Unisys A 12

MANAGEMENT SUMMARY

UPDATE: *Unisys streamlined its line of A Series computers with the addition of the A 12E and the A 17 mainframes. The A Series now includes the A 1, A 4, and A 6 "smallframes" (which replaced the A 2, A 3, and A 5); the A 10X Models (the A 9 is no longer actively marketed); the A 12 systems; the A 15X Models; and the new A 17 Systems. Performance power for the A Series ranges from 1.0 for the single-processor A 1 to 144.0 for the four-processor A 17N. The A 12E is the new entry point into the large-scale A Series family. The A 12E is field upgradable to the A 12, A 15, or the A 17. Unisys has reduced purchase prices for the A 12 and the A 15, providing an economic incentive for users wishing to upgrade to the larger systems. Kits to upgrade the A 12E to the A 12 or to the A 15 are available right now. The A 12 upgrade to the A 17F will be shipped in May 1988.*

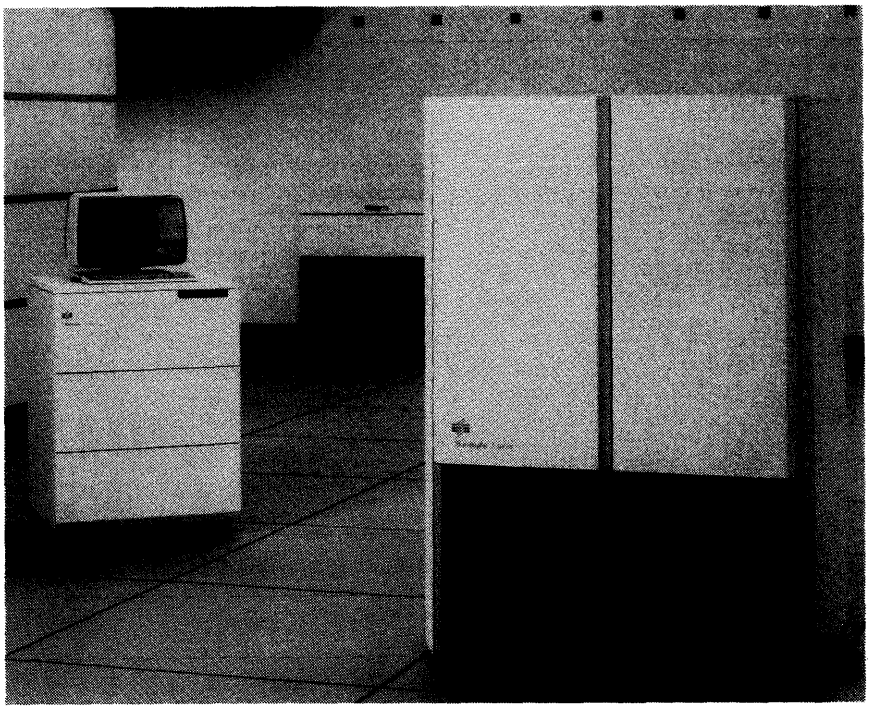
The A 12 is a general-purpose data processing system and can serve as a centralized processing hub, a distributed processing node, a program development system, or a disaster recovery system. The midsized A 12 is the most compact of the large-scale A Series mainframes. The Central Processor, the Memory Storage Unit with 24 megabytes to 144 megabytes of main memory, the Memory Control, and the Host Data Unit are housed in a single, air-cooled cabinet occupying less than 10 square feet. Using a pipeline, look-ahead architecture, the five processors in the central processor module (CPM) work concurrently, overlapping many processing steps. This provides the high-speed system throughput necessary for on-line transaction processing (OLTP) and remote applications. The

Unisys has added the A 12E to its A 12 Series of general-purpose mainframes. The A 12E lowers the entry-level price for the Unisys large-scale systems over the previously released A 12 model. The A 12 systems are field-upgradable to the A 15 and A 17, increasing processing power nearly 13 times. The A 12 models are object-code compatible with all other systems in the A Series family. They feature a distributed architecture and are supported by the MasterControlProgram/AdvancedSystem(MCP/AS) operating system.

MODELS: A 12E and A 12.
CONFIGURATION: The A 12E and A 12 are single-processor systems with from 24 to 144 megabytes of main memory, expandable in 24-megabyte increments. The I/O system contains 12 to 48 Data Link Processors, which are responsible for information transfer.
COMPETITION: Amdahl 580, Honeywell Bull DPS 88, IBM 308X and 3090.
PRICE: The purchase price for a basic A 12E is $795,000, and the basic A 12 is priced at $1,304,000.

CHARACTERISTICS

MANUFACTURER: Unisys Corporation, P.O. Box 500, Blue Bell, Pennsylvania 19424. Telephone (215) 542-4011.



The Unisys A 12 system consists of two single-processor models, offering pipeline architecture for increased efficiency and greater throughput. Main memory capacity ranges from 24 megabytes to 144 megabytes, expandable in 24-megabyte increments. The A 12 is object-code compatible with all the A Series mainframes and is field-upgradable to the A 15 and A 17.

Unisys A 12

internal design of the CPM places specific emphasis on optimizing the execution of scientific-oriented work loads. To further enhance system performance, the microprogrammable Host Data Unit services I/O queues independently from the CPM, freeing the central processor to execute user work. The Data Link Processors (DLPs) also reduce the burden on the CPM by performing all peripheral-dependent functions.

The optional Software Disk Cache utility, originally introduced for the A 12 and A 15, is now available on the A 12E. Software Disk Cache ensures that data is directly accessible from main memory rather than disk by designating a complement of main system memory as a disk cache unit. Fast information access is particularly important in a transaction processing environment. According to the vendor, a 40 percent increase in performance is average; some internal benchmark tests showed an even higher percentage.

Software Disk Cache is especially advantageous for users whose major applications evolve around transaction processing, such as banks, brokerage houses, hotel chains, and airlines.

COMPETITIVE POSITION

With only a moderate (6 percent) increase in mainframe sales predicted for this year, vendors must review marketing strategies for their large-scale, general-purpose computers. The two fastest-growing segments of the computer market are scientific computing and on-line transaction processing (OLTP). Scientific processors and OLTP systems can be independent or linked to a mainframe. Because regular OLTP systems do not have the large storage capacity of general-purpose mainframes, applications requiring a large data base, such as airline reservation systems, are still based on Unisys or IBM mainframes. Unisys also considers the financial services industry a key market. The vendor hopes to expand its presence in this market from document processing to the other banking areas. Unisys will face stiff opposition from IBM, which has the biggest installed base, followed by NCR, the specialist in small banking systems. However, with the recent acquisition of Timeplex, the wide area network vendor, Unisys will be in a good position to challenge IBM for contracts with the bigger banking institutions worldwide. Timeplex' T1 and packet-switching technology will provide those institutions with the ability to link all their branch offices located in different areas. The large-scale A Series, with its high availability, large main memory, and unique software features (Disk Cache, Memory Disk, and Mirror Disk), provides the fast access demanded in a transaction processing environment.

Unisys introduced the A 12E to provide a smoother upgrade path and plug a performance gap in the midsection of its A Series product lineup. The A 12E is rated at 66 percent of the A 12's performance. Competitors in the same performance range with the A 12 systems include the IBM 4381 Model 24 and the 3090 Model 150E, the

Canada: Unisys Canada, 2001 Sheppard Avenue East, North York, Ontario M2J 4Z7. Telephone (416) 495-0515.

MODELS: Unisys A 12E and A 12.

DATA FORMATS

BASIC UNIT: sixty-bit word consisting of forty-eight data bits, four control bits, and eight error correcting bits.

FIXED-POINT OPERANDS: Each single-precision integer operand 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 four-, six-, seven-, or eight-bit characters.

FLOATING-POINT OPERANDS: Integer and floating-point operands have the same format and may be freely combined in arithmetic operations.

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

INTERNAL CODE: Eight-bit EBCDIC is standard. Information coded in ASCII (the primary data communications code) can also be processed.

