Siemens System 7.500

MANAGEMENT SUMMARY

Announced at the Hanover Fair in April 1979, the Siemens System 7.500 currently consists of three models—the 7.521, the 7.531 and the 7.541.

This announcement was Siemens' answer to IBM's new medium-scale central processors—the 4300 Series—which had been announced four months earlier. Siemens appears to be following its usual marketing strategy in providing a machine which attempts to match an IBM model in terms of features, price and performance.

Caught by surprise, like many other computer manufacturers, Siemens dropped three recently announced 7,700 models—the 7.706, 7.708 and 7.718—when it announced the new 7.500 compact computer series. The 7.521 is said to be a modified version of the 7.706 but 40% more powerful and the 7.531 has succeeded the 7.708 and 7.718. The largest model, the 7.541, designed for the computer center, is said to be a completely new model, but has a similar processor architecture to the existing 7.760 of the 7.700 series.

Historically, Siemens has been in the computer industry since 1954 with the Siemens computer 2002. Six years later the universal Siemens 3003 was announced. In 1965 Siemens introduced the System 4004 family which was based on the RCA Spectra 70. Under a licence agreement with RCA, Siemens initially marketed the full range of RCA's third generation Spectra 70 line as competition to IBM's System/360. One year later Siemens entered the process control computer market by announcing the Siemens 300. In 1970 the 4004 was extended and in 1974 the System 7.000 was born based on 1K-bit chips. Two years later Siemens introduced state of the art technology by producing 4K and 16K-bit chips and using them on the 7.738, 7.748, 7.760, 7.761 and 7.762. In 1978 Siemens signed an exchange of product and know-how agreement with Fujitsu in Japan and decided to produce the large System 7.800. At the same tiem, by taking over the Norwegian company Tanberg. Siemens introduced a small business system, the System 6.000. With the ➢

Siemens new Compact Computer System 7.500 is designed for both the office environment (Models 7.521 and 7.531) and the computer center (Model 7.541). Competitive with IBM's 4300 Series, the System 7.500 provides an attractive alternative. Monthly rent ranges from just over DM 4000 for the smallest model to more than DM 17,000 for the largest model.

CHARACTERISTICS

MANUFACTURER: Siemens Aktiengesellschaft, Bereich Datenverarbeitung, Hoffmannstrasse 51, Postfach 70 00 78, D-8000 Munchen 70, West Germany. Telephone: (089) 722-1. Telex 5288-0. Siemens also has offices in Austria, Belgium, Denmark, France, Italy, Netherlands, Spain, Sweden, Switzerland, and South Africa.

MODELS: Siemens Compact Computer System 7.500, models 7.521, 7.531, and 7.541.

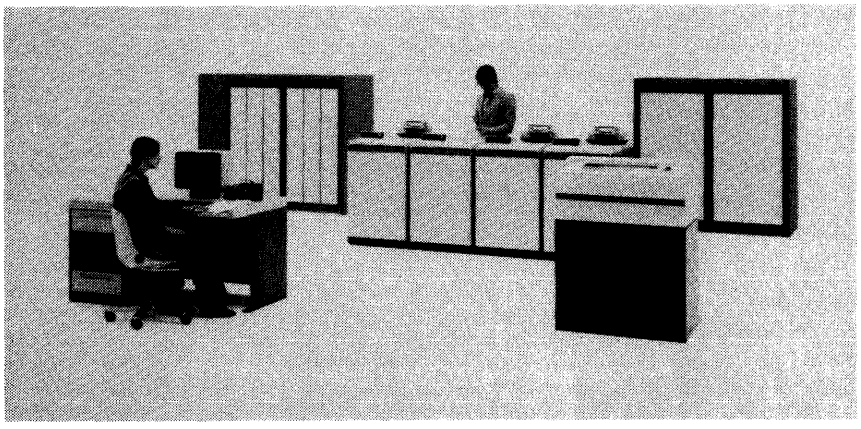
DATA FORMATS

BASIC UNIT: An 8-bit byte. Each byte can represent 1 alphanumeric character, 2 BCD digits, or 8 binary bits; 2 bytes represent a 16-bit half-word; 4 bytes represent a 32-bit word, and 8 bytes represent a 64-bit double word.

FIXED POINT OPERANDS: A 16-bit half-word can represent a 15-bit signed integer; while a 32-bit word can represent a 31-bit signed integer or a 32-bit unsigned binary value.

FLOATING POINT OPERANDS: A 32-bit word is used to represent a signed, short floating point number with a 7-bit characteristic and a 24-bit mantissa. A signed, long floating point number can be represented in a 64-bit double word with a 7-bit characteristic and a 56-bit mantissa. For extended floating point representation, a signed double precision format is available through the use of two 64-bit double words: 7-bits of the first double word are used to represent the characteristic and the remaining 56 bits of that double word plus 56 bits of the following double word are used to represent a 112-bit mantissa (28 hexadecimal or 34 decimal digits).

INSTRUCTIONS: 2, 4, or 6 bytes in length. See the table below. ➢



The System 7.541, the largest of the three Siemens System 7.500 models, is designed for climate controlled computer centers. The other, smaller models, the System 7.521 and System 7.531, are designed for office environments. The series is upward compatible with the larger Siemens System 7.700 family.

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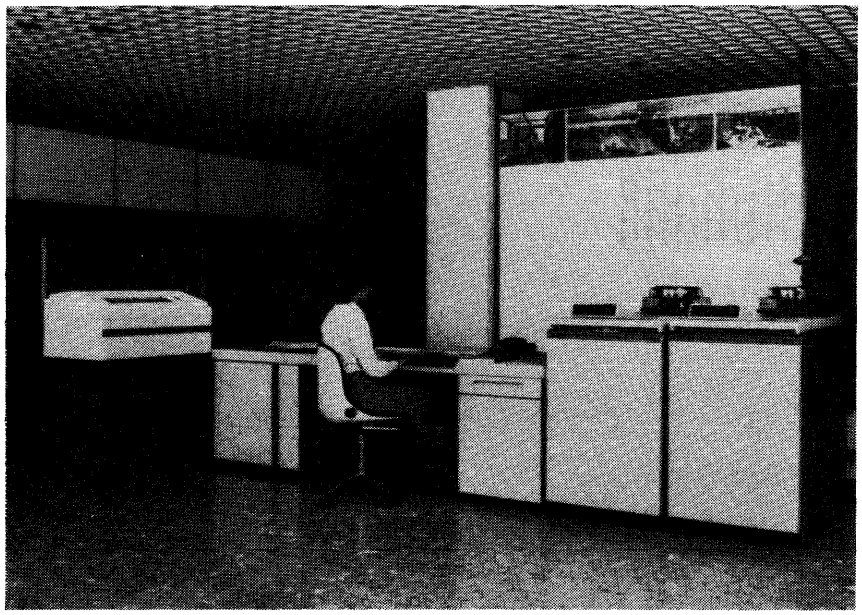


The System 7.521, the entry-level model in the Siemens System 7.500 series, is designed for office environments. The central processor and the central workstation are built into a desk-sized enclosure.

intention of producing 64K-bit chips in the 1980's, Siemens announced the new compact System 7.500.

The most noteworthy aspects of Siemens' new product line are: 1) improved price/performance over the 7.700 series; 2) new technology providing a compact computer series which take up very little physical space; 3) versatility of the smaller two models with respect to environmental conditions; 4) low power consumption; 5) integrated I/O channels; 6) runs only under the BS/2000 virtual operating system; 7) full compatibility with the 7.700 series.

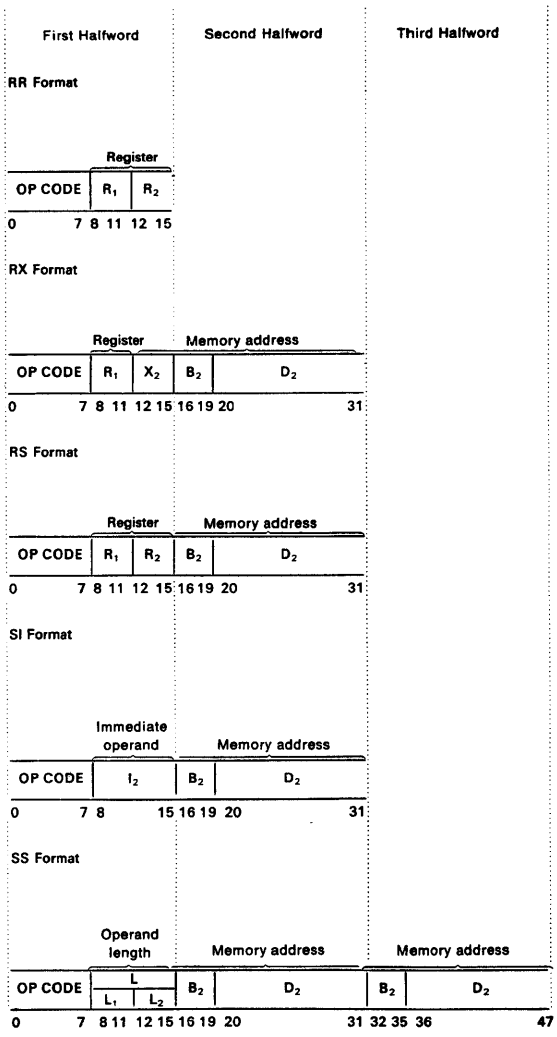
All three models incorporate 16K-bit RAM chips. The 16,384-bit chip represents a considerable increase in degree of integration compared to the 4,096-bit chips used in the older Siemens System 7.000 machines. There are plans at the end of 1980 to incorporate even larger integrated chips such as the 65,536-bit VMOS memory chip, where 150,000 components are contained in an area of 25.6mm² (7.1 x 3.6).

