Siemens System 7.700

MANAGEMENT SUMMARY

Consisting of eleven central processor models, the Siemens 7.700 series is a mature product line spanning the performance range of the high-end IBM System/3 to the 3033N. The small- to large-scale West German built systems have been successful as attractive alternatives to low-end System/360 and /370 users, especially those running under DOS or DOS/VS. Offered at prices considerably lower than those of their IBM counterparts, the 7.700 line features a full complement of conventional and high-performance peripheral support, including a laser printer capable of printing up to 20,000 lines per minute. Comprehensive software support including sophisticated on-line and data base facilities is also available.

The System 7.700 (originally dubbed the 7.000) was officially launched in January 1974 with the introduction of the 7.720, 7.730, and 7.740. In October 1978, Siemens made a major expansion of the System 7.700 by announcing four new high-end mainframe models with performance ranging from 1.6 to 4.0 million instructions per second.

The new models include the 7.761 and 7.762 biprocessor systems running under the BS 2000 virtual memory operating system, and the larger 7.770 and 7.780 which

Introduced seven years ago as an alternative to the IBM System/370, the Siemens System 7.700 consists of 11 central processor models offering a wide performance range and comprehensive software and peripheral support. Only five top-end models (7.760 and above), introduced in 1978, are in new production. All other models are marketed on an as-available basis, having been replaced in Siemens marketing by the 7.500 processors, which feature improved price/performance.

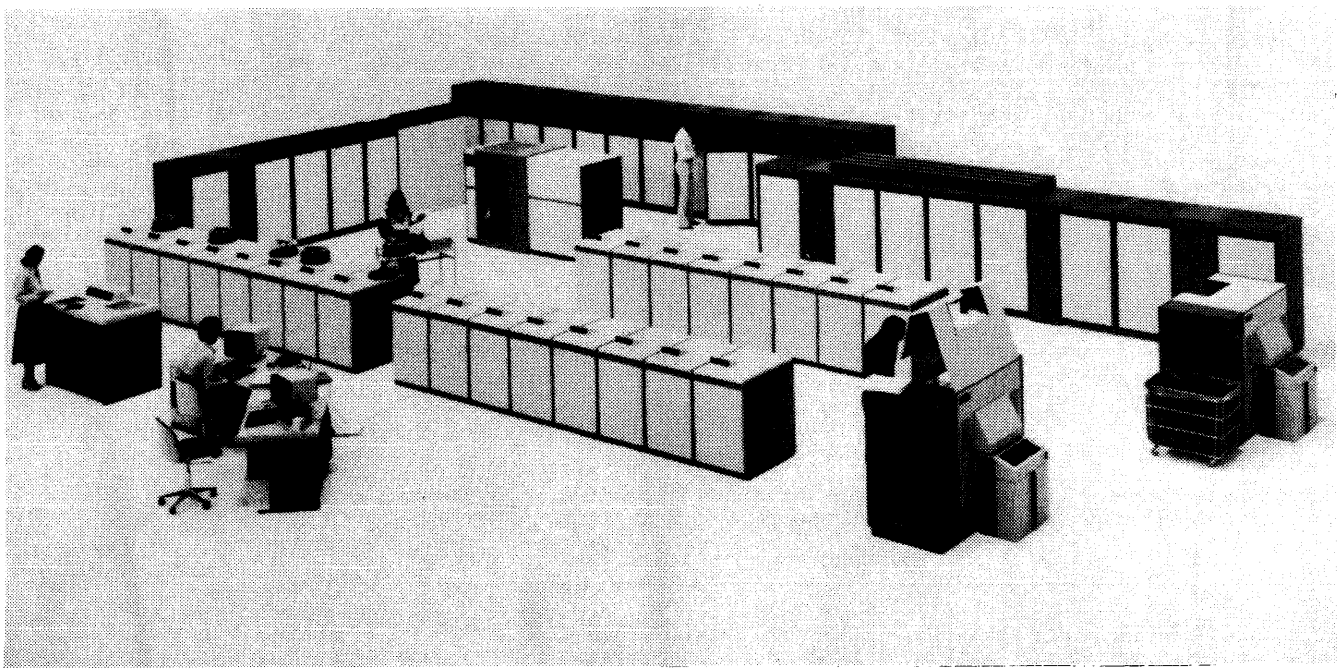
CHARACTERISTICS

MANUFACTURER: Siemens Aktiengesellschaft, Bereich Datenverarbeitung, Otto Hahn Ring 6, Post Office Box: 830951, D-8000 Munchen 83, West Germany. Telephone (089) 636. Telex: 52109-0.

MODELS: Siemens System 7.700 Models 7.722 version 2, 7.730 version 2, 7.738, 7.740 version 2, 7.748, 7.755, 7.760, 7.761, 7.762, 7.770, 7.780.

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.



At the top of the System 7.700 line, the 7.780 features a number of enhancements over the smaller models, including a processor with physically split instruction and execution units that use 5-level pipelining, 64K-bit-chip main memory, and improved dynamic address translation hardware. Instruction throughput on the 7.780 is about 4.0 greater than on the previous top-of-the-line 7.760.

REFERENCE EDITION. This is a mature product line, and no significant further developments are anticipated. Because of its importance, coverage is being continued, but no future update is planned.

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TABLE I. CPU CHARACTERISTICS OF SYSTEM 7.700 MODELS

CHARACTERISTICS	Model 7.722-2	Model 7.730-2	Model 7.738	Model 7.740-2	Model 7.748	Model 7.755
AVAILABILITY						
Date of announcement	Jan. 1976	Jan. 1976	July 1976	September 1974	July 1976	November 1975
Date of first delivery	Apr. 1976	July 1976	October 1976	May 1975	October 1976	March 1976
OPERATING SYSTEM						
BS 1000	Yes	Yes	Yes	Yes	Yes	Yes
BS 2000	No	Yes	Yes	Yes	Yes	Yes
MAIN MEMORY						
MOS chip size, bits	1K and 4K	1K and 4K	4K	1K and 4K	4K	1K and 4K
Read cycle time	615 ns/8 bytes	615 ns/8 bytes	615 ns/16 bytes	615 ns/16 bytes	615 ns/16 bytes	615 ns/16 bytes
Write cycle time	785 ns/8 bytes	785 ns/8 bytes	785 ns/8 bytes	785 ns/8 bytes	785 ns/8 bytes	785 ns/8 bytes
Capacity, bytes	FE 98,304 G 131,072 GE 163,840 GF 196,608 GFE 229,376 H 262,144 HF 327,680 HFE 360,448 HG 393,216 I 524,288 IG 655,360 IH 766,432	FE 98,304 G 131,072 GE 163,840 GF 196,608 GFE 229,376 H 262,144 HF 327,680 HFE 360,448 HG 393,216 I 524,288	I 524,288 IH 786,432 J 1,048,576	G 131,072 FG 196,608 H 262,144 HG 393,216 I 524,288 IG 655,360 IH 786,432 J 1,048,576	J 1,048,576 JI 1,572,864 K 2,097,152	I 524,288 IH 786,432 J 1,048,576 JI 1,572,864 K 2,097,152 KI 2,621,440 KJ 3,145,728 KJI 3,670,016 L 4,194,304
CACHE MEMORY						
Capacity, bytes	None	None	2,048	2,048	4,096	8,192
Cycle time	—	—	375 ns/4 bytes	375 ns/4 bytes	360 ns/4 bytes	360 ns/4 bytes
CONTROL MEMORY						
Capacity, bytes	32,768	32,768	49,152	49,152	49,152	49,152
VIRTUAL MEMORY						
Address space, bytes	None	16,777,216	16,777,216	16,777,216	16,777,216	16,777,216
FEATURES						
Fixed point arithmetic	Standard	Standard	Standard	Standard	Standard	Standard
Floating point arithmetic	Standard	Standard	Standard	Standard	Standard	Standard
Decimal arithmetic	Standard	Standard	Standard	Standard	Standard	Standard
Interval timer	Standard	Standard	Standard	Standard	Standard	Standard
Time of day (TOD) clock	Standard	Standard	Standard	Standard	Standard	Standard
Program timers	3 standard	3 standard	3 standard	3 standard	3 standard	3 standard
Real-time clock	Standard	Standard	Standard	Standard	Standard	Standard
Memory protect feature	Standard	Standard	Standard	Standard	Standard	Standard
Auto instruction retry	Standard	No	No	No	No	No
Dynamic address translation	No	Standard	Standard	Standard	Standard	Standard
Error detection and correction in memory	Standard	Standard	Standard	Standard	Standard	Standard
CHANNELS						
Selector channel	No	No	No	No	No	No
Byte-multiplexor channel	Std.; ext. optional	Std.; ext. optional	Standard	Standard	Standard	Standard
Block-multiplexor channel	Std.; extension optional	Std.; ext. optional	Std.; extension optional	Std.; extension optional	Std.; extension optional	Std.; extension optional