MAIN MEMORY

The Memory Subsystem consists of a Memory Storage Unit (MSU) and a Memory Control (MC). The Memory Control provides the processor interface to the memory subsystem, which contains from one to six memory storage boards. Main memory is based on 256K-bit Dynamic RAM (DRAM) chip technology and is expandable in 24-megabyte increments, from a base of 24 megabytes to a maximum of 144 megabytes. The Memory Control contains a purgeless cache mechanism that extends the memory system to the requestors' caches, allowing only one master of the data referenced by a memory address to exist in the system. If the original is in main memory, the requestors may have copies in their caches. The copies cannot be modified by the requestor. The MC accepts jobs from, and initiates jobs to, its requestors to cause selective blocks of data to migrate back to memory from the requestors' caches. This eliminates the need to periodically purge the cache to maintain accuracy of main memory. Data will reside in a requestor's cache until it is displaced by more recently needed data or is required by another requestor. The Requestor Interface Modules (RIMs) provide all the logic required to interface a requestor (Central Processor, Host Data Unit) to the memory system. The RIM contains the cache control tables and data storage for uncompleted store operations. The Storage Interface Modules (SIMs) provide the interface between the memory control and the storage units.

STORAGE TYPE: 256K-bit Dynamic RAM Single Inline Package (SIP) storage boards.

CAPACITY: For memory capacity of the A 12, refer to Table 1.

CYCLE TIME: Not available from the vendor.

CHECKING: Logic in the Memory Control (MC) performs automatic detection and correction of single-bit errors and detection of multiple-bit errors.

RESERVED STORAGE: Not available on the A 12 models.

Unisys A 12

TABLE 1. SYSTEM CHARACTERISTICS

MODEL	A 12E	A 12
SYSTEM CHARACTERISTICS		
Date announced	November 1987	March 1986
Date first delivered	November 1987	Third quarter 1986
Field upgradable to	A 12	A 15FX
Relative performance	11.2*	16.8*
Number of processors	1	1
Cycle time, nanoseconds	62.5	62.5
Word size, bits	48	48
Operating systems	MCP/AS	MCP/AS
MAIN MEMORY		
Type	256K-bit DRAM	256K-bit DRAM
Minimum capacity, bytes	24M	24M
Maximum capacity, bytes	72M	144M
Increment size	24MB	24MB
Cycle time, nanoseconds	Not available	Not available
BUFFER STORAGE		
Minimum capacity	30KB	30KB
Maximum capacity	30KB	30KB
Increment size, bytes	Not applicable	Not applicable
INPUT/OUTPUT CONTROL		
Number of channels:		
Byte multiplexer	Not applicable	Not applicable
Block multiplexer	Not applicable	Not applicable
Word	Not applicable	Not applicable
Other	12 to 48 DLPs	12 to 48 DLPs

**Based on a relative performance of 1.0 for the A 1 Model F.*

Honeywell Bull DPS 88/861, and the Amdahl 5890 Model 190E. The IBM 4381 has 16 to 64 megabytes of memory and 12 to 24 I/O channels and costs $890,000. In comparison, the Unisys A 12E with 12 to 72 megabytes of memory and 12 to 48 DLPs (channels) costs $795,000. The 3090 Model 150E has 32 to 64 megabytes of memory and 16 to 32 I/O channels and is priced at $1,650,000; the Honeywell Bull DPS 88/61 with a memory capacity of 32 to 64 megabytes and 64 channels is priced at $1,740,000; and the Amdahl 5890 Model 190E has 32 to 256 megabytes of memory, 16 to 48 I/O channels, and a price of $2,625,000. The Unisys A 12 is priced at $1,304,000 and includes 24 to 144 megabytes of memory and 12 to 48 DLP. A direct comparison is not possible because of the different architectures, operating systems, and instruction sets employed by these systems.

ADVANTAGES AND RESTRICTIONS

The A 12 operates under the MCP/AS operating system, which includes several important products and features. Among them are MicroView, a micro/mainframe link; InfoView, a multiwindow capability for microcomputers; and Data-Aid, an information management facility. Memory Disk and Mirror Disk are two of the major features of the MCP/AS. Memory Disk provides a cost-effective method to improve performance by using the system's large main memory as a disk unit. The increase in speed of memory access over disk access is significant. With Mirror Disk, realtime data on disk units are duplicated, increasing data integrity through multiple pack copies. Critical packs and crucial data base systems are key targets for mirroring.

The A Series offers one of the widest ranges of object code-compatible systems in the industry. No program or

CENTRAL PROCESSOR

The Central Processor Module (CPM) utilizes Very Large Scale Integration (VLSI), Emitter Coupled Logic (ECL) gate array technology. Microcode is used as the source of control for operator execution. The A 12 CPM is part of a distributed system and is functionally subdivided into the following five relatively independent submodules that perform concurrent functions:

- **Program Control Unit (PCU)**
- **Reference Unit (RU)**
- **Execution Unit (EU)**
- **Write Unit (WU)**
- **Memory Access Unit (MAU)**

Operations are distributed through the five concurrent units, allowing execution order to be determined by resource availability rather than code sequence order.

The Program Control Unit fetches operators from its program cache and translates the operators from the external machine stack architecture into a three-address operation for processing by the Reference Unit and the Execution Unit. These addresses are pointers to locations in the Central Data Buffer, which contains 64 registers. Along with these addresses, the PCU allocates a job number and passes other pertinent information necessary to complete the operation. The job number is used to maintain overall orderly processing of an operator in the various pipelines of the Reference Unit and Execution Unit. The Central Data Buffer locations assigned by the PCU to an operator are deallocated at the end of the operation.

The Reference Unit uses the operator queues built by the Program Control Unit and calculates the absolute address for all data required to perform the operation. It also

Unisys A 12

data code conversion is necessary when moving from the A 1 through the A 17 systems. In addition, the A Series is object-code compatible with all previous models of the former Burroughs large-scale computer product line. The A Series is not compatible with its Unisys stablemate, the former Sperry 1100 family of mainframes. The two incompatible product lines will be merged through communications links and fourth-generation language (4GL) software, primarily for users who have both architectures installed. Unisys has to protect not only its own huge investment in the two diverse product lines, but also the investment of its substantial user base. Unisys will continue to enhance its different mainframe architectures and operating systems "forever and a day," according to its Chairman W. Michael Blumenthal. This sounds faintly reminiscent of the promises the U.S. government made to the Indians, "as long as the grass grows."

USER REACTION

A food service company in Michigan upgraded from an A 9F to an A 12 system and rated the ease of expansion as excellent. The A 12 is used as an organizational system, supporting over 60 local and 20 remote terminals. Applications include accounting, billing, purchasing, order processing, inventory, payroll, and personnel records. Communications are handled by the CP2000 communications processor, and the user is very satisfied with its performance. The user rated the good to excellent in ease of operation and reliability of both the mainframe and the peripherals. Vendor's technical support and maintenance service were rated fast and efficient.

For more information on user ratings for the Unisys A Series, please refer to Page 70C-000EB-101. □

fetches data from its data cache. If the data is not present in cache, it will prompt the Memory Access Unit to provide the data from the main memory via the cache.

The Execution Unit performs all arithmetic and logic operations on data from the preallocated locations in the Central Data Buffer. The results of an Execution Unit operation may either be stored in the Central Buffer registers or sent to cache memory and the Write Unit.

The Write Unit logic provides and manages a buffer for storing data from the Execution Unit before sending it to the Reference Unit for storage in the data cache. This action minimizes the impact on the Execution Unit of operators that perform write operations.

The Memory Access Unit is pipelined and can handle up to eight separate active requests simultaneously; it can also process returns concurrently. The MAU performs nonlocal references, memory control initiated purges, and return operations. It also handles system message traffic and system interrupts.

SPECIAL FEATURES: The Maintenance Subsystem is housed in its own cabinet and consists of integrated error detection and fault isolation units, dedicated Host Maintenance Controllers (HMCs) for error logging and mainframe data access, the System Maintenance Station (SMS II), and the ET2160 intelligent workstation functioning as the System Control/Maintenance Diagnostic Processor (SC/MDP). The System Maintenance Station executes hardware diagnostics and test routines, monitors all A 12 cabinets, and is responsible for system configuration and initialization. It allows remote access to all maintenance functions and remote hardware or system software support through an RS-232 remote support link. The Maintenance Subsystem includes two 85M-byte disk drives, a quarter-inch streaming tape drive, and a 5¼-inch diskette drive.

