Unisys B 7900

MANAGEMENT SUMMARY

UPDATE: *The Unisys B 7900 (formerly the Burroughs B 7900) is a mature product line. The vendor has made no enhancements to the systems hardware or software since our last update. To encourage users to buy the systems outright instead of leasing them, Unisys has sharply reduced the purchase prices for the B 7900 systems, as much as $2,660,000 for the high-end Model M. Lease and maintenance charges have been increased, and software prices have been revised. The extensive changes are reflected in the updated price list which follows this report.*

The Unisys B 7900 Series of large-scale computers comprises six models. The entry-level, single-processor B 7900 E with 6 megabytes of main memory; the Model F with one central processor and 12 megabytes of memory; the B 7900 DE, a dual processor version of the B 7900 E featuring 18 megabytes of main memory; the dual-processor Model H with 24 megabytes of memory; the Model K with three central processors and a 36-megabyte main memory; and the high-end Model M with four central processors and 48 megabytes of memory.

The B 7900 is based on a distributed system architecture which uses specialized functional processing units including a Central Processing Module for instruction execution, a Host Data Unit for high-speed data transfer, and an Auxiliary Processor which off-loads some of the functions of the central processor. The B 7900 Central Processing Module consists of a Program Control Unit which acts as the stack machine, a Data Reference Unit which calculates data addresses, an Execution Unit that performs all arithmetic and logic functions, a Store Queue where data is temporarily stored, a Memory Access Unit which provides ➢

The B 7900 is a large-scale general purpose computer system featuring distributed system architecture. Multiple specialized functional processing units, each with a different capacity and orientation, provide the right balance for varying workloads.

MODELS: B 7900 Models E, F, DE, H, K, and M.
CONFIGURATION: The B 7900 system has from one to four central processors with 6 to 144 megabytes of main memory, expandable in 6-megabyte increments.
COMPETITION: Amdahl 580, Honeywell DPS 88, IBM 308X, and NAS AS/9000 Series.
PRICE: Purchase prices for basic configurations range from $800,000 for the Model E to $2,940,000 for the Model M.

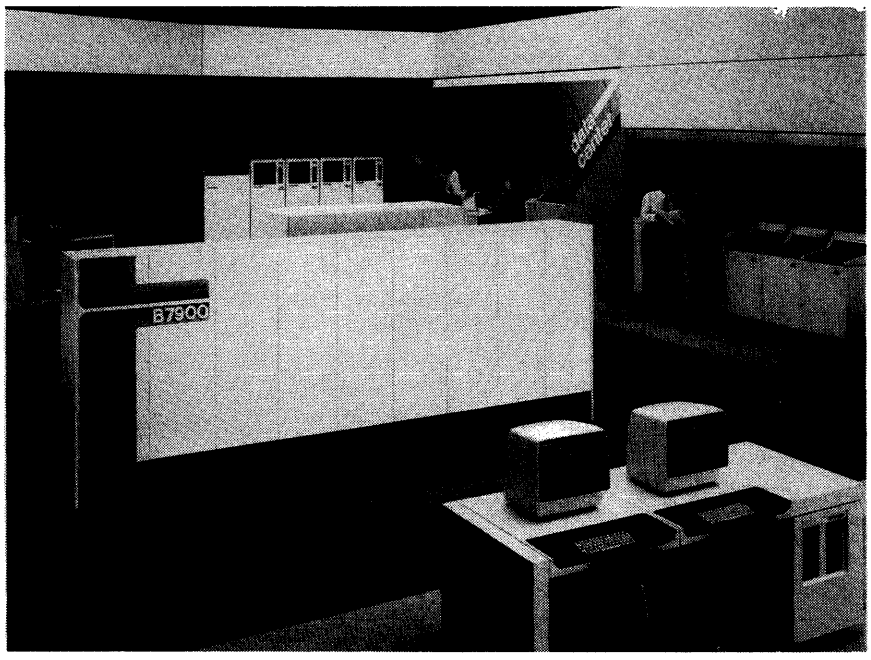
CHARACTERISTICS

MANUFACTURER: Unisys Corporation, P.O. Box 500, Blue Bell, Pennsylvania, 19424 Telephone (215) 542-4011. Canada: Unisys Canada, 2001 Sheppard Avenue East, North York, Ontario M2J 4Z7. Telephone (416) 495-0515.

MODELS: Unisys B 7900—Models E, F, DE, H, K, and M.

DATA FORMATS

BASIC UNIT: Fixed-length memory word, consisting of 48 data bits, 3 control bits, and 1 parity bit. Eight additional bits, used for automatic error correction, are standard in all ➢



The basic B 7900 F system includes a central processor with 12 megabytes of main memory, an operator console with three displays and keyboards, and a freestanding I/O and data communications subsystem.

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an interface between the central processor and up to two Memory Subsystem Modules, and a Card Test Station for use in tests performed by the maintenance engineer.

Main memory capacity of a B 7900 system can range from 6 to 144 megabytes. Expansion beyond 48 megabytes requires a second Memory Subsystem Module which contains a second Memory Control Processor.

The Input/Output subsystem module consists of two processing units, the Auxiliary Processor and the Host Data Unit. These units off-load functions from the central processor and support high volumes of data transfer, respectively. The I/O subsystem also consists of a series of specialized microprocessors called Data Link Processors (DLPs). These units perform peripheral-dependent functions, relieving the central processor of that responsibility. The DLPs also handle information transfer to and from memory via the Message Level Interface (MLI). The I/O Subsystem module includes four I/O Base Modules, each connecting to one or more Message Level Interfaces.

The B 7900 Data Communications subsystem employs one or more Network Support Processors (NSPs). The NSP uses an internal distributed architecture that divides the communications workload between the NSP and a series of microprocessors called Line Support Processors (LSPs). The NSP and LSPs are incorporated into the I/O base modules of the B 7900 Input/Output Data Communications Subsystem, providing for a common data communications and input/output architecture. The NSP is responsible for subsystem control, link control, and line discipline control. By off-loading these functions, the central processor can use its processing cycles for message processing rather than communications housekeeping, providing for higher throughput levels. The basic NSP comes equipped with 512K bytes of Integrated Circuit (IC) memory.

COMPETITIVE POSITION

The B 7900 H dual-processor model competes with the Honeywell DPS 88/861 and the NAS AS/9070. The DPS 88/861 with 32 megabytes of main memory and 32K bytes of buffer storage is priced at $1,740,000. The NAS AS/9070 has a price tag of $3,041,000 and features from 16 to 64 megabytes of main memory and 64K bytes of buffer storage per CPU.

The B 7900 M four-processor model competes with the IBM 3084 QX, which also has four processors. The 3084 QX features from 32 to 128 megabytes of main memory and four 64K-byte buffer storage units. But the system consoles, power, and coolant units are not included in the purchase price of $3,885,000. The Unisys B 7900 with a main memory capacity of from 48 to 144 megabytes and a 96K-byte cache is priced at $2,940,000 including one operator console, power, and coolant system.

ADVANTAGES AND RESTRICTIONS

The B 7900 is object code compatible with the B 5900, B 6900, and all the A Series computer systems. The B 7900 systems. Each word can hold one single-precision operand, half of a double-precision operand, one descriptor, or six 8-bit instruction syllables.

OPERANDS: Integer and floating-point operands have the same format and may be freely combined in arithmetic operations. Each single-precision operand (integer or floating-point) occupies one word and consists of a 6-bit octal exponent with sign and a 39-bit fraction with sign. Each double-precision operand occupies two words and consists of a 15-bit octal exponent with sign and a 78-bit fraction with sign. String operands may consist of a variable number of 4- or 8-bit characters.

INSTRUCTIONS: One to twelve 8-bit syllables in length. Syllables are packed six to a program word and executed sequentially from left to right.

INTERNAL CODE: 8-bit EBCDIC is standard. Information coded in ASCII can also be processed. ASCII is the primary data communications code. In general, characters are collated according to their internal binary values.

MAIN MEMORY

STORAGE TYPE: See Table 1.

CAPACITY: For memory capacities on the B 7900, refer to Table 1.

CYCLE TIME: The read access time is 450 nanoseconds per word or 75 nanoseconds per byte.

CHECKING: A parity bit with each word is generated during writing and checked during reading. The B 7900 system generates and checks an 8-bit error detection byte during each main memory reference, permitting automatic rewrite correction of single-bit errors and detection of multiple-bit errors.

STORAGE PROTECTION: Provided by a combination of hardware and software. A memory protect bit prevents user programs from writing into locations which have the protect-bit set. Attempts by programs to index beyond their assigned data areas are automatically detected.

One of the major system components of the B 7900 is the Memory Subsystem Module which consists of a Memory Control, up to four Memory Storage Units, and the appropriate power supply modules. The Memory Storage Unit contains from one to two million 60-bit words which are structured as 1.5-megabyte sections utilizing eight word phasing. The Memory Control has the capability of addressing 48 megabytes of main memory with a bandpass of 72 megabytes per second. The B 7900 system can be configured with up to three Memory Controls providing up to 144 megabytes of main memory. The Memory Control consists of the following major components: the Requestor Interface Adapter, the Memory Interface Adapter, the priority Resolution Module, the Error Module, and the Requestor Interrupt Module.

The *Requestor Interface Adapter* acts as a control to the interface protocol between a requestor, such as the Central Processing Module, the Auxiliary Processor, or the Host Data Unit, and the memory subsystem. Communication handled by the Requestor Interface Adapter is done through the use of control words and data words. Up to eight Requestor Interface Adapters can be configured on a single Memory Control.