feature 64K-bit memory chips and can run under either the BS 1000 real memory operating system or under BS 2000. Both operating systems include batch, remote batch, and transaction processing capabilities.

Coincident with the announcement of these Siemens built models, four IBM MVS compatible Fujitsu supercomputers, dubbed the System 7.800, were added to the West

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

FLOATING POINT OPERANDS: A 32-bit word is used to represent a signed, short floating point number with a 7-bit characteristic and a 24-bit mantissa. A signed, long floating point number can be represented in a 64-bit double word with a 7-bit characteristic and a 56-bit mantissa. For

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TABLE I. CPU CHARACTERISTICS OF SYSTEM 7.700 MODELS (continued)

CHARACTERISTICS	Model 7.760	Model 7.761	Model 7.762	Model 7.770	Model 7.780
AVAILABILITY					
Date of announcement	October 1976	October 1978	October 1978	October 1978	October 1978
Date of first delivery	July 1978	December 1979	December 1979	1982	1982
OPERATING SYSTEM					
BS 1000	No	No	No	Yes	Yes
BS 2000	Yes	Yes	Yes	Yes	Yes
MAIN MEMORY					
MOS chip size, bits	16K	16K	16K	64K	64K
Read cycle time	1200 ns/32 bytes	1200 ns/32 bytes	1200 ns/32 bytes	52 ns-104 ns	52 ns-65 ns
Write cycle time	600 ns/8 bytes	600 ns/8 bytes	600 ns/8 bytes		
Capacity, bytes	J 1,048,576 JI 1,572,864 K 2,097,152 KI 2,621,440 KJ 3,145,728 KJI 3,670,016 L 4,194,304 LJ 5,242,880 LK 6,291,456 LKJ 7,340,032 M 8,388,608	K 2,097,152 KJ 3,145,728 L 4,194,304 LJ 5,242,880 LK 6,291,456 LKJ 7,340,032 M 8,388,608	K 2,097,152 KJ 3,145,728 L 4,194,304 LJ 5,242,880 LK 6,291,456 LKJ 7,340,032 M 8,388,608	K 2,097,152 L 4,194,304 LK 6,291,456 M 8,388,608	K 2,097,152 L 4,194,304 LK 6,291,456 M 8,388,608
CACHE MEMORY					
Capacity, bytes	32,768	32,768 x 2	32,768 x 2	32,768	65,536
Cycle time	200 ns/8 bytes	200 ns/8 bytes	200 ns/8 bytes	52 ns/8 bytes	52 ns/8 bytes
CONTROL MEMORY					
Capacity, bytes	61,440	61,440 x 2	61,440 x 2	16,384 (2,048 64-bit microinstructions) for instruction unit; 147,456 (144-bit microinstructions) for execution unit	
VIRTUAL MEMORY					
Address space, bytes	16,777,216	8,388,608	8,388,608	6,291,456	6,291,456
FEATURES					
Fixed point arithmetic	Standard	Standard	Standard	Standard	Standard
Floating point arithmetic	Standard	Standard	Standard	Standard	Standard
Decimal arithmetic	Standard	Standard	Standard	Standard	Standard
Interval timer	Standard	Standard	Standard	Standard	Standard
Time of day (TOD) clock	Standard	Standard	Standard	Standard	Standard
Program timers	3 standard	3 standard	3 standard	3 standard	3 standard
Real-time clock	Standard	Standard	Standard	Standard	Standard
Memory protect feature	Standard	Standard	Standard	Standard	Standard
Auto instruction retry	Yes	Yes	Yes	Yes	Yes
Dynamic address translation	Standard	Standard	Standard	Standard	Standard
Error detection and correction in memory	Standard	Standard	Standard	Standard	Standard
CHANNELS					
Selector channel	No	No	No	No	No
Byte-multiplexor channel	Standard	Standard	Standard	Standard	Standard
Block-multiplexor channel	Std.; extension optional	Standard	Standard	Standard	Standard

German giant's product offerings, and the System 7.000 was renamed the 7.700 to distinguish the two incompatible lines.

At the 1979 Hanover Fair, Siemens announced the System 7.500 and replaced the 7.706, 7.708, and 7.718 models with 7.500 model equivalents. Siemens is steering users to the newer 7.500 series, which offers 7.700

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.

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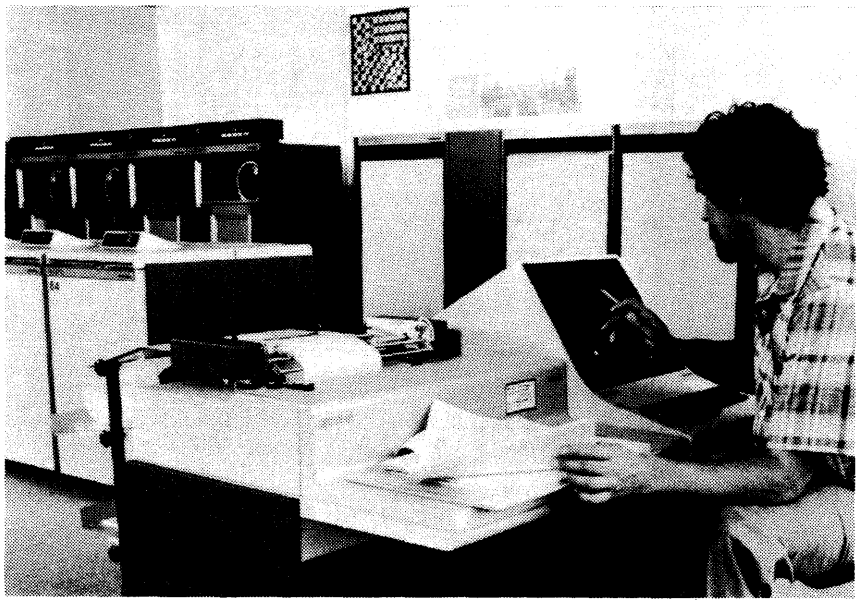

Existing 7.760 installations can be field-upgraded to a 7.761 or 7.762 biprocessor status through the attachment of a second, modified 7.760 processor, yielding about a 50 percent improvement in instruction throughput.

equivalents in performance, but lower in price. The 7.700 models are still available for BS 1000 users; however the 7.500 series is the new product line being actively marketed.