PHYSICAL SPECIFICATIONS: The dimensions for the A 12 cabinets are listed in the following chart.

A 12E and A 12	Width (in.)	Ht. (in.)	Depth (in.)	Wt. (lb.)
Processor/Memory Cabinet	43.7	69	31.7	1,000
I/O Cabinets (each)	29.0	44	29.0	450
System Maintenance Station	29.0	44	29.0	300

The three cabinets occupy 27 square feet of floor space and have a power consumption of 16.2 kVA. Heat to air output is 49,600 Btu per hour.

CONFIGURATION RULES

A basic A 12 configuration consists of one central processor module; a memory storage unit containing 24 megabytes of memory (expandable in 24-megabyte increments, up to 72 megabytes for the A 12E and 144 megabytes for the A 12); two to eight independent I/O cabinets, each with two I/O base modules supporting from 12 to 48 Data Link Processors (DLPs); a system maintenance station; one ET2160 SC/MDP maintenance terminal; two Line Expansion Modules (LEMs); one T27 operator display terminal (ODT); one operator console DLP-3; and one ODT adapter for additional ET1100 operator display terminals.

INPUT/OUTPUT CONTROL

The Host Data Unit (HDU) located in the processor/memory cabinet provides the interface between main memory and the independent I/O cabinets through two Message Level Interfaces (MLIs). Each Message Level Interface connects to an I/O base module in the I/O cabinet. The I/O base modules contain a series of specialized microprocessor-based Data Link Processors (DLPs). These units control the transfer of information to and from the peripheral subsystem, thereby relieving the central processor of that responsibility.

The Data Link Processors 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 will accept multiple I/O message requests and queue them for processing. The DLP then initiates the peripheral-dependent functions required to perform the I/O transfer, independent of the central system. Each DLP includes local memory that is used to buffer the data transfer operations.

MASS STORAGE

For information on mass storage devices for the A 12, refer to Table 2.

INPUT/OUTPUT UNITS

For information on magnetic tape units and printers used with the A 12, refer to Table 3.

Unisys A 12

TERMINALS

For information on terminals used with the A 12, refer to Table 4.

COMMUNICATIONS

The A 12 Data Communications Subsystem allows a modular approach to the design of small, medium, and large data communications networks. It includes the Data Communications DLP (DCDLP) with four communications lines for the configuration of entry-level data communications networks. For more extensive data communications requirements, the A 12 supports Network Support Processors (NSPs). Local Area Networks and Wide Area Networks can also be implemented with the Integrated Communications Processor DLP (ICPDLP), Communications Processor Local Area Network (CPLAN), CP2000 Communications Processor, and Burroughs Network Architecture (BNA II).

The *NSP* is a programmable front-end processor that serves as the central element of the communications subsystem; it contains 512K bytes of integrated circuit memory. 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 handles subsystem control, data link control, and line discipline control functions. Subsystem control includes control of data links and stations, information transfer, and network reconfiguration. Data link control involves tracking logical status of communications lines; making and breaking connections on switched lines; first-level recovery; and determining which line-protocol function is to be performed next and, on multipoint lines, for which station. Station control includes keeping track of the ready/not ready and enabled/disabled conditions for input status of stations on a communications line, device control for properly formatting output display, and handling user options.

The information transfer function includes translating between logical station addresses, transmitting output messages to stations, forwarding input messages from stations to the central system, and performing application-dependent editing upon both output and input messages on a per-station basis. The network reconfiguration function allows an installation to assign, remove, or swap stations or communications lines, permitting dynamic network revisions as the environment changes.

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 communications lines with subbroadband speeds of up to 19.2K bits per second (bps). A special version of the LSP is available for installations requiring 56K bps transmission speeds. This specialized LSP services a single 56K Line Adapter and supports transmission rates of 56K bps. The same configuration flexibility available with NSPs is available with LSPs. Multiple communications paths can be activated through the use of MCP/AS operator console commands.

A *Quad Line Adapter* (*QLA*) provides the electrical interface between the LSP and each communications line. The QLA maintains physical control of the line, accumulates characters, and transfers them to or from the LSP. Each QLA includes 4K bytes of local memory for storing of translation tables, message buffers, line parameters, polling sequences, and the code required to control the communications line and line discipline.

The QLAs are packaged in sets of four. Each set accommodates the electrical interfaces for four lines and can be specified as either character oriented or bit oriented. Most communications protocols use character-oriented transmission; Burroughs Network Architecture (BNA II) uses bit-oriented transmission. For each line position within a QLA, one of three types of electrical interfaces must be specified: RS-232, for U.S. modem connection; CCITT V.24, for international modem connection; or TDI/20, for direct connection. Different electrical interfaces can be intermixed within the same QLA, and character- and bit-oriented QLAs can be intermixed on the same LSP. Each LSP accommodates up to four Quad Line Adapters and up to 16 lines.

The *CP2000 Communications Processor* connects to the A 12 through the Integrated Communications Processor (ICP) and can be used as a front-end processor. When placed in a remote location, the CP2000 performs as a concentrator or controller. Together with the enhanced BNA II Network Services software, the communications processor provides distributed processing capabilities, control of terminal networks, and gateways which allow Unisys mainframes to communicate with IBM systems through SNA networks.

SOFTWARE

The Source System Software Facility for the A 12 includes the Master Control Program/Advanced System (MCP/AS) operating system, Microcode, Utilities, an Algol compiler, a DC Algol compiler, Work Flow Language (WFL), Menu Assisted Resource Control (MARC), and Cross Reference Symbolic.

OPERATING SYSTEM: The *Master Control Program/Advanced System (MCP/AS)*, designed to support the advanced architecture of the A Series family of computers, is the operating system used by the A 12. The operating system software 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/AS routines. The second-level routines handle the 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.

Jobs are submitted to the operating system through the Operator Display Terminal (ODT) and/or the system input units. As the control statements 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 operating system 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. The job

Unisys A 12

TABLE 2. MASS STORAGE

MODEL	Multi-Disk8-2/4	B 9494-10I	B 9494-10S	B 9494-12	B 9494-24
Cabinets per subsystem	2	2 to 8	2 to 8	1 to 8	1 to 8
HDAs per cabinet	2 to 4 Winchester	2 fixed	2 fixed	1 fixed	2 fixed
Capacity per HDA	250MB formatted	1084MB formatted	962MB formatted	868MB formatted	1736MB formatted
Average seek time, msec.	18	21.7	13.7	16	17
Average access time, msec.	26.3	30	22	24.3	25.3
Average rotational delay, msec.	8.3	8.3	8.3	8.3	8.3
Data transfer rate	2.4MB per sec.	1.2MB per sec.	1.2MB per sec.	3MB per sec.	3MB per sec.
Controller model	Storage Module Device interface	B 9387-51C, B 9387-52C	B 9387-51C, B 9387-52C	B 9389, B 9399	B 9389, B 9399
Comments	—	Requires A 304-91 DLP-3	Requires A 304-91 DLP-3	Requires A 304-91 DLP-3	Requires A 304-91 DLP-3

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 operating system controls 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. Segment Descriptors, maintained in a portion of the stack base known as the Segment Dictionary, are the basis for the implementation of virtual memory. In contrast to the fixed-page concept utilized in many storage allocation schemes, programs can be divided into variable-length segments, which are brought into main memory only as they are needed. In MCP/AS, Segment Descriptors contain a length field, an Actual Segment Descriptor (ASD) number field, and a touched bit. The length field specifies the length of the code segment in words. The touched bit indicates the status of the ASD number field. If the touched bit is on, the ASD number field points to an ASD table entry, and the ASD table entry points to the code segment in memory or on disk. If the touched bit is off, the code segment is on disk and has never been referenced.

A Data Descriptor fetches data to the stack or stores data in a storage area outside the stack. The Data Descriptors contain a length or index field, ASD number field, touched bit, copy bit, indexed bit, and size field. The size field indicates the size of the data items in the data segment. The index bit indicates the status of the length or index field. If the index bit is on, the length or index field is an index. The touched bit indicates the status of the ASD number field. If the touched bit is on, the ASD number field points to an ASD table entry. The ASD table entry points to the data segment in memory or on disk. If the touched bit is off, the data segment has never been referenced by the program. If the copy bit is off, it specifies that the data descriptor is the original descriptor for a data segment.

