Siemens System 7.500

MANAGEMENT SUMMARY

Currently consisting of seven models, the Siemens System 7.500 is Germany's answer to the IBM 4300 and 303X Series. Covering a MIPS range from 0.13 to 4.5, the series encompasses a much wider spectrum than any of its competitors.

In January 1979, IBM announced their new medium-scale central processors—the 4300 "E" Series—and in so doing, severely increased the competitive pressure on most of the other mainframe vendors. Siemens, following its traditional marketing strategy, boldly met the challenge head-on by introducing the 7.521, 7.531, and 7.541 models three months later at the Hanover Fair. The Siemens 7.500 Series offered users an appealing alternative to the new IBM opponents, since it provided a dramatically improved price/performance ratio over the 4300.

Fifteen months later, Siemens further solidified its new 7.500 user base through the enhancement of the series in the form of four new processor models, designated the 7.536, 7.551, 7.561, and 7.571.

With the announcement of the four new processor models, Siemens emphasized the fact that there is one compatible series and one operating system facilitating a smooth user migration path. All Siemens competitors have more series and more than one operating system covering the System 7.500 performance range, and the 7.500 models are completely compatible with each other, using the same 169 instruction set and operating under BS2000.

The 7.531 and 7.536 compete directly against IBM's 4331 models 1 and 2, respectively, while the 7.541 competes against the larger 4341. The three new top-end models—the 7.551, 7.561, and 7.571 compete against the IBM 3031, 3032, 3033N and the 3033, respectively. The larger Siemens IBM plug-compatible mainframe System 7.800 series is aimed at existing IBM users.

In marketing the System 7.500, Siemens is placing a large emphasis on its ease and simplicity of operation, its ➢

An eventual replacement for the Siemens System 7.700 Series, the Siemens System 7.500 comprises seven processor models providing a MIPS range varying from 0.13 to 4.5. Competitive with the IBM System/38 and the IBM 4300 and 303X Series, the 7.500 provides an attractive alternative because it consists of one compatible series with one operating system. Monthly rental ranges from about DM 4,000 for the smallest models, to DM 127,000 for the largest model.

CHARACTERISTICS

MANUFACTURER: Siemens AG, Bereich Datenverarbeitung, Otto Hahn Ring 6, Postfach 83 09 51, D-8000 Munchen 83, West Germany. Telephone: (089) 6361. Telex: 52109-265.

MODELS: Siemens System 7.500 Compact Computer, models 7.521, 7.531, 7.536; Siemens System 7.500, models 7.541, 7.551, 7.561, 7.571.

DATE ANNOUNCED: 7.521 and 7.531, April 1979; 7.536, June 1980; 7.541, April 1979; 7.551, 7.561, and 7.571, June 1980.

DATE OF FIRST DELIVERY: 7.521, January 1980; 7.531, November 1979; 7.541, September 1979; 7.536, first quarter 1982; 7.551, fourth quarter 1981; 7.561, first quarter 1982; 7.571, first quarter 1982.

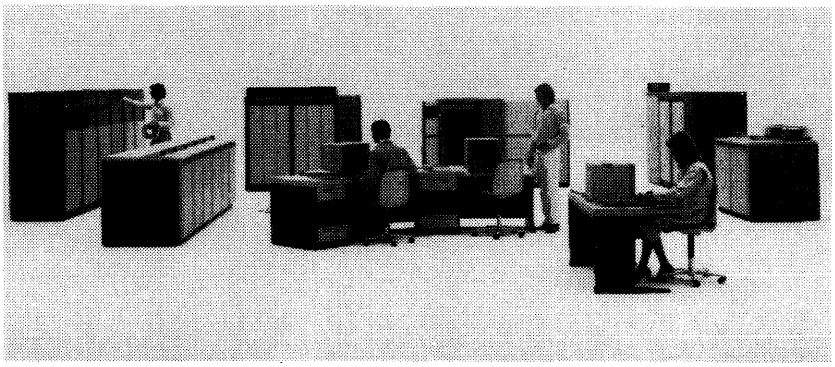
NUMBER INSTALLED TO DATE: As of February 1981—7.521, 79; 7.531, 347; 7.541, 150.

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 16-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 ➤



Scheduled for delivery the first quarter of 1982, the System 7.571 is the largest of the seven Siemens 7.500 models, and is approximately as powerful as IBM's 3033 and Siemens' own plug-compatible mainframe 7.872. The basic configuration is composed of the central processing unit, a main memory of four megabytes expandable to eight megabytes, a cache memory of 64K bytes, and one input/output processor with six block multiplexor channels. A theoretical maximum of 384 disk drives can be supported.

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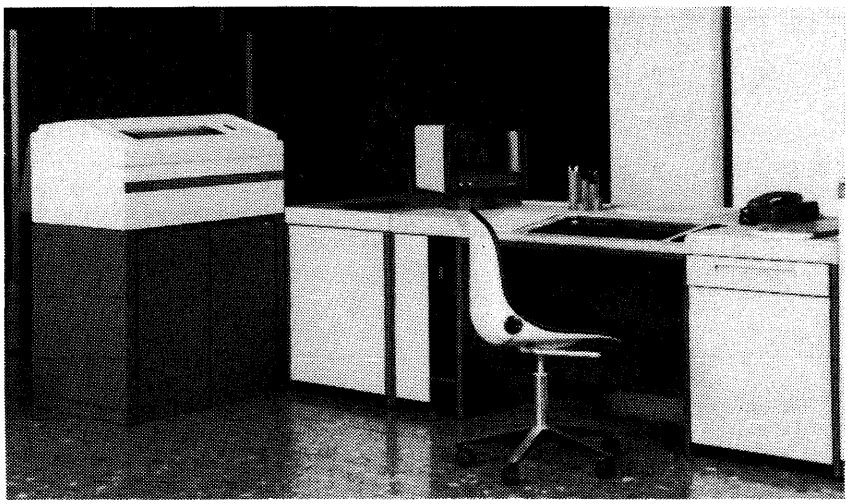


As the 7.500 Series entry-level model, the 7.521 compact computer comes with 512K bytes of main memory and is built into a desk enclosure with system keyboard/display, floppy disk drive, a direct disk storage adapter, and a 300-line-per-minute printer. The 7.521 can be operated by non-technical staff in an office environment.

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.

It appears that Siemens will eventually replace the older Siemens 7.700 models with 7.500 equivalents in performance but lower in price. Although still available for BS1000 users, the 7.700 models are not being actively marketed to new users, as the 7.500 models have a far better price/performance ratio. However, users needing more powerful models immediately will be sold the more expensive top-end 7.700 models, which are still being manufactured. Siemens is thus giving BS1000 users time to convert to the newer and more efficient BS2000, which runs on both the System 7.500 and System 7.700.

