6376-0202-6590	Magnetic Tape Unit; 200 ips, PE/GCR, includes connection cable to controller	23,190	2,950	1,230
6373-0101-0000	Magnetic Streaming Tape Subsystem; 75 ips, primary unit	25,990	2,988	1,350
6373-0102-0000	Magnetic Streaming Tape Unit; 75 ips, includes connecting cable to controller, secondary unit, only 1 secondary drive is supported	17,745	2,280	945
1401-C161-0610	Cable to connect the 6373 and 6376 Magnetic Tape Subsystems to the Application or the Data Storage Processors	330	NC	NA
1401-C128-0610	Cable to connect the 6373 and 6376 Magnetic Tape Subsystems to the 6280 Switch	180	NC	NA
PRINTERS				
64730-0102-7298	Band Printer Subsystem; 1,500 lpm, includes 6409 printer adapter, power stacker, 64-character band, and cables	35,550	3,000	1,736
6471-0201-0000	Band Printer Subsystem; 2,000 lpm, includes power stacker, DPI adapter, line counter, 64-character print band, and cables	39,500	4,800	2,482
6471-K901-0000	Print Band; 96 characters	500	NA	NA
6450-0101	Printer; matrix, 400 lpm	7,200	804	NA
6450-0201	Printer; matrix, 800 lpm	9,100	852	NA
6436-0101	Laser Printer; 15 ppm	6,560	1,068	NA
COMMUNICATIONS				
9800-0600-1000	Link Level Communications System (LLCS) Communications Module; contains 1 control module and 1 processor attachment cable	5,115	220	NA
9800-0600-1008	LLCS Communications Module; contains 1 control module, 4 dual TTY line modules, and 1 processor attachment cable	8,475	340	NA
9800-0600-1016	LLCS Communications Module; contains 1 control module, 8 dual TTY line modules, and 1 processor attachment cable	11,870	460	NA
9800-0600-1024	LLCS Communications Module; contains 1 control module, 12 dual TTY line modules, and 1 processor attachment cable	16,350	580	NA
9800-0600-1032	LLCS Communications Module; contains 1 control module, 16 dual TTY line modules, and 1 processor attachment cable	19,605	700	NA
9800-P611	LLCS Communications X.25 Line Module; supports 1 line connected to a Telenet X.25 Network	1,375	148	NA
TERMINALS				
4902	Video Display Terminal; color, half/full duplex, asynchronous	1,595	120	NA
4920	Video Display Terminal; color, half/full duplex, asynchronous	995	103	NA
4940	Video Display Terminal; color, half/full duplex, asynchronous	595	96	NA

**Includes maintenance.*
NA—Not available.
NC—No charge.

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SOFTWARE PRICES

		Onetime License Fee ($)	Monthly License Fee ($)	Monthly Software Maint. ($)
VRX/E BASIC SYSTEM SOFTWARE				
D011-0013-0001	VRX/E Operating System; 9811 and 9821, requires 1 magnetic tape unit attached to the Data Storage Processor	NC	NC	83
D011-0013-0002	VRX/E Operating System; 9822, 9832, 9842, requires 1 magnetic tape unit attached to the Data Storage Processor	NC	NC	165
D011-0013-0003	VRX/E Operating System; 9863 and 9884, requires 1 magnetic tape unit attached to the Data Storage Processor	NC	NC	248
D011-0013-0008	VRX/E Operating System; 9800XP Processor	NC	NC	213
D011-0014-0000	VRX/E STAM; System Telecommunications Access Method	NC	NC	28
D011-0015-0000	VRX/E TRAN-PRO; Transaction Processing	NC	NC	110
D011-0016-0000	VRX/E Multi-Tran	NC	NC	146
D011-0017-0000	VRX/E System Performance Monitor	NC	NC	28
D011-0018-0000	VRX/E Interactive Virtual System (IVS) Basic	3,900	130	55
D011-0019-0000	VRX/E Cobol Compiler; includes VRX/E C Runtime System	5,000	167	72
D011-021-0000	VRX/E C Compiler	5,000	167	72
D011-025-0000	VRX/E C Runtime System	1,000	34	7
D205-0117-0000	V/OLTDS-T/P Interface Module	5,000	NA	24
D900-0469-0000	Tower Union Software; requires 9800/Tower interface and 0470 Tower Union software	NC	NC	NC
D900-0470-0000	Tower Union Software; requires 9800/Tower interface and 0469 Tower Union software	6,000	200	38
D900-0527-0000	System Bus Adapter, VRX/E operating system, requires SBA hardware kit	17,000	567	213
G1A6-0001-0000	VRX/E Data Management (DMS) Tools Package	10,000	334	125
G1A6-0002-0000	Relational Data Base System (DBSR)	25,000	835	250
G1A6-0003-0000	VRX/E Fourth Generation Language Total	20,000	995	250
G1A6-0006-0000	VRX/E Remote Job Entry (RJE)	2,500	84	13
G1A6-0007-0000	VRX/E Remote Batch Subsystems for Networks (RBS/NET)	2,200	74	11
D011-0007-0000	VRX/E Binary Synchronous 3270 Telecommunications Driver (BSC TCD)	1,200	40	8
D011-008-0000	VRX/E Telecommunications Access Method (TAM)	755	25	7
G100-0040-0000	VRX/E Data Management System/Data Entry (TP)	2,000	67	12
D011-0010-0000	VRX/E X.25 Data Terminal Equipment (DTE) Base	5,500	184	25
D011-0011-0000	VRX/E X.25 Data Terminal Equipment (DTE) RTS	1,000	34	5

NC—Not applicable.
NC—No charge. ■