In marketing the System 7.500, Siemens is placing a large emphasis on its ease and simplicity of operation, its teleprocessing and dialogue-oriented aspects, its usefulness in system development work, its extensive range of packaged application software, its reliability, availability, servicing and maintenance features, and its security system.

The smaller two models feature: desk-type architecture, ergonomic design, non-critical climatic requirements, simple installation, and a design suitable for the office environment.

Monthly rent for the basic configuration (see table 2) of the models 7.521, 7.531 and 7.541 is DM 4080, DM 4660 and DM 17,500 respectively.

Instruction Formats



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CHARACTERISTICS OF SYSTEM 7.500

	MODEL 7.521	MODEL 7.531	MODEL 7.541
SYSTEM CHARACTERISTICS			
Date of announcement	April 1979	April 1979	April 1979
Planned date of first delivery	April 1980	Nov. 1979	April 1980
Virutal Memory (address space, bytes)	Up to 8,388,608 per user	Up to 8,388,608 per user	Up to 8,388,608 per user
Operating System	BS 2000	BS 2000	BS 2000
MAIN MEMORY			
MOS chip size, bits	16K	16K	16K
Cycle time (nanoseconds)	380/8 bytes	250/8 bytes	200/8 bytes
Minimum capacity, bytes	524,288	524,288	2,048,000
Maximum capacity, bytes	1,048,576	1,572,864	4,096,000
Increments, bytes	524,288	524,288	1,024,000
Cache memory			
Capacity, bytes	none	8192	16,384
Control memory			
Capacity, bytes	32,768	32,768	62,464
PROCESSING UNIT			
Machine cycle time, nanoseconds	320	320	105
Processing unit features:			
Fixed point arithmetic	Standard	Standard	Standard
Floating point arithmetic	Standard	Standard	Standard
Decimal arithmetic	Standard	Standard	Standard
Interval timer	Standard	Standard	Standard
Time of day (TOD) clock	Standard	Standard	Standard
Program timers	3 standard	3 standard	3 standard
Elapsed time clock	Standard	Standard	Standard
Memory protect feature	Standard	Standard	Standard
Auto instruction retry	Standard	Standard	Standard
Dynamic address translation	Standard	Standard	Standard
Automatic error detection and recovery	Standard	Standard	Standard
Number of trunks (BLMUS and BYMUX)	1 to 4	1 to 6	14 to 31
Bus architecture	Yes	Yes	No

The 7.521 and the 7.531 compact computers are built into desk enclosers equipped with system keyboard, a second display (optional on the 7.521, standard on the 7.531) for interactive applications processing, and a floppy disc drive. Both machines can be operated by non-technical staff and can be located in an office environment.

At the top end, 7.541 is three times more powerful than the 7.531 and is intended for airconditioned computer centers. Like the 7.531, the 7.541 has a cache memory but double the size (16K bytes) and its processor is functionally split to accelerate operations. Unlike the other two models, the 7.541 central console unit is physically separate from the central processor. A service processor provides on-line maintenance functions and handles editing of error information and error recovery support when a malfunctioning component or the operating system can no longer perform this function.

The Siemens System 7.521 CPU has a standard memory of 512K bytes and can be extended to 1024K bytes. A

INTERNAL CODE: EBCDIC.

MAIN STORAGE

STORAGE TYPE: MOS 16K-bit chips. Around 22,000 transistors and 18,000 capacitors are accommodated on a chip measuring 2.9 x 5.6 mm. Siemens plans to use 64K-bit chips beginning about the end of 1980.

CAPACITY: See Table 1.

CYCLE TIME: See Table 1.

CHECKING: Memory protection, error detection and single-bit-error correction are standard on all models. Microprograms continuously perform checking. Automatic instruction retry is standard on all models. The control memory, the registers and all data paths are subject to parity checking. All the data in the memory is checked by an 8-bit Hamming code. One bit errors are corrected while multiple bit errors are noted. There are also error recovery routines built into the BS/2000 operating system. Detailed information (four error words) concerning detected machine errors and the internal status of the machine at the time the error was detected, is produced automatically by the hardware and stored in main memory.

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7.521 offers, at a lower price, the same instruction execution speed as a Siemens 7.730-2. The 7.521 performance capability appears to fall between that of the Siemens 7.722-2 and a Siemens 7.730-2. The Siemens System 7.521 should replace the lower end System 7.000 as a medium-scale entry-level computer.

With a relative performance of twice the 7.521, the Siemens System 7.531 CPU includes a 512K standard memory which can be expanded in modules of 512K to 1536K. The 7.531 should compete well with IBM's new 4331 and Honeywell's Level 64 DPS 320 as both its CPU cycle time and memory cycle time are faster. Its cache memory of 8K bytes is said to have the same instruction execution speed as a Siemens System 7.738.

The Siemens System 7.541 CPU has standard memory of 2 megabytes which can be expanded in 1 megabyte modules up to 4 megabytes. Its instruction execution speed is 1.4 times faster and its relative performance better than the Siemens System 7.755, and it competes directly with IBM's 4341. Other similar performance computers are Honeywell's 66/05, Univac's 1100/61 CL, Burroughs' B 3950, NCR's V-8565 MP, and ICL's 2956/10.

On the models 7.521 and 7.531, the main peripheral units are attached via the Input/Output processor, which is attached to the co-ordinator of the central processing unit. The heart of the I/O processor is a microprocessor which monitors the byte multiplexer channel and the disk storage adapter. The byte multiplexer channel can have the following peripheral units attached to it: magnetic tape units with controller, printers, card readers, card punches, and floppy disk I/O units. The byte multiplexer channel has a capacity extension option of three trunks for the 7.521 and five trunks for the 7.531. Units attached to the individual trunks can operate and transfer data concurrently as long as it is within the total data rate.

Disk drives connect to the disk storage adapter. The total number of disk drives which can be attached is four on the 7.521 and six on the 7.531. The data transfer rate of the adapter is 806K bytes per second.

The I/O system of the model 7.541 has one byte multiplexer channel and up to five block multiplexer channels which can operate in both the block multiplex mode and the selector mode. The byte multiplexer channel allows the addressing of up to 256 units which can operate concurrently in the time division multiplex mode. Block multiplexer channels can also have 256 devices attached to it. Subchannel registers for the byte multiplexer channels and the block multiplexer channels are located in a reserved section ofmain memory called the shadow memory which is not available to the user. Maximum on-line storage varies from 1680 megabytes on the 7.521 to over 13,000 megabytes on the 7.541.

There are three exchangeable disk drive models with storage capacities of 63, 126 and 300 megabytes,

STORAGE PROTECTION: A main memory access control provides both read and write protection and prevents unauthorized access to main memory or modification of the main memory contents. Storage protection is implemented by dividing main memory into 2K-byte blocks and assigning a 5-bit storage key to each block. Four of these bits specify the actual protection key for a specific block. The fifth bit controls whether the memory block is to be protected only against write accesses or against read and write accesses from other programs. Program authorization to access main memory takes the form of a 4-bit user key that enables protection of up to 15 concurrent programs.

In the virtual memory mode, memory protection is implemented by 4-level ring protection. Each ring is assigned one 2-bit number for read accesses and another for write accesses; these numbers define the address space to which the ring belongs. A 2-bit ring state indicator indicates the ring levels which can be accessed.

CENTRAL PROCESSORS

There are currently three CPU models in the 7.500 series, all using MOS/LSI technology. Two of these processors, the 7.521 and the 7.531, are designed for the office environment (desk-type architecture). The third model, although compact, is designed for computer centers with air-conditioning facilities.