The *Memory Interface Adapter* is responsible for controlling the flow of information between the internal bus of the Memory Control and the Memory Storage Unit. Up to four Memory Interface Adapters can be configured on a single

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TABLE 1. SYSTEM COMPARISON

MODEL	B 7900 E	B 7900 F	B 7900 DE	B 7900 H	B 7900 K	B 7900 M
SYSTEM CHARACTERISTICS						
Date announced	October 1984	December 1982	May 1985	December 1982	December 1982	September 1984
Date first delivered	—	July 1983	—	July 1983	July 1983	—
Field upgradable to	B 7900 F	B 7900 H	B 7900 K	B 7900 K	B 7900 M	—
Relative performance	1.0	1.4	1.6	1.8	2.5	3.7
Number of processors	1	1	2	2	3	4
Cycle time, nanoseconds	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Word size, bits	48	48	48	48	48	48
Operating systems	MCP	MCP	MCP	MCP	MCP	MCP
MAIN MEMORY						
Type	64K MOS	64K MOS	64K MOS	64K MOS	64K MOS	64K MOS
Minimum capacity, bytes	6M	12M	18M	24M	36M	48M
Maximum capacity, bytes	12M	18M	24M	96M	96M	144M
Increment size	6M	6M	6M	6M	6M	6M
Cycle time, nanoseconds	75	75	75	75	75	75
BUFFER STORAGE						
Minimum capacity	—	—	—	—	—	—
Maximum capacity	24K	24K	48K	48K	72K	96K
Increment size	—	—	—	—	—	—
INPUT/OUTPUT CONTROL						
Number of channels:						
Byte multiplexer	—	—	—	—	—	—
Block multiplexer	—	—	—	—	—	—
Word	—	—	—	—	—	—
Other	Up to 48 Data Link Processors	Up to 48 Data Link Processors	Up to 48 Data Link Processors	Up to 48 Data Link Processors	Up to 48 Data Link Processors	Up to 48 Data Link Processors

is positioned between the A 12 and the A 15, filling a price/performance void that exists between these two systems, and gives Burroughs one of the widest ranges of object code-compatible systems in the computer industry. This compatibility provides the user with a smooth upwards migration path without costly conversions. All B 7900 models can be field upgraded to the next level. In addition the Models H, K, and M are capable of being partitioned, thus providing fully redundant systems. Partitioning results in a highly available hardware system capable of continuing operation while failing components are isolated and repaired. For B 7900 users who needed to expand their system resources, the B 7900 M with a main memory of 144 megabytes is a welcome addition.

The B 9494-12 thin film disk subsystem with a capacity of 868 megabytes of formatted and 1320 megabytes of unformatted storage and a transfer rate of 3 megabytes per second is now available to the B 7900 user.

Although Burroughs has implemented customer-assisted troubleshooting and remote diagnostic facilities, documentation is still an area that needs improvement, according to the users.

USER REACTION

Datapro's 1986 Computer System User Survey yielded only seven responses from B 7900 users representing six different industries. The principal applications of the system were in accounting, billing, banking, payroll, personnel, order processing, manufacturing, and health care. Five of the seven users converted from smaller Burroughs systems to the B 7900. All but one of the users had more than 30 local workstations and more than 60 remote terminals connected to the system. The Database Management System (DMS II) was used by all seven respondents and was

Memory Control and each can make requests simultaneously to the Memory Storage Unit to which it is connected.

The *Priority Resolution Module* services the memory access requests and manages the use of the internal bus structure of the Memory Subsystem Module. The requests are recorded and prioritized as they arrive.

The *Error Module* detects and corrects any single-bit errors and detects any multibit errors. It also reports any errors that have been encountered during the operation of the Memory Storage Unit or the Memory Control, to the Requestor Interrupt Module.

The *Requestor Interrupt Module* interrupts the designated requestor using unique interrupt lines. Hardware and software interrupt buffers are maintained for each requestor within the Memory Subsystem Module.

CENTRAL PROCESSOR

The B 7900 Central Processing Module (CPM) is part of a distributed system and consists of six major functional units: a Program Control Unit, a Data Reference Unit, an Execution Unit, a Store Queue, a Memory Access Unit, and a Card Test Station.

The *Program Control Unit* provides for the execution of operators by the appropriate unit, when ready, rather than execution in a conventional serial order from the code string. The Program Control Unit is structured to be the stack machine of the Central Processing Module. A three-address operation is performed for processing by the Data Reference Unit and the Execution Unit. These addresses act as pointers to locations in the Central Data Buffer containing 64 registers. The Program Control Unit allocates a job number and passes it along with the addresses and other pertinent information necessary to complete the operation. This job number is used to maintain overall orderly processing of an operator in the various pipelines of the Data Reference Unit and the Execution Unit. The addresses assigned to an operator are deallocated at the end of the operation.

The *Data Reference Unit* makes use of the pipelines built by the Program Control Unit and is responsible for calculating

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given a rating from good to excellent. The users rated the ease of operation excellent, and the reliabiltiy of the system from fair to excellent. But documentation was rated poor by one user, fair by four users, and good by two users, indicating some room for improvement in this area. Five users have a disaster recovery plan in place, and three users have established an information center. Five respondents would recommend this system to other users while two respondents were undecided.

Prospective buyers of the B 7900 may wish to consult the Report "User Ratings of Mainframes," on Page 70C-000EB-101 for user experiences with other medium- and large-scale Burroughs computers. □

the absolute address for all data required to perform the operation. It also fetches the data from its data cache or it makes a demand of the Memory Access Unit to provide the data from main memory via cache.

The *Execution Unit* performs all arithmetic and logic operations on data which had its location in the Central Data Buffer preallocated by the Program Control Unit. Data which is derived by the functions of the Execution Unit can be stored either in the Central Data Buffer registers or it can be sent to cache memory and the Store Queue.

The *Store Queue* logic provides and manages a 192-byte buffer which is used to store the data received from the Execution Unit before sending it to the Memory Access Unit for storage in main memory. This eliminates repeated writes to the same main memory location by discarding all but the newest entries to the buffer.

The *Memory Access Unit* provides an interface between the Central Processing Module and up to two Memory Subsystem Modules. The capability of the Central Processing Module to address up to 144 megabytes of main memory is accomplished through the use of Memory Environment Registers. These registers allow a selected six megabytes of the full available memory to be visible to a process in the Central Processing Module at any given time. The Memory Access Unit services all main memory operations requested by the Program Control Unit, Data Reference Unit and the Store Queue. All data fetched from main memory by the Memory Access Unit are forwarded to data cache; all program fetches are forwarded to program cache. All data stores from the Store Queue are forwarded to main memory by the Memory Access Unit.

The *Card Test Station* is a maintenance facility which is used to test style logic circuit cards. Tests are available for all logic cards in the Central Processor, Host Data Unit, Memory Control, Auxiliary Processor and Maintenance Hardware cards.

DESCRIPTORS: A descriptor is a word often used to describe a data or program area in storage. There are three types: data, string, and segment descriptors. A data descriptor defines a data area by specifying its starting address in either main or disk storage, its size, and certain other descriptive information. String and segment descriptors provide similar information about data areas organized as character strings and about program segments, respectively.

INSTRUCTION REPERTOIRE: There are three basic types of instruction syllables: operators, value calls, and name calls.

A value call is two syllables (16 bits) long. It causes the specified operand to be brought into the top location of the stack.

A name call is also two syllables (16 bits) long. It causes the specified address to be placed in the top location of the stack.

Operators range from 1 to 12 syllables in length, though most are only 1 or 2 syllables long. Each operator causes the specified operation to be performed. There are approximately 250 operators in the basic instruction repertoire.

The arithmetic operators cause the two operands at the top of the stack to be combined according to the specified binary arithmetic process, with the result placed at the top of the stack. Floating-point and integer operands of single or double precision may be freely combined. Other word-mode operators perform logical operations, comparisons, branches, field or bit manipulation, stack management functions, subroutine entry and exit, etc.

A flexible group of string operators is used to transfer, compare, scan, translate, pack, unpack, and edit.

CONFIGURATION RULES

The basic system B 7900 E central system consists of one Central Processor, one I/O Subsystem Module, on Memory Control Module 6 megabytes of main memory, one Memory Interface Adapter, one Operator Console, one System Control Cabinet, three Operator Display Terminals, and one Operator Maintenance Terminal.

The basic system B 7900 F central system consists of one Central Processor, one I/O Subsystem Module, one Memory Control Module, 12 megabytes of main memory, two Memory Interface Adapters, one System Control Cabinet, one Operator Console, three Operator Display Terminals, and one Operator Maintenance Terminal.

The basic system B 7900 DE central system consists of the same components as the B 7900 F with one additional central processor and one 6-megabyte memory increment.

The basic system B 7900 H central system consists of the same components as the B 7900 F with one additional central processor and two 6-megabyte memory increments.

The basic system B 7900 K central system consists of the same components as the B 7900 F with two additional central processors, one additional 6-megabyte memory module with a Memory Interface Adapter, and three 6-megabyte memory increments.

The basic system B 7900 M central system consists of four Central Processors, one I/O Subsystem Module, two Memory Control Modules, 24 megabytes of main memory, four Memory Interface Adapters, four 6-megabyte memory increments, one Operator Console, one System Control Cabinet, three Operator Display Terminals, and one Operator Maintenance Terminal.

Each of the above B 7900 central systems is field-upgradable to the next level. For further expansion of the B 7900 configuration, the Partitioning, Availability, and Capacity (PAC) kit is available. It is designed to provide for higher levels of reliability and performance.