The top-end 7.500 models are not scheduled for release until the first quarter of 1982; so, existing 7.700 users in immediate need of more powerful models will be sold the top-end 7.700 models (7.760 and above), which are still being manufactured. Siemens is thus also giving BS 1000 users time to convert to the newer and more efficient BS 2000, which runs on both the System 7.500 and 7.700.

Siemens has enhanced the System 7.700 with the release of particularly strong technology. The 7.760, released in October 1976, was the first computer from a large manufacturer to incorporate 16K-bit RAM chips. An even higher degree of integration was realized through the implementation of 64K-bit chip memory featured on the 7.770 and 7.780.

Siemens emphasizes the reliability/availability/serviceability (RAS) of the new System 7.700 models. The 7.761 and 7.762 biprocessor systems feature dynamic processor and I/O system reconfigurability, and extensive software-supported diagnostic routines. The 7.761 and 7.762 mainframes each include two modified 7.760 processors, two hardware multiply/divide units, two control memories, two cache memories, one common main memory, and an input/output system. The two processors in a 7.761 or 7.762 mainframe each handle a separate instruction and data flow, and communicate with each other via a processor/processor interface. Each processor has a writable 61,440-byte control memory and a 32,768-byte cache memory. Main memory, which is shared between the two processors, is composed of 16K-bit chips and ranges in capacity from 2,097,152 to 8,388,608 bytes. Sections of main memory, called "shaded" or "shadow" memory, are reserved for specific operating system routines and are not accessible to the user. In addition to

INSTRUCTIONS: 2, 4, or 6 bytes in length, specifying 0, 1, or 2 memory addresses, respectively.

INTERNAL CODE: EBCDIC.

MAIN STORAGE

STORAGE TYPE: N-MOS semiconductor memory is employed in all of the System 7.700 models. See Table I for memory capacity per chip for each model.

CAPACITY: See Table I.

CYCLE TIME: See Table I.

CHECKING: Memory protection, error detection, and single-bit error correction in main memory are standard on all models. Microprograms continuously perform checking.

An automatic instruction retry is also included. The control memory, the registers and all data paths are subject to parity checking. All data read in main memory are checked by an error correction code (8-bit Hamming code). One-bit errors are corrected while 2-bit errors and many multiple-bit errors are detected.

Error recovery routines are built into the BS 1000 and BS 2000 operating systems. Software routines for machine error recovery are aided by detailed information (four error words) concerning the machine errors detected and the internal machine status at the time the error was detected. This information is generated automatically by the hardware and stored in main memory.

The 7.770 and 7.780 have enhanced error detection/correction facilities that recover 1- to 4-bit control memory errors, correct 1- and 2-bit main memory errors, and detect all 3-bit and some multiple-bit main memory errors. In addition, the larger two models use a service processor that executes system maintenance routines and stores error information on two dedicated floppy disks integrated into the operator console.

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

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TABLE II. REGISTER-TO-REGISTER INSTRUCTION TIMES FOR SYSTEM 7.700 (MS)

Instruction	Type	Models								7.760	
		7.722-1	7.722-2	7.730-1	7.730-2	7.738	7.740	7.748	7.755	7.761/7.762	7.770/7.780
Add (A)	RX	11.06	8.36	7.40	4.97	3.421	2.796	1.517	1.157	0.572	
Subtract (S)	RX	11.06	8.36	7.40	4.97	3.421	2.796	1.513	1.153	0.572	
Multiply Short to Long (ME)	RX	96.46	77.16	45.84	45.83	9.415	8.790	7.021	6.661	5.666	
Divide Short (DE)	RX	207.12	103.06	57.24	57.23	15.058	14.433	12.691	12.331	10.339	
Add Normalized Long (AD)	RX	46.53	28.58	25.28	25.27	6.810	6.185	4.738	4.378	2.831	
Subtract Normalized Long (SD)	RX	47.71	30.72	27.18	27.18	6.561	5.936	4.498	4.138	3.041	
Multiply Long (MD)	RX	219.02	149.13	69.93	69.90	20.703	20.078	18.082	17.722	13.489	
Divide Long (DD)	RX	538.17	206.65	121.54	121.50	35.851	35.226	32.628	32.268	27.979	Data not yet available.
Add Decimal (AP)	SS	31.92	27.43	24.26	24.25	7.012	6.387	4.618	4.258	1.937	
Compare Decimal (CP)	SS	65.14	46.83	35.78	16.14	7.084	6.459	4.903	4.543	1.412	
Pack (PACK)	SS	48.47	33.65	27.55	12.84	7.085	6.460	4.910	4.550	4.550	
Branch on Condition (BC)	RX	5.37	6.41	4.08	3.07	2.957	2.350	0.995	0.995	0.624	
Load (L)	RX	8.83	6.44	5.70	4.49	3.416	2.791	1.513	1.153	0.572	
Store (ST)	RX	8.72	6.35	5.62	4.41	3.331	2.706	1.589	1.229	0.446	
Load Multiple (LM)	RS	28.49	22.13	14.85	11.36	5.489	4.864	3.337	2.977	1.618	
Move (MVC)	SS	27.00	23.20	20.52	20.52	9.212	8.587	7.156	6.796	2.567	
Compare Logical (CLC)	SS	66.01	50.98	25.73	19.86	9.403	8.778	6.973	6.613	1.727	

"shaded" memory, 65,536 bytes of memory are reserved for maintenance purposes.

The 7.761 input/output system consists of one channel control unit with one byte multiplexor channel and up to eight block multiplexor channels. The 7.762 input/output system features two channel control units, each handling one byte multiplexor channel and up to six block multiplexor channels. The maximum input/output data transfer rate for both the 7.761 and 7.762 is 10.2 megabytes per second.

A four-year monthly rental contract for the 7.761 and 7.762 with minimum main memory starts at about DM 100,000.

At the top of the System 7.700 line, the 7.770 and 7.780 feature a number of enhancements over the smaller models, including a processor with physically split instruction and execution units that use 5-stage pipelining, 64K-bit-chip main memory, and improved dynamic address translation hardware. Instruction throughput on the 7.770 and 7.780 is about 2.5 and 4.0 time greater, respectively, than on the previous top-of-the-line 7.760.

The instruction and execution units that make up a 7.770 or 7.780 processor are controlled by separately loaded microcode. Control memory capacity is 2,048 64-bit microinstructions for the instruction unit, and 8,192 144-bit microinstructions for the execution unit. Cache memory, which is directly linked to the instruction unit, has a total capacity of 65,536 bytes, divided into four 16,384-byte banks. Because the cache contains the most frequently referenced data and the most active program sections, Siemens claims that over 95% of memory requests can be satisfied by the cache which has an access time of 52 nanoseconds per 8 bytes. The 7.770 and 7.780 also feature an 8,192-byte bipolar write buffer which smooths the flow of data from the central processor to main memory.

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 (for all processors except the 7.722), 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.

RESERVED STORAGE: The 7.761 and 7.762 mainframes share a common main memory which reserves a section called "shaded" or "shadow" memory for information required for servicing peripheral devices, error logout, and diagnostic routines. These sections are not accessible to the user and their size depends on the system configuration. In addition to "shaded" memory, 65,536 bytes of memory are reserved for maintenance purposes.

CENTRAL PROCESSORS

There are eleven current CPU models in the 7.700 series. All of the CPU's have fixed-point, floating-point, and decimal arithmetic facilities. Each has a time-of-day clock, a real-time clock, an internal timer, and three program timers. Memory protection, error detection and correction in main memory, and a byte-multiplexor channel are all standard.