All of the CPUs have fixed point, floating point and decimal arithmetic facilities. Each has a time of the day clock, an elapsed time clock, an internal timer and 3 program timers. Memory protection, automatic error detection and recovery, auto instruction retry, dynamic address translation, and a byte multiplexer channel are all standard.

The two smaller CPUs, the model 7.521 and model 7.531, are built into a desk. Included as standard on both models are a keyboard, a monitor screen, and a maintenance panel in a slide-in module for easy access. In addition, the model 7.531 has a 1920-character display terminal for interactive communication in its basic configuration. The same display terminal can be added to the model 7.521.

The larger model 7.541 is physically different from the two smaller models and has a central operator console for operator-system dialogue.

All models have virtual addressing capabilities with dynamic address translation. A working space of up to 8 megabytes is available to each user.

On the 7.521 and 7.531, the central processor accesses instructions and data in main memory via the co-ordinator, which is located among the I/O processor, the main processor, the memory controller and the central processor. Four bytes are always transferred simultaneously between the processor and the memory access control, whereas data interchange between main memory and the memory access control is handled eight bytes at a time.

The 7.541 central processor is functionally split into two logically independent processors: an Instruction Processor and an Execution Processor. The instruction processor fetches information from main memory concerning instructions to be processed and also interprets the instruction type so that it can perform the required operand address calculations. These tasks run concurrently with the execution of instructions by the execution processor. With the RR instruction format, the instruction processor can prefetch up to 10 instructions.

If there is a conflict between the execution and instruction processors, prefetched information and any addresses already calculated are declared invalid. This should rarely occur as

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respectively, and an average access time of 37.5 ms. The fixed disk storage unit available has a capacity of 420 megabytes and an average access time of 40.5 ms. The two smaller disk drives have been produced especially for the 7.500 series.

The magnetic tape units (800 or 1600 bpi) read/write speeds vary from 20K to 80K bytes per second depending on model and density used. Units consisting of two drives, with a recording density of 1600 bpi and read/write speeds of 780 to 1250 bytes per second can be attached only to the model 7.541.

Regarding printers, there are four impact models available with speeds ranging from 300 to 2000 lines per minute, depending on model and character set. The normal 64-character set used is in the OCR-B font. For the model 7.521 and 7.531 one may choose from three printers: 300, 600 or 1200 lpm. The high speed printer (2000 lpm) is only available for the 7.541. On the model 7.541, one may attach Siemens' laser printer.

Card readers (80-column cards) with a reading rate of 660 or 1000 cards per minute and card punches operating between 100 and 300 cards per minute are available. There is also a 90-column card option.

The "magazine" floppy disk I/O unit comprises either one or two stations with a hopper and a stacker. Each can hold up to 17 floppy disks. A standard floppy disk drive (256K-byte floppy disk) can also be attached to the 7.541. A second floppy disk drive can be attached to the models 7.521 and 7.531.

Data display terminals and/or printer terminals can be attached to all systems. The models 7.521 and 7.531 can have up to four data display terminals and three printer terminals connected. Two data display terminal models, the 8160 and the 8162, are available. The 8160 has a character set of 64 or 95 characters while the 8162 has a set of 190 characters. Display format is 80 characters by 24 lines.

All three models can support teleprocessing. The 7.521 can have up to 16 local connections and 1 long distance line. Remote connections can be expanded up to three at the expense of four local lines. Both the 7.521 and the 7.531 have integrated processors (Integrated Terminals Controller or Integrated Front-end Processor). In the case where there are not sufficient connections (more than 32) on the 7.531, an extra front-end processor can be attached to a byte multiplexer channel. All models can link up to the TRANSDATA 960 communication computer system. The software for teleprocessing is based on "Program System for Teleprocessing and Network Control" (PDN) and programs in the BS 2000 operating system.

Siemens considers data security of extreme importance and has provided a number of means to protect the data and the system. Terminals can be locked by a keyboard

constant communication is maintained between the execution and instruction processors.

The processor system handles the following tasks: program interrupt servicing, real and virtual memory protection, communication with main memory, and dynamic address translation. Processor data paths are four bytes while the interface between the processor system and the cache is eight bytes wide.

Several timers are included in the processor system. An elapsed time clock automatically generates external interrupts at one second intervals. The contents of the timer registers are decremented every 100 μs until the counter reaches zero. The interval timer, with a resolution of 100 μs and full count-down cycle of 6.5 seconds, enables the operating system to set a time after which a program interrupt is to be generated. The three program timers (with a range of 119 hours each) permit a program interrupt when the count goes negative.

SERVICE PROCESSOR: An integral part of the 3026-1 central operator console is the service processor (SVP). This separately powered subsystem is made up of a microprocessor with a 64K byte main memory and two floppy disk drives (one for the system and one for maintenance) and is housed in the central operator console. The SVP connects to the central processor via a special interface.

All maintenance procedures and diagnostic routines are carried out by the SVP, which is also responsible for editing error information, producing messages in clear text, and supporting error recovery when a malfunctioning component or the operating system can no longer perform this task.

INSTRUCTION REPETOIRE: The System 7.500 processors all employ the full 7.700 series set of 169 instructions, including facilities for processing variable length, decimal, and fixed-point binary operands. The floating-point instructions provide single, double, and extended precision. Extended-precision instructions handle operands with a 112-bit mantissa (28 hexadecimal or 34 decimal digits) while double precision floating point instructions handle operands with a 56-bit mantissa. The breakdown of the 169 instructions is as follows: 13 privileged, 21 data transfer, 8 branch, 13 logical, 14 binary, 22 fixed-point, 11 decimal, 51 floating point, 3 stack, 4 edit, and 9 miscellaneous.

INSTRUCTION TIMES: No precise timing information is currently available. Unofficially, it is assumed that the model 7.521 has instruction times similar to the 7.730-1, the model 7.531 is the same as the 7.738, and the model 7.541 is 1.4 times faster than the 7.755.

INDIRECT ADDRESSING: Yes.

REGISTERS: There are no index registers; but there are 43 4-byte general purpose registers that can be used for base and index register functions in address computations, for transferring addresses, or for holding operands in binary and logical operations. In addition, a number of special purpose registers are provided.

Processor State	No. of General Registers Usable
P1	16
P2	16
P3	6
P4	5

In P1 and P2, the complete set of general and control registers is available. In P3 and P4, the number of general registers is limited to 6 and 5, respectively; and several program-related control registers are not available. A set of floating point registers is shared by all processor states.

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switch and can be protected by a badge reader against unauthorized access. In addition, the operating system prevents unauthorized access by making the operator identify himself by means of an identification code. Another feature prevents memory accesses outside the address space for a particular task and prevents unauthorized access to disk files. A check is made of the user group, user name and password before a user may have access to data contained in the data base.

A hierarchical system of data permits classification of users so that some have access to all data, while others have access to only some of the data. Siemens has thus provided an extremely flexible and versatile security system with the 7.500 series.

Compilers are available for COBOL, FORTRAN, PL/1 SPL, BASIC, APL, ALGOL, PASCAL and RPG2. Programs can also be written in assembler.

To simplify system operation, Siemens has provided a version of the BS/2000 virtual memory operating system with a better user interface. Users can operate the system with a set of some 20 commands and can control all important functions with the help of an additional 30 commands.

An innovative training system called "Teachware" familiarizes operators and users with the BS2000 commands. Teachware is based on the principle of man-machine communication. Programmed instructions enable those who are already familiar with other computer systems to teach themselves via an integrated video terminal about the System 7.500 and BS2000. This has the advantage that an operator can learn at his own pace in a real life environment.

The complete BS/2000, with approximately 2 million instructions, supports all types of operations; i.e., time-sharing, transaction processing, and local and/or remote batch processing. BS/2000, initially designed in 1969 but first released to the public in December 1975, is now in its 5th release. It has been designed to cover the entire computer performance range. With the compact range the BS/2000 is customized to meet the exact requirements of the configuration ordered. With all 7.500 models, the customer chooses at the time of ordering the amount of virtual memory per user he wishes to have. From a programmer's point of view, a major advantage of the BS/2000 is its uniform command language in all modes of operation.

System 7.500 software tools, application software packages, and the database management tools are priced separately. The Universal Transaction Monitor (UTM) provides program management, message communication, storage management, log file, transaction control, and integrated format control for transaction processing applications.

With the System 7.500, Siemens wishes to sell the concept of the development computer, a problem-solving

For some instructions, two adjacent 4-byte general registers are combined to form an 8-byte field. Other instructions can reference up to 16 general registers at one time.

Four 8-byte registers for floating point calculations are also provided. These registers can hold either a short 4-byte or a long 8-byte floating point number. The short floating point number is contained in the four high-order bytes of the register: in order to accommodate extended floating point numbers, two registers can be paired to form a 16-byte field.