The Actual Segment Descriptor (ASD) memory management provides monolithic memory management of memory sizes up to 72 megabytes on the A 12E and 144 megabytes on the A 12. The ASD table is an area in memory which can contain up to 1 million entries. Each entry in this table is a multiple-word structure. The operating system will initially allocate an ASD table of a size that is proportional to the amount of main memory. The ASD Operator Display Terminal command allows the operator to display the size of the table and the maximum number of entries used, as well as to change the size of the table.

The ability to change the size of the ASD table assures the user that the table is large enough for the work load, but not so large as to waste memory. The ASD table contains an entry for each code or data segment which has been touched. A touch will occur on the first reference to the code or data segment. At that time, the MCP/AS operating system will allocate an entry in the ASD table. An entry in the ASD table contains an address field and a presence bit. The presence bit indicates the status of the address field. If the presence bit is on, the data or code segment is in memory and the address field contains a 32-bit physical memory address. If the presence bit is off, the data or code segment is on disk and the address field contains the record number of the item in the overlay or code file.

With ASD memory management, when an area of physical memory is overlaid, all data and segment descriptors point to a common descriptor, the ASD; a bit maintained in the ASD entry specifies whether or not the segment has been altered. The segment will only be written to disk if it has been altered.

True dynamic memory allocation is a feature of the operating system. 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 operating system automatically overlays these new segments over other program or data segments that have not been accessed recently.

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 lower and upper 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

Unisys A 12

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 9495-24	9	1600	PE	200	320,000
	9	6250	GCR	200	1,250,000
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
BT3244	9	1600	PE	75	120,000
	9	6250	GCR	75	470,000
BT3266	9	1600	PE	125	200,000
	9	6250	GCR	125	780,000
BT3288	9	1600	PE	200	320,000
	9	6250	GCR	200	1,250,000

Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
B 9246-6	650 lpm	132	10	6 or 8	4 to 20
B 9246-12	1,250 lpm	132	10	6 or 8	4 to 20
B 9246-24	2,000 lpm	132	10	6 or 8	4 to 20

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, memory links, control words, and tables maintained by the operating system.

The MCP/AS provides comprehensive input/output and file control facilities. Whenever possible, peripheral devices are automatically assigned to symbolic files 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 printers. This makes it unnecessary to delay the processing of a job because of the nonavailability of a particular I/O unit.

Communications between the system operator and the operating system 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: 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.

The *Menu Assisted Resource Control (MARC)* module has been enhanced under MCP/AS to provide a more flexible system. The MARC module offers menu assistance for all system operations. Complete on-line help and teach information is available. A direct interface allows a user to define, create, and name commands to be executed by MARC. Products and features such as PrintS and ReprintS are supported by MARC.

Work Flow Management is an MCP/AS facility that provides enhanced capabilities 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 within each job as the user prescribes. Facilities provided by the Work Flow Management System include sequencing and synchronizing 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. WFL has been enhanced with the Print statement, providing a batch interface to the PrintS and ReprintS system.

PrintS is integrated with the MCP/AS and provides routing and scheduling of files for printing and controls when and where to print. Printer backup file control descriptors maintain the number of copies to be printed by destination and handle the file after printing. Several descriptors control the presentation of printed files in terms of forms, banners, and transformation of data. *ReprintS* extends these PrintS facilities to remote printers.

Memory Disk is a major feature of the MCP/AS operating system. With Memory Disk, some portion of the system's main memory can be used as a disk unit. Up to two units of Memory Disk can be specified as a family or as individual units. Each unit is declared in terms of pages, with 768K bytes per page. Up to 80 pages are possible per unit, or a total of 120 megabytes for two units. Each unit must be identified as a unique peripheral unit and will be treated as a disk. From 3 megabytes up to 120 megabytes of memory can be specified as disk, and files from any disk unit can be copied to the Memory Disk units.

Unisys A 12

Mirror Disk is the parallel functioning of two to four disks where all the units are exact copies of each other. This feature is an extension of the MCP/AS operating system. Critical operations, key object program packs, and data base systems should be mirrored. Each pack can be copied up to three times, with each pack family and each of its copies constituting a mirrored set. On-line creation of mirrors is allowed while still providing access to the master pack. An audit trail is maintained to identify which areas have already been copied, are to be copied, and are in the process of being copied. At the completion of the mirror creation, a recopy of updated areas will take place to ensure the mirrored copy is brought up to the level of the master. Members of a mirrored set residing off-line are audited and updated to match the master and then placed on-line.

Software Disk Cache is an optional utility available for the A 12. Disk Cache allows frequently or recently accessed portions of the disk subsystem to reside in main memory. Access to this memory-resident data takes place at memory speed, reducing I/O time to almost zero. Disk Cache requires a minimum of 24 megabytes of memory to be allocated to the Software Disk Cache and a separately licensed operating system module.

PROGRAMMING LANGUAGES: A wide range of high-level and interpreter languages are supported, including APL, Algol, Basic, Cobol 68 and 74, Fortran 66 and 77, Pascal, PL/1, and RPG II.

DATA BASE MANAGEMENT: *DMS II* is a comprehensive Data Base Management System which uses MCP/AS facilities for accessing records in the data base to achieve greater runtime efficiency. Through the operating system facilities, the DMS II data base can be accessed by applications 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 are 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 of information by different applications 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. DMS II recovery capabilities include the ability to audit transactions as they are referenced or added to the data base and a checkpoint/restart capability. A recovery utility is automatically initiated by the operating system in the event of system failure to effect recovery of the data base and the restart of applications programs. In addition, DMS II permits the data base to be dumped concurrently with updates to the files, so that dumps correspond to the current audit trail.

DMS Inquiry is an optional extension of DMS II and 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 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 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.

DMS II DB Analyzer gives detailed statistical and descriptive attributes of both the physical and logical data base implementation. The information is presented by means of a series of predefined report programs, aiding the user in determining the efficiency of the current implementation, changing the structure for increased efficiency, and deciding when reorganization is needed.

DMS II DB Monitor provides realtime monitoring and control of the status of a DMS II data base. DB Monitor provides dynamic monitoring of current data base performance statistics such as memory usage, audit trail attributes, sync point/control point frequency, buffers allocated for each structure, and user counts of the number of programs accessing the data base and one or more structures within it.

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 uncouples the application from the data base and allows data base changes without a corresponding recompilation of the application program in most cases.

The *Advanced Data Dictionary System (ADDS)* is a DMS extension providing for the centralized definition, storage, and retrieval of data descriptions. Information about DMS II data base definitions, Cobol 74 file structures, and SDF screen formats are all stored in the ADDS data base. Line and page scrolling allow easy browsing of data base structures and their entities. A security mechanism restricts access to the dictionary contents by assigning an authorized user code when ADDS is first brought on-line. Tracking of Cobol 74 programs is optionally enforced by the Dictionary Administrator. If enforced, all Cobol 74 programs must have a valid ADDS program name identified in the dictionary. A set of report programs provide on-line support and store the specifications of printed reports for future viewing and modification.

Extended Retrieval with Graphic Output (ERGO) is an enhanced inquiry and reporting system used to access DMS II data bases and conventional files defined in the Advanced Data Dictionary System. 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.

Data-Aid is a new, interactive, menu-driven system complemented by on-line Help and Teach. If a new data base is to be described, Data-Aid transfers the user to ADDS. Data-Aid monitors the generation of the data base software modules and the data base initialization, then transfers the user to ERGO to load the data base through the ERGO update capabilities and report against it. On request, Data-Aid will initiate and track the Dump, Copy, and Recovery functions of the data base.

For more information on DMS II, please refer to Page SW25-944YT-401 in Volume 3.