The 7.761 and 7.762 mainframes each include two modified 7.760 processors, two hardware multiply/divide units, two control memories, one common main memory, and an input/output system. The two processors in a 7.761 or 7.762 mainframe each handle a separate instruction and data flow, and communicate with each other via a processor/processor interface.

At the top of the System 7.700 line, the 7.770 and 7.780 feature a number of enhancements over the smaller models, including a processor with physically split instruction and execution units that use 5-level pipelining, 64K-bit-chip main memory, and improved dynamic address translation hardware. Instruction throughput on the 7.770 and 7.780 is about 2.5 and 4.0 times greater, respectively, than on the previous top-of-the-line 7.760.

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Main memory for the 7.770 and 7.780 ranges in capacity from 2,097,152 to 8,388,608 bytes and is composed of 65,536-bit (64K-bit) chips, 40 of which make up a 262,144-byte module.

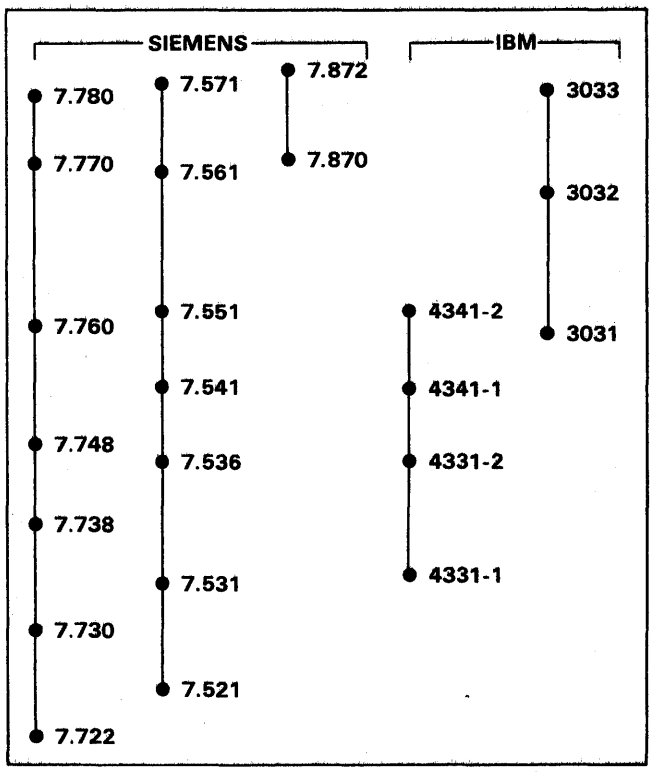
The improved dynamic address translation hardware for the 7.770 and 7.780 features three address translation buffers, each with 64 entries. During address translation, a row is selected in each of the buffers by using parts of the segment and page portions of the virtual address. Results of previous two-level address translations can be held in the buffers for up to eight tasks, each with its own virtual address space.

The 7.770 and 7.780 feature an input/output processor as standard equipment, and can be optionally equipped with a second. The 7.770 input/output processor has one byte multiplexor channel and from four to six block multiplexor channels; the 7.780 input/output processor has one byte and four block multiplexor channels. With one input/output processor, the maximum I/O data transfer rate for both mainframe models is 6.0 megabytes per second; with two, 10.2 megabytes per second.

A four-year monthly rental contract for a 7.770 with 4,194,304 bytes of main memory starts at about DM 115,000; for a 7.780 with 6,291,456 bytes of main memory, at about DM 165,000.

All of the members of the Siemens 7.700 family offer source code and operating system compatibility, as well as the ability to grow using the same peripherals. It is also possible for Siemens 4004 users to run existing programs

TABLE III. PERFORMANCE COMPARISON CHART



All of the processors have the same 169-instruction repertoire. Except for the 7.722, each has virtual addressing capabilities with dynamic address translation for a working space ranging from 6,291,456 to 16,777,216 bytes. The improved dynamic address translation hardware for the 7.770 and 7.780 features three address translation buffers, each with 64 entries. During address translation, a row is selected in each of the buffers by using parts of the segment and page portions of the virtual address. Results of previous two-level address translations can be held in the buffers for up to eight tasks, each with its own virtual address space. Other features of the individual CPU's are detailed in Table I.

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.

INDIRECT ADDRESSING: Yes.

INSTRUCTION REPERTOIRE: There are 93 fixed-point instructions consisting of 21 data transfer instructions; 8 branch instructions; 13 logical instructions; 11 decimal instructions; 14 unsigned binary instructions; 22 signed binary instructions; and 4 edit instructions. There are 51 floating-point instructions consisting of 14 shift instructions; 33 arithmetic instructions; and 4 compare instructions. There are also 13 privileged instructions (including I/O and control instructions); 3 stack instructions; and 9 miscellaneous instructions.

INSTRUCTION TIMES: Register-to-register instruction times for a series of System 7.700 operations are shown in Table II.

CACHE MEMORY: Between the real memory and the processor is a high-speed cache memory that buffers instructions and data prior to processing. The cache is based on the memory system's 16-byte width of access. Models 7.738 and 7.740 have one 2K-byte bank of entries consist-

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TABLE IV. USERS' RATINGS IN TERMS OF WEIGHTED AVERAGES

	Ease of Operation	Reliability of Mainframe	Reliability of Peripherals	Responsiveness	Effectiveness	Trouble-Shooting	Education	Documentation	Operating Systems	Compilers and Assemblers	Applications Programs	Ease of Programming	Ease of Conversion	Overall Satisfaction
Model 7.722	2.9	3.2	2.5	3.0	2.7	2.4	2.9	2.4	2.7	2.8	2.6	2.8	2.6	2.8
Model 7.730	2.7	3.4	2.8	3.0	2.8	2.4	2.8	2.3	2.8	3.0	2.7	2.8	2.7	2.9
Model 7.738	3.1	3.4	3.0	3.4	2.8	2.4	2.8	2.3	3.0	3.2	2.7	2.7	2.4	2.9
Model 7.740	3.0	3.3	3.3	3.0	2.8	2.3	2.7	2.0	3.5	3.0	2.7	3.0	2.7	3.0
Model 7.748	2.9	3.0	2.6	2.7	2.6	2.0	2.3	1.9	2.6	3.0	2.0	2.7	2.4	2.7
Model 7.760	2.4	2.8	2.8	2.8	2.5	2.2	2.5	2.1	2.8	2.8	2.5	2.7	2.3	2.8
Siemens 7.700 All Models	2.8	3.2	2.8	3.0	2.7	2.3	2.7	2.2	2.8	3.0	2.6	2.8	2.5	2.9

Basis for computing Weighted Averages is 4 for each user rating of Excellent, 3 for Good, 2 for Fair, and 1 for Poor

and data on the 7.700's, since Siemens' SIM-BS 1000 simulator allows the BS 1000 operating system, developed for the System 4004, to run without modification under the BS 2000 operating system in a System 7.700 machine.

COMPETITION

Table III illustrates the power of the system 7.700 models relative to the Siemens 7.500 and 7.800 system models, as well as in comparison to the competing IBM systems.

USER REACTION

In April 1980, Datapro surveyed 94 System 7.700 users who collectively owned, rented, or leased 106 separate computer systems. The characteristics of this user population and a composite of the ratings given by these users are presented in Table IV.

The system population was distributed as follows:

Model 7.722	22 systems
Model 7.730	26 systems
Model 7.738	25 systems
Model 7.740	4 systems
Model 7.748	9 systems
Model 7.760	20 systems

The weighted averages of the ratings supplied by these System 7.700 users in 14 important performance categories are presented in the "User's Ratings" table for each processor model represented in the survey population.