The PAC kit consists of one I/O Subsystem Module, one Memory System Module, one Operator Console, two Operator Display Terminals, and one Operator Maintenance Terminal. The MMS kit includes one I/O Subsystem Module, 12 megabytes of memory, and two Memory Interface Adapters.

The PAC kit can be added to all B 7900 models. On models B 7900 H, K, and M, the addition of the PAC and MMS kit provides a fully redundant system and these systems can

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function either as a monolithic multiprocessor system or as two independent systems. This flexibility allows configuration alterations, through software commands, according to changes in the processing environment.

INPUT/OUTPUT CONTROL

The Input/Output Subsystem Module is a modular subsystem which houses the Auxiliary Processor, the Host Data Unit and the I/O Base Modules. It contains Memory Environment Registers to address up to 144 megabytes of main memory.

The Auxiliary Processor's major function is to off-load selected systems software functions from the central processor.

It also performs maintenance processing for the system by using its own three-megabyte local memory and interfacing to the preselected I/O Base Modules. The Auxiliary Processor consists of several components; the Processor, the Local Memory Controller, the Memory Control Module, and the Interrupt and Maintenance Module.

The *Processor* is made up of a number of major sections. The Micro Master Control Processor supports the complete operator set implemented in the central processor and provides object code compatibility. It contains memory to house the entire microcode set to avoid overflow into the external memory. It is the key module in the processor providing execution command signals to the other modules within the Auxiliary Processor.

The Program Controller decodes operators and determines entry points into the microcode in the Micro Master Control Processor. It also provides information to the Data Processor.

The Data Processor performs all arithmetic and logic operations on data. It includes 16 registers which maintain the state of the Auxiliary Processor.

The Auxiliary Processor Host Dependent Port's primary function is to translate the 52-bit Auxiliary Processor local memory word to the 16-bit I/O subsystem word. Four Message Level interfaces connect to the Host Dependent Port; however, only one is in service at a time. The Host Dependent Port is only used by the Auxiliary Processor to perform maintenance functions and is not active during normal operation.

The *Auxiliary Processor Local Memory Controller* is active only when the Auxiliary Processor is functioning in the maintenance mode; it then provides the interface between the processing element and local memory. This Local Memory Controller contains error detection/correction and logging logic.

The *Auxiliary Processor Memory Control Module* provides, for the Auxiliary Processor, a main memory interface and a cache memory system. This interface allows the Auxiliary Processor to communicate with up to two B 7900 Memory Subsystem Modules. The cache contains 768 bytes of code and 768 bytes of data which is organized as 32 eight-word pages. The cache hardware automatically prefetches code with one page look ahead.

The *Auxiliary Processor Interrupt and Maintenance Module* provides an interface to the system interrupt bus and system maintenance exchange.

This Module includes Auxiliary Processor identification information and supports the Auxiliary Processor Memory Control Module.

The Host Data Unit handles all I/O data transfers between the main memory and the I/O subsystem. Whenever possible, data transfers to and from memory are 48 bytes each. Through the use of Memory Environment Registers, the Host Data Unit has the capability of addressing up to 96 megabytes of memory. The Host Data Unit includes the following major modules: the Memory Bus Control, the Host Dependent Port, the Queue Manager, and the I/O Base Modules.

The *Memory Bus Control* is responsible for controlling the memory operations of the Memory Subsystem Module and the internal requestors of the Host Data Unit. The Control can accommodate a maximum of four internal requestors: the Queue Manager and three Host Dependent Ports. A bus architecture is used to transfer the data and any bus-parity errors are detected by the Control. The Memory Bus Control can service up to two Memory Subsystem Modules.

The *Host Dependent Port* provides the interface between the Host Data Unit and the I/O subsystem via a Message Level Interface. This Host Dependent Port controls the Message Level Interface and is responsible for the format, integrity, and transfer of all I/O data directly to and from main memory. Only one Message Level Interface per Host Dependent Port is active at a time, although two are provided. While the Host Dependent Port can support a burst rate of 8 megabytes per second, the Host Data Unit is configured with three Host Dependent Ports, thus providing a bandpass of 24 megabytes per second.

The *Queue Manager* maintains the I/O jobs for the Host Dependent Ports. The Queue Manager contains 12,000 bytes of local memory used to store copies of Input/Output Control Blocks relating to I/O requests in progress. Two queue pointers are maintained by the Queue Manager; one which points to the address of the Host Data Unit's Home Address queue and the second which points to the Host Data Unit's error command queue. A 256-word RAM is also maintained by the Queue Manager and is used in the Halt/Load sequence. This RAM includes data pertaining to the Halt/Load unit and the bootstrap code to be executed by the processor.

There are four *I/O Base Modules* included in the Input/Output Subsystem Module which house the components of the Input/Output Subsystem and the Data Communications Subsystem.

I/O CHANNELS: In place of conventional I/O channels, the B 7900 input/output subsystem uses specialized microprocessors called Data Link Processors (DLPs). These units control the transfer of data between peripheral subsystems and main memory, thereby relieving the central processor of that responsibility. The DLPs are also responsible for information transfer to and from memory via the Message Level Interface. Each type of peripheral subsystem has its own specialized DLP. Some DLPs (such as those for disk drives) can service multiple peripheral devices of the same type. In operation, a DLP receives a request for an I/O data transfer from the central processor via the Message Level Interface. Some DLPs (such as those for disk drives) can accept multiple I/O requests and queue them for processing. The DLP then initiates the peripheral-dependent functions required to perform the I/O data transfer. Data is transferred through a Message Level Interface to or from main memory. Each DLP includes local memory that is used to buffer the data transfer operations.

Each of the I/O Base Modules can be connected to up to four Host Dependent Ports with each DLP in the I/O Base Module being logically assigned to a system through logic in the I/O Base Module. Although a DLP can be assigned to only one Host Dependent Port at a time, it may be transferred, by MCP operator console commands, to an alternate

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TABLE 2. MASS STORAGE

MODEL	B 9484-51	B 9494-41	B 9484-12	B 9494-5	B 9494-10	B 9494-12
Cabinets per subsystem	Up to 8	1	2 to 16	2 to 16	2 to 8	1 to 8
Disk packs/HDAs per cabinet	2 removable	2 fixed	1 removable	1 removable	2 fixed	1 fixed
Capacity	130MB	400MB	252MB	542MB	1084MB	868 MB formatted
Tracks/segments per drive unit	—	—	—	—	—	—
Average seek time, msec.	16	19.8	20.2	13.7	13.7	7.7
Average access time, msec.	25	28	28.5	22	22	16
Average rotational delay, msec.	8.3	8.17	8.3	8.3	8.3	8.3
Data transfer rate	605,000	650,000	1,200,000	1,200,000	1,200,000	3,000,000
Controller model	B 9387-4X	B 9387-4X	B 9387-51 B 9387-52	B 9387-51 B 9387-52	B 9387-51 B 9387-52	B 9389 B 9399
Comments	Requires AX 304-9X DLP	Requires AX 304-9X DLP	Requires AX 304-9X DLP; can be intermixed with B 9494-5 for a maximum of 16 drives	Requires AX 304-9X DLP; can be intermixed with B 9484-12 for a maximum of 16 drives	Requires AX 304-9X DLP; can be intermixed with B9494-5 and B 9484-12 for a maximum of 16 drives	Requires AX 304-90 DLP

Host Dependent Port; however, the alternate Host Dependent Port must be physically attached to the I/O Base Module containing the specific DLP.

I/O DATA RATES: Data is transferred between the Host Dependent Port, the DLPs and the central system in the form of blocks or messages at the rate of eight megabytes per second. Information is transferred through the Message Level Interface and the Message Level Interface Port to and from the memory subsystem. All of the DLPs in an I/O Base Module share the same Message Level Interface; contention for the interface is resolved by priority logic in the I/O Base Module. The buffer memories in the individual DLPs permit simultaneous peripheral operations.

MASS STORAGE

For information on mass storage devices for the B 7900, refer to Table 2.

INPUT/OUTPUT UNITS

For information on magnetic tape units and line printers used with the B 7900, refer to Table 3.

TERMINALS

For information on terminals used with the B 7900, refer to Table 4.

COMMUNICATIONS CONTROL

The modular B 7900 data communications subsystem offloads communications responsibilities from the central processor and distributes them to one or more Network Support Processors (NSPs). The NSP's internal architecture divides the communications workload between the NSP and a series of microprocessors termed Line Support Processors (LSPs). The NSP and LSPs are incorporated into the I/O Base Modules of the B 7900 Input/Output Data Communications subsystem, providing a common data communications and input/output architecture. The third hardware component required for a data communications subsystem is the Line Adapter, which provides the electrical interface for each communication line.

NETWORK SUPPORT PROCESSOR: The NSP is a programmable front-end processor that serves as the central element of B 7900 communications subsystem. It contains 512K bytes of integrated circuit memory. The NSP handles subsystem control, data link control, and line discipline control functions. Interaction between the NSP and the central system is performed at the message level, eliminating the need to interrupt the central system each time a character or word of data is to be transferred. The NSP is programmed by means of Burroughs' Network Definition Language II (NDL II), a descriptive, parameter-driven language.

A great deal of flexibility is available in the configuration of the B 7900 Communications System allowing for Network Support Processors to have multiple paths. Only one physical connection between the NSP and the Host Data Unit may be active at a time; however, an alternate path may be activated through the use of MCP operation console commands.