DATA MANAGEMENT: The *InfoExec* is based on semantic data model technology and consists of an integrated

Unisys A 12

TABLE 4. TERMINALS

MODEL	ET 1100	T 27	B 26	B 38
DISPLAY PARAMETERS				
Max. chars./screen	2,080	1,920	2,240	2,240
Screen size (lines x chars.)	24 x 80	24 x 80	29 x 80	29 x 80
Symbol formation	7 x 9 dot matrix	7 x 9 dot matrix	9 x 12 dot matrix	9 x 12 dot matrix
Character phosphor	P39 green	P39 green	White	P31 green
Total colors/no. simult. displayed	Not applicable	Not applicable	Not applicable	Not applicable
KEYBOARD PARAMETERS				
Style	Typewriter	Typewriter	Typewriter	Typewriter
Character/code set	128 ASCII	128 ASCII	128 ASCII	128 ASCII
Detachable	Standard	Standard	Standard	Standard
Program function keys	10	12	10	10
OTHER FEATURES				
Buffer capacity	512KB	None	512KB	1MB
Tilt/swivel	Standard	Standard	Standard	Standard
Graphics capability	None	None	Optional	Optional
TERMINAL INTERFACE	RS-232-C, TDI	RS-232-C, TDI	RS-232-C, RS-422, Centronics parallel	RS-232-C, RS-422, Centronics parallel

family of products. The InfoExec components required to establish a functional data base include ADDS, DMS II, and Semantic Information Manager (SIM).

SIM manages all physical aspects of the data base, providing data independence for programs. Data independence allows the structure of a SIM data base to be changed without affecting the programs that access it, thereby minimizing the impact of any physical data base change. SIM provides full referential integrity, a particular type of logical consistency, in information contained in the data base. It ensures that relationships are correctly maintained when data items are changed. SIM also enforces data base security at several levels, including a user's ability to access, create, update, and delete data.

A SIM data base is defined and controlled by ADDS. Data dictionary support provides a menu-assisted method of describing the data base, eliminating the need for a complex, syntax-oriented data definition language. All ADDS menus are complemented with on-line Help and Teach information to assist users.

The *Operations Control Manager (OCM)* provides administrative support for operations procedures such as data base archiving and reorganization.

The InfoExec series incorporates two inquiry and reporting facilities. The *Interactive Query Facility (IQF)* for conventional terminals permits authorized individuals to access and update the data base. IQF allows extensive control over report formats. Specified information can be extracted from the data base and transferred to a personal computer for analysis and update. Inquiries and reports are formulated interactively through menu guidance and report painting. All IQF updates to the data base are automatically subjected to the integrity and security constraints managed by SIM to prevent invalid information to corrupt the data base.

The *Workstation Query Facility (WQF)* for intelligent workstations is supported on Unisys PCs, B 25 workstations, or IBM PCs to assist users in formulating reports. Information is supplied by the mainframe and the workstation functions as a user interface, with pop-up and pull-down menus, function keys, mouse support, and graphics serving as guides.

DATA COMMUNICATIONS: The special-purpose programming tool *Network Definition Language II (NDL II)* enables users to define and generate customized NSP control programs for data communications applications. These programs equip the NSP to handle line disciplines, buffer management, message queuing, auditing, and supervision of the flow of messages between user-coded programs and remote terminals. This enables the user's application programs to deal with remote terminals in the same manner as with conventional, on-site peripheral devices. IBM data communications algorithms allow Burroughs networks to interface to non-Burroughs terminals utilizing 3270 and 2780/3780 protocols. The IBM 3270 protocol supports both terminals and printers compatible with the IBM 3270 bisynchronous protocol for DLP-based systems. A point-to-point bisynchronous algorithm enables DLP-based A Series systems to support communications to IBM 2780/3780 RJE terminal devices.

The *Interactive Datacomm Configurator (IDC)* is an extensive tool to aid in the on-line development, implementation, and maintenance of data communications. It provides a menu-driven interface to configure the data communications subsystem from a workstation or the operator display terminal. The terminal network configuration can be changed dynamically without interruption to the network. A new enhancement enables the IDC to convert NDL to NDL II.

The *Generalized Message Control System (Gemcos)* 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 applications programs. All transaction terminals in the network are controlled by the Gemcos-created MCS and interfaced to the applications programs and the data base. Gemcos enables users to develop transaction processing applications programs independently of the network environment. The input to Gemcos is coded in the Transaction Control Language, a descriptive, free-form language that uses keywords to describe both the network environment and the requirements for message routing, message formats, access control, and recovery.

The *Communication Management System (Coms)* is an advanced communications monitor facility. Coms provides most of the features offered by Gemcos and enables users to develop transaction programs independently of the network environment. Coms supports direct windows, providing multiple views of the system, and allows Cobol 74 programs to communicate with it. Verification of messages received by a terminal are confirmed back to the direct

Unisys A 12

window. Programs communicate dynamically over a modem with a station. This dial-out capability is flexible and easy to use within an application program.

The *Command and Edit (Cande)* program 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 to develop and test programs remotely in an on-line environment concurrently with the execution of applications programs. It also provides effective control of the access, security, and charging functions in a computer time-sharing network.

Remote Job Entry (RJE) 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) software is designed to enhance the interaction of terminals with host CPUs in a network environment. BNA is also designed to facilitate a move into distributed data processing. Through the BNA architecture, 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 works with existing Unisys terminal networks and with the Global Memory multiprocessing facility available on the vendor's large-scale processors. BNA depends on logical links rather than physical links, relying on network tables maintained in the host processor 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 communications between tasks being executed at various hosts; control of the creation, update, and transfer of data from host to host; and handling of communications 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 connect Unisys processors to packet-switching services using X.25 procedures. Links can also be established to non-Unisys machines using software such as NDL II.

PROGRAM DEVELOPMENT: The *Logic and Information Network Compiler II (Linc II)* is a fourth-generation programming language which generates complete on-line, realtime systems, including programs, data base descriptions, screen formats, transaction management, and network management. Where possible, the Linc II Interactive System utilizes menu and checklist formats to provide user guidance in the development process. The central menu is referred to as the Activities Menu and provides access to all areas within the Interactive System. All documentation for Linc II will be available on-line in the Linc II Interactive System.

The Linc II Data Dictionary facility provides a new level of project control for the user when developing Linc II applications; it allows the user to specify common data items and their characteristics to ensure consistency whenever those data items are used in Linc II-developed applications. There are two levels within the Data Dictionary facility. The Global level is for data items to be used across multiple Linc II applications, and the Local level is for single Linc II applications.

Using Linc II, all screen and report formats are built through an interactive painting process. This process permits a screen or report format to be developed and displayed without requiring a generation, but a generation is still required to put the form into production. The Linc II-enhanced generation process, using the interactive syntax checking and screen and report painting features, will significantly reduce the previous Linc generation times as well as the number of generations necessary to create the production version. The Linc II Logic Editor is used to enter the specifications for global logic, global setup, data items, keywords, profiles, teach/help text for a screen format, and all types of on-line and report logic. Linc II command syntax convention is still required by the Linc II Editor. As a page of logic is entered and the screen is transmitted, the Editor will verify all information for syntax errors and return the page with any errors highlighted. Temporary memory areas can be defined within the Editor to allow the user to store commonly used logic. Up to nine temporary memory areas can be used, with each area allowing 23 lines of stored logic.

The *Query Mode* facility allows a user to perform generalized interrogations about a Linc II application specification. Essentially, Query provides a higher level "where used" capability, which aids the user in remembering particular naming conventions devised for a Linc II application.

The *Test and Debug System (TADS)* is an interactive, source-level debugging tool supporting Cobol 74, Fortran 77, and Algol. The debugging code is generated at compilation time and is evoked when the application program is executed with the TADS option set. Program execution will terminate at the initiation of a conditional or unconditional breakpoint specified by the programmer via TADS. Data is then displayed and modified as appropriate, and the execution of the program can continue.

For more information on Linc II, please refer to Page SW15-944YT-401 in Volume 3.

UTILITIES: The Master Control Program includes a variety of utility routines that perform functions such as system resource management, data transcription, library maintenance, and system log analysis. Also included are a multilingual system and an intelligent printer support facility. 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 errors, I/O errors, violations of memory protection, parity errors, and write lockout errors.

OTHER SOFTWARE: The *Intelligent Distributed Editor (IDE)* supports the Fortran 77, Cobol 74, and Algol languages and offers source file editing and text editing extensions. IDE is available in two versions. In the first version, functions are performed on the host system and interaction is achieved via a standard display terminal. The second version runs under Infoview II on an intelligent workstation, off-loading much of the mainframe overhead associated with editing into the workstation, thus balancing resource utilization between these processing units.