Three 32-bit control registers are used to contain processor control information: the Program Counter Register (PCR); the Interrupt Status Register (ISR), and the Interrupt Mask Register (IMR). These registers can only be altered by privileged instructions in the system state.

CACHE MEMORY: The CPU's of the models 7.531 and 7.541 contain a high speed cache memory which is situated between main memory and the processor. Its function is to buffer instructions and data prior to processing. During each read operation required by the central processor, a check is made as to whether the addressed item of information is present in the cache. In the model 7.531, the 8K-byte cache is located between main memory and the co-ordinator and reduces access time from 560 ns to 250 ns, 90 percent of the time.

The cache (16K bytes) of the model 7.541 has two 32-byte wide cache banks each holding 256 entry locations. In cases where the addressed item is not found in the cache, four groups of 8 bytes are fetched from main memory into the cache. The 32 bytes that contain the addressed item are then placed in one of the 256 entry locations of the cache bank and the addressed bytes are transferred to the central processor. Entries are handled using a first in, first out procedure. Siemens claims that 95 percent of the time the cache reduces the read cycle time to 200 ns.

CONTROL MEMORY: On all models, the control memory stores microprograms for controlling the CPU and I/O processor and provides buffers for the channel and function registers. On the 7.521 and 7.531, the microprograms are loaded automatically from floppy disc into the 32K-byte control memory during the initial program loading. Control memory is a reserved portion of main memory. On the model 7.541, the microprograms are loaded from the floppy disc drive into the writeable control memory (capacity 61K bytes) which is separate from main memory. In order to detect errors which might prevent the operating system from starting, a quick test is made before entering the microprograms. This microprogrammed function test checks the central processor, the control memory, the main memory system, and the I/O system.

SHADOW MEMORY: The model 7.541 is provided with a shadow memory which stores diagnostic routines and information required for servicing devices connected to the byte multiplexor channel and the block multiplexor channels. The size of the shadow memory depends on the system's configuration. Users may not access the space occupied by the shadow memory.

DYNAMIC ADDRESS TRANSLATION (DAT): Virtual addresses are converted during processing into real addresses by the DAT facility using segment and page tables. The segment table defines each user's virtual memory allocation and contains one entry for each segment. The segment entries refer to the real memory addresses in the page tables which in turn indicate which pages are currently located in real memory. Each segment has an associated page table.

An Address Translation Memory (ATM) has 128 entries to guarantee a first level hit in the search for a page in 90 to 95 percent of all cases under normal program conditions.

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approach aimed at improving software development productivity during analysis, design, implementation, and maintenance. Emphasis is put on interactive programming and on providing programming hardware at the actual place of work of the engineer, designer, or programmer. Tools available to facilitate software development and maintenance are BYBLOS (design and documentation), COLUMBUS (structured programming), TESTMANAGER and MMS (test and measurement); FMS and DAVID (file management), COTUNE and FORTUNE (program run analysis), GPSP (macroprocessor), FORMPLAG (editing and checking terminal input), and DOCULITY (text editing).

Siemens feels that by delegating software development tasks to a separate, relatively low cost compact computer, it guarantees independence from computer center operations, constant availability, no impairment of the production operation, and no burden on development from the production operation.

For the System 7.500, existing data management systems such as the Universal Database Management Systems (UDS) and SESAM have been provided in an additional "compact" release. UDS simplifies system operation by handing routine data management tasks, including construction of databases. The major components of UDS are the Data Definition Language (DDL), the Database Handler, the Data Manipulation Language, the Interactive Query Language, and service programs. SESAM assists mainly with interactive procedures and processing.

A wide range of applications packages is also available on the System 7.500 for general commercial applications such as accounting, personnel management, purchasing, warehousing, order processing, manufacturing, and disk data management. Other packages include DIFIB (interactive accounting), COMET (a system for corporate decision-making), ISI (industrial planning and control), TRAFIC (transport optimasion and vehicle fleet schedule), SINET (interactive system for network analysis), GPSS and SICOS (simulation of models with discrete and continuous operations), and METHAPLAN (methods base).

Marketing of the System 7.500 is concentrated in Europe, with emphasis upon Germany, Benelux, Italy, Denmark, Austria, Sweden, Switzerland, and Spain. Recently, Siemens has opened offices in France to capture some of the French market. At the moment, the UK is served from the continent. Siemens also intends to market the system in both the eastern block countries and South Africa.

Siemens intends the System 7.500 to penetrate both the entry level market and the market for existing users of medium-scale computers. To do this, Siemens provides conversion tools and facilities. Compatibility is excellent when converting from computers based on RCA's Spectra series architecture.□

To execute the address translation, a row in the ATM is selected by means of parts of the segment and page portions of the 7 bit virtual address. The entries in the ATM can be addressed by these bits because the pages have fixed locations. When an entry has been retrieved, a comparison is made between portions of the virtual address and the entry in the ATM. If they match, it results in the real page number, which forms the real address together with the displacement from the virtual address. If they do not match, the segment and page tables in main memory are used. The segment tables define each user's virtual memory allocation and contain one entry for each segment. The entries in the segment table refer to the real memory address in the page tables. The page tables in turn indicate the pages which are currently located in the real memory. Each segment has an associate page table. Since the channels contain no address translation hardware, the virtual address which is incorporated in the channel commands must be translated before the I/O operations are performed.

For 4K pages and a virtual address space of 8 megabytes, the DAT facility is designed for 3 level operations.

OPERATIONAL MODES: There are four processor states:

P1 = Processing State
P2 = Interrupt Response State
P3 = Interrupt Control State
P4 = Machine Condition State

In P1 and P2, user programs and program interrupts are processed; and in P3 and P4, program interrupts are analyzed. Each processor state has its own set of general and control registers that function independently of other processor states. All the timers run in P1 and P2; the interval timer and the program timers are deactivated for P3 and P4.

COMPATIBILITY FEATURES: The System 7.500 includes all of the System 4004 instructions, making the systems source code compatible. Because of the high degree of compatibility between the 4004 and the IBM 360/370, a relatively simple conversion is possible at the source langauge level between these IBM systems and the 7.500 Series. Compatibility is also excellent when converting from the Univac Series 90 (nee RCA Spectra 70).

SIMULTANEITY: Memory is interleaved in the 7.521 and 7.531 so that 8 bytes are fetched from alternate memory banks resulting in 16 bytes being fetched during a single memory read cycle. Instruction execution is overlapped on the 7.541 by dividing the processor into an Instruction Processor and an Execution Processor.

INPUT/OUTPUT CONTROL

INPUT/OUTPUT PROCESSOR: Both the 7.521 and 7.531 have an I/O processor made up of three parts: a disk storage adapter (DDSA), a byte multiplexor channel, and a test facility. All I/O devices except the console and mass storage devices are linked to the byte multiplexor channel. The mass storage devices link to the test facility. The kernel of the I/O processor is a microprocessor which acts as the channel controller. It monitors both the byte multiplexor channel and the DDSA data and command chaining. The I/O processor is controlled by 32-bit instructions.

The integrated I/O system of the 7.541 comprises the channel control unit with one byte multiplexor channel and two or more block multiplexor channels. All input and output data passing through the channels are addressed with real addresses. For this reason, all data addresses contained in the channel command word must be real addresses even in virtual mode operation.

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Data moving from the I/O system to main memory is stored in referenced main memory locations, whereas data moving from main memory to the I/O system is copied into the cache. To avoid the lowering of performance when there is a conflict between channels and the central processor, special hardware facilities in the cache act as intermediate and exchange buffers. Data transfers occur after the execution of the privileged Start Device instruction of the central processor. The microprograms, which control the data transfer between the peripheral units and main memory are interrupted briefly whenever there is an I/O request so that they may service it.

The central processor is notified by an interrupt when all data pertaining to an I/O operation have been transferred. If there are no further I/O requests, the interrupted central processor microprogram is continued.

I/O CHANNELS: The models 7.521 and 7.531 feature two integrated channels, a byte multiplexor channel (BYMUX) and a disk storage adapter (DDSA). All I/O devices, with the exception of disk storage units, connect to the byte multiplexor channel. An optional front-end processor and magnetic tape units can be attached to the models 7.521 and 7.531. Both the 75212 byte multiplexor channel on the 7.521 and the 75312 byte multiplexor channel on the 7.531 have a printer attachment as standard. Up to three extension trunks can be added to the 75212 and up to five extension trunks to the 75312.