About 60 percent of the systems were rented, 39 percent were purchased, and 14 percent were leased. Some users indicated that parts of their systems were purchased, and other components were either leased or rented.

Of the 94 responses we have tabulated, the principal applications the users have installed are:

ing of 128 rows of 16-byte blocks. Model 7.748 has two banks; and Model 7.755 has four banks. Model 7.760 has four 8K cache banks each consisting of 256 rows of 32-byte blocks. The entries are handled using a FIFO procedure. The processor communicates with the cache over 4-byte data paths on Models 7.722 through 7.755, and by an 8-byte data path on Models 7.760 through 7.780.

The 7.761 and 7.762 mainframes each include two modified 7.760 processors, thus providing 2 x 36,768 bytes of cache memory. The 7.770 and 7.780 cache memories are directly linked to the instruction unit, having a total capacity of 65,536 bytes divided into four 16,384-byte banks. The 7.770 and 7.780 also feature an 8,192-byte bipolar write buffer which smooths the flow of data from the central processor to main memory.

CONTROL MEMORY: On Models 7.722 and 7.730, the control memory contains the microprograms for controlling the CPU and the I/O processor as well as the buffers for the channels and function registers. The control memory is loaded automatically without operator intervention during initial program loading from the system disk. It is inaccessible to the user. On the 7.760, a writable control memory containing 4,096 120-bit double words is loaded from a floppy disk. In addition, a read-only 3,072-byte microprogram memory is also provided for the 7.760. Each processor of the 7.761 and 7.762 mainframes has a writable 61,440-byte control memory. The instruction and execution units that make up a 7.770 or 7.780 processor are controlled by separately loaded microcode. Control memory capacity is 2,048 64-bit microinstructions for the instruction unit, and 8,192 144-bit microinstructions for the execution unit.

Models 7.738 through 7.755 also have a Writable Control Memory (WCM) which is used for diagnostic and maintenance purposes. See Table 1 for the control memory capacity for each 7.700 model.

DYNAMIC ADDRESS TRANSLATION: For Models 7.730 through 7.760, virtual addresses for active pages are converted during processing into corresponding real addresses by the DATA facility that uses the segment and page tables for this purpose. 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.

A special hardware facility, the Content Addressable Memory (CAM) with 8 entries, is provided to increase the

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Accounting	61%
Government	22
Manufacturing	32
Payroll/Personnel	62
Service Bureau	19
Banking/Finance	12
Engineering/Scientific	15
Retail/Wholesale	19
Transaction Processing	14
Utilities	12
Other	17

Of the 94 respondents, 10 indicated they planned to replace their present system in 1980 with another Siemens model. None of the respondents indicated they planned to replace their present system with a different manufacturer's computer system in 1980.

Of the users planning to acquire or implement additional software in 1980, 30 said they intended to acquire additional software from Siemens, and 23 said they planned to acquire proprietary software from other suppliers.

The major area of planned expansion was data communications. 25 users planned to expand their data communications facilities, and 7 users anticipated increasing their distributed processing facilities.

The users were asked if they would recommend their present system to another user in their same situation. About 88 percent of the users said they would recommend their present system, and about 10 percent said they would not.

Of the users who answered negatively, a majority indicated that they have outgrown their present system and were planning to upgrade in the near future.

From a list of the possible advantages to the system, the users were asked to check off any or all significant ones. This list is presented in the order of relative importance to the users.

translation speed on the 7.730. On the 7.738 and larger models, an Address Translation Memory (ATM) has 128 entries to ensure a first-level hit in the search for a page in 90-95% of all cases under normal program conditions.

To perform address translation in Models 7.738 and larger, a row in the ATM is selected by means of parts of the segment and page portions of the virtual address (7 bits). The entries in the ATM can be addressed by these bits since the pages have fixed locations. After an entry has been selected, a comparison is made between portions of the virtual address and the entry in the ATM. When the two match, or hit, the result is the real page number which, together with the displacement from the virtual address, forms the real address. If there is no hit, the DAT facility makes use of the segment and page tables.

Since the channels contain no address translation hardware, virtual addresses incorporated in channel commands must be translated before I/O operations are performed.

For 2K pages and a virtual address space of 16 megabytes, the DAT facility is designed for 2-level operation. For 4K pages and an address space of 8 megabytes, the DAT facility is designed for 3-level operation (also employed in the System 4004/151 CPU).

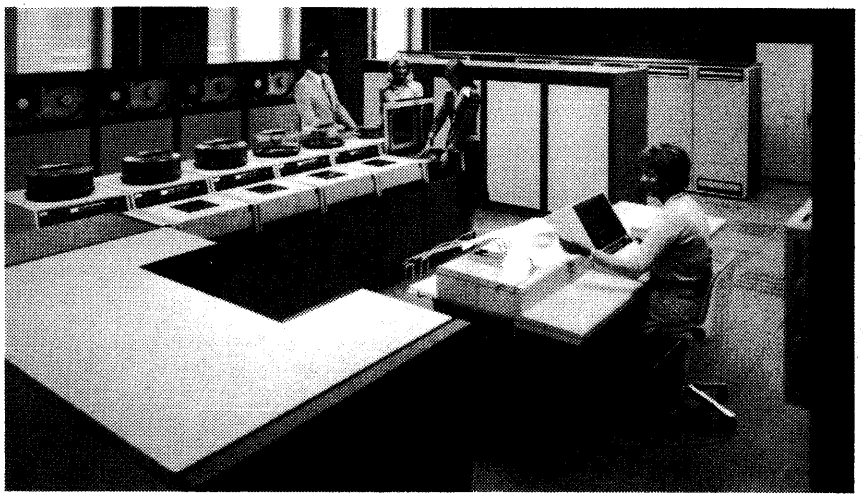
The improved dynamic address translation hardware for the 7.770 and 7.780 features three address translation buffers, each with 64 entries. During address translation, a row is selected in each of the buffers by using parts of the segment and page portions of the virtual address. Results of previous two-level address translations can be held in the buffers for up to eight tasks, each with its own virtual address space.

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 7.700 includes all of the System 4004 instructions, making the



Each of the Siemens 7.700 models offers a wide variety of operator console configurations. Shown here is a 3030 Central Console with a CRT, keyboard, tabulator, control panel, and a 180-cps hardcopy page printer (Model 3030). Up to three auxiliary consoles (3020-10 or 3023-10) can be located up to 10 kilometers from the CPU and can be attached to any Series 7.700 model.

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1) System is easy to expand/reconfigure.

2) Users are happy with response time.

3) Program/data carried over from other systems are compatible as vendor promised.

4) Productivity aids help us to keep programming cost down.

5) Database language is efficient and effective.

6) System costs were less than expected.

7) Delivery and/or installation of equipment was ahead of schedule.

8) System is power/energy efficient.

9) Terminals/peripherals carried over from other systems are compatible as vendor promised.

10) Delivery of required software was ahead of schedule.

The users were also requested to check a list of ten possible problems they may have encountered with the system. The majority of users did not indicate that they have any problems. However, 23 percent of the users felt that the system proposed by the vendor was too small, and 22 percent reported they have a problem keeping up with vendor enhancements/changes to hardware/software.

The survey results seem to indicate a relatively high degree of user satisfaction, especially in the areas of mainframe reliability and responsiveness of maintenance service. Users are also apparently satisfied with the compilers and assemblers.

Apparently Siemens' aggressive determination in providing computer users with an alternative to IBM equipment must be given very serious consideration, as evidenced by equal user ratings of IBM and Siemens (2.8) in Germany.