LINE SUPPORT PROCESSORS: The LSPs are a series of specialized microprocessors that provide the connection between the Line Adapters and the NSP. Information is transferred between the LSP and the NSP at the message level, reducing NSP interruptions and allowing more information to be transferred at a time. A single Line Support Processor can support up to 16 half- or full-duplex communication lines with subbroadband speeds of up to 19.2 bits per second. A special version of the LSP is available for installations requiring 56K-bit transmission speeds. This specialized LSP services a single 56K-bit Line Adapter and supports transmission rates of 56K bits per second.

The same configuration flexibility available with Network Support Processors is available with Line Support Processors. Multiple communication paths may be activated through the use of MCP operator console commands.

LINE ADAPTERS: A Line Adapter provides the electrical interface between the LSP and each communication line. The Line Adapter maintains physical control of the line, accumulates characters, and transfers them to or from the LSP. Each Line Adapter includes 4K bytes of local memory for storage of translation tables, message buffers, line parameters, polling sequences, and the code required to control the communication line and line discipline.

The Line Adapters are packaged in sets of four. Each set, called a Quad Line Adapter, accommodates the electrical interfaces for four lines and may be specified as either character-oriented or bit-oriented. (Character-oriented transmission is used in most of the current communications protocol, while bit-oriented transmission is employed in newer protocol such as Burroughs Network Architecture.) For each line position within a Quad Line Adapter, one of three types of electrical interfaces must be specified: RS-232 for U.S. modem connection; CCITT V.24 for international

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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.
B 9495-82	9	1600	PE	75	120,000
B 9495-83	9	1600	PE	125	200,000
B 9495-32	9	1600	PE	75	120,000
	9	6250	GCR	75	470,000
B 9495-33	9	1600	PE	125	200,000
	9	6250	GCR	125	780,000
B 9495-32M with built-in formatter	9	1600	PE	75	120,000
	9	6250	GCR	75	470,000
B 9495-33M with built-in formatter	9	1600	PE	125	200,000
	9	6250	GCR	125	780,000

Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
B 9246-12	1250 lpm	132	10	6 or 8	4 to 20 in.
B 9247-15	1500 lpm	132	10	6 or 8	4 to 20 in.
B 9247-16	750 lpm	132	10	6 or 8	4 to 20 in.
B 9247-21	2000 lpm	132	10	6 or 8	4 to 20 in.

modem connection; or TDI/20, for direct connection. Different electrical interfaces can be intermixed within the same Quad Line Adapter, and character- and bit-oriented Quad Line Adapters can be intermixed on the same LSP. Autocall is available for any Line Adapter as a no-charge feature. Each LSP accommodates up to 4 Quad Line Adapters and up to 16 lines.

A special subbroadband LSP will support a single Line Adapter with a CCITT V.35 or BELL 303 Electrical Interface and a maximum transmission rate of 56,000 bits per second.

INTER-SYSTEM CONTROL (ISC): This facility is designed to establish a local network of large-scale Burroughs systems connected through an I/O channel link. ISC operates under the control of Burroughs Network Architecture (BNA). The BNA Host Service and Network Services provide the resource sharing among the I/O-coupled processors in the network. Files can be created and accessed on any system in the network, and jobs and files can be transferred from one system to another. A communications terminal that is physically connected to one system can be logically connected to another. And, if desired, all application programs can be developed and tested on one system in the network and then distributed to the system that will execute them.

ISC hardware components consist of Host Controls and HUBs. The Host Control 2 (HC2) is a Data Link Processor that resides in a DLP slot in the host's I/O subsystem. Each HC2 provides bidirectional data flow; therefore, only one HC2 is required to read and write to a single host. The HUB, which is housed in a freestanding cabinet, provides interaction between the Host Controls and must be used when connecting two or more host processors. HUB4 permits the interconnection of up to 4 Host Controls, while HUB16 permits interconnection of up to 16 Host Controls. However, to add more than two Host Controls, a HUB Expansion Adapter is required for each additional Host Control.

SOFTWARE

The System Software Facility includes the Master Control Program (MCP) operating system, Utility Programs, an Algol compiler, the Network Definition Language II (NDL II), the basic Generalized Message Control System (GEMCOS), SMF II Site Management, DC Algol compiler, Workflow Language (WFL), Cross Reference Symbolic, NSP/LSP Firmware, Interactive Datacomm Configurator (IDC), Program Binder, and one additional compiler.

MASTER CONTROL PROGRAM: The MCP Release 3.4 is an integrated operating system that oversees and controls all operations of the B 7900 system. It consists of a group of routines organized in three-level hierarchical fashion. The first level is a kernel routine that fields all interrupt signals and transfers control to the appropriate MCP routines. The second-level routines handle the MCP's major task: dynamic resource allocation of main memory, disk storage, I/O devices, processors, and time among the concurrently operating programs. The third-level routines handle utility functions such as job scheduling, control card interpretation, file control, library maintenance, etc. The multilevel MCP also allows processing to continue while faulty hardware is being diagnosed or new system software is tested and debugged.

The Menu Assisted Resource Control (MARC) module is an extension to the MCP which simplifies operations. The Marc module offers menu assistance for all system operations. It is supplemented with full Help/Teach support and, according to Burroughs, enhances overall operations capabilities.

Jobs are submitted to the MCP through the systems input units, which can be a card unit or a disk or tape file performing as a "pseudo card unit." As the control state-

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ments for each task are analyzed, a partial stack is created on a schedule queue containing the estimated main memory requirements, the priority, the maximum amount of processing time and I/O time, the size and location of the file parameter block, the working storage stack size and the size and location of code segments. The program scheduling priority ordinarily is specified by the programmer, although a default option automatically assigns a priority job one-half the maximum allowable priority.

The MCP maintains a queue of jobs available for initiation. A scheduling routine evaluates resource and priority requirements of the programs in the queue and schedules their execution so as to utilize the system's resources efficiently in a multiprogramming mode, using either single or multiple processors. The job sequence is dynamically rescheduled whenever a high-priority job is introduced into the schedule. When the required resources are available (for example, when a job completes processing or suspends itself to await completion of an input/output operation) an available job with the highest priority is added to the processing mix. Jobs submitted from remote terminals are interpreted and entered into the schedule queue and are added to the multiprogramming mix in much the same way as batch jobs.

The MCP maintains control of tasks through the use of stacks, descriptors, and tables that summarize the history and current status of each task in process. A stack is created for each job in the system to provide storage for basic program and data references. When a task is activated, four high-speed registers are linked to the task's stack memory area. In addition, an area of high-speed local memory is available to contain additional portions of the active stack, for fast access. The contents of the top-of-stack registers are maintained automatically by the central processor hardware according to the requirements of the executing program. Central processors can handle multiple active stacks organized into a tree structure. The tree-structured organization allows program code and program data and variables to be described at different stack levels, thus permitting program code to be reentrant and shared. The tree-structured stack also enables a single task to split itself into two independent tasks by establishing a new link on the stack to make full use of a multiprocessor configuration or to multiprogram independent processes.

Both data and program segments are referenced through descriptors. A Data Descriptor is used to fetch data to the stack or to store data in a storage area outside the stack. Both the absolute address and the length of the data array are specified in the Data Descriptor, along with a Presence Bit which indicates whether the referenced data is located in main memory or in disk storage. Segment Descriptors, maintained in a portion of the stack base known as the Segment Dictionary, are the basis for the Burroughs implementation of virtual memory. In contrast to the fixed-page concept utilized in many storage allocation schemes, Burroughs programs can be divided into variable-length segments, which are brought into main memory only as they are needed. Segment Descriptors contain the address of the segment in main memory or secondary disk storage, the length of the program segment, and a Presence Bit to indicate whether the program segment is located in main memory or disk storage.

True dynamic memory allocation is a feature of the MCP. The compilers automatically divide all object programs into logical, relocatable segments. Moreover, all object programs are reentrant. Because code is never modified during execution, two or more jobs can concurrently make use of a single program segment residing in main memory. Program and data segments are automatically transferred from disk storage to main memory when needed. When necessary, the MCP automatically overlays these new segments over other program or data segments that have not been accessed recently. If the old segment contains modifiable data, it is written on a disk file prior to being overlaid; if it is a program segment or a read-only data segment, this "roll-out" operation is unnecessary. The MCP attempts to concentrate program segments in one area of memory and data segments in another to avoid excessive "checkerboarding" of memory.

Main memory is allocated to programs in working sets, which represent the amount of memory each program most often requires during execution to process efficiently. The optimum working set size is calculated first by the compiler, and afterward it is recalculated by the MCP each time the program is executed. Time-sharing operations are assigned a contiguous block of memory, with allocation of memory to time-sharing programs controlled by a Swapper. Memory within the time-sharing area is divided into fixed-size partitions that can be shared among time-sharing users. The Swapper can be invoked from the operator console.

Memory protection is provided by a combination of hardware and software features. Two registers associated with the stack mechanism, the Base of Stack register and the Stack Limit register, define the upper and lower limits of the stack. An interrupt is generated if an attempt is made to exceed these limits. When an element in a data array is referenced, an automatic comparison of the index value of the data element and the length of the data area as specified in the Data Descriptor identifies any attempt by a program to reference beyond its designated data area. In addition, control bits in each word prevent a user program from altering program segments, data descriptors, segment descriptors, and memory links, control words, and tables maintained by the MCP.