The transfer rate of an individual byte multiplexor trunk varies from 60 kilobytes/second to 300 kilobytes/second depending on the mode of operation; i.e., multiplex or selector. In multiplex mode, several devices can share the same channel, while in selector mode, only one I/O device can use a trunk. I/O devices attached to individual byte multiplexor channel trunks may simultaneously perform I/O operations as long as the aggregate data rate is not surpassed.

Disk drives connect to the 75214 or 75314 disk storage adapter. Both the 7.521 and 7.531 have two DDSA extensions as standard. Two more extensions can be added to the 7.521 and four more are available on the 7.531. Both fixed and exchangeable disk drives can be attached. The data rate of the disk storage adapter is 806 kilobytes/second.

The 7.541 features three integrated channels as standard: two 75414 Block Multiplexor Channels and one 75412 Byte Multiplexor Channel with eight trunks for connecting slow peripherals. Two of these trunks are taken up by the central operator console and the system printer.

An optional feature expands the byte multiplexor channel to a maximum of 16 trunks. In this case, another 256 I/O devices can be connected for a total of 256 I/O devices. These can operate concurrently in the time division multiplex mode. In the normal mode, the maximum aggregate transfer rate of all the devices connected to the byte multiplexor channel is 200 kilobytes/second. The maximum transfer rate for a single trunk of a byte multiplexor channel is normally 129 KBS; however, if the trunk is operated in the burst mode via magnetic tape controllers, the maximum data rate is 238 KBS.

A further three 75414 Block Multiplexor Channels can be added. Each block multiplexor channel provides the means of attaching 256 I/O devices that can operate in both multiplex and selector mode. The maximum transfer rate is 2000 KBS for channels 1 and 2 and 1600 KBS for channels 3 to 5.

Each block multiplexor channel is fitted with two 16-byte exchange buffers and a 2-byte intermediate buffer. This feature allows parallel servicing of data requests, resulting in optimization of data throughput. In the multiplex mode, I/O operations are divided into blocks. In the selector mode, only a single I/O operation can be performed at one time on a trunk. The total transfer rate of the 7.541 I/O system is 6000 KBS.

CONSOLE I/O: The consoles of the 7.521 and the 7.531 are built into a workstation with an integral system keyboard/display and a floppy disc drive. A second display for interactive processing is optional on the 7.521, standard on the 7.531. The system display provides 12 lines of 80 characters, the second display provides 24 lines of 80 characters. The larger 7.541 has its own separate 3026-1 central console. Subconsoles may be located up to 2 kilometers from the CPU.

3026-1 CENTRAL CONTROL CONSOLE: This console for the model 7.541 includes a video terminal, keyboard, console printer, and control panel. An optional 30243 floppy disk unit can be used to enter relatively small amounts of user data. The console also contains the service processor. The 7.541 system may be enhanced by attaching either the 3025-10 or 3024-10 sub-console to the service processor. Sub-consoles may be located up to 10 km from the central processor, and up to 3 sub-consoles may be attached.

3025-10 SUB-CONSOLE: This console consists of a 30241 monitor screen (16 lines of 80 characters) and keyboard.

3024-10 SUB-CONSOLE: This console consists of a 30241 monitor screen (16 lines of 80 characters), keyboard, and console printer (180 characters per second). This can only be operated in conjunction with the 30241 Data Display Terminal.

TELEPROCESSING

All models of the 7.500 system provide for teleprocessing applications. For short distances (up to 2 km) teleprocessing, the model 7.531 contains as standard an Integrated Terminal Controller (ITC). The ITC is optional on the model 7.521. When both short and long haul communications are required, the ITC is replaced by an Integrated Front-End Processor (IFEP). Teleprocessing on the model 7.541 is handled via the compact front-end processor 75419 or the Transdata 960 data communications system, and the 8170 multipurpose controller for short distance teleprocessing.

75218 INTEGRATED TERMINAL CONTROLLER (ITC): An option on the model 7.521 and standard on the model 7.531, the ITC supports up to four 8160-7 data display terminals or 8112-7 printer terminals at distances up to 2 km. To expand the number of terminals, a Line Trunk Unit for the ITC permits up to four trunks to be added. Up to three Line Trunk Units may be added to both the 7.521 and 7.531, providing a maximum of 16 terminals (12 via the three line trunk units and 4 via the ITC). To increase the number of terminals on the 7.531 beyond 16, up to four line trunk extensions may be added, each supporting up to four 8160-7 data display terminals.

75219/75319 INTEGRATED FRONT-END PROCESSOR (IFEP): The IFEP's are used for connecting the various terminals and communication facilities of the TRANSDATA range to the 7.500 systems and can be installed instead of the ITC. On the standard version of the IFEP on the 7.521, there are 4 trunks for local terminals and up to 3 long distance lines. When more than 12 local terminals are connected, only one long distance line can be supported. The IFEP links to a TRANSDATA 960 block line buffer: either the 96512 double block buffer for MSV/LSV protocols or the 96520/21 block line buffer for HDLC protocol. Four trunks for local terminals are also standard on the 7.531. Up to 11 long distance lines can be added, but the number of long distance lines is reduced when more than

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12 local terminals are connected. The standard IFEP memory of 128K bytes can be expanded by 64K on the 7.521 and by 64K or 128K on the 7.531.

75219-20/75319-20 LINE TRUNK UNITS: These units permit the connection of up to four 8160-7 data display terminals or 8162-7 data display terminals or 8112-7 printer terminal controllers to the IFEP on the 7.521 or 7.531.

75319-50 LINE TRUNK EXTENSION: For use with the IFEP on the model 7.531, this extension for local connections can support up to four 8160-7 data display terminals and three 75219-20 line trunk units. Up to 4 extensions can be added, providing a maximum of 16 more terminals. If this is not sufficient, another IFEP can be connected to the byte multiplexor channel on the model 7.531.

Teleprocessing on the model 7.541 is implemented through the compact front-end processor and the modular TRANSDATA 960 data communication system which comes in various configurations. TRANSDATA configurations vary from a host computer with several remote or local terminals to thousands of terminals distributed over a large area. There are three communication computer systems to choose from, the 968X front-end processor for short distance processing, the 967X remote front-end processor for long distance processing, and a 966X terminal computer. Hardware network modules include data transmission facilities, 8901/2/3 concentrators and the 8906 interface expanders. Terminal subsystems that can be connected are the 810 terminal system comprising data display terminals, cluster controllers, and printers (e.g., the 8112 printer terminal), and the 970 terminal system containing terminals and printer terminals.

MASS STORAGE

Four mass storage devices with capacities ranging from 63 to 420 million bytes are available for use on all System 7.500 models. Two of the disk drives, the 3454 and the 3464, have specifically been produced for the 7.500 series. The other two, the 3468 and the 3470, are also available on the System 7.700. Four other models, the 3450, the 3455, the 3460, and the 3465, can be attached only to the 7.541. The devices are connected either via the trunks of the disk storage adapter on the 7.521 or 7.531 or disk controllers on the 7.541.

The table below shows the maximum on-line mass storage capacity for each 7.500 model:

Model	Capacity (megabytes)
7.521	1680
7.531	2520
7.541	13440

3454 DISK DRIVE: This removable-disk drive has 9 recording surfaces with 404 tracks each and a capacity per track of 16,384 bytes for an overall capacity of 63 megabytes. The data transfer rate is 806 kilobytes per second. Average access time is 37.5 ms, and rotational speed is 2400 rpm. The 3454 disc drive connects to all models of the System 7.500.

3464 DISK DRIVE: This removable disk drive has 9 recording surfaces with 808 tracks each and a capacity per track of 16,384 bytes for an overall capacity of 126 megabytes. The data transfer rate is 806 kilobytes per second. Average access time is 37.5 ms, and rotational speed is 2400 rpm. The 3454 disk drive connects to all models of the System 7.500.

3468 DISK DRIVE: This removable-disk drive has 19 recording surfaces with 808 (plus 15 reserved) tracks each, and a capacity per track of 19,750 bytes for an overall capacity per spindle of 303,202,000 bytes. The data transfer rate is 806 kilobytes per second. The average head positioning time of 28 ms plus the average rotational delay of 12.5 ms yields an average access time of 40.5 ms. The rotational speed is 2,400 rpm. The 3468 connects directly to all models of the System 7.500.

3470 FIXED-DISK DRIVE: This device has 19 recording surfaces with 1350 tracks each, including spares, and a capacity per track of 16,384 bytes for an overall capacity of 420,249,600 bytes. The data transfer rate is 806 kilobytes per second, the average access time is 20 ms, and rotational speed is 2400 rpm. Average bit density is approximately 6000 bpi (roughly 240 bits per mm). The 3470 connects directly to all models of the System 7.500.