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 7.700 Series. Compatibility is also excellent when converting from the Univac Series 90 (nee RCA Spectra 70).

Current System 7.700 users who wish to convert to the newer Models 7.761 through 7.780 can transport their application software with only minor modifications. Existing 7.760 installations can be field-upgraded to 7.761 or 7.762 biprocessor status through the attachment of a second, modified 7.760 processor, yielding about a 50-percent improvement in instruction throughput.

SIMULTANEITY

Memory is interleaved in Models 7.738 through 7.780, so that 8 bytes (Models 7.737 through 7.755) or 16 bytes (7.760 through 7.780) are fetched from alternate memory banks resulting in 16 bytes (Models 7.738 through 7.755) or 32 bytes (Models 7.760 through 7.780) being fetched during a single memory read cycle. Instruction execution is also overlapped on the 7.760 by dividing the processor into an Instruction Preprocessor and an Instruction Execution Processor whereby 32-byte segments of instructions/data are fetched from main memory to cache memory. Instructions are decoded by the preprocessor prior to execution.

The 7.770 and 7.780 feature a processor with physically split instruction and execution units that use 5-level pipelining. The pipelining technique breaks instruction processing into five steps that are executed by the instruction and execution units. The instruction (or pipeline) unit, which includes dynamic address translation hardware and a branching unit, handles instruction prefetch and interpretation, operand address calculation, and memory operand reading prior to, or simultaneously with, instruction execution. The execution unit executes the preprocessed instructions, stores results in the register set or main memory, and performs management tasks (e.g., interrupt handling).

Specifically, the five steps in the pipelining technique are as follows: 1) reading of an instruction block and dynamic address translation, 2) interpretation of an instruction (microprogram branch), 3) calculation of an actual memory address, 4) reading of a memory operand or instruction at a branch destination, including dynamic address translation, and 5) execution of an instruction. Steps 1 through 4 are handled by the instruction unit, and step 5 is handled by the execution unit.

TABLE V. SALIENT I/O CONTROL CHARACTERISTICS

I/O CONTROL CHARACTERISTIC	MODELS											
	7.722-1	7.722-2	7.730	7.738	7.740	7.748	7.755	7.760	7.761	7.762	7.770	7.780
Max. Channel Throughput (kilobytes per second)	750	1400	3000	4500	4500	6000	6000	6000	10,200	10,200	10,200	10,200
Number of Byte Multiplexor Channels	1	1	1	1	1	1	1	1	1	1 x 2**	1	1
Throughput Multiplex Mode (kilobytes per second)	60	60	60	140	140	200	200	200	200	200	200	200
Throughput Burst Mode (kilobytes per second)	300	300	300	233	233	238	238	238	238	238	238	238
Number of Block Multiplexor Channels	1*	1	1-2	2-4	1-4	2-6	2-6	2-6	2-8	(2-6)x2	4-6	4
Throughput Mux-1-Byte kilobytes per second	450	1000	1250	1500	1500	1660	1660	1660	1660	1660	1660	1660
Throughput Mux-2 Byte	—	—	2400	2400	2400	3330	3330	3330	3330	3330	3330	3330

* Selector Channel
**Features two channel control units.

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The West German electronics giant promises to maintain their marketing strategy in providing a machine which attempts to match an IBM model in terms of features, price, and performance.□

INPUT/OUTPUT CONTROL

CONSOLE I/O: A variety of console control equipment is available for attachment to the Series 7.700.

3020 CENTRAL CONTROL CONSOLE: This console includes a CRT, keyboard, tabulator and control panel, attachments for up to three 3020-10 or 3023-10 sub-consoles, and an attachment for one auxiliary console printer. The sub-consoles may be located up to 10 kilometers from the CPU, and can be connected to Models 7.722 through 7.760. The screen can display 16 lines of 80 characters each, and the optional console printer operates at 180 characters per second.

3023 CENTRAL CONTROL CONSOLE: This console includes a 180 character per second page printer capable of printing 80 characters per line, a keyboard and control panel, and attachments for up to three 3020-10 or 3023-10 sub-consoles which can be located up to 10 kilometers from the CPU. The 3023 can be connected to Models 7.722 through 7.760.

3024 CENTRAL CONTROL CONSOLE: This console is used on the 7.761, 7.762, 7.770, and 7.780 central units. The 3024 central operator console consists of VDU (80 character positions plus end-of-text character for each line, 16 lines), logging printer (90 characters per second), keyboard, and operator panel. The character set includes 96 characters.

The 7.761 and 7.770 central operator consoles can support up to three 3024-10 or 3025-10 sub-consoles. Maximum line length for connection of all consoles is 10 kilometers.

The 7.762 and 7.780 units are normally operated via two central operator consoles. One 3024-10 or 3025-10 sub-console can be connected to each of the two central operator consoles.

The central operator console for the 7.761 and 7.762 can be equipped with one floppy disk drive, and the 7.770 and 7.780 operator consoles can be equipped with a third floppy disk drive for I/O of user data, if necessary.

A service processor has been integrated into the central operator console of the 7.770 and 7.780 units, helping to increase availability and improving operatability through on-line maintenance functions, editing of error information and messages in clear text, and support of error handling procedures.

I/O CONTROL: Salient characteristics for all the System 7.700 models are summarized in Table V. Details are presented below.

On the 7.722 version 1, a byte multiplexor channel with 5 trunks, each with a 60 kilobytes per second transfer rate, is standard: one of these trunks is reserved for the operator console. Up to 256 devices can be addressed by the byte multiplexor channel for concurrent operation in the time-division multiplex mode. The byte multiplexor channel can be extended by 2 fast trunks (options 72226 and 72227 Byte Multiplexor Channel Extensions) for an additional 300 kilobytes per second. A selector channel, capable of connecting one I/O controller with a transfer rate of 450 kilobytes per second, is also standard. The maximum I/O data transfer rate is 750 kilobytes per second; for the 7.722 version 2 the rate is 1400 kilobytes per second. The version 2 enables block multiplex operation, and a 72228 Block Multiplexor Channel Extension expands the block multiplexor channel to 2 trunks.

On the 7.730, a byte multiplexor channel with 6 trunks is standard: one of these trunks is reserved for the operator console. Up to 256 devices can be addressed by the byte multiplexor channel for concurrent operations in the time-division multiplex mode. The byte multiplexor channel can be extended by 2 fast trunks (options 73027 and 73028 Byte Multiplexor Channel Extensions). A block multiplexor channel with 2 trunks is also standard. The system can be expanded to a maximum of 2 block multiplexor channels (option 73042 Second Block Multiplexor Channel), each connecting 2 I/O controllers. The maximum transfer rate of a block multiplexor channel is 1250 kilobytes per second in the 1-byte mode, and 2400 kilobytes per second with the 2 byte features (73040). The maximum I/O data transfer rate of the 7.730 is 3000 kilobytes per second.

On the 7.738, a byte multiplexor channel with 8 trunks is standard with a maximum channel data transfer rate of 140 kilobytes per second: one of these trunks is reserved for the operator console. Up to 256 devices can be addressed by the byte multiplexor channel for concurrent operation in the time-division multiplex mode. Two block multiplexor channels that allow addressing of up to 256 devices each and that can operate in both block multiplex and selector modes are also standard. Each block multiplexor channel has 3 trunks. The system can be expanded to a maximum of 4 block multiplexor channels via the 73843 and 73844 additional block multiplexor channel options. The maximum transfer rate per block multiplexor channel is 1500 kilobytes per second using the 1-byte interface, and 2400 kilobytes per second using the 73840 2-byte feature. The maximum I/O data transfer rate for the 7.738 is 4500 kilobytes per second.