Unisys A 12

Reporter III is a report writer designed to simplify the retrieval, analysis, and reporting of information maintained in computer files. Reporter III 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 III is available in an Advanced version, an Audit version, and an On-Line version. Advanced Reporter III 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 III 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.

The *Screen Design Facility (SDF)* features both screen painting facilities and data entry functions such as field verification, status checking, required field, and many more. An extended inquiry capability displays all form libraries defined in the SDF indexed file or the ADDS dictionary.

The *Transaction Processing System (TPS)* provides the framework and methodology for implementing an application system for high-volume, on-line transaction processing. TPS synchronizes data base and input message recovery and centralizes, formalizes, and simplifies, message interfaces and user programming. It also provides an interface to access remote data bases using the BNA network.

Infoview II manages the interconnection of intelligent workstations including the B 25 and ET2000 with the A Series host mainframe. Up to five windows can be assigned using Unisys MT terminal emulation. One of these windows can be used to run an application program under the workstation native mode. Native mode for Infoview II will function under MS-DOS on an ET2000 or under BTOS on a B 25. Infoview II manipulates the window environment with the keyboard arrow keys or a mouse device. To further control the local workstation environment, the commands View, Edit, Repeat, and Write, as well as a scrolling capability, have been added. Copy and paste functions support the transfer of text between windows, allowing for more effective editing when working with multiple source files.

PRICING AND SUPPORT

POLICY: The A 12 is available for purchase or 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 a day, 7 days a week). The standard maintenance agreement for purchased systems covers maintenance of the equipment for eight consecutive hours per day Monday through Friday only; extended maintenance is available at higher rates.

All maintenance charges listed in this report are for monthly maintenance Metro 1 (city) Plan A.

All lease plans can 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.

SUPPORT: Users can purchase Unisys' Program Product Service Agreement, which provides various Support Service packages. The availability of a particular service package (PSA) is product dependent. Generally, PSAs provide ongoing program product service and/or field service. Program product service deals with corrections by the program product design facility. Field service provides program product problem identification assistance via telephone and/or on-site. Five service packages are defined: Software Product Support (PSA 1), for computers and customers who will not require on-site program product problem assistance; Extended Software Product Support (PSA 2), for computers and customers who will require on-site program product problem assistance; Centralized Software Product Support (PSA 3), for selected program products where only telephone service is needed; Software Product Assistance (PSA 4), for micro and PC products only; and Basic Software Product Support (PSA 5), for certain products for which telephone and on-call services are not generally available.

Mainframe computer systems will be supported from a hardware and operating system (MCP/AS) standpoint for at least seven years from date of last manufacture. Reworked, refurbished, and remarketed models are guaranteed support from a hardware and operating system (MCP/AS) standpoint for a period of five years from date of delivery. Notification of termination of either hardware or operating system support, or both, will be provided at least 24 months in advance of such termination. Unisys will support the current and immediately preceding version of each major release of the operating system and utilities.

All software is unbundled. Program products for the A 12 are offered under a plan which provides for the use of the products on a designated system on a month-to-month or extended basis.

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 Management and Operations, Control Systems, Network Systems, Data Base Systems, Programming Systems, and Applications.

TYPICAL CONFIGURATION: The following configurations illustrate a typical A 12E and A 12 system. The quoted prices include all necessary hardware, but no software.

Unisys A 12

A 12E:		A 12:	
One single processor with 24MB of memory, 1 Independent I/O Cabinet with 2 DLP bases, 1 additional Independent I/O Cabinet with 2 DLP bases, 2 Line Expansion Modules, 1 System Maintenance Station, 1 operator console DLP-3, 1 ODT adapter for ET1100 terminal, 1 ET2160 maintenance terminal, 1 free-standing operator display terminal, 1 system installation kit	$795,000	One single processor with 24MB of memory, 1 Independent I/O Cabinet with 2 DLP bases, 1 additional Independent I/O Cabinet with 2 DLP bases, 2 Line Expansion Modules, 1 System Maintenance Station, 1 operator console DLP-3, 1 ODT adapter for ET1100 terminal, 1 ET2160 maintenance terminal, 1 free-standing operator display terminal, 1 system installation kit	$1,304,000
1 MD8-4 multidisk (1000MB)	32,500	1 24MB memory upgrade	192,000
2 B9495-83 tape drives (125 ips)	44,894	3 B9494-10S disk drives (1084MB)	180,000
1 X304-95 SMD DLP	1,345	3 B9495-83 tape drives (125 ips)	67,341
1 B9499-22 tape controller (2x8)	85,288	1 B9387-51C disk controller (1x8)	15,750
2 B9246-6 line printers (650 lpm)	30,870	1 B9387-52C disk controller (2x8)	21,000
1 X246-95 printer/tape DLP	5,250	1 B9499-22 tape controller (2x8)	85,288
1A341-93 ODT adapter (ET1100)	3,536	2 B9246-12 line printers (1,250 lpm)	89,250
1 X113-ICP integrated communications processor	14,200	1 AX246-92 line printer DLP-2	4,620
1 X378-10 data communications DLP	8,400	1 AX395-91 tape DLP-2	7,717
10 ET1100 terminals	16,590	1 AX304-91 disk DLP-3	7,581
		3 AX372-5 Network Support Processor	110,250
		12 AX378-1 Line Support Processors	50,400
		48 AX378-3/4 quad line adapters	151,200
		20 ET1100 terminals	33,180
TOTAL PURCHASE PRICE:	$1,037,873	TOTAL PURCHASE PRICE:	$2,319,577

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
PROCESSORS AND MEMORY					
A 12E	Basic System; includes one single processor, 24MB main memory, one independent I/O cabinet with 2 DLP bases, one additional independent I/O cabinet with two DLP bases, two line expansion modules, one system maintenance station, one operator console DLP, one ODT adapter for ET1100 terminal, one ET2160 maintenance terminal, one freestanding operator display terminal, and one system installation kit	795,000	1,838.00	43,592	33,223
A 12	Basic System; includes one single processor, 24MB main memory, one independent I/O cabinet with 2 DLP bases, one additional independent I/O cabinet with two DLP bases, two line expansion modules, one system maintenance station, one operator console DLP-3, one ODT adapter for ET1100 terminal, one ET2160 maintenance terminal, one freestanding operator display terminal, and one system installation kit	1,304,000	3,088.00	172,606	55,597
A 12-UT2	Upgrade Kit; A 12E to A 12	560,000	—	—	—
A 12-UT5	Upgrade Kit; A 12 to A 15 F	1,824,000	—	98,586	74,744
A 12-MEM	Additional Memory; 24 megabytes	192,000	108.00	10,142	7,637
SYSTEM OPTIONS					
A 12-IIO	Independent I/O Cabinet; two DLP bases	45,000	138.00	2,630	2,023
A 12-IO2	Additional Independent I/O Cabinet; two DLP bases	45,000	138.00	2,630	2,023
A 12-CON	Console Table	15,000	—	803	608
A 930-2	I/O Base Exchange for two processor system (required for each base to be exchanged)	4,725	15.50	217	168
A 930-3	I/O Base Exchange for three processor system (required for each base to be exchanged)	6,825	23.00	314	233
A 930-4	I/O Exchange for four processor system (required for each base to be exchanged)	8,925	30.00	410	297
A 995-92	Distribution Module (one required for each base to be exchanged when upgrading from two to three, or three to four processors)	2,625	8.00	119	92
A 995-93	Line Expansion Module (LEM 1x4)	3,859	19.00	149	121
A 995-94	Line Expansion Module; upgrade kit (1x4 to 1x7)	2,100	20.00	141	115
A 341-93	Adapter for additional operator display terminal (ET1100 only)	3,536	15.50	214	160