3450 DISK DRIVE: This removable-disk drive has 19 recording surfaces with 404 tracks each, and a capacity per track of 13,030 bytes for an overall capacity per spindle of 100,018,280 bytes. The data transfer rate is 806 kilobytes per second, the average access time is 30 ms, and rotational speed is 3600 rpm. The 3450 connects only to the 7.541.

3455 DISK DRIVE: This removable-disk drive has nine recording surfaces with 404 tracks each, and a capacity per track of 19,750 bytes for an overall capacity per spindle of 71,811,000 bytes. The data transfer rate is 806 kilobytes per second, the average access time is 25 ms, and rotational speed is 2400 rpm. The 3455 connects only to the 7.541.

3460 DISK DRIVE: This removable-disk drive has 19 recording surfaces with 808 tracks each, and a capacity per track of 13,030 bytes for an overall capacity per spindle of 200,036,560 bytes. The data transfer rate is 806 kilobytes per second, the average access time is 30 ms, and rotational speed is 3600 rpm. The 3460 connects only to the 7.541.

3465 DISK DRIVE: This removable-disk drive has nine recording surfaces with 808 tracks each, and a capacity per track of 19,750 bytes for an overall capacity per spindle of 143,622,000 bytes. The data transfer rate is 806 kilobytes per second, the average access time is 25 ms, and rotational speed is 2400 rpm. The 3465 connects only to the 7.541.

3170 FLOPPY DISK I/O UNIT: This unit is a peripheral device for the Siemens System 4004 (Models/35 to /151) 7.500 and 7.700. Connected via a byte multiplexor channel or selector channel, it enables the computer to read and write floppy disks.

Apart from the standard disk initialization, as used in the TRANSDATA 920 Floppy Disk Data Entry System, floppy disks can also be initialized and processed with variable formats on the 3170. Thus it is possible via the 3170 Floppy Disk I/O Unit to read data stored by various systems on floppy disks into a Siemens System 4004 or 7.000 computer.

The basic 3170 consists of one I/O station. This unit can be field upgraded with an expansion feature to include a second I/O station. The 3170 has a channel adapter with a controller which operates in the time-division multiple mode in the dual configuration. Each I/O station has two 128-byte buffers for data storage as standard and a stacker with a capacity of 20 floppy disks. Feed, alignment and stacking of the floppy disks are fully automatic.

The controller is microprogrammed and consists of a fast bipolar LSI microprocessor. The data medium has a standard storage capacity of 1898 records of up to 128 bytes each. A single floppy disk can store a maximum of 19 independent files. A variable block length feature enables records to be written in multiple lengths of 128 bytes, up to a maximum of 4096 bytes, corresponding to a number of 26 down to 1 sector per track.

The maximum reading rate is 4680 records per minute (standard format), and the maximum writing rate is 3120 records per minute (standard format).

Rotational speed of the 3170 is 360 rpm, with a recording density of 3200 bpi, and an average access time of 242 ms. Data is organized into 77 tracks consisting of 74 data tracks plus 3 spares. In standard format, there are 26 sectors per track and 128 bytes per sector to give a maximum disk capacity of 246,272 bytes. In variable format there can be 26, 15, 8, 4, 2, or 1 sectors per track and 128, 256, 512, 1024, 2048, or 4096 bytes per sector to give a maximum disk capacity of about 245K to 303K bytes.

Options for the 3170 include the 31701 Floppy Disk Initialization feature to enable program controlled initialization of floppy disks in accordance with the ECMA proposed standard; the 31702 Variable Block Length feature to enable processing of variable block lengths with simultaneous buffering of 4096 data bytes (up to one complete track); and the 31703 Dual I/O Station Expansion feature that enables overlapped reading and writing on two I/O stations connected to one channel.

MAGNETIC TAPE EQUIPMENT

There are eleven different magnetic tape units available for use with the System 7.500 models. All are 9-track units.

3521 MAGNETIC TAPE UNIT: This is a 9-track device that has recording densities of 320 bytes per cm (800 bpi) and 640 bytes per cm (1600 bpi), read/write speeds of 20 and 40 kilobytes per second, a rewind speed of 3.65 meters per second, and a forward tape speed of 0.635 meters per second. A 3511 magnetic tape controller with circuitry for four drives can optionally be incorporated into the 3521 housing.

3523 MAGNETIC TAPE UNIT: This drive is identical to the 3521 except that it has read/write speeds of 40 and 80 kilobytes per second and a forward tape speed of 1.27 meters per second.

3570 MAGNETIC TAPE UNIT: This is a 9-track device that has a recording density of 640 bytes per cm (1600 bpi), a read/write speed of 30 kilobytes per second, a rewind speed of 7.6 meters per second, and a forward tape speed of 0.48 meters per second. The 3570 MTU consists of two magnetic tape drives, the MT-controller, and the power supply. The 3570 connects directly and has control circuitry for four additional 3530 tape drives.

3571 MAGNETIC TAPE UNIT: This is a 9-track drive that has a recording density of 640 bytes per cm (1600 bpi), a read/write speed of 60 kilobytes per second, a rewind speed of 7.6 meters per second, and a forward tape speed of 0.95 meters per second. The 3751 MTU consists of two magnetic tape drives, the MT-controller, and the power supply. The 3751 connects directly and has control circuitry for four additional 3531 tape drives.

3530 MAGNETIC TAPE DEVICE: This drive is identical in characteristics to the 3570 except that it has no control circuitry. This device connects to the 3570 and uses its control circuitry and power supply.

3531 MAGNETIC TAPE DEVICE: This drive is identical in characteristics to the 3571 except that it has no control circuitry. This device connects to the 3571 and uses its control circuitry and power supply.

3540 MAGNETIC TAPE DEVICE: This is a 9-track unit that has a recording density of 320 (NRZ), or 640 (PE) bytes per cm (800 or 1600 bpi, respectively), a read/write speed of 60 (NRZ) or 120 (PE) kilobytes per second, a rewind speed of 5.7 meters per second, and a forward tape speed of 1.9 meters per second. The 3540 connects to a 3510-01, -02, -03, or -04 controller.

3550 MAGNETIC TAPE DEVICE: This is a 9-track unit that has a recording density of 320 (NRZ) or 640 (PE) bytes per cm (800 or 1600 bpi, respectively), a read/write speed of 120 (NRZ) or 240 (PE) kilobytes per second, a rewind speed of 10.4 meters per second, and a forward tape speed of 3.8 meters per second. The 3550 connects to a 3510-01, -02, -03, or -04 controller.

3554 MAGNETIC TAPE DEVICE: This is a 9-track unit that has a recording density of 320 (NRZ) or 640 (PE) bytes per cm (800 or 1600 bpis, respectively), a read/write speed of 160 (NRZ) or 320 (PE) kilobytes per second, a rewind speed of 14.5 meters per second, and a forward tape speed of 5.1 meters per second. The 3554 connects to a 3512-01, -02, -03, or -04 controller.

3557 HIGH DENSITY MAGNETIC TAPE DEVICE: This 9-track unit has a recording density of 640 (PE) or 2460 (GCR) bytes per cm (1600 or 6250 bpi, respectively), a read/write speed of 200 (PE) or 780 (GCR) kilobytes per second, a rewind speed of 12.2 meters per second, and a forward tape speed of 3.18 meters per second. Up to eight 3557's connect to a 3513 controller.

3559 HIGH DENSITY MAGNETIC TAPE DEVICE: This 9-track unit has a recording density of 640 (PE) or 2460 (GCR) bytes per cm (1600 or 6250 bpi, respectively), a read/write speed of 320 (PE) or 1250 (GCR) kilobytes per second, a rewind speed of 16.2 meters per second, and a forward speed of 5.1 meters per second. Up to eight 3559's connect to a 3513 controller.

LINE PRINTERS: There are five printers which can be attached to the System 7.500 with speeds ranging from 300 lines per minute on the slowest printer to 21,000 lines on the laser printer.

The model 3333 line printer is standard on the 7.521; the model 3336 printer and the model 3340 printers are options. The model 3336 printer is standard on the 7.531; the 3333 and the 3340 are options. The 7.541 may have any of the printers attached to it. Additional printers can be attached via the byte multiplexer channel.

Printer characteristics are described below.

3333 PRINTER: This device uses a print drum and can print 136 characters per line using a character set of 64 or 96 characters. Using the 64 character drum, the print speed is 600 lines per minute. Horizontal spacing is 10 characters per inch and vertical spacing is 6 or 8 lines per inch. A paper tape vertical formatting unit is standard.