The MCP provides comprehensive input/output and file control facilities. It automatically assigns peripheral devices to symbolic files whenever possible to minimize operator intervention. Three tables are maintained by the operating system containing label equation and file attribute information such as the access type, peripheral type, physical unit being used, etc. This allows modification of file specifications at program execution time. Blocking, buffering, label checking, and other standard I/O control functions are performed in accordance with the programmer's specifications. Magnetic tape drives or disk files can be freely used as backup or "pseudo" devices for card readers, punches, and printer. This makes it unnecessary to delay the processing of a job because of the nonavailability of a particular I/O unit.

Communication between the system operator and the MCP is accomplished through a combination of CRT display units, keyboards, control statements, and a comprehensive system log. The status of the system and of the jobs in progress is presented on the CRT displays. Messages and requests can be keyed by the operator, and the system responses are displayed on the CRT. Jobs are usually submitted to the system in the form of a set of control statements accompanied by a source language deck, or alternatively through control statements entered through the console keyboard if the programs have previously been compiled and stored on disk. Jobs to be compiled must be accompanied by a compile statement identifying the compiler to be used and specifying one of three types of compilations: a compile and execute, compile for the library, or compile for the syntax. Optional control statements for all jobs contain an execution statement, process time statement, priority statement, and I/O statements which associate file labels with specific input/output devices.

Work Flow Management is an MCP facility that provides enhanced facilities for the control of task initiation and resource allocation. The Work Flow Language (WFL) enables users to describe each job as a network of interrelated tasks. The WFL compiler accepts these control statements as input and generates machine code to control the tasks

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TABLE 4. TERMINALS

MODEL	ET 1100	ET 2120	B 21-2TS
DISPLAY PARAMETERS			
Max. chars./screen	2080	2080	2240
Screen size (lines x chars.)	24 x 80	24 x 80	28 x 80
Symbol formation	7 x 9 dot matrix	7 x 9 dot matrix	7 x 9 dot matrix
Character phosphor	Green	Green	Green
Total colors/no. simult. displayed	—	—	—
KEYBOARD PARAMETERS			
Style	Typewriter	Typewriter	Typewriter
Character/code set	128 ASCII	ASCII	ASCII
Detachable	Standard	Standard	Standard
Program function keys	10	10	10
OTHER FEATURES			
Buffer capacity	256K	256K	256K
Tilt/swivel	Standard	Standard	Standard
Graphics capability	No	Yes	Yes
TERMINAL INTERFACE	RS-232-C, TDI	RS-232-C, TDI	RS-232-C, RS-422

within each job as the user prescribes. Facilities provided by the Work Flow Management System include sequencing and synchronizing of related tasks via input from control statements, improved consistency in task restarts after system failures, job summary printouts, multiple job scheduling queues for different levels of service, interfaces for installation-tailored system control programs, and accounting records grouped by job.

LANGUAGES: Languages supported on the B 7900 are: Cobol 68 and 74, Fortran 77, Algol, PL/1, APL, Basic, RPG II, and Pascal.

DATA COMMUNICATIONS SOFTWARE: Communications control functions in B 7900 systems are divided among the MCP, a message control system, and programs in the Network Support Processor (NSP). Together, these facilities can handle interactive time-sharing, remote inquiry, remote job entry, and various other communications facilities.

Programs for the NSP can be produced by the Network Definition Language II (NDL II) compiler. The user simply describes the characteristics of his terminal and their associated line disciplines. The compiler produces the code needed to drive the NSP and establish the interfaces with its terminals. These programs equip the NSP to poll communications lines, answer and terminate calls, format messages, translate codes, manipulate data, and perform line discipline functions.

The Interactive Datacomm Configurator (IDC) provides menu support of terminal network configurations. If standard terminals and protocols are used, IDC can replace NDL II with its menu support, simplifying network establishment and maintenance.

NDL II Analyzer is a data communications utility program for NSP-based systems. It accesses the Network Information File (NIF) and an NSP dump file to produce information concerning the status of an NDL II source program running on an NSP. It provides additional information to the network administrator responsible for managing NDL II programs.

Burroughs offers three major message control systems: Gemcos, Cande, and RJE, which are described in the following paragraphs.

GENERALIZED MESSAGE CONTROL SYSTEM (GEMCOS): This software system generates an installation-defined message control system (MCS) that manages a transaction-oriented communications network, provides security, handles transaction routing, controls message formatting, and provides a transaction processing interface for application programs. All transaction terminals in the network are controlled by the Gemcos-created MCS and interfaced to the application programs and the data base. Thus, Gemcos enables users to develop transaction processing application programs independently of the network environment. The input to Gemcos is coded in the Transaction Control Language, a high-level descriptive, free-form language that uses key words to describe both the network environment and the requirements for message routing, message formats, access control, recovery, etc.

The Format Generator is an optional extension that provides Gemcos users with an on-line message format generator. The user enters a "picture" of a formatted message on the display screen, and this is automatically converted into a Transaction Control Language format description for the GEMCOS MCS.

The Communication Management System (COMS) is an advanced communication monitor facility. Coms provides most of the features offered by Gemcos and offers high transaction performance and resource efficiencies, according to Burroughs. COMS has been integrated with the MCP and other system software.

COMMAND AND EDIT LANGUAGE (CANDE): This time-sharing Message Control System enables multiple users at remote terminals to create programs or data files, compile and execute programs, edit and alter programs or files, search files, send messages to other terminals, and perform a variety of other functions. Files created through Cande can be saved and used later by the same user or by other users to whom access is granted. Cande provides the capability for interactive program development and testing concurrently with the execution of application programs. It also provides effective control of the access, security, and charging functions in a computer time-sharing network.

The SECURITY SUPPORT Library is an extended support library which permits additional security control facilities. When used, it will be called each time a user logs on and further verifies the user code, charge code, access code, and station identification.

The Editor is a programmer productivity aid that runs as a user task under Cande. It can be used to create and maintain program text and simple documents as it is a general line- and page-oriented text editor. It reduces the number of keystrokes required to manage the file by providing a "win-

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dow" into the desired file which simplifies editing and line manipulation.

REMOTE JOB ENTRY (RJE): This Message Control System enables users at remote batch terminals to enter jobs into the computer system in the same manner as if they were on-site in the computer room. RJE allows files to be transferred between remote systems, and enables terminals attached to remote systems to be controlled by the host system.

BURROUGHS NETWORK ARCHITECTURE (BNA): A set of software designed to enhance the interaction of terminals with host central processors in a network environment, BNA is also designed to facilitate a move into distributed data processing. Through the BNA architecture, Burroughs processors and terminals can be granted access to data bases throughout a network, job tasks and information files can be transferred from one point to another, and data processing resources available in a network can be shared among participants regardless of location. BNA is designed to work with existing Burroughs terminal networks. BNA depends on logical links rather than physical links, relying on network tables maintained in the host processors for routing. All routing is through host mainframes. Services provided by BNA include those designated host and those designated network. Host services include coordination of communication between tasks being executed at various hosts; control of the creation, updating, and transfer of data from host to host; and handling of communication with logical points within the network. Network services perform message routing, linking hosts using the Burroughs Data Link Control (BDLC) bit-oriented protocol. Network services also permit connection of Burroughs processors to packet-switching services using X.25 procedures. Links can also be established to non-Burroughs machines using currently available software.

BNA also supports the Inter-System Control (ISC) subsystem, which is used to physically establish a local processor-to-processor network of large-scale Burroughs computer systems. ISC permits users on one system in a local network to access and share the resources of other systems through the BNA Host Services and Network Services.

REPORTER III: This is a report writer designed to simplify the retrieval, analysis, and reporting of information maintained in computer files. Reporter II accepts report specifications coded in a free-form report description language and generates a Cobol program tailored to produce the required report. The system can retrieve input data from multiple files and/or DMS II data bases, select data based on a wide range of criteria, perform arithmetic and statistical functions, sort data in ascending or descending order according to multiple keys, control access through a password system, produce automatically formatted reports, and create one or more files of extracted data for subsequent processing or reporting.

In addition to the basic version, Reporter II is available in an Advanced version, an Audit version, and an On-Line version. Reporter II (Advanced) adds the capabilities for generation of multiple reports in one pass through the input data, creation of summary-only (matrix) reports, and controlled formatting for special reports or preprinted forms. Audit-Reporter extends the Reporter II system by providing auditors with effective software tools for testing and evaluating the records produced by an EDP system. The On-Line Reporter is an optional module that can be added to any of the three preceding systems to provide an on-line mode of operation that enables users at remote terminals to enter, generate, compile, and execute report programs.

LOGIC AND INFORMATION NETWORK COMPILER (LINC): This fourth-generation programming language generates complete, on-line, realtime systems, including programs, data base descriptions, screen formats, transaction management, and network management. It is designed to do so with only one set of English-like specifications. The system includes the Linc Definition Language (LDL), a high-level, nonprocedural, business-oriented language used to identify and define the user's needs. LDL allows for a single system specification without regard to actual program and application construction and provides full syntax checking. It includes both the systems and data definitions and is used to define the report and inquiry requirements. The Linc System Generator takes the defined specifications and produces the programs required to establish, maintain, and report against the business data. Linc optimizes the generated systems to the host Burroughs system, and eliminates redundant programming code and data elements as well as data and logic inconsistencies. The system provides for multiple independent accounting periods, support for batch programs, provisions for data integrity and security, transaction entry in any sequence, full on-line, realtime inquiry and maintenance of data, and an on-line "help" function.