Unisys A 12

		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
DATA LINK PROCESSORS					
A 341-90	Operator Console DLP-3	8,400	29.00	447	351
X110-90	BCL Card Reader DLP	3,700	46.00	231	193
X112-90	BCL Card Punch DLP	3,700	46.00	231	193
X246-95	Printer Tape DLP (B9246-6/12 and B9498)	5,250	34.00	319	252
X246-91	Printer DLP (B9246-10/12)	4,725	46.00	268	220
X293-30	Nonimpact Printer DLP	4,725	46.00	268	220
X393-90	NRZ Magnetic Tape DLP	7,560	46.00	379	301
X395-91	PE Magnetic Tape DLP	7,560	46.00	379	301
X395-92	GCR Magnetic Tape DLP	7,560	46.00	379	301
X304-90	Host Transfer Interlaced DLP	7,560	46.00	379	301
X304-91	Host Transfer Sequential/Interlaced DLP	7,560	46.00	379	301
X304-95	SMD DLP II	9,345	49.00	555	435
X304-97	XSMD DLP	14,500	49.00	816	631
X304-99	SMD Expander	1,890	19.00	115	88
X113-ICP	Integrated Communications Processor DLP (for A 12)	14,200	95.00	1,178	919
X 378-10	Data Communications Processor DLP	8,400	39.00	489	381
X394-93	FIPS Hyperchannel DLP-2 (for A 3, A 9, A 10, A 12), includes two 50 ft. I/O cables, bus and tag terminals, or two 100 ft. I/O cables, bus and tag terminals	21,000	150.00	1,345	1,075
MASS STORAGE					
MD8-2	Multidisk; 2 spindles, 500MB	19,500	90.00	1,124	879
MD8-4	Multidisk; 4 spindles, 1000MB	32,500	180.00	1,918	1,508
B 9494-10I	Fixed Disk Drive; 1048MB, dual spindle interlaced	50,400	227.00	3,158	2,370
B 9494-10S	Fixed Disk Drive; 1084MB, dual spindle sequential	60,000	227.00	3,685	2,773
B 9387-51C	Controller; 1x8 spindle, one interface, cable, and I/O databus kit	15,750	71.00	747	563
B 9387-52C	Controller; 2x8 spindle, two interfaces, cables, and I/O databus kits	21,000	106.00	992	744
B 9494-12	Fixed Disk Drive; 868MB, single spindle, thin-film head	34,450	120.00	—	1,495
B 9494-24	Fixed Disk Drive; 3.5GB, 2 spindle, thin film	98,140	215.00	4,434	4,024
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 9399-E	Dual String Controller and 3.5GB fixed disk drive	129,150	295.00	—	5,317
MAGNETIC TAPE UNITS					
B 9495-82	Magnetic Tape Unit; PE, 75 ips, 120KB	16,000	181.50	819	648
B 9495-83	Magnetic Tape Unit; PE, 125 ips, 200KB	22,447	206.50	1,029	811
B 9499-14H	Controller 125 ips, 1x4, with cabinet for B 9495-82/83	11,465	154.50	821	636
B 9495-24	Magnetic Tape Drive; 200 ips, 1250/320KB, PE/GCR	36,225	312.00	1,446	1,172
B 9495-32	Magnetic Tape Drive; 75 ips, 470/120KB, PE/GCR	17,750	209.00	1,011	732
B 9495-33	Magnetic Tape Drive; 124 ips, 780/200KB, PE/GCR	19,000	220.50	1,146	826
B 9499-22	Magnetic Tape Controller; 2x8, PE/GCR, with two signal and one communications cable	85,288	567.50	3,237	2,591
B 9499-42	PE/GCR Tape Exchange; 2x16, for B 9499-22, with one communications cable	7,571	32.00	309	242
BT3244	Slave PE/GCR Tape Drive; 75 ips	22,475	155.00	1,365	1,090
BT3241-1	Controller: 1x8 with 75 ips drive and one DLP	57,960	355.00	3,450	2,740
BT3266	Slave PE/GCR Tape Drive; 125 ips	24,100	210.00	1,535	1,240
BT3261-1	Controller, 1x8 with 125 ips drive and one DLP	70,450	465.00	4,245	3,385
BT3288	Slave PE/GCR Tape Drive; 200 ips	32,500	290.00	2,080	1,685
BT3281-1	Controller; 1x8 with 200 ips drive and one DLP	86,000	530.00	5,120	4,070
PUNCH CARD EQUIPMENT					
B 9116	Card Reader; 600 cpm, 80 column	11,372	127.50	528	417
B 9213	Card Punch; 300 cpm	31,085	630.00	1,434	1,120
PRINTERS					
B 9246-24	Printer; 2,000 lpm, with HSSI interface	48,000	520.00	3,315	2,715
B 9246-12	Band Printer; 1,250 lpm, 132 positions, with HSSI interface	44,625	440.00	1,745	1,448
B 9246-6	Line Printer; 650 lpm, 132 positions, with HSSI interface	15,435	205.00	611	529
TERMINALS					
ET 1100	Operator Display Terminal; 14-inch, with keyboard, RS-232-C/TDI data communications	1,659	21.50	113	85
ET 2160	Maintenance Display Terminal; 14-inch, monochrome, with keyboard, bit-mapped graphics capabilities, 512K-bit RAM, RS-232/TDI data communications	2,895	54.00	—	—
B 26	Basic Workstation; 80186 processor, 256KB memory, 12-in. monochrome display, standard keyboard	2,465	30.00	—	—
B 38	Workstation; system MCP, 386 processor, 1MB master cluster 12-in. monochrome display, OFIS expanded business keyboard, power supply module, line cord	5,700	49.00	—	—

Unisys A 12

		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
COMMUNICATIONS EQUIPMENT					
A 378-11	Network Support Processor; DLP 2 with 512KB memory	36,750	215.00	2,216	1,756
A 378-1	Line Support Processor; supports up to 4 quad adapters	4,200	16.50	163	140
A 378-7	Line Support Processor; 56KB, includes interface	10,290	41.50	452	376
A 378-3	Quad Line Adapter II; character	3,150	26.00	—	125
A 378-4	Quad Line Adapter II; bit	3,150	26.00	—	125
1-QD	Fore Plane Jumper Cables; for 1, 2, 3, or 4 Quad Line Adapters	NC	—	—	—
A 369-10	RS-232 Electrical Interface; character-/bit-oriented interface	NC	—	—	—
A 369-11	CCITT Electrical Interface; character-/bit-oriented interface	NC	—	—	—
A 369-12	TDI Electrical Interface; character-/bit-oriented interface	NC	—	—	—
A 369-40	Autocall Feature	NC	—	—	—
CP 2000-P	Communications Processor; cabinet, processor, and memory	13,500	47.00	1,040	797
CP 2000-K01	Memory Expansion Kit	4,000	18.00	312	237
CP 2011-80	Line Module; 8-TDI	5,250	19.00	405	313
CP 2011-221	Line Module; 2-RS-232, 2-TDI	4,570	19.00	358	275
CP 2011-401	Line Module; 4-RS-232, 1-RS-366	3,560	19.00	286	221
CP 2012-V35	Line Module; 2-V.35	4,500	19.00	351	270
CP 2012-X21	Line Module; 2-X.21, 1-TDI	4,500	26.00	362	281
CP 2013-1	Line Module; CP LAN	7,925	19.00	599	454
CP 2014-1	Blank I/O Connector	NC	—	—	—
X 203-ICP	Integrated Communications Processor for A 12	15,620	50.00	868	673
CP 2021-128	Disk Processor	3,680	15.50	287	221
CP 2022-200	Disk Drive	1,870	17.00	160	127
CP 2013-2	Extended LAN Kit	750	—	—	—
CP 2049-901	T-Bar Connector	55	—	—	—
CP 2049-902	LAN Terminator	80	—	—	—
CP 2049-903	Adapter N to TNC	50	—	—	—
Inter-System Control					
A 320-IHC	Independent Hub Cabinet	22,270	142.50	865	711
A 320-5	HUB 16; includes 2 port capabilities	9,040	60.50	363	297
A 320-6	HUB Expansion; provides additional 1 port capability	771	6.00	39	31
CB 736	Inter-System Control Cable; 50 ft. (FCC)	NC	—	—	—
CB 737	Inter-System Control Cable; 100 ft. (FCC)	NC	—	—	—
Peripheral Reconfiguration					
A 890-PRC	Peripheral Reconfiguration Cabinet	5,512	37.50	238	197
A 890-3	Disk Control Kit (B9387-5X B9389)	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
Peripheral Power Control					
A 304-PPC	Peripheral Power Control; power for B9387-41/42, B9387-51/52, and B9389 controllers (one 304-PPC per subsystem)	1,155	—	83	68
B9387-RPC	Remote Power Control	236	—	20	17
B9389-RPC	Remote Power Control	210	—	11	8
CB 865	Cable for B9387-RPC; 50-ft.	850	—	59	48
CB 866	Cable for B9389-RPC; 100-ft.	619	—	32	23
CB 867	Cable for B9389-RPC; 200-ft.	1,018	—	52	38