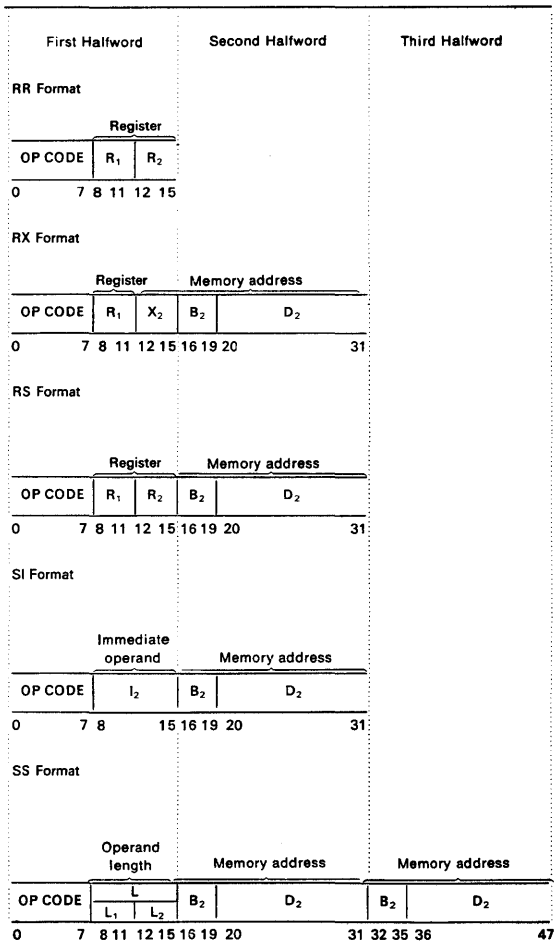
Since the time when Siemens entered data processing and information technology in 1954, this branch has developed into one of the company's major areas of interest. In 1957, Siemens presented the world's first series of fully transistorized computers, the Siemens 2002. Six years later, the Siemens 3003 was announced. In 1965, Siemens introduced the 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 evolved, 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 market the large, Fujitsu-built System 7.800. At the same time, by taking over the Norwegian company Tandberg, Siemens introduced a small business system, the System 6.000. With the 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

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.

Instruction Formats



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CHARACTERISTICS OF SYSTEM 7.500

MODEL	7.521	7.531	7.536	7.541	7.551	7.561	7.571
Date of Announcement	April 1979	April 1979	June 1980	April 1979	June 1980	June 1980	June 1980
Date of first delivery	January 1980	November 1979	First quarter 1982	September 1979	Fourth quarter 1981	First quarter 1982	First quarter 1982
MIPS Range	0.13	0.24	0.50	0.75	1.25	2.70	4.50
Relative performance (370/158-3 = 45)	5.8	11	22	33	58	130	220
MAIN MEMORY							
Read cycle time, nanoseconds	360/8 bytes	N/A	N/A	N/A	N/A	N/A	N/A
Minimum capacity, bytes	524,288	524,288	2,097,152	2,097,152	2,097,152	4,194,304	4,194,304
Maximum capacity, bytes	1,048,576	2,097,152	3,145,728	4,194,304	8,388,608	8,388,608	8,388,608
Increments, Bytes	524,288	524,288	1,048,576	1,048,576	2,097,152	2,097,152	4,194,304
CACHE MEMORY							
Capacity, bytes	—	8K	8K	16K	16K	32K	64K
Read cycle time, nanoseconds	—	250/8 bytes	80/8 bytes	200/8 bytes	80/8 bytes	52/8 bytes	52/8 bytes
Hit rate	—	90%	90%	95%	93%	94%	97%
PROCESSING UNIT							
Machine cycle time, nanoseconds	240	240	80-120	105	80-120	52	52
Number of I/O processors	1	1	1	1	1	2	2
Bus architecture	Yes	Yes	Yes	No	Yes	Yes	Yes
Central operator console	Integrated with CPU	Integrated with CPU	1	1	1	1+1	1+1
Add-on auxiliary consoles	—	—	3	3	3	3+3	3+3
Direct channels for Disk Storage	4	6	16	—	—	—	—
Aggregate data rate, MB/S	1.1	1.74	6	6	16	28	28
BYTE MULTIPLEXOR CHANNEL							
Number	1	1	1	1	2	2	2
Number of trunks available per channel	1 to 3	1 to 5	5	6 to 14	8	8	8
Data rate, KB/S	300	930	400	200	400	400	400
Trunk data rate, KB/S	60 or 300	20 or 320	280	129 or 238	280	280	280
BLOCK MULTIPLEXOR CHANNEL							
Number	—	—	2	5	6	12	12
Number of trunks per channel	—	—	2	2	2	2	2
Data rate, MB/S	—	—	2	2 and 1.6	2	2	2
Maximum Number of disk drives	4	6	80	160	192	384	384
Teleprocessing Pre-processor	IVR-B integrated pre-processor	IVR integrated pre-processor	IVR integrated pre-processor	CVR compact pre-processor	CVR compact pre-processor	DVR Front-end processor	DVR Front-end processor

series, 2) new technology providing a compact computer series which takes 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) full compatibility with the 7.700 and 7) fast bi-polar cache memory.

All three older models incorporate 16K-bit RAM chips. The 16,438-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.

Siemens will be producing the later-announced models with the larger integrated 65,546-bit VLSI memory chips,

INTERNAL CODE: EBCDIC.

MAIN STORAGE

STORAGE TYPE: MOS 16K-bit chips are used in the models now being manufactured. For the models in production from fourth quarter 1981, VLSI 64K-bit chips will be used on all models.

CAPACITY: See Characteristics table.

CYCLE TIMES: See Characteristics table.

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

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incorporating 150,000 components in an area of 25.6 square millimeters. The prototypes of the 7.536 and 7.551 still have the 16K-bit chips; however, in the mid 80's all models will be based on VLSI technology. In addition, the latest Emitter Coupled Logic (ECL) circuitry and fast bi-polar cache memories will be employed.

The smaller two models (7.521, 7.531) feature desk-type architecture, ergonomic design, non-critical climatic requirements, simple installation, and a design suitable for the office environment.

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

Considered as part of the compact computer class and intended for use in an office environment, the 7.536 has a separate central operator console.

The upper-end models (7.541 and above) are all intended for air-conditioned computer centers.

All models, except for the smaller model (7.521), use fast bi-polar cache memory to speed up operations. The exact speed and size can be found in the Characteristics table.

The smaller two models have integrated console units; the other models use a separate central console workstation. A second central console workstation can be attached to the second optional input/output processor of the larger two models (7.561, 7.571).