For the 7.740, the I/O channel characteristic and configuration rules are identical to those of the 7.738 except that only 1 block multiplexor channel with 2 trunks is standard. The 2-byte feature for the block multiplexor(s) is the 74040; the additional block multiplexors are the 74045, 74047, and 74048; and the 74046 is used to extend a single block multiplexor channel to 3 trunks. The byte multiplexor channel can be extended by the 74025 Byte Multiplexor Channel Extension with 8 additional trunks.

On the 7.748, 7.755, 7.760, and 7.761 systems, a byte multiplexor channel with 8 trunks capable of supporting a maximum data transfer rate of 200 kilobytes per second is standard; one of these trunks is reserved for the operator console. Up to 256 devices can be addressed by the byte multiplexor channel for concurrent operating in the time-division multiplex mode. The byte multiplexor channel can be extended by the 74825 Byte Multiplexor Channel Extension with 8 additional trunks for the 7.748 (option 75525 for the 7.755, option 77625 for the 7.760); the byte multiplexor channel on the 7.761 system can be extended to 16 trunks via the 76125 option. Two block multiplexor channels are standard with 3 trunks each that allow addressing of up to 256 devices each in either block multiplexor or selector modes. The system can be expanded to a maximum of 6 block multiplexor channels via the 74843, -4, -5, and -6 Additional Block Multiplexor Channel Options for the 7.748 (75543, -4, -5, and -6 for the 7.755; or 77643, -4, -5, and -6 for the 7.760). The 7.761 I/O system can be expanded to a maximum of 8 block multiplexor channels via the 76143, -4, -5, -6, -7, and -8 Additional Block Multiplexor Channel Options. The maximum transfer rate per channel is 1660 kilobytes per second using the 1-byte interface and 3330 kilobytes per second using the 74840 2-byte feature for the 7.748 (75540 for the 7.755; 77640 for the 7.760; and 76140 for the 7.761). The maximum I/O data transfer rate for the 7.748, 7.755 or 7.760 is 6000 kilobytes

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per second; and the maximum I/O data transfer rate for the 7.761 is 10,200 kilobytes per second.

The 7.762 input/output system features two channel control units, each handling one byte multiplexor channel and up to six block multiplexor channels. The maximum input/output data transfer rate is 10,200 kilobytes per second.

The 7.770 and 7.780 feature an input/output processor as standard equipment, and can optionally be equipped with a second. The input/output processors are self-contained, stand-alone units connected to the main memory system. They also interface with the central processor and the service processor. The input/output processors are controlled by separate control memories loaded from floppy disk. Each input/output processor contains a channel controller which coordinates simultaneous operation between channels and sets up data paths between the channels and the input/output processors. The 7.770 input/output processor has one byte multiplexor channel and from four to six block multiplexor channels; the 7.780 input/output processor, one byte multiplexor and four block multiplexor channels. With one input/output processor, the maximum I/O data transfer rate for both mainframe models is 6000 kilobytes per second; with two, 10,200 kilobytes per second.

MASS STORAGE

There are seven mass storage devices available, with capacities from 55 to 420 million bytes, for use on the System 7.700 models. All, but the 3440 disk can be connected to a 3416 controller, and various mass storage units can be mixed in a 3416 subsystem for a maximum configuration of 16 drives with an overall capacity of 6720 megabytes.

3440 DISK DRIVE: This removable-disk drive has 19 recording surfaces with 400 tracks each and a capacity per track of 7214 bytes for an overall capacity per spindle of 54,826,400 bytes. The data transfer rate is 312 kilobytes per second, the average access time is 35 ms, and rotational speed is 2400 rpm. The 3440 connects to a 3413 controller for attachment to the System 7.700 Models 7.722 through 7.780.

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 a 3414-01, 3416-01, or 3416-11 controller for attachment to System 7.700 Models 7.722-2 through 7.780. The Siemens 3450 is IBM 3330-01 compatible.

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 a 3414-03, 3416-03, or 3416-13 controller for attachment to any System 7.700 model with the exception of Model 7.722 Version 1; or for mixed installation with the 3460's to a 3416-02 or 3416-12 controller for attachment to any System 7.700 Models 7.730 through 7.780.

3460 DISK DRIVE: This removable-disk drive has 19 recording surfaces with 808 tracks each, and a capacity per track of 13,030 bytes for an overall capacity per spindle of 200,036,560 bytes. The data transfer rate is 806 kilobytes per second, the average access time is 30 ms, and rotational speed is 3600 rpm. The 3460 connects to a 3414-02, 3416-02, or 3416-12 controller for attachment to the System 7.000 Models 7.730 through 7.780. The 3460 is IBM 3330-11 compatible.

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 a 3414-04, 3416-04, or 3416-14 controller for attachment to any System 7.700; or for mixed installation with 3460's to a 3416-02 or 3416-12 controller for attachment to Models 7.730 through 7.780.

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 2400 rpm. The 3468 connects to a 3414-04, 3416-04, or 3416-14 controller for attachment to any other System 7.700. For mixed installation with 3470 drives, the 3468 can be connected to a 3416-05 or 3416-15 controller; or with 3465 drives, to a 3416-04 or 3416-14 controller, for attachment to Models 7.730 through 7.780.

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). Up to eight 3470's can be connected to a 3416-05, or up to sixteen 3470's to a 3416-15 controller for attachment to Models 7.730 through 7.780. The 3470 operates under BS 2000. A maximum subsystem can consist of 16 drives per channel for an overall capacity of 6720 megabytes.

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

Apart from the standard disk initialization, as used in the TRANSDATA 920 Floppy Disk Data Entry System, floppy disks can also be initialized and processed with variable formats on the 3170. Thus it is possible via the 3170 Floppy Disk I/O Unit to read data stored by various systems on floppy disks into a Siemens System 4004 or 7.700 computer.

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

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

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

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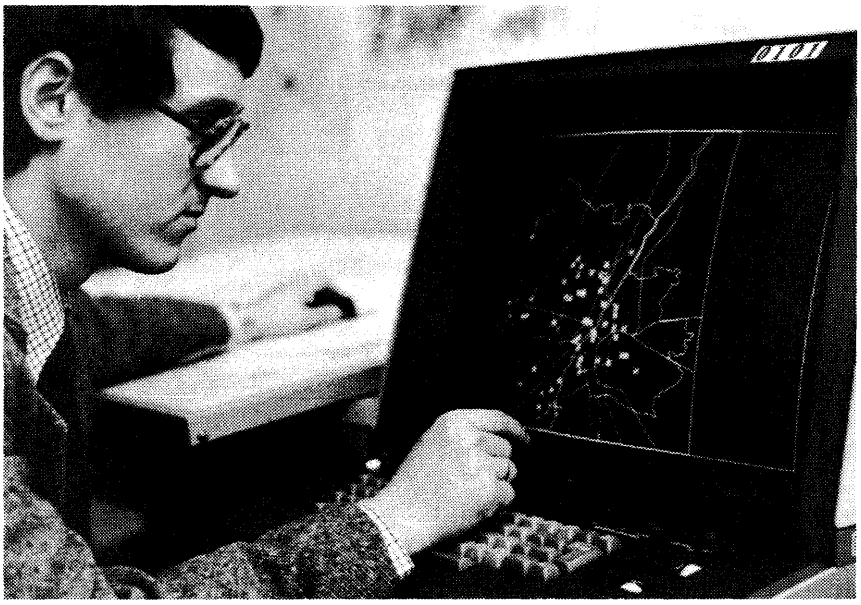

Siemens' interactive graphic system, IGS, is available for System 7.700 models running under BS 2000 (i.e., all except entry level 7.722-2). The optional software package allows two-dimensional figures to be created and manipulated on a graphic terminal with the help of over 100 instructions.