3336 PRINTER: This device uses a print drum and can print 136 characters per line, using a character set of 64, 81, 82, or 96 characters plus the blank or space. Using the 64-character drum, the print speed is 600 lines per minute; with the 81- or 82-character drum, the print speed is 533 lines per minute; and with the 96-character drum, the print speed is 436 lines per minute. Horizontal spacing is 10 characters per inch, and vertical spacing is 6 or 8 lines per inch. The 3336 accepts standard rim-punched forms 102 mm (4 inches) to 425 mm (16.75 inches) in width. A paper tape vertical formatting unit is optional.

3340 PRINTER: This device is a chain-driven unit that can print either 136 or 160 characters per line, using a character set of 48, 64 or 106 characters plus the blank or space. Using the 48-character chain, the print speed is 1170 lines per minute; with the 64-character chain, the print speed is 960 lines per minute. Horizontal spacing is 10 characters per inch, and vertical spacing is 6 or 8 lines per inch. Powered forms stacking and a form feed are available as optional features 33401 and 33410, respectively. Forms feed is standard on sub-models -12 and -14.

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Sub-models 3340-11 and -12 have one forms feed and can accept forms from 52 to 555mm in width. Sub-models 3340-13 and -14 have two forms feeds and can accept forms from 52 to 471 mm in width on the first feed and 104 to 523 mm in width on the second feed. All of the printer sub-models can format pages from 8 to 16 inches in length.

3343 PRINTER: This device is a chain-driven unit that can print either 132 or 136 characters per line, using a 48, 64, or 96-character set plus the blank or space. Using the 48-character chain, the print speed is 2000 lines per minute; with the 64-character chain, the print speed is 1630 lines per minute. Horizontal spacing (print density) is 10 characters per inch, and vertical spacing is 6 or 8 lines per inch. Powered forms stacking and a forms feeder are standard. The 3343 can accept forms from 102-508 mm in width, and can format pages from 8-14 inches in length.

3352 LASER PRINTER: This device is a laser-beam unit that can print 136, 163, or 204 characters per line, using a 128 (standard) or 255 (option 33522) character set plus the blank or space. Horizontal spacing (print density) is 10, 12, or 15 characters per inch; and vertical spacing is 6, 8, or 12 lines per inch. Print speed for both character sets is 10,500 lines per minute with a vertical spacing of 6 lines per inch; 14,000 lines per minute with a vertical spacing of 8 lines per inch; and 21,000 lines per minute with a vertical spacing of 12 lines per inch.

On a character basis the 3352 can print up to 70,000 characters per second. Powered forms stacking and a forms feeder are standard.

The 3352 can accept forms from 165-400 mm in width and can format pages from 8-14 inches in length. Line advance is performed at a rate of 0.74 ms per line no matter how many lines are advanced at once.

PUNCHED CARD EQUIPMENT

There are three models of 80-column card reader and one 80-column card punch available for the System 7.500.

3150-01 CARD READER: This unit operates at 1000 cpm. The card input hopper can hold 1200 cards, and two 1200 card output stackers are used. Attachments for the 3150-01 include the 31501 Binary Read feature, the 31502 Ticket/Stub Card feature, the 31503 Mark Read feature, the 31504 Automatic-End-of-File feature, and the 31505 90-column feature.

3150-02 CARD READER: This unit differs from the 3150-01 only in having a 3000 card capacity input hopper.

3150-03 CARD READER: This unit operates at 660 cpm. The card input hopper can hold 1200 cards, and two 1200 card output stackers are used. Attachments include all of the optional features available for the 3150-01 or 3150-02 except the 31503 Mark Read feature.

3160 CARD PUNCH: This unit operates at 100-290 cpm, and has a 1200-card input hopper and two 1100-card output stackers. A 31601 binary punching feature is available as an option.

SOFTWARE

Software for the System 7.500 includes the virtual memory operating system BS 2000, nine language processors, data management systems, tools for software development, and a variety of application software packages.

BS 2000 OPERATING SYSTEM: All three System 7.500 models use BS 2000 as their operating system. BS 2000, a virtual memory operating system, was first introduced in December 1975. Since then it has been developed, improved, and enhanced to include the TRANSDATA DCM communications access system for simplified programming of time-sharing and batch operations. The version of BS 2000 (version 5.1) used on the 7.500 models lets first-time users operate the system using only 20 commands. Important functions can be utilized with the help of an additional 30 commands. This version of BS 2000 also offers improved data/program security, on-line maintenance routines, a more efficient system/user interface, and "eventing routines" that permit concurrently running programs to be synchronized so that data can easily be exchanged among them. This release for the System 7.500 has been designed so that it can be tailored to meet the exact requirements of the configuration ordered.

The essential features of BS 2000 comprise dynamic memory management, concurrent support of local or remote batch processing, multi-programming, and interactive processing (time-sharing) for multiple users under control of a time-slice oriented management system.

Under BS 2000, real memory is divided into pages of 2048 bytes each. Virtual memory is divided into consecutive segments of 65,536 bytes, each containing 32 pages. BS 2000 combines two pages to form a 4096-byte page. Page tables define the relationship between real and virtual memory at any moment in time. These tables are continuously updated and monitored for pages which are not being used frequently. Based on this, the page management system then allocates real memory to new pages.

There are two main types of programs under BS 2000: privileged and non-privileged routines. The Control System is privileged and consists of the Executive, the Data Management System, the Teleprocessing System, and System Services. Non-privileged routines consist of language processors, utility routines, and user programs.

The Executive performs the following functions:

- Handling console I/O
- Processing user command language
- System accounting, spooling
- Interrupt handling.

The Data Management System handles I/O operations except for data terminals and the console(s), including file management and the shareability of files. Access methods supported by the Data Management System include SAM (Sequential Access Method), ISAM (Indexed Sequential Access Method), PAM (Primary Access Method), and BTAM (Basic Tape Access Method). PAM can only access 2048-byte pages.

The Teleprocessing System supports remote access to the computer system including facilities for resource management, logon/logoff, support of logical or virtual terminals, data transfer, and error handling.

System Services include an Interactive Debugging Aid, a Desk Calculator function, a Dynamic Linking Loader, and an Audit Mode for generation of branch address tables.

For execution, tasks are classified as either interactive or background (batch). Interactive tasks are initiated via the keyboard of a data terminal. Batch tasks can be assigned any of 9 priorities.

Operating system components (except the Executive), user programs and application programs are stored in virtual memory and relocated into real memory during execution. Virtual memory space is reallocated to the programs during loading.

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Real memory under BS 2000 is divided into two sections: one is reserved for the Executive and the real-memory resident programs, and the other is divided into 2K page frames. All paging is done on demand only.

Virutal memory is subdivided into 6 classes. Classes 1-4 are reserved for the system, while Classes 5 and 6 are available to the user. Class 6 memory is available for user-written programs and begins at the low-order end of the available memory area. Class 5 memory comprises the high-order 64K and is used for tables and buffer areas that have to be set up for user tasks.

Dynamic Address Translation is handled via a special Address Translation Memory (ATM) that holds 128 entries. Each ATM entry contains a Segment and Page reference that is combined with a virtual address displacement to result in a real address. A hit will result in 90-95% of all address references using this multi-level address translation scheme. When an address cannot be determined on the first pass through the ATM, a fall back to Segment/Page tables with an additional 256 entries is required. A maximum of 2-levels are required for 2K-page addressing, and 3-levels are required for 4K-page addressing schemes (4004/151).

LANGUAGE PROCESSORS: Nine languages are available on the System 7.500. They are RPG 2, ALGOL 60, ANS COBOL, FORTRAN IV, PL/1, BASIC, APL, PASCAL, and Assembler.

UDS COMPACT: UDS COMPACT is a compact version of the Siemens UDS data base handler which is based on the proposals made by CODASYL (Conference on Data System Languages). UDS COMPACT enables users to initialize a data base from a display terminal, retrieve data, and perform routine management tasks. UDS recognizes all records of a particular record type. Standard keys are defined and referenced by database statements. Compound search expressions allow the selection of records based on the contents of items within the record.

Clerical staff and occasional users of the data base may access it through a non-procedural Interactive Query Language (IQL). Users can formulate selections and output conditions based on relationships of items from different record types. IQL permits data base modifications, deletions, and insertions.

UDS has a fast restart facility in the case of system failure. Transaction-oriented back up and a number of facilities for restoring destroyed data provide a high level of data base availability.

The major components of UDS COMPACT are comparable to the standard version and include (1) a Data Definition Language (DDL) for defining the logical structure of data as seen by a user program and for defining the logical structure of the database as a whole, (2) a Data Base Handler (DBH), (3) a Data Manipulation Language (DML), (4) an Interactive Query Language (IQL), and (5) other service programs. For public sector use, a Compatible Database Interface (KDBS) has been developed.

UDS COMPACT runs under BS 2000 versions 5.1 and 6.0 and requires at least 500K bytes of main memory.