Up to three sub-consoles may be attached to the central operator console at a distance up to two kilometers.

A service processor provides on-line maintenance functions and handles error recovery support when a malfunctioning component or the operating system can no longer perform this function.

Main memory ranges from 0.5 megabytes on the two smaller models to 8 megabytes on the larger three models. On the smaller two models, the main memory can be extended in 0.5 megabyte increments to a maximum of 1 megabyte on the 7.521 and 2 megabytes on the 7.531. The 7.536 memory capacity can be expanded from 2 megabytes to 3 megabytes, and the 7.541 memory can be expanded from 2 to 3 to 4 megabytes. The minimum capacity on the 7.551, 7.561, and 7.571 is 2 megabytes, 4 megabytes, and 4 megabytes, respectively, and can be expanded in 2 megabyte increments to a maximum of 8 megabytes (7.551, 7.561). Memory capacities for the 7.571 are 4 megabytes and 8 megabytes.

Monthly rental for the basic central processor configuration ranges from DM 4040 for the 7.521 to DM 127,000 for the largest model, the 7.571.

memory, the registers and all data paths are subject to parity checking. All the data in the memory are checked by an 8-bit Hamming code. One bit errors are corrected while multiple bit errors are noted on models 7.521 through 7.551; two-bit errors are corrected on models 7.561 and 7.571. There are also error recovery routines built into the BS2000 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.

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.

Memory access control on models 7.536 to 7.571 connects the two I/O processors and the central processors via the cache stores, coordinates memory requests, and contains an 8K-byte write buffer (models 7.561 and 7.571 only).

CENTRAL PROCESSORS

There are currently seven models in the 7.500 Series. These seven models can be divided into two classes: office environment, and computer center. The 7.521, 7.531, and 7.536 belong to the office environment classification. The 7.521 and 7.531 have desk-type architecture, and the 7.536 is a free-standing computer with a separate central operator console. The 7.541, 7.551, 7.561, and 7.571 have been designed for operation in larger 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 models, from the 7.536 upwards to the largest 7.571, are physically different from the two smaller models and all have 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 proc-

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INPUT/OUTPUT

On the smaller three models, the disk drives are attached to the Direct Disk Storage Adapter (DDSA). On the larger four models, they attach to the Block Multiplexor (BLMUX) Channel trunks. The total number of disk drives which can be attached to the smaller models are 4, 6, and 16 on the 7.521, the 7.531, and the 7.536 respectively. The data transfer rate of the DDSA is 806K bytes per second. The number of BLMUX trunks available for disk units varies from 10 on the 7.541 to 24 on the 7.571 with 2 input/output processors.

Each BLMUX can also have 256 devices attached to it. The data rate is 1.6 megabytes/second on the 7.531. On Model 7.541 the data rate on BLMUX 1 and 2 is 2 megabytes/second, on BLMUX 3 to 5 it is 1.6 megabytes/second. The data rate is 2.0 megabytes/second on the BLMUX of the newer models (7.536, 7.551, 7.561, 7.571). Aggregate data rates can be seen in the table.

The slower peripherals, such as tape drives (with the exception of drives having read/write rates of 780 kilobytes/second and 1250 kilobytes/second), card readers and punches, floppy disk drives, central console workstations, and printers attach to the trunks of the Byte Multiplexor Channel (BYMUX). The BYMUX allows the addressing of up to 256 units, which can operate concurrently in the time division multiplex mode. Subchannel registers for the BYMUX and BLMUX are located in a reserved section of main memory called the shadow memory which is not available to the user. The number of BYMUX trunks and data rate for each model can be seen in the Characteristics table.

PERIPHERALS

There are six exchangeable disk drive models with storage capacities between 63 and 300 megabytes and average access times of 37.5 to 42.5 ms. The fixed disk storage unit available has a capacity of 420 megabytes and an average access time of 32.5 ms. The two disk drives with storage capacities of 63 and 126 megabytes have been produced especially for the 7.500 Series.

The magnetic tape units (800, 1600, or 6250 bpi) have read/write speeds from 20K to 1250K bytes per second depending upon model and density used. Units with a recording density of 6250 bpi and read/write speeds of 780 to 1250 bytes per second can be attached only on the Model 7.536 upwards.

There are four impact printers available with speeds ranging from 300 to 2000 lines per minute, depending on model and character set. The normal 64-character set used is the OCR-B font. For the Model 7.521, 7.531, and 7.536 one may choose from three printers: 300, 600, or 1200 lpm. The high-speed printer (2000 lpm) and the laser printer (21,000 lpm) are available only on models 7.541 to 7.571.

essor, 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 constant communication is maintained between the execution and instructions 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.

The models 7.536 and 7.551 have the same architecture and are different from the older 7.541. The central processor is made up of the 32-bit processing unit, the transfer unit for memory access, and the control unit. Memory traffic and program processing can run in parallel.

The autonomous control unit with its own microinstruction registers controls and monitors all procedures of the central processor and services the interfaces of the separate I/O processor and the service processor.

The I/O processor of models 7.536, 7.551, 7.561, and 7.571 is a 32-bit microcoded data bus system and is made up of two processors—the command editing unit and the transfer unit—and byte and block multiplexor channels. The I/O processor is linked to main memory via memory access control.

The models 7.561 and 7.571 have similar architecture and are different from the smaller models. Their components include the central processor, the input/output processor, and main memory. The central processor is composed of the cache memory, the instruction processor and a control memory, command execution processor, and another control memory linked to the input/output processors via the coordinator. The central processor is linked to the main memory via the cache and memory access control. Both the 7.561 and 7.571 use 5-level pipelining.

SERVICE PROCESSOR: An integral part of the 3026-1 and 3026-2 central operator consoles 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 main-

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Card readers (80-column cards) with a reading rate of 660 or 1,000 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) is available for all 7.500 models. A second Floppy disk drive can be attached to the models 7.521, 7.531, and, using a second operator console, also to models 7.561 and 7.571.

Data display terminals and/or printer terminals can be attached to all systems. The 8160 data display terminal has a character set of 64 or 95 characters. Display format is 80 characters by 24 lines.

All models can support teleprocessing. For local teleprocessing, i.e., distances up to two kilometers, an Integrated Terminal Controller (ITC) is used on the three smaller models. The ITC-b on the 7.521 can handle up to 16 terminals. The ITC on the 7.531 and 7.536 can handle up to 32 terminals by the addition of an ITC local line extension. For remote processing, there are three different front-end or pre-processors available. The models 7.521, 7.531, and 7.536 all use the Integrated Front-End Processor (IFEP). The 7.541 and 7.551 use the compact front-end processor (CVR) and the larger models use the DVR front-end processor. The entire range of BS2000 Transdata products can be added to all the pre- and front-end processors.