DATA MANAGEMENT SYSTEM II (DMS II): This comprehensive data base management system is integrated with the MCP operating system and uses MCP facilities for accessing records in the data base to achieve greater runtime efficiency. Through the MCP facilities, the DMS II data base can be accessed by application programs operating in multiple processing environments, such as batch, remote job entry, time-sharing, and transaction processing. DMS II incorporates a Data And Structure Definition Language (DASDL) that provides for the logical description of data in sets or subsets and for mapping the logical data into physical structures. A variety of retrieval methods is supported, including indexed sequential, indexed random, and bit vectors. The latter method creates indices that require small amounts of disk storage and permit very fast searches.

DMS II permits multiple indices to be established for accessing a file, and each file can be accessed by any of the available access methods to provide retrieval information by different application programs. User language interfaces to the data management system are provided for the Cobol, Algol, RPG, and PL/1 languages. When multiple programs are accessing the data base, DMS II provides lockout protection at the record level to prevent simultaneous updating of a record. The system also has extensive on-line recovery capabilities that can automatically recover from a system or applications program failure. For further information refer to the DMS II report on Page 70E-117MM-101 in Volume 3.

DM INTERPRETER is a DMS II facility which expands the capabilities and control characteristics of DMS II. It provides an interpretive interface to a DMS II data base, permitting non-DMS II languages access to DMS II-managed information. This allows for extended flexibility in a DMS II environment. It decouples the application from the data base and allows data base changes without a corresponding recompilation of the application program in most cases.

DB CERTIFICATION is a DMS II utility which will certify the structures of a DMS II data base as they physically reside on secondary storage, enhancing data base integrity. It ensures that the file is accessible, that data within a structure (including control information) is consistent and valid, and that relationships between structures are correct.

DMS INQUIRY: This optional extension of DMS II provides an easy-to-use language that enables non-EDP personnel to access the data base via remote terminals. Users can "browse" through information stored in the data base

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and retrieve it either serially or randomly, without the delays normally associated with programming and debugging an inquiry program. Users with appropriate security clearances can also update existing information in the data base and add new records or delete existing records. The DMS II audit trail captures a record of all data base maintenance functions to facilitate automatic recovery.

ADVANCED DATA DICTIONARY: This DMS extension simplifies the design and maintenance of the data base by maintaining comprehensive, up-to-date documentation of the data base environment. The Data Dictionary maintains its own DMS II data base containing information that describes the data base structure and the application programs accessing the data base. The data structure is defined in terms of physical and logical data bases, data sets, subsets, remaps, and data items. The Data Dictionary also supports program tracking and the Screen Design Facility (SDF).

A utility permits the entry of descriptive text information to aid in describing the data base environment. A set of report programs extracts information from the dictionary and produces formatted reports on a printer or display screen. Whenever there is a need to revise a DMS II data base, the Data Dictionary can provide the user with a list of all the application programs that will be affected by the change.

EXTENDED RETRIEVAL with GRAPHIC OUTPUT (ERGO): This advanced inquiry and reporting system is used with DMS II data bases. Ergo offers a graphic representation of information and defines the relationships between data sets and powerful selection expressions to filter the data used in reports. Ergo features a prompt mode and Help commands to guide the user. Multiple presentation formats allow the user to select the most appropriate graphic output representation.

SYSTEMS MANAGEMENT FACILITY II (SMF II): SMF II provides information on system resource usage, hardware performance, and system availability. Two modules are available: SMF II System Resource Management and SMF II Site Management. The SMF II System Resource Management module extracts pertinent data from the system logs, combines this data with sampling data obtained from the MCP, and measures the usage of system resources. The SMF II Site Management module logs the incidence and nature of system-detected faults in processors and peripheral devices during normal system operation. The SMF II Query Program provides customized reports in either batch or interactive mode. The SMF II System Resource Management module and Site Management module can be used independently in a standalone environment, or they can be integrated to provide a comprehensive performance management system.

UTILITY ROUTINES: The Master Control Program includes a variety of utility routines that perform functions such as data transcription, library maintenance, and system log analysis. The MCP Load Control Facility permits data and control statements to be "spooled" to disk for subsequent access by system pseudo card readers. Printer and punch output can be routed to disk or tape files under MCP, program, or operator direction for output upon command by the operator or automatically when a suitable device is available. Library maintenance routines include Copy and Move statements that permit files to be transferred between library tapes and disk storage.

The System Log program accumulates statistics relating to the execution of programs, the number of file openings and closings, and data on system operation such as halt/load information, time/date changes, the amount of system overhead, and operator input messages. Errors detected during system operation are stored in a Maintenance Log that includes descriptor errors, invalid memory address error, I/O errors, violations of memory protection, parity errors, and write lockout errors.

PRICING

CONTRACT TERMS: The B 7900 system is available for purchase or for lease under a one-year, three-year, or five-year lease agreement. The standard lease agreement entitles the customer to unlimited use of the equipment and includes full-time equipment maintenance coverage (24 hours/day, 7 days/week). The standard maintenance agreement for purchased systems covers maintenance of the equipment for eight consecutive hours per day on Monday through Friday only; extended maintenance coverage is available at higher rates.

All maintenance charges listed in this report are for "Metro 1" (city) plan A. All lease plans may include purchase options that allow 50 percent of the rental paid during the first 36 months to be applied toward the purchase price at any time during the lease period.

SOFTWARE: All software is unbundled. Program products for the B 7900 are offered under a plan which provides for the use of the products on a designated system on a month-to-month basis.

TECHNICAL SUPPORT: Users can purchase Unisys's technical support under either of two product service agreement; PSA-1 and PSA-2. PSA-1 provides access to a support center, via a telephone network, to answer operational questions pertaining to software products in warranty class 1. Assistance is also provided in problem identification/verification and advice is given on known problem detours and fixes. In addition, PSA-1 provides centralized services for fault report analysis with the intent to resolve errors in the software products. These centralized services also develop and distribute maintenance releases and related documentation. Local services are available on a time and material basis.

PSA-2 includes those services provided by PSA-1 in addition to providing local services, as required, for assistance with problem isolation and identification, fault report preparation and installation of fixes, detours, and updated releases.

EDUCATION: Users can obtain the necessary training by paying for individual courses. The currently available courses range from 1 to 10 days in length, and fall into the following broad categories: Systems Support, Operations, Languages, Environment (data base and data communications), and Applications.

EQUIPMENT: The following configurations illustrate a typical single-processor B 7900 system, a dual-processor B 7900 system, and a four-processor B 7900 system. The quoted prices include all necessary hardware, but no software.

ENTRY-LEVEL B 7900 MODEL E: Includes a B 7900 E Central System (one central processor, one I/O Subsystem Module, one Memory Control Module, 6 megabytes of main memory, one Memory Interface Adapter, one Operator Console, one System Control Cabinet, three Operator Display Terminals, and one Operator Maintenance Terminal) plus three 400-megabyte B 9494-41 fixed disk drives, one B 9387-42 2x8 controller, one AX 304-91 disk pack DLP, six B 9495-33 GCR/PE magnetic tape units (780K), one B 9499-22 2x8 controller, one AX 395-92 tape DLP, one B 9247-15 line printer (1500 lpm), one AX 247-94 line printer DLP, one B 378-11 network support Processor (512K), four AX 378-1 line support processors, 16 AX 369-4 quad line adapters, and 10 ET 1100 terminals. The purchase price is $1,308,006.

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MEDIUM-LEVEL B 7900 MODEL H: Includes a B 7900 H Central System (two central processors, one I/O Subsystem Module, one Memory Control Module, 24 megabytes of main memory, two Memory Interface Adapters, one Operator Console, one System Control Cabinet, three Operator Display Terminals, and one Operator Maintenance Terminal) plus one B 7001-6P1 6-megabyte memory increment with Memory Interface Adapter, eight 400-megabyte B 9494-41 fixed disk drives, two B 9387-42 2x8 controllers, two AX 304-91 disk pack DLPs, 12 B 9495-33 GCR/PE magnetic tape u nits (780K), two B 9499-22 2x8 controllers, two AX 395-92 tape drive DLPs, two B 9247-15 line printers (1500 lpm), two AX 247-94 line printer DLPs, two AX 378-11 network support Processors (512K), eight AX 378-1 line support processors, 32 AX 369-4 quad line adapters, and 20 ET 1100 terminals. The purchase price is $2 894,730.

HIGH-LEVEL B 7900 MODEL M: Includes a B 7900 M Central System (four central processors, one I/O Subsystem Module, two Memory Control Modules, 24 megabytes of main memory, four Memory Interface Adapters, four 6-megabyte memory increments, one Operator Console, one System Control Cabinet, three Operator Display Terminals, and one Operator Maintenance Terminal) plus two B 7001-6P1 6-megabyte memory increments with two memory interface adapters, one B 7095-90C I/O expansion, eight 1048-megabyte B 9494-10 fixed disk drives, two B 9387-52 2x8 controller, one B 9387-30 disk expander, two AX 304-91 disk pack DLPs, 16 B 9495-33 GCR/PE magnetic tape units (780K), two B 9499-22 2x8 controllers, three AX 395-92 tape drive DLPs, four B 9247-15 line printers (1500 lpm), four AX 247-94 line printer DLPs, four AX 378-11 network support processors (512K), 16 AX 378-1 line support processors, 64 AX 369-4 quad line adapters, and 40 ET 1100 terminals. The purchase price is $4,878,185.