SESAM COMPACT: A linear data base system, SESAM COMPACT provides interactive procedures for database initialization and maintenance; interactive database processing; a CALL interface which permits user programs to be written in RPG, COBOL and other high level languages; and password at the record field level.

GOLEM INFORMATION RETRIEVAL SYSTEM: This system provides access to the system from remote terminals. GOLEM uses a flexible, interactive, conversational language for data access that includes features for browsing, specification of descriptor ranges, etc. GOLEM also supports simultaneous terminal operations for multiple application programs, and can handle stored data in variable formats. Documents are logically divided into segments, and 5-level access codes are used to ensure data access security. Under BS 2000, GOLEM is a pageable program.

UNIVERSAL TRANSACTION MONITOR: Part of the TRANSDATA Data Communication Method (DCM), UTM controls, monitors, and protects the simultaneous interaction of multiple terminal users with the system. UTM performs such functions as program management, message communication, storage management, log file, transaction control, and integrated format control.

Model 7.521 uses UTM-B1 while models 7.531 and 7.541 use UTM-B3. UTM is run under BS 2000 from release 5.1 and requires 50K bytes of main memory.

SOFTWARE TOOLS

BYBLOS is a documentation system which can be used throughout system development. BYBLOS is a text processing system, a data base and a data dictionary/directory. Its objective is to assist in the documentation of a project, its performance, system architecture, its data, and its program/module specifications. BYBLOS requires 850 pages and runs under BS 2000 version 5.1. It can be used interactively or in batch mode.

COLUMUS, a tool for structured programming, facilitates the conception and the development of programs. It provides automatic structural representations (structural lists and structograms). COLOMBUS comes in three versions, COLOMBUS-CO8 for COBOL, COLOMBUS-FOR for FORTRAN and COLUMBUS-ASS for assembler. All three can be run on the System 7.500. The COBOL COLOMBUS requires 153 pages while the assembler COLOMBUS requires 132 pages.

TESTMANAGER tests individual modules within programs. It simulates the interfaces with calling and called modules. TESTMANAGER monitors tests, provides output logs, and offers a thorough set of test documentation. It requires 114 pages and can be used in both interactive and batch mode.

MMS (Module Measuring System) is used to optimize software by identifying inefficient modules. MMS needs 61 pages and can be run in both batch and interactive modes.

FMS (File Management System) economizes on disk storage allocations for small amounts of sequential and indexed sequential data. FMS requires 36 pages and can be run in both batch and interactive mode.

COTUNE and FORTUNE are used for fine tuning programs written in COBOL and FORTRAN, respectively. FORTUNE requires 48 pages while COTUNE requires 135 pages.

GPSP (General Purpose String Processor), a macro processor, requires 116 pages of memory.

DAVID, a data and archives management system, requires 555 or 462 pages of memory.

FORMPLAG edits and controls input data from terminals. It requires 72 pages of memory.

DOCULITY, a format program for the preparation of text, facilitates the documenting of a project. It can be used in both batch and interactive mode and requires 40 pages.

Siemens System 7.500

APPLICATIONS SOFTWARE

DIFIB is an interactive accounting system.

COMET-PS supports planning and control functions. Given parameters and variables, it provides alternative solutions and is aimed at the construction industry. It needs 120 pages and costs about DM 13,087.

ISI comes in four versions: ISL-IDA, ISI-MW, ISI-GD, and ISI-TW. ISI-IDA is a system for order processing in industry and commerce. Its main functions are data capture, file updating, file retrieval using the matchcode system, and stock control. ISI-IDA uses 100 pages and costs about DM 33,500. It can be used in both batch and interactive mode.

ISI-MW is a stock control system. In batch mode, it needs 43 pages, and in interactive mode, 300 pages. It costs between DM 30,537 and DM 32,297. ISI-GD is a data management system that maintains an element file (product definition or title, work places, time needed to produce) and a structural file (relationships between elements). It needs 38 pages in batch mode and 400 pages in interactive mode. It costs between DM 26,180 and DM 28,360. ISI-TW optimizes resources and reduces machine idle time. It runs only in batch mode and needs 100 to 150 pages. It costs about DM 16,150.

HOREST 2 is a warehouse system aimed at optimizing stock levels. There are three versions with prices from DM 13,508 to DM 21,812.

TRAFIC is an optimization program for organizations involved with vehicle scheduling. It needs 130 pages and costs about DM 18,329.

SINET is an interactive system for network planning analysis. It needs 87 pages and costs between DM 29,694 and DM 65,434 depending on features chosen.

GPSS (General Purpose Simulation System) is for operations research modeling. It needs 60 pages and costs about DM 10,485.

SICOS (Simulation of Continuous Systems) is another modeling system for scientific engineering and mathematical applications. It can be run in both batch and interactive mode. It needs 150 pages and costs about DM 13,990.

METHAPLAN is a planning and analysis system that comes in several versions; i.e., for planning, applied mathematics, statistics, optimization, and forecasting. Prices vary from DM 8725 to over DM 15,000.

PRICING

The prices that follow are Datapro estimates based upon publicly available information and have not been approved by Siemens. All prices are in Deutsche Marks (DM). ■

EQUIPMENT PRICES

		Monthly Rental (3-year lease) (DM)
SIEMENS 7.521		
Model 7.521 basic configuration, 512K bytes of main memory, monitor screen, switchable keyboard, 1 floppy disc drive, byte multiplexer channel with 75212-32 printer attachment, 3333 line printer, direct disk storage adapter with 2 extensions		4080
75210-10	Main memory extension (512K)	452
75212-X	BYMUX extension (max 3)	140
75216-X	DDSA extension	80
75211-3	2nd floppy disk drive	300
75211-5	Console hard copy printer	553
75218	Integrated Terminal Controller (ITC)	216
75218-20	ITC line adapter (4 lines per adapter)	60
75219	Integrated front-end processor-B (128KB)	625
75219-30	IFEP memory extension (64KB)	125
75219-20	IFEP line adapter unit	60
75212-34	Printer attachment* for a 3336	800
75212-36	Printer attachment* for a 3340	30

*only for system printers

SIEMENS 7.531		
Model 7.531 basic configuration, 512K bytes of main memory, monitor screen, data display terminal, 3336 line printer, 1 floppy disc drive, 75319 ITC with 3 local connections for data display terminals or printer terminals DDSA with two extensions, BYMUX channel		4660
75310-10	Main memory extension (512K)	452
75310-15	Main memory extension (512K)	452
75312-X	BYMUX extension (max 5)	140
75314-X	DDSA extension	80
75311-3	2nd floppy disc drive	300
75311-5	Console hard copy printer	553
75318-20	ITC line adapter	60
75318-50	ITC local line extension (16-32)	497
75319	IFEP (128KB)	680
75319-3X	IFEP memory extension (64KB)	125
75319-20	IFEP line adapter unit	60
75319-50	IFEP local line extension	497
75312-32	Printer attachment* for a 3333	736
75312-36	Printer attachment* for a 3336	30

*only for system printers

SIEMENS 7.541		
Model 7.541 basic configuration, 2M bytes of main memory, operator console with video terminal and console printer; 3336 line printer, byte multiplexer channel, 2 block multiplexer channels		17,500
75410-30	Main memory extension from 2M to 3M bytes	904
75410-40	Main memory extension from 3M to 4M bytes	904
75414-3	Third block multiplexer channel	400
75414-4	Fourth block multiplexer channel	350
75414-5	Fifth block multiplexer channel	250
75412-1	Byte multiplexer extension	769
75412-36	Printer attachment for	30
75412-37	Printer attachment for	60
75412-39	Printer attachment for	140
PERIPHERALS		
3150-01	Card reader 1000 cpm	1320
3160	Card punch 100-300 cpm	1378
3170	Floppy disc I/O unit	1550
3333	Line printer	1100
3336	Line printer	920
3340	Line printer	3981
3521	Magnetic tape device 20/40 KB/S	730
3523	Magnetic tape device 40/80 KB/S	850
3511	Magnetic tape controller for 3521/3523	345
3570	Magnetic tape unit 30 KB/S	2876
3530	Magnetic tape device	790
3571	Magnetic tape unit 60 KB/S	3419
3531	Magnetic tape device 60 KB/S	1013
3054	Disc storage unit 63MB	770
34514	Converter	470
3464	Disc storage unit 126MB	1240
3468	Disc storage unit 300MB	2214
3670	Fixed disc storage unit 420MB	1170
8160-7	Data display terminal (1920 ch)	165
8162-7	Data display terminal (1920 ch)	416
8112-7	Printer Terminal (IFEP only) controller	
8122	Dataprinter	218