The software for teleprocessing is based on "Program System for Teleprocessing and Network Control" (PDN) and programs in the BS2000 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 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.

SOFTWARE

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

tenance) and is housed in the central operator console. The SVP connects to the central processor and the I/O processors via a special interface.

All local 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. Remote maintenance is facilitated via the 3026-2 console.

INSTRUCTION REPERTOIRE: 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.

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.

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 all models, with the exception of Model 7.521, contain a high-speed cache memory 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 to 250 ns 90 percent of the time.

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To simplify system operation, Siemens has provided a version of the BS2000 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 BS2000, with approximately 2 million instructions, supports all types of operations; i.e., time-sharing, transaction processing, and local and/or remote batch processing. BS2000, initially designed in 1969 but first released to the public in December 1975, is now in its 6th release. It has been designed to cover the entire computer performance range. With the compact range the BS2000 is customized to meet the exact requirements of the configuration ordered. With all 7.500 models, the customer chooses at the time of system generation the amount of virtual memory per user he wishes to have (1 to 4 megabytes). From a programmer's point of view, a major advantage of the BS2000 is its uniform command language in all modes of operation.

System 7.500 software tools, application software packages, and the data base 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 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 (test 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.

The 7.536 also has an 8K-byte cache with a cycle time of 80 nanoseconds and a hit rate of 90 percent.

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.

The 7.551 has eight 2K-byte banks, or a total cache of 16K bytes. Each bank is 32 bytes wide with 64 entry locations each. The cycle time is 80 nanoseconds.

The 7.561 has two 16K-byte banks, or a total cache of 32K bytes. There are 1024 entry locations, 16 bytes each. The cycle time is 52 nanoseconds, with a hit rate of 94 percent.

The 7.571, with four 16K-byte banks, or a total of 64K-bytes, had a cycle time of 52 nanoseconds and a hit rate of 97 percent.

The 7.561 and 7.571 both have write cache consisting of four 2K-byte banks with 64 entry locations, 32 bytes wide.

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. On models 7.536, 7.551, 7.561, and 7.571, the control memories of the processors are loaded from the shadow memory on demand.

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.

On models 7.536, 7.551, 7.561, and 7.571, the shadow memory areas also serve to store microprogram portions of all the CPU components. They are loaded from the floppy disk drive.

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) guarantees a first level hit in the search for a page in 90 to 95 percent of all cases under normal program conditions.

To execute the address translation, a row in the ATM is selected by means of parts of the segment and page portions of the virtual address. The entries in the ATM can be

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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 data bases. 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).

COMPETITIVE POSITION

Based on Diebold statistics, Siemens' main market is the Federal Republic of Germany, where it has a 20.5% share of the market. In the other European countries, Siemens' market share ranges from 2% to 18%. Taking the whole of Western Europe, Siemens has a 10.5% share of the market.

The table below shows Siemens' market share in the countries in which it markets its computers as of the beginning of 1980.

COUNTRY	PERCENTAGE
Federal Republic of Germany	20.5
Belgium/Luxembourg	18.0
Austria	14.5
Denmark	8.5
Spain	5.0
Italy	4.0
Switzerland	3.5
The Netherlands	3.0
Sweden	2.0
South Africa	1.0

France has not been quoted in the above table, as Siemens has only recently opened offices in France as a separate unit in order to capture some of the lucrative French computer market. Previously, the Siemens computers had been marketed and maintained by Cii, when both were part of the old UNIDATA consortium.

Siemens Data France, at a press conference in June 1980, said their aim was to reach computer sales of 250 million French francs by 1982.

It is still too early to predict how the system 7.500 will effect the market positions. As of January 1981, 575 System 7.500 machines had been delivered.

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.

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 language 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 models 7.541 to 7.571 by dividing the central 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 Model 7.536 Input/Output Processor is made up of the following components: an editing unit, a transfer unit, an integrated terminal controller, one byte multiplexor channel, two optional block multiplexor channels, and one DDSA. Both the editing unit and the transfer unit are autonomous microprogrammed processors.

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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RELATIVE PERFORMANCE OF 7.500 MODELS

Model	7.521	7.531	7.536	7.541	7.551	7.561	7.571
Relative performance							
7.521 = 1	1	2	4	6	9	21	35
370/158-3 = 45	5.8	11	22	33	58	130	220
KOPS	130	240	500	750	1250	2700	4500

Originally announced as Siemens' answer to IBM's E Series, the 7.500 now covers both the 4300 and 303X Series.

As the computer market is not homogeneous throughout Europe, the Siemens 7.500 faces competition from different vendors in the various European countries. However, one competitor everywhere is IBM, the industry leader.

As on previous occasions, Siemens is following its usual marketing strategy of matching models against IBM's.

With a similar performance to the older and more expensive Siemens 7.730-2, the bottom-end model 7.521 will be marketed as either an entry-level machine or as a program development computer. With a performance of 0.13 MIPS, it also competes against IBM's 38-5, CII-HB's 64/DPS 2, and Univac's 80-3.

The models 7.531 and 7.536 compete directly against IBM's 4331 models 1 and 2 respectively, while the model 7.541 competes against the larger 4341 model 1.

The three new top-end models—the 7.551, the 7.561, and the 7.571—will compete against the IBM 3031 or 4341 model 2, 3032, 3033N or 3033S, and the 3033, respectively.

Always conscious of IBM and the new IBM plug-compatible mainframes, Siemens intends to increase their market share by attracting potential customers of Honeywell's DPS 7 and DPS 8 as well as potential customers of Univac's 1100/60 and 1100/80 Series.

Because Siemens does not market computers actively in the United Kingdom, ICL computers are not really considered strong competition.

In Italy, where Siemens has 4% of the market, they might find competition from IBM plug-compatible OC 5300 Series, built by IPL and marketed in Europe by Olivetti Computers.

USER REACTION

Datapro's 1980 survey of computer system users in France, Germany, and the United Kingdom, yielded 5 responses from Model 7.531 users. The responses included 3 German users and 2 French users.

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.

The Input/Output Processor architecture of the 7.551 is similar to the 7.536, except that it does not have an integrated terminal controller, nor a DDSA.

Both the 7.561 and 7.571 models have the same I/O processor architecture. Both allow an additional optional I/O processor which is needed if one adds either the optional BYMUX and/or the six optional BLMUX's. The I/O processors connect to the coordinator, which is part of the central processor. Each I/O processor supports one BYMUX and six BLMUX's. Each I/O processor is also connected directly to the main memory.