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
PROCESSORS AND MAIN MEMORY					
B 7900 E	Central System; includes one Central Processor, one I/O Subsystem Module with 4 I/O bases, one Memory Control Module and cabinet 6 megabytes of main memory, one Operator Console, one System Control Cabinet, three Operator Display Terminals, and one Operator Maintenance Terminal	800,000	4,059.00	67,538	50,042
B 7900 F	Central System; includes one Central Processor, one I/O Subsystem Module with 4 I/O bases, one Memory Control Module and cabinet, 12 megabytes of main memory, one Operator Console, one System Control Cabinet, three Operator Display Terminals, and one Operator Maintenance Terminal	1,235,000	4,863.50	120,780	84,238
B 7900 DE	Central System; includes two Central Processors, one I/O Subsystem Module with two Host Dependent Ports, one Memory Control Module and cabinet, 12 megabytes of main memory, one 6-megabyte memory increment, one Operator Console, one System Control Cabinet, three Operator Display Terminals, and one Operator Maintenance Terminal	1,150,000	4,858.00	120,777	84,236
B 7900 H	Central System; includes two Central Processors, one I/O Subsystem Module with 4 I/O bases, one Memory Control Module and cabinet, 12 megabytes of main memory, two-6 megabyte memory increments, one Operator console, one System Control Cabinet, three Operator Display Terminals, and one Operator Maintenance Terminal	1,750,000	5,856.00	179,071	124,259
B 7900 K	Central System; includes three Central Processors, one I/O Subsystem Module with 4 I/O bases, one Memory Control Module and Cabinet, 18 megabytes of main memory, three 6-megabyte memory increments, one Operator Console, one System Control Cabinet, three Operator Display Terminals, and one Operator Maintenance Terminal	2,380,000	7,001.50	239,028	165,945
B 7900 M	Central System; includes four Central Processors, one I/O Subsystem Module with 4 I/O bases, one Memory Control Module and Cabinet, one PAC Memory Control Module and Cabinet, 24 megabutes of main memory, four 6-megabyte memory increments, one Operator Console, one System Control Cabinet, three Operator Display Terminals, and one Operator Maintenance Terminal	2,940,000	9,008.00	297,189	226,125
B 7900-ETF	E to F Upgrade; includes one upgrade kit and 6 megabytes of main memory	550,000	806.00	52,972	32,761
B 7900-FTH	F to H Upgrade; includes one Central Processor and 12 megabytes of main memory	754,000	993.50	58,243	43,825
B 7910-FTH	F to H Upgrade; includes one Central Processor and 12 megabytes of main memory, one PAC I/O Subsystem Module, one PAC Memory Control Module and Cabinet, one Operator Console, two Operator Display Terminals, and one Operator Mailntenance Terminal	1,494,000	4,341.00	98,935	75,391
B 7900-EDE	E to DE Upgrade; includes one Central Processor and 12 megabytes of main memory, one E to DE upgrade kit	550,000	959.50	53,192	30,906
B 7900-HTK	H to K Upgrade; includes one Central Processor, and 12 megabytes of main memory	779,000	2,136.00	59,841	45,423
B 7900-KTM	K to M Upgrade; includes one Central Processor, 12 megabytes of main memory, one PAC Memory Control Module and Cabinet	875,000	1,016.50	84,629	66,494
B 7910-KTM	K to M Upgrade; includes on Central Processor and 12 megabytes of main memory	754,000	983.00	58,773	42,778

**For 5-day, 8-hour service.*
***Includes 7-day, 24-hour maintenance coverage.*
NC—No charge.

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		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
PROCESSORS AND MAIN MEMORY (Continued)					
B 7910-PAC	Partitioning Upgrade; includes one I/O Subsystem Module, one Memory System Module and Cabinet, one Operator Console, two Operator Display Terminals, one Operator Maintenance Terminal	740,000	3,347.50	40,638	31,566
B 7920-PAC	Partitioning Upgrade; includes one I/O Subsystem Module, one Operator Console, two Operator Display Terminals, one Operator Maintenance Terminal	600,000	3,003.00	32,428	25,192
B 7900-MMS	Monolithic Multiprocessor System; includes one Memory Control Module and 12 megabytes of main memory	450,000	918.00	27,766	21,178
B 7001-6P1	Primary Memory Module; 6-megabyte	127,000	287.50	10,367	7,170
B 7001-6S	Secondary Memory; 6-megabye	102,000	287.50	8,946	6,205
SYSTEM OPTIONS					
B 7901	Central Processor Module IV	550,000	2,763.00	48,515	34,134
B 7900-AP	Auxiliary Processor; (without memory)	195,000	516.50	12,005	8,442
B 7900-CON	Operator Console	70,000	173.00	4,264	2,985
B 7095-90C	I/O Expansion Cabinet	60,000	748.50	4,443	3,347
B 7930-2	I/O Base Module Exchange; for 2 processor system, required for each base to be exchanged	3,676	6.50	126	109
B 7930-3	I/O Base Module Exchange; for 3 processor system, required for each base to be exchanged	4,725	12.50	167	145
B 7930-4	I/O Base Module Exchange; for 4 processor system, required for each base to be exchanged	5,775	19.00	203	175
B 7095-92	Distribution Module; one required for each base to be exchanged when upgrading from 2 to 3 or from 3 to 4 processors	1,576	6.50	58	47
B 7095-93	Logic Expansion Module (1x7)	3,676	21.00	152	124
B 9361-23	Additional Operator Display	3,098	30.00	146	135
DATA LINK PROCESSORS					
AX 110-90	Card Reader DLP-2 (B 9115/16/17)	3,739	37.50	128	111
AX 112-90	Card Punch DLP-2 (B 9112/13)	3,676	36.50	126	104
AX 395-91	PE Magnetic Tape DLP-2 (B 9495-82/-83)	7,717	55.50	250	215
AX 395-92	GCR/PE Magnetic Tape DLP-3 (B 9495-22/-23/-32/-33/-32M/-33M)	7,717	55.50	250	215
AX 304-90	Disk Pack DLP-2 (interlaced)	7,581	55.50	257	222
AX 247-94	Train Printer DLP-2 (B 9247-15)	4,620	36.50	159	137
AX 246-92	Line Printer DLP-2; 2000 lpm (B 9246-12/-21)	4,620	36.50	159	137
AX 304-91	Disk Pack DLP-3 (sequential interlaced)	7,581	39.00	400	285
AX 393-90	NRZ Magnetic Tape DLP-3	7,560	46.00	379	301
AX 293-30	Non-Impact Printer DLP-3	4,500	28.00	235	187
B 7341-90	Operator Display DLP-3	8,106	83.00	264	229
MASS STORAGE					
B 9484-12	Disk Pack Drive; 252 megabytes, single spindle	33,000	145.50	1,569	1,180
B 9484-51	Dual Disk Pack Drive; 130 megabytes	21,000	189.00	956	793
B 9494-5I	Disk Drive; 542 megabytes, single spindle, interlaced	26,500	110.00	1,624	1,219
B 9494-10I	Fixed-Disk Drive; 1048 megabytes, dual spindle, interlaced	50,400	227.00	3,158	2,370
B 9987-3	Dual Port Feature for B 9494-5	2,100	21.00	97	75
B 9494-41	Fixed-Disk Drive; 400 megabytes, dual spindle	24,832	137.00	1,632	1,339
B 9494-12	Fixed-Disk Drive; 868 megabytes, single spindle, thin film head	34,450	120.00	—	1,495
B 9387-51C	Controller; 1x8 spindle	15,750	71.00	747	563
B 9387-52C	Controller; 2x8 spindle	21,000	106.00	992	744
B 9987	Dual Host Switch for B 9387-51/-52	5,000	15.00	230	170
B 9987-2	Dual Port Feature for B 9484-12	2,100	24.50	99	77
B 9987-1	Dual Port Feature for B 9484-41	6,174	32.00	216	181
B 9389	Dual Storage Controller	53,600	176.00	—	2,448
B 9389-DH	Dual Host Option for B 9389	5,450	19.00	—	251
B 9399	Dual String Controller	26,100	85.00	—	1,192
B 9387-41	Controller; 2x4	22,400	93.50	1,793	1,688
B 9387-42	Controller; 2x4	33,000	217.50	2,506	2,146
B 9387-24	Disk Exchange; required when more than two B 9387-51/-52 controllers are configured	21,000	70.00	979	736
B 9387-30	Expander (2x); exchange expansion rack, exchange module, required when more than four B 9387-51 or two B 9387-52 controllers are configured	11.235	18.00	522	392