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

SOFTWARE PRICES

		Limited Time-Plan	Annual Product Service Agreements	
		Monthly License Fee ($)	PSA 2 ($)	PSA 1 ($)
Product Description				
A 12-ASE	System Software for the A 12E includes Master Control Program/Advanced System (MCP/AS), Algol Compiler, DC Algol Compiler, CPM Microcode, Utilities, Workflow Language, Menu Assisted Resource Control, Cross Reference Symbolic	3,400	1,615	935
A 12-ASF	System Software for the A 12 includes Master Control Program/Advanced System (MCP/AS), Algol Compiler, DC Algol Compiler, Program Binder, CPM Microcode, Utilities, Workflow Language, Cross Reference Symbolic, Menu Assisted Resource Control	3,531	16,771	971

Unisys A 12

		Limited Time-Plan	Annual Product Service Agreements	
		Monthly License Fee ($)	PSA 2 ($)	PSA 1 ($)
Compilers				
A 12-APB	APL B	357	2,196	1,260
A 12-ATD	Test and Debug (Algol)	210	1,188	684
A 12-BSC	Basic Compiler	262	1,380	756
A 12-COB	Cobol Compiler (ANSI 68)	262	1,512	876
A 12-C74	Cobol Compiler (ANSI 74)	262	1,008	564
A 12-CTD	Cobol 74 Test and Debug System	210	1,188	684
A 12-FOR	Fortran Compiler (Level H)	262	1,512	876
A 12-F77	Fortran Compiler (ANSI 77)	262	1,260	684
A 12-FTD	Fortran 77 Test and Debug System	210	1,188	684
A 12-PAS	Pascal Compiler	393	2,388	1,380
A 12-PL1	PL/1 Compiler	341	2,016	1,128
A 12-RPG	RPG II Compiler	262	1,380	756
A 12-SRT	Sort Utility	236	874	504
Productivity Aids				
A 12-LN2	Logic and Information Network Compiler (Linc II)	4,400	39,828	18,972
A 12-L2R	Linc II Run Time System	560	—	—
A 12-DCL	Linc II Development Partner; includes Linc II Compiler, Cobol 74 Compiler, Communications Management System (Entry), Extended Retrieval with Graphic Output, DMS II, DB Interpreter	—	47,508	23,292
Support Utilities				
A 12-BAR	Activity Reporting	131	756	432
A 12-SMR	SMF II System Resource Management	420	2,388	1,380
A 12-LOG	Logger	78	432	252
A 12-BSL	Billing Support Library	78	432	252
A 12-SSL	Security Support Library	78	432	252
A 12-IPF	Intelligent Printer Support Facility	168	936	564
A 12-MLS	Multilingual System	262	1,512	876
A 12-CMM	Software Disk Cache Module; includes disk cache module key	5,280	11,400	6,360
A 12-DAC	Infoguard; requires SMF II System Resource Management	675	3,648	2,028
Data Communications				
A 12-DCS	Data Communications Software Package includes Network Definition Language II (A 12-NDL), Interactive Data Communications Configurator (A 12-IDC), and NSP/LSP Firmware (A 12-NSF)	262	1,512	876
A 12-NCS	Network Communications Subsystem includes Network Administration Utility (A 12-NAU) and Network Services II (A 12-NSS)	262	1,512	876
A 12-BNS	BNA Network Service	1,260	7,176	4,152
A 12-CDE	CANDE; Command and Edit	341	1,260	756
A 12-COE	Communications Management System; Entry	840	3,144	1,824
A 12-COT	Communications Management System	1,575	5,976	3,456
A 12-DIA	Diagnostic MCS	78	432	252
A 12-EDI	The Editor	210	1,188	684
A 12-ESN	SNA 3270 Emulator	138	660	385
A 12-FSL	Format Support Library	115	624	372
A 12-HSV	Host Services	1,260	7,176	4,152
A 12-L62	SNA LU 6.2 Service Manager	240	1,140	660
A 12-MCB	Gemcos (Basic)	802	4,872	2,820
A 12-MCA	Gemcos (Advanced)	1,177	6,096	3,528
A 12-MCT	Gemcos (Total)	1,391	7,956	4,620
A 12-MCF	GEMCOS; Format Generator (requires MCA or MCT)	267	1,536	888
A 12-NDA	NDL II Analyzer	78	432	252
A 12-RJE	Remote Job Entry	105	564	312
A 12-RMP	Remote Print System	315	1,824	1,068
A 12-SDF	Screen Design Facility	288	1,548	864
A 12-SJE	SNA/RJE	90	428	248
A 12-X25	X.25 MCS	420	2,388	1,380

(1) Onetime charge.

Unisys A 12

		Limited Time-Plan	Annual Product Service Agreements	
		Monthly License Fee ($)	PSA 2 ($)	PSA 1 ($)
Data Management				
A 12-DM2	DMS II Data Management System II	1,837	6,984	4,032
A 12-ERG	Extended Retrieval with Graphic Output (requires DMT)	525	2,892	1,572
A 12-DI2	DMS II Inquiry	315	1,824	1,068
A 12-IDD	Advanced Data Dictionary System	892	5,100	2,952
A 12-DBA	DMS II Data Base Analyzer	210	1,188	684
A 12-DDM	DMS II Data Base Monitor	210	1,188	684
A 12-DMT	DMS II DM Interpreter	183	1,008	564
A 12-DMC	DMS II DB Certification	210	1,188	684
A 12-DME	Data-Aid	210	1,188	684
A 12-TPS	DMS II Transaction Processing System	236	1,320	756
A 12-OC2	Interpro Operations Control Manager	175	948	528
A 12-IE1	Information Executive (InfoExec) Package 1; includes InfoExec/ADDS, InfoExec/SIM, InfoExec/SIM Directory	1,500	8,100	4,500
A 12-IE2	Information Executive (InfoExec) Package 2; includes InfoExec/ADDS, InfoExec/SIM, InfoExec/SIM Directory, Data Management System II	2,950	15,936	8,856
A 12-IQF	InfoExec Interactive Query Facility	675	3,648	2,028
A 12-OCM	InfoExec Operations Control Manager; requires InfoExec IE1 or IE2 package	175	948	528
A 12-QP	InfoExec Query Package; includes InfoExec/IQF, InfoExec/WQF-Host	1,013	5,472	3,036
A 12-WQF	InfoExec Workstation Query Facility; Host	675	3,648	2,028
Reporting				
A 12-RP3	Reporter III	682	3,780	2,016
A 12-OR3	Online Reporter III (requires RP3)	78	432	252
Workstation Integration (Host)				
A 12-DES	Data Entry System	401	2,244	1,284
A 12-DE2	On-line Data Entry System ODESY	428	2,052	1,212
A 12-DTS	Data Transfer System	210	1,188	684
A 12-HLS	Host-Link Server	535	2,880	1,596
A 12-IDF	Intelligent Distributed Editor (B 20, ET2000, PC)	315	1,788	1,032
Networking System Software				
A 99-NCF	Network Control Facility includes Network Control Manager (A 99-NCM), Distributed Control Agent (A 99-DCA), and Graphics Display Module (A 99-GDM)	249	1,764	936
A 99-CPG	Custom Protocol Generator	*(1)* 15,000	1,880	1,680
A 99-CPC	CP2000 Configurator	126	756	432
CP2000 Software and Protocols				
CP 2000-COS	CP2000 Operating System Software	80	480	300
C 99-TTY	TTY Station Group	40	240	180
C 99-BSC	Bisynchronous Station Group	50	300	180
C 99-X25	X.25 Protocol	210	1,200	720
C 99-X21	X.21 Protocol	90	540	300
C 99-ST2	SNA PU T2 Adapter	96	480	300
C 99-SDL	SDLC Station Group	60	300	180

(1) Onetime charge. ■