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 for 7.521 or from 20 kilobytes/second to 320 kilobytes/second for model 7.531 depending on the mode of operation; i.e., multiplex or selector. In multiplex mode, several devices can share the same trunk, 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.

Various speed peripherals connect to the 7.536 by a standard BYMUX, two optional BLMUX's, or by one DDSA; terminal workstations are connected via the integrated ter-

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	Excellent	Good	Fair	Poor	WA*
Ease of Operation	1	4	0	0	3.2
Reliability of mainframe	3	2	0	0	3.6
Reliability of peripherals	0	5	0	0	3.0
Responsiveness of maintenance service	2	3	0	0	3.4
Effectiveness of maintenance service	0	4	1	0	2.8
Technical Support					
Troubleshooting	0	4	1	0	2.8
Education	0	2	3	0	2.4
Documentation	0	3	2	0	2.6
Operating Systems	1	4	0	0	3.2
Compilers and Assemblers	1	4	0	0	3.2
Applications Programs	0	1	1	0	—
Ease of Programming	1	4	0	0	3.2
Ease of Conversion	1	3	0	1	2.8
Overall Satisfaction	1	4	0	0	3.2

*Weighted average for Siemens 7.531 based on a scale of 4.0 for excellent.

The average age of the 7.531 system was 3 months; 40 percent were leased, 40 percent were purchased, and 20 percent were rented.

The principle applications the users had installed were:

Accounting	4
Manufacturing	3
Payroll/Personnel	3
Education	1
Government	1
Engineering/Scientific	1
Retail	1
Utilities/Power	1

Four of the five users planned to acquire additional software from the same manufacturer and three said they planned to expand their data communications facilities. Two planned to implement distributed processing and one user planned to acquire proprietary software.

Some of the users complained about late delivery of the hardware and the software. But for the most part users responded enthusiastically to the advantages of the system. Three out of five users cited response time as a significant advantage of the system, and four users were particularly impressed with the productivity aids which were helping them keep programming costs down. Two users indicated the easy expandability of the system was a very positive feature, and three users felt that the programs/data were compatible as Siemens had promised. All five users said they would recommend the 7.531 to another user in the same situation.□

minal controller. The slower peripherals are attached to the BYMUX, the faster peripherals to the BLMUX, and the disk drives to the DDSA.

The BYMUX on the 7.536 has 8 trunks, three of which are taken up by (a) the central operator station, which includes the 30263 floppy disk I/O, the 30262 console printer, and control screen plus keyboard; (b) the 3336-5 system printer; and (c) an additional optional integrated terminal controller. This leaves five trunks for the slow peripherals. The cumulative rate for the BYMUX is 400 kilobytes per second. The data rate for each trunk is 280 kilobytes per second.

The two optional 75364-2 and 75364-3 BLMUX's have two trunks for fast peripherals. The data rate for each BLMUX is 2 megabytes per second. The DDSA has up to 16 extensions.

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. A total of 256 I/O devices can be addressed and 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 kilobytes/second, however, if the trunk is operated in the burst mode via magnetic tape controllers, the maximum data rate is 238 kilobytes/second.

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 kilobytes/second for channels 1 and 2 and 1600 kilobytes/second 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 kilobytes/second.

The 7.551 has one standard BYMUX. Two of the eight trunks are taken up by the central operator console and the 3336-5 system printer. There are six trunks available for slow peripherals. The BYMUX data rates are the same as with the BYMUX on the 7.536. In addition, an optional 75512-16 BYMUX with eight trunks can be attached. A total of six BLMUX's (three standard and three optional) can be attached for fast peripherals.

The 7.561 multiplexor configuration is structured in the following manner: attached to each I/O processor (the second one is optional) is one BYMUX (eight trunks) and six BLMUX's (two trunks per BLMUX). The first four BLMUX's are part of the basic configuration. The 75614-5 and 75614-6 BLMUX's are optional.

The 7.571 multiplexor configuration is the same as the 7.561, with the exception of including six BLMUX's as part of the basic configuration.

The data rates of the BYMUX and BLMUX on the 7.536, 7.551, 7.561, and 7.571 are all the same: 400 kilobytes per second per BYMUX, 280 kilobytes per second per BYMUX trunk, and 2 megabytes per second per BLMUX. The aggregate data rates are: 7.536—6 megabytes per second, 7.551—16 megabytes per second, 7.561—16 megabytes per second for one I/O processor, 7.571—28 megabytes per second for two I/O processors.

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 disk 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

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characters; the second display provides 24 lines of 80 characters. The larger 7.541 has its own separate 3026-1 central operator console. Models 7.536, 7.551, 7.561, and 7.571 all have their own separate 3026-2 central operator console. With the exception fo the 7.521 and the 7.531, up to three sub-consoles may be attached.

3026-1 CENTRAL OPERATOR CONSOLE: This console for the Model 7.541 includes a video terminal (16 lines of 80 characters), keyboard, and control panel. A 30262 console printer and a 30263 floppy disk unit are optional. The latter can be used to enter relatively small amounts of user data. The console also contains a service processor for IPL, diagnostic IPL, and improved maintenance. 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.

3026-2 CENTRAL OPERATOR CONSOLE: This console for models 7.536, 7.551, 7.561, and 7.571 includes a video terminal (24 lines plus one status line, 80 characters per line), control panel, keyboard, and a Service Processor, which has two floppy disk drives for IPL, diagnostic IPL, monitoring, reconfiguration of the system, and remote maintenance. The 30262 console printer and the 30263 floppy disk unit can be attached. Three 3026-10 sub-consoles can be attached to the central operator console at a maximum distance of 2 kilometers.

3026-10 SUB-CONSOLE: This console includes a video terminal (24 lines plus 1 status line, 80 characters per line), a keyboard, and a control panel. The 30262 console printer (90 characters per second) can 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), the models 7.531 and 7.536 include as standard an Integrated Terminal Controller (ITC). The ITC is optional on Model 7.521. When both short and long distance communications are required, the ITC is replaced by an Integrated Front-End Processor (IFEP). Teleprocessing on models 7.541 and 7.551 is handled via the compact front-end processor 75419/75519. In addition, the TRANSDATA communications processors 9684 and 9687 can be attached as front-end processors. The larger models 7.561 and 7.571 use the DVR Front-End Processor 9687. The entire range of BS2000 TRANSDATA products can be added to all front-end processors.

The modular TRANSDATA 960 data communication system 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 communications systems to choose from: the 968X front-end processor, the 967X remote front-end processor, and the 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 comprising terminals and printer terminals.

75218/75318/75368 INTEGRATED TERMINAL CONTROLLER (ITC): An option on the Model 7.521 and standard on models 7.531 and 7.536, 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, 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 and the 7.536 beyond 16, one 75318/75368 line trunk extension may be added, supporting up to four 8160-7 data display terminals and up to three trunk units, providing a maximum of 16 or more terminals.