**For 5-day, 8-hour service.*
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NC—No charge.

Unisys B 7900

		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
MAGNETIC TAPE UNITS					
B 9495-82	Magnetic Tape Unit; 120K, 75 ips, PE Exchange	16,000	81.50	819	648
B 9495-83	Magnetic Tape Unit; 200K, 125 ips, PE Exchange	22,447	206.50	1,029	811
B 9499-14H	Controller; includes 1x4 Master Electronic Exchange Cabinet for B 9495-82/83, 125 ips PE Control Module	11,465	154.50	821	636
B 9499-18M	Controller; includes 1x8 Master Electronic Exchange Cabinet for B 9495-82/83, 75 ips PE Control Module	21,060	154.50	866	670
B 9499-28M	Controller; includes 2x8 Master Electronic Exchange Cabinet for B 9495-82/83, two 75 ips PE Control Modules	51,240	337.00	2,347	1,398
B 9499-2XH	Controller; includes 2x16 Master Electronic Exchange Cabinet for B 9495-82/83, two 125 ips PE Control Modules	53,940	337.00	2,464	1,604
B 9499-3XM	Controller; includes 3x16 Master Electronic Exchange Cabinet for B 9495-82/83, three 75 ips PE Control Modules	83,310	496.00	3,650	2,516
B 9499-4XH	Controller; includes 4x16 Master Electronic Exchange Cabinet for B 9495-82/83, four 125 ips PE Control Modules	110,200	658.00	4,783	3,317
B 9999-4H	NRZI Option for B 9495-82 and -83 drives; 75/125 ips	827	8.50	34	29
B 9495-32	Magnetic Tape Unit; 470/120K, 75 ips, GCR/PE	17,750	209.00	1,011	732
B 9495-32M	Magnetic Tape Unit, 470/120K, 75 ips, GCR/PE, with 1x4 formatter	46,000	336.00	2,202	1,772
B 9495-33	Magnetic Tape Unit; 780/200, 125 ips, GCR/PE	19,000	220.50	1,146	826
B 9495-33M	Magnetic Tape Unit; 780/200, 125 ips, GCR/PE, with 1x4 formatter	46,000	344.50	2,318	1,865
B 9499-21	GCR/PE Controller; 1x8	42,635	286.00	1,614	1,301
B 9499-22	GCR/PE Controller; 2x8, includes two 1x8 GCR/PE Controllers	85,288	567.50	3,237	2,591
B 9499-23	GCR/PE Controller; 3x8, includes three 1x8 GCR/PE Controllers	127,899	854.50	4,838	3,890
B 9499-24	GCR/PE Controller; 4x8, includes four 1x8 GCR/PE Controllers	170,553	1,138.50	6,439	5,184
B 9499-42	GCR/PE Exchange for B 9499-22; 2x16	7,571	32.00	309	242
B 9499-43	GCR/PE Exchange for B 9499-23; 3x16	9,680	42.50	403	335
B 9499-44	GCR/PE Exchange for B 9499-24; 4x16	11,356	42.50	470	376
B 9999-3	Dual Host Switch	5,905	25.00	201	166
TERMINALS					
ET 1100	Terminal Workstation with keyboard, RS-232-C, TDI	1,659	21.50	113	85
ET 2120	Terminal Workstation with keyboard, character graphics, 256KB RAM	1,395	16.50	143	106
B 21-2TS	Microcomputer System, Level 1 Workstation, 256KB RAM	1,800	57.00	—	—
CARD EQUIPMENT					
B 9115	Card Reader; 300 cpm, 80 column	8,608	92.00	396	313
B 9116	Card Reader; 600 cpm, 80 column	11,372	127.50	528	417
B 9213	Card Punch; 300 cpm, 80 column	31,085	630.00	1,434	1,180
B 9915	51-Column Read Feature for B 9115, and B 9116	844	NC	28	21
PRINTERS					
B 9247-15	Train Printer; 1500 lpm, 132 positions	33,000	842.00	2,669	2,227
B 9247-16	Train Printer; 750 lpm, 132 positions	12,000	388.00	1,043	879
B 9246-12	Train Printer; 1250 lpm, 132 positions, high-speed interface	44,625	440.00	1,745	1,448
B 9246-21	Train Printer; 2000 lpm, 132 positions, HSSI interface	40,000	826.00	3,571	2,923
B 9942-10	Additional Train Module; for B 9247-14, -15	3,408	66.00	186	159
COMMUNICATIONS EQUIPMENT					
AX 378-11	Network Support Processor IV-2	42,000	215.00	2,478	1,953
AX 378-1	Line Support Processor III	4,200	29.00	—	156
AX 378-7	Line Support Processor; 56K-bit	10,290	42.00	—	339
AX 369-8	Line Support Processor; BDLC	4,200	33.00	—	173
AX 369-3	Quad Line Adapter; (Character)	3,150	26.00	—	125
AX 378-3	Quad Line Adapter II; (Character)	3,150	26.00	—	120
AX 369-4	Quad Line Adapter; (Bit)	3,000	26.00	138	121
AX 378-4	Quad Line Adapter II; (Bit)	3,150	26.00	—	125
AX 369-10	RS-232 Electrical Interface; (Character, Bit)	NC	—	—	—
AX 369-11	CCITT V.24 Electrical Interface; (Character, Bit)	NC	—	—	—
AX 369-12	TDI/20 Electrical Interface; (Character, Bit)	NC	—	—	—
AX 369-61	CCITT V.35 Electrical Interface; (Bit)	NC	—	—	—
AX 369-41	Autocall Feature; (Character, Bit)	NC	—	—	—
B 9378-6	Network Support Processor III to Network Support Processor IV Upgrade	6,300	—	259	194
B 9378-9	Line Support Processor to Line Support Processor III Upgrade	2,100	—	86	64

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Unisys B 7900

		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
INTER-SYSTEM CONTROL					
A 320-IHC	Independent Hub Cabinet	22,270	142.50	865	711
A 320-5	Hub 16; includes 2-port capability	9,040	60.50	363	297
A 320-6	Hub Expansion; additional 1-port capability	771	6.00	39	31
AX 321-2	ISC Host DLP-3	12,459	71.50	469	386
PERIPHERAL RECONFIGURATION CABINET					
A 890-PRC	Peripheral Reconfiguration Cabinet	5,512	37.50	238	197
A 890-3	Disk Kit; (B 9387-4X, B 9387-5X, B 9389)	1,765	15.00	72	61
A 890-34	Disk Kit; (B 9387-4X, with B 9387-3X exchange)	1,765	15.00	72	61
A 890-4	PRC PE/NRZ Magnetic Tape Control Kit	3,859	22.50	163	127
A 890-8	PRC GCR Magnetic Tape Control Kit	2,095	15.00	89	71

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SOFTWARE PRICES

		Limited Time-Plan	Annual Product Service Agreements	
		Monthly License Fee ($)	PSA 2 ($)	PSA 1 ($)
B 7000 SSF	System Software Facility; includes Master Control Program (MCP), Utility Programs, Algol Compiler, DC Algol Compiler, Program Binder, Gemcos (Basic), DCP Program Generator/Network Definition Language, Menue Assilsted Research Center (Marc), SMF II Site Management, Workflow Language, and one additional compiler	2,545	12,960	7,500
Compilers				
B 7000 ATD	Test and Debug (Algol)	160	372	185
B 7000 BSC	Basic Compiler	264	1,428	828
B 7000 APL	APL/700	264	1,428	828
B 7000 COB	Cobol Compiler (Ansi 68)	264	1,428	828
B 7000 C74	Cobol Compiler (Ansi 74)	264	1,236	720
B 7000 PL1	PL/1 Compiler	264	1,428	828
B 7000 FOR	Fortran Compiler (IBM Level H)	264	1,428	828
B 7000 F77	Fortran 77 Compiler	275	1,428	833
B 7000 RPG	Report Program Generator	282	1,392	816
B 7000 PAS	Pascal Compiler	355	1,272	696
B 7000 SRT	Sort Utility	220	900	432
Support Utilities				
B 7000 BAR	Activity Reporting	132	720	420
B 7000 LOG	System Logger	84	468	264
B 7000 SSL	Security Support Library	77	384	228
B 7000 SMR	SMF II Resource Management	500	2,400	1,392
B 7000 BSL	Billing Support Library	77	384	228
B 7000 MLS	Multilingual System	50	300	180

Unisys B 7900

		Limited Time-Plan	Annual Product Service Agreements	
		Monthly License Fee ($)	PSA 2 ($)	PSA 1 ($)
Data Communications				
B 7900 NCS	Network Communications Subsystem	230	1,320	780
B 7000 BNS	BNA Network Services	1,089	6,204	3,588
B 7000 RJE	Remote Job Entry	100	504	300
B 7000 RMP	Remote Print System	250	1,428	828
B 7000 FSL	Format Support Library	110	660	360
B 7000 HSV	Host Services	1,100	6,300	3,660
B 7000 DIA	Diagnostic MCS	84	420	240
B 7000 MCB	Gemcos (Basic)	594	2,988	1,728
B 7000 MCA	Gemcos (Advanced)	985	4,752	2,748
B 7000 MCT	Gemcos (Total)	1,183	5,964	3,456
B 7000 MCF	Gemcos Format Generator	231	1,092	636
B 7000 CDE	Command and Edit (Cande)	297	1,380	804
B 7000 EDI	The Editor	275	1,428	833
B 7000 SDF	Screen Design Facility	220	744	372
B 7000 COT	Communications Management System	1,210	3,360	1,680
B 7000 COE	Communications Management System (Entry)	630	2,028	1,008
Data Management				
B 7000 DM2	DMS II	1,400	4,020	2,020
B 7000 DI2	DM Inquiry	290	1,596	924
B 7000 DBA	Data Base Analyzer	225	1,200	696
B 7000 DDM	Data Base Monitor	225	1,200	696
B 7000 DIC	Data Dictionary	322	1,656	960
B 7000 DMT	DM Interpreter	180	912	540
B 7000 DMC	DM Certification	220	1,200	756
B 7000 DME	Data-Aid	150	855	495
B 7000 ERG	Extended Retrieval with Graphic Output (requires DM Interpreter)	550	2,640	1,104
B 7000 TPS	Transaction Processing System Host	200	1,068	504
B 7000 IDD	Advanced Data Dictionary	740	2,820	1,440
Reporting				
B 7000 RP3	Reporter III	625	2,856	1,560
B 7000 OR3	On-Line Reporter III (requires RP3)	65	336	204
Workstation Integration				
B 7000 DES	Data Entry System	394	1,524	768
DC 7000 HLS	Host-Link Server	480	800	400
B 7000 FDE	Intelligent Distributed Editor	250	1,428	828
B 7000 DTS	Data Transfer System	180	912	432
Productivity Aids				
B 7000-LN2	Logic Information Network Compiler	4,815	24,600	11,280
B 7000-L2R	Linc II Run Time System	480	—	840