75219/75319/75369 INTEGRATED FRONT-END PROCESSOR (IFEP): The IFEP's are used for connecting the various terminals and communications facilities of the TRANSDATA range to models 7.521, 7.531 and 7.536, 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 TRANSDATA 960 block line buffers: either the 96511/96512 block buffer for MSV/LSV protocols or 96520/21 block buffer for HDLC protocol (lines speeds up to 9600 or 48,000 bps). Four trunks for local terminals are also standard on the 7.531. Up to 11 long distance lines can be added, but he number of long distance lines is reduced when more than 12 local terminals are connected. The standard IFEP memory of 192K bytes can be expanded by 64K or 128K on the 7.521 and by 64K, 128K, or 192K on the 7.531 and 7.536.

75219-20/75319-20/75369-20 LINE TRUNK UNITS: These units permit the connection of up to four 8160-7 data display terminals or 8112-7 printer terminal controllers to the IFEP on the 7.521, 7.531, or 7.536.

75319/75369-50 LINE TRUNK EXTENSIONS: For use with the IFEP on models 7.531 and 7.536, this extension for local connections can support up to four 8160-7 data display terminals and three 75319-20/75369-20 line trunk units, providing a maximum of 16 more terminals.

75419/75519 COMPACT FRONT-END PROCESSOR (CVR): The CVR's are used for connecting the various terminals and communication facilities of the TRANSDATA range to models 7.541 and 7.551. There are up to 32 trunks for local terminals (2 km) or up to 12 long distance lines. The 96511/12 and 96520/21 block buffers are used for MSV/LSV and HDLC protocols, respectively. Line speeds of up to 9600 or 48,000 bits per second are possible. The number of long distance lines is reduced when more than 12 local terminals are connected. The standard CVR memory is 256K bytes and can be expanded by 128K bytes.

CONFIGURATION RULES

MODEL 7.521: As the 7.500 series entry-level model, the 7.521 comes with 512K bytes of main memory, a keyboard with monitor screen, one floppy disk drive, one byte multiplexor channel with an attachment for the printer, one direct disk storage adapter (DDSA) with two trunks, and a 300 line per minute printer.

Main memory can be expanded to one megabyte. Disk drives attach directly to the DDSA trunks and a maximum of four disks can be supported, yielding a mass storage capacity of 1,680 megabytes. It is possible to add three more extension trunks to the byte multiplexor channel. The basic configuration does not include a terminal controller nor front-end processor. If required, the ITC-B or IFEP-B can be installed.

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As a stand-alone, medium-scale computer, the 7.521 does have its limitations, but when used as a second computer for program and systems development for which it is also intended, the entry-level model is functionally ideal. In addition, the 7.521 is suitable as a node in a network. A typical configuration, with basic software rents for approximately DM 11,500.

MODEL 7.531: With a relative performance about twice that of the 7.521, the Model 7.531 comes with 512K bytes of main memory, 8K bytes of cache memory, a monitor screen, data display terminal, one floppy disk drive, one integrated terminal controller with four local connections for data display terminals, a direct disk storage adapter with two extensions, one byte multiplexor channel with an attachment for the printer, and one 600 line per minute printer.

Main memory can be expanded in 512K increments to 2 megabytes. A maximum of six disk drives can be supported by the disk storage adapter, yielding a maximum on-line mass storage capacity of 2,520 megabytes. It is possible to add five more extension trunks to the byte multiplexor channel. A typical configuration with basic software rents for approximately DM 14,500.

MODEL 7.536: At the top-end of the "compact" computer class is the more recently announced Model 7.536. Unlike the 7.521 and the 7.531 compact computers, which have a desk-like design and an integrated central operator console, the 7.536 is a free-standing computer with a separate central operator console like the Model 7.541. Nevertheless, it can be used in an office environment. It is also possible to add three auxiliary consoles. Deliveries are scheduled for the first quarter of 1982. A preliminary version, using 16K-bit chips, will be available during mid-1981 and will run under version 6.0 and 6.2 of BS2000. The preliminary version will be housed in two cabinets, while the final version, based on the 64K-bit chips, will take half the space. The final hardware version will run under version 7.0 of BS2000.

The basic configuration is made up of the central processor with 8K bytes of cache memory, a microprocessor based input/output processor, two megabytes of main memory, a 3026-2 central operator console containing a service processor, a 3336 600-line-per-minute printer, an integrated terminal controller, a direct disk storage adapter, four disk units (fixed or removable), and one byte multiplexor channel with connections for the operator station, the system printer, and integrated terminal controller with five additional trunk extensions.

There are many options which can be added to the basic 7.536 configuration. The main memory can be expanded to three megabytes. As with the 7.521 and 7.531, the disk drive units connect to the Direct Disk Storage Adapter (DDSA) allowing for a maximum of 16 disk drives, 10 more than on the 7.531. By attaching 16 420-megabyte fixed-disk units, one can obtain a maximum capacity of 6,720 megbytes of on-line storage.

For long distance teleprocessing, the entire range of BS2000 TRANSDATA products can be linked to the integrated front-end processor (IFEP) as on the 7.531. For short distances, up to 2000 meters, the 7.536 uses the same integrated terminal controller (ITC) as the 7.531, permitting up to 32 display or printer terminals. As an option, two block multiplexor channels can be added. The maximum total data rate for all channels is 6 megabytes per second, the same as on the 7.541 and over three times the rate on the 7.531.

The Model 7.536 with two megabytes of main memory, three disk drives of 126 megabytes each, 12 workstations, and one 300 line-per-minute printer, rents for DM 17,400 over a 36-month period. The basic software rents for DM 1,650 per month.

MODEL 7.541: Fifty percent more powerful than the Model 7.536, the 7.541 is at the bottom-end of the computer center class of computers. With a basic configuration of 2 megabytes of main memory, 16K bytes of cache memory, a 3026-1 central operator console containing a service processor, one byte multiplexor channel with 6 free trunks, two block multiplexor channels with three trunks per channel, and one 600-line-per-minute printer, the Model 7.541 rents for DM 17,500.

Main memory can be expanded in one megabyte increments to 4 megabytes. The byte multiplexor channel trunks can be expanded to a total of 14, and a further 3 block multiplexor channels can be added. Monthly rental for a typical configuration including software costs approximately DM 48,000.

MODEL 7.551: Competing directly against IBM's 3031 and Honeywell's DPS 7/70, the Model 7.551 must be used in an air-conditioned computer center environment. Similar in architecture to the 7.541, the 7.551 has a larger main memory capacity (up to 8 megabytes), a faster cache memory (80-nanosecond cycle time compare to the 200-nanosecond cycle time on the 7.541), a higher aggregate data rate (16 megabytes per second) and a different input/output channel configuration in terms of the number of byte and block multiplexor channels.

The basic configuration is made up of a central processor with 16K bytes of cache memory and a microprocessor based input/output processor, 2 megabytes of main memory, a 3026-2 central operator console containing a service processor with floppy disk drive for diagnosis and maintenance, a 3336 line printer, three block multiplexor channels, and one byte multiplexor channel with eight trunks, two of which are taken up by the central operator console and the system printer. The byte and block multiplexor channels each have a data rate of 400K bytes per second and 2,000K bytes per second, respectively. Each trunk on the byte multiplexor has a data rate of 280K bytes per second. The main memory can be expanded from the basic 2 megabytes in 2-megabyte modules up to 8 megabytes.

The mass storage devices connect to disk controllers with a maximum of 32 disk units per controller. The disk controllers connect to the block multiplexor. As there are a maximum of six block multiplexors and each block multiplexor can support one disk controller, the 7.551 can theoretically handle up to 192 disk units for a maximum on-line capacity of 80,640 megabytes. The block multiplexor channel can also address up to 256 devices per channel. A second byte multiplexor with eight trunks is offered as an option on the 7.551. The byte multiplexor is used for the slower peripherals. Up to three 3026-10 sub-consoles may also be attached up to 2000 meters away. As with the 7.541, teleprocessing is implemented through the 75519 compact pre-processor and the modular TRANSDATA 960 data communication system. The entire range of BS2000 TRANSDATA products can be added.

First deliveries are planned for the fourth quarter of 1981 with version 7.0 of BS2000. A preliminary version with different specifications based on 16K-bit chips will be ready in mid 1981. This model will run under version 6.0 and 6.2 of BS2000. The Model 7.551 with four megabytes of main memory, eight disk drives of 420 megabytes each, three tape drives, 600-line-per-minute printer, and 16 workstations will rent for DM 67,000 per month, including basic software.

MODEL 7.561: Based on a hierarchy of different speed and different size memories as well as two separate input/output processors, the 7.561 offers more or less the same computing power and features as IBM's 3032, 3033N and 3033S, Honeywell's DPS 8/70 mono- and bi-processors and UNIVAC's 1100/82. Siemens also intends to produce bi-

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processor configurations of the system in the future. The 32K-byte, 52-nanosecond cache memory is larger and faster than those on the smaller models. Each I/O processor handles up to six block multiplexors and one byte multiplexor. Each byte multiplexor channel has up to eight trunks while each block multiplexor has two for a total of 12 trunks for each I/O processor. The aggregate data rate for both I/O processors is 28 megabytes per second. Each block multiplexor channel has a maximum data rate of 2 megabytes per second, and the data rate of the byte multiplexor is 400K bytes per second, the same as on the other models.

The basic configuration is made up of the central processing unit, a main memory of four megabytes, a cache memory of 32K bytes, and one input/output processor with four block multiplexor channels and a byte multiplexor channel. Expansion capabilities include a maximum of eight megabytes of main memory, six block multiplexor channels per I/O processor, and a second I/O processor. The mass storage devices attach to the disk controller, which attaches to the block multiplexor. Theoretically, the 7.561 can handle up to 384 disk drives.

Unlike the 7.551, teleprocessing on the 7.561 is implemented through the DVR front-end processor and the modular TRANSDATA 960 communication system. The entire range of TRANSDATA products can be added.

The typical model 7.561 with four megabytes of memory and peripherals rents for about DM 155,000 per month.

MODEL 7.571: Similar in architecture to the 7.561, the 7.571 is the newest top-end model and is approximately as powerful as IBM's 3033 and Siemens' own plug-compatible bi-processor mainframe, the 7.872.

The main difference from the 7.561 is that the cache is twice the size (64K), and the basic configuration has six block multiplexor channels against the four on the 7.561. Monthly rentals for typical top-end 7.571 configurations with disk drives, printers, and workstations are around DM 220,000.

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 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 to models 7.536, 7.541, 7.551, 7.561, and 7.571. The devices are connected either via the trunks of the disk storage adapter on the 7.521, 7.531, or 7.536, or disk controllers on the other models.

For the number of disk units which can be attached to each model, see the Characteristics table.

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 3464 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 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 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 to Model 7.536 and above.

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 to Model 7.536 and above.

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 3640 connects to Model 7.536 and above.

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 to Model 7.536 and above.

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 or block 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. Each I/O station has a 4096-byte buffer for data storage of one complete track as standard and a stacker with a capacity of 17 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

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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 242,272 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; and the 31703 Dual I/O Station Expansion feature that enables overlapped reading and writing on two I/O stations connected to one channel each.

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 4.10 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 (NRZ40) 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 bpi, 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.

PRINTERS

There are five line 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 per minute 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 to 7.551. On the 7.531 to 7.536, the 3333 and the 3340 are options; on the 7.541 to 7.551, the 3340, 3343, and the 3352 are options. Any of the five printers may be attached to systems 7.536 through 7.571 as additional printers. Additional printers can be attached via the byte multiplexor channel.

3333 PRINTER: This device uses a print band and prints 136 characters per line using a character set of 64 or 96 characters. Using the 64 character band, the print speed is 300 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 prints 136 characters per line using a character set of 64, 81, 82, or 96 characters. 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 standard.

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. 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.

Sub-models 3340-11 and -12 have one forms feed and can accept forms from 52 to 555 mm 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. 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, concurrently using up to four character sets from a loadable 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 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. Paper advance is performed at a speed of 0.74 m per second no matter how many lines are advanced at once.

The 3352 can print up to 255 copies of a page and suppress parts of the text in the first five copies. Line densities can be changed within a page and print densities within a line. Forms can be printed using the 33521 forms overlay facility.

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 BS2000 virtual memory operating system, nine language processors, data management systems, tools for software development, and a variety of application software packages.

BS2000 OPERATING SYSTEM: All System 7.500 models use BS2000 as their operating system. BS2000, 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 6.0) 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 BS2000 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.

BS2000 OPERATING SYSTEM

MODEL	Version 5.1	Version 6.0	Version 6.1	Version 6.2	Version 7.0
7.521	●	●		●	●
7.531	●	●		●	●
7.536		●		●	●
7.541	●	●		●	●
7.551		●		●	●
7.561			●		●
7.571			●		●

The essential features of BS2000 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 BS2000, 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. BS2000 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.

Therea re two main types of programs under BS2000: 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

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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.

Real memory under BS2000 is divided into two sections: one is reserved for the Executive and the real-memory resident programs, and the other is divided into 4K page frames. All paging is done on demand only.

Virtual 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 BS2000 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. For public sector use, a compatible Database Interface (KLDS) has been developed.

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 BS2000, 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 all other models use UTM-B3. UTM is run under BS2000 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 BS2000 version 5.1. It can be used interactively or in batch mode.

COLOMBUS, a tool for structured programming, facilitates the conception and the development of programs. It provides automatic structural representation (structural lists and structograms). COLOMBUS comes in three versions, COLOMBUS-COB for COBOL, COLOMBUS-FOR for FORTRAN and COLOMBUS-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 between calling and called modules. TESTMANAGER monitors tests, provides output

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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.

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: ISI-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. ISO-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

MODEL 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 — Monthly Rental (3-year lease) (DM): 4,284

		Monthly Rental (3-year lease) (DM)
75210-10	Main memory extension (512K)	475
75212-X	BYMUX extension (max 3)	147
75216-X	DDSA extension	84
75211-3	2nd floppy disk drive	315
75211-5	Console hard copy printer	581
75218	Integrated Terminal Controller (ITC)	227
75218-20	ITC line adapter (4 lines per adapter)	63
75219	Integrated front-end processor-B (128KB)	656
75219-30	IFEP memory extension (64KB)	131
75219-20	IFEP line adapter unit	63
75212-34	Printer attachment* for a 3336	840
75212-36	Printer attachment* for a 3340	32

*only for system printers

MODEL 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 — Monthly Rental (3-year lease) (DM): 4,893

		Monthly Rental (3-year lease) (DM)
75310-10	Main memory extension (512K)	475
75310-15	Main memory extension (512K)	475
75312-X	BYMUX extension (max 5)	147
75314-X	DDSA extension	84
75311-3	2nd floppy disc drive	315
75311-5	Console hard copy printer	581
75318-20	ITC line adapter	63
75318-50	ITC local line extension (16-32)	522
75319	IFEP (132KB)	504
75319-3X	IFEP memory extension (64KB)	131
75319-20	IFEP line adapter unit	63
75319-50	IFEP local line extension	522
75312-32	Printer attachment* for a 3333	773
75312-36	Printer attachment* for a 3336	32

*only for system printers

Siemens System 7.500

EQUIPMENT PRICES

		Monthly Rental (3-year lease) (DM)
MODEL 7.536		
Model 7.536 basic configuration, 2M bytes of main memory, operator console with service processor and monitor screen, 3336 line printer, byte multiplexor channel, direct disk storage adapter with four extensions, BYMUX channel, integrated data station controller for connection of data display terminals		11,150
75360-30	Main memory extension up to 3M bytes	950
75364-X	BYMUX extension (max 2)	420
75368-20	Integrated data station line adapter unit	63
75368-50	Integrated data station local line extension	522
75369	Integrated Front-End Processor (IFEP)—192KB	743
75369-X	IFEP memory expansions from 64 KB to 384 KB	131
75369-20	IFEP line adapter unit	63
75369-50	IFEP local line extension	522
75362-32	Printer attachment for a 3333	773
75362-34	Printer attachment for a 3336	840
75362-36	Printer attachment for a 3340	32
MODEL 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		18,375
75410-30	Main memory extension from 2M to 3M bytes	950
75410-40	Main memory extension from 3M to 4M bytes	950
75414-3	Third block multiplexer channel	420
75414-4	Fourth block multiplexer channel	368
75414-5	Fifth block multiplexer channel	263
75412-1	Byte multiplexer extension	807
75412-36	Printer attachment for a 3340	302
75412-37	Printer attachment for a 3343	63
75412-39	Printer attachment for a 3352	147
75419	Compact front-end processor (CVR)	3,071
MODEL 7.551		
Model 7.551 basic configuration, 2M bytes of main memory, operator console with service processor and monitor screen, 3336 line printer, BYMUX channel, three BLMUX's		30,100
75510-X	Main memory extension from 2M to 8M bytes	1,900
75512-16	Second byte multiplexor channel	1,614
75514-4	Fourth block multiplexor channel	368
75514-X	Fifth and sixth block multiplexor channels	263
75519	Compact front-end processor—256KB	3,530
75519-33	Preprocessor memory extension from 128K to 384K bytes	262
75512-34	Printer attachment for 3336-5	840
75512-36	Printer attachment for 3340	32
75512-37	Printer attachment for 3343	63
75512-39	Laser-printer attachment 3352	147
MODEL 7.561		
Model 7.561 basic configuration, 4M bytes of main memory, BYMUX, 4 BLMUX's		84,790
3026-2	Operator console with service processor and integrated floppy disk drives (2)	1,706
3026-3	Operator console	1,560
3026-10	Auxiliary workstation	832
30262	Console printer-characters/sec	581
75610-X	Main memory extension to 8M bytes in 2M byte increments	3,800
75616	Second I/O processor	12,900
75614-X	3-6 block multiplexor channels	1,600
MODEL 7.571		
Model 7.571 basic configuration, 4M bytes of main memory, BYMUX, 6 BLMUX's		125,400
3026-2	Operator console with service processor and integrated floppy disk drives (2)	1,706
3026-3	Operator console	1,560
3026-10	Auxiliary workstation	832
30262	Console printer-90 characters/sec	581
75710-80	Main memory extension from 4 to 8M bytes	7,600
75716	Second I/O processor	15,500
75714-X	3-6 block multiplexor channels	1,600
75219-X	2 IFEP memory extensions from 64K to 320K bytes	131
75319-X	3 IFEP memory extensions from 64K to 384K bytes	131
PERIPHERALS		
3150-01	Card reader 1000 cpm	1,386
3160	Card punch 100-300 cpm	1,447
3170	Floppy disc I/O unit	1,628
3333	Line printer	1,155
3336	Line printer	966
3340	Line printer	4,226
3521	Magnetic tape device 20/40 KB/S	767
3523	Magnetic tape device 40/80 KB/S	893
3511	Magnetic tape controller for 3521/3523	362
3570	Magnetic tape unit 30 KB/S	3,020
3530	Magnetic tape device	830
3571	Magnetic tape unit 60 KB/S	3,590
3531	Magnetic tape device 60 KB/S	1,064
3454	Disc storage unit 63MB	809
34514	Converter	493
3464	Disc storage unit 126MB	1,302
3468	Disc storage unit 300MB	2,325
3470	Fixed disc storage unit 420MB	1,229
8160-7	Data display terminal (1920 ch)	173
8162-7	Data display terminal (1920 ch)	257
8112-7	Printer Terminal (IFEP only) controller	
8122	Dataprinter	210

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