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

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

MAGNETIC TAPE EQUIPMENT

There are eleven different magnetic tape units available for use with the System 7.700 models. All are 9-track units.

3521 MAGNETIC TAPE UNIT: This is a 9-track device that has recording densities of 320 bytes per cm (800 bpi) and 640 bytes per cm (1600 bpi), read/write speeds of 20 and 40 kilobytes per second, a rewind speed of 3.65 meters per second, and a forward tape speed of 0.635 meters per second. A 3511 magnetic tape controller with circuitry for four drives can optionally be incorporated into the 3521 housing. The 3521 is for use with all System 7.700 models.

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 to Models 7.722 through 7.780 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 to Models 7.722 through 7.780 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 on the System 7.700 Models 7.722 through 7,780.

3550 MAGNETIC TAPE DEVICE: This is a 9-track unit that has a recording density of 320 (NRZ) or 640 (PE) bytes per cm (800 or 1600 bpi, respectively), a read/write speed of 120 (NRZ) or 240 (PE) kilobytes per second, a rewind speed of 10.4 meters per second, and a forward tape speed of 3.8 meters per second. The 3550 connects to a 3510-01, -02, -03, or -04 controller on the System 7.700 Models 7.722 through 7.780.

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 on the System 7.700 Models 7.730 through 7.780.

3557 HIGH DENSITY MAGNETIC TAPE DEVICE: This 9-track unit has a recording density of 640 (PE) or 2460

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(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 on the System 7.700 Models 7.730 through 7.780.

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 on the System 7.700 Models 7.730 through 7.780.

HIGH SPEED PRINTERS

There are four line printers available for the System 7.700 models. They operate at speeds of 436 to 600 lines per minute for the drum printer; 960 to 2000 lines per minute for the chain printers; and up to 21,000 lines per minute for the ultra-fast 3352 laser printer. All of the printers except the laser printer can be attached to Models 7.722 through 7.780; the laser printer can be attached only to Models 7.730 through 7.780 operating under BS 2000. All of the printers are fully buffered.

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

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

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

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

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

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

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

PUNCHED CARD EQUIPMENT

There are three models of 80-column card reader and one 80-column card punch available for the System 7.700. All attach to any model from the 7.722 through the 7.780.

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.

PUNCHED PAPER TAPE EQUIPMENT

There are four paper tape readers and two paper tape punches available for use with any System 7.700 Model 7.722 through 7.780.

4223 PAPER TAPE READER: This device can read up to 1200 characters per second in a forward direction, and accepts 5, 6, 7, or 8-channel tape or Olivetti-LS code-on tapes 17.4, 25.4, 22.2, or 20.5 mm wide. Attachments include a tape collection bin, a manual rewinder, and an unwinder (standard). A 4222 or 4220 controller is required.

4229 PAPER TAPE READER: This device can read up to 1500 characters per second in a forward direction, and accepts 5, 6, 7, or 8-channel tape in widths of 17.4, 22.2, or 25.4 mm. Attachments include a tape collection bin and an unwinder. A 4222 or 4220 controller is required.

4229-S PAPER TAPE READER: This device can read up to 1500 characters per second in either forward or reverse direction, and accepts 6-channel typesetting tapes with a width of 22.2 mm. Attachments include a tape collection bin, and an unwinder. A 4222 or 4220 controller is required.

4229-O PAPER TAPE READER: This device can read up to 1270 characters per second in either forward or reverse direction, and accepts 6-channel rectangular Olivetti code-on tapes with a width of 20.5 mm. Attachments include a tape collection bin, and an unwinder. A 4222 or 4220 controller is required.

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4228 PAPER TAPE PUNCH: This device can punch up to 150 characters per second in 5, 6, 7, or 8-channel code-on 17.4 or 25.4 mm tape. An unwinder is standard and a 45294 Take-Up Winder is available as an option. A 4221 or 4220 controller is required.

4228-S PAPER TAPE PUNCH: This device can punch up to 150 characters per second in 6-channel typesetting tape with a width of 22.2 mm. Attachments include a standard unwinder, and an optional 45294 Take-Up Winder. A 4221 or 4220 controller is required.

DOCUMENT READERS

Two document readers are available for attachment to Models 7.722 through 7.780. Both can read either pencil marks or high-speed printer characters from documents with a thickness of 0.10-0.18 mm, a width of 95-200 mm, and a length of 145-305 mm. The acceptable document format allows for a maximum of 65 columns; each with 24 positions. Each reader has one document input bin capable of holding 500 documents, one output bin capable of holding 500 documents, and a reject pocket holding 150 documents.

The 3262-01 Document Reader operates at 100-150 documents per minute; and the 3262-02 Document Reader operates at 50-75 documents per minute.

DISPLAY TERMINALS

8150 DATA DISPLAY STATION: This unit consists of a controller, a keyboard, and a fully-buffered CRT. The screen provides for a 20-line display with up to 54 characters per line. The 64-character set is used. Asynchronous, half-duplex data communications lines with rates of 1200 or 2400 bps are handled. The 8150 accepts ISO 7-bit code.

8151 DATA DISPLAY STATION: This unit has characteristics identical to those of the 8150 except that either asynchronous or synchronous, half-duplex lines of 1200, 2400, 4800 or 7200 bps are handled.

8152 DATA DISPLAY STATION: This units consists of a controller, a keyboard, and a fully buffered CRT capable of graphics representations. The screen provides for a 16-line display with up to 81 characters per line. Either a 64 or 95-character set is supported. Either asynchronous or synchronous half-duplex lines of 1200, 2400, 4800, or 9600 bps are handled. The 8152 accepts ISO 7-bit code.

8153 DATA DISPLAY STATION: This unit consists of a controller, a keyboard, and a fully buffered CRT. The screen provides for a 6-line display with up to 40 characters per line. The 64-character set is used. Asynchronous half-duplex lines with rates of 600, 1200, or 2400 bps are handled. The 8153 accepts ISO 7-bit code.

8161 DATA DISPLAY STATION: This unit consists of a CRT with an integrated controller and a keyboard. The screen provides for a 24 line display and 54, 64, or 80 characters per line. Either a 64 or 95-character set is supported with 12 special characters. Synchronous half-duplex lines with rates from 600 to 9600 bps are handled. The 8161 accepts ISO 7-bit code.

3976 CRT TERMINAL: This unit is a graphic display, 7-color terminal capable of displaying 2048 alphanumeric characters. Data transmission rate is 9600 bps.

PRINTER TERMINALS

8101 KEYBOARD-PRINTER TERMINAL: This unit can print 6-10 characters per second using a print bar mechanism; or can transmit data at 50, 75, or 100 bps. The 8101 provides a 32-character set and can print up to 104 characters per line on continuous forms.

8103 KEYBOARD-PRINTER TERMINAL: This unit can print 18.67 characters per second using a print bar mechanism, or can transmit data at 200 bps. The 8103 provides either a 64 or 95-character set, and can print up to 143 characters per line on continuous forms.

8110 KEYBOARD-PRINTER TERMINAL: This unit includes a buffered keyboard and can print 120-180 characters per second using a print bar mechanism; or can transmit data at up to 4800 bps. The 8110 provides either a 64 or 95-character set, and can print up to 143 characters per line on continuous forms.

8100 HARDCOPY PRINTER: This unit is a print-only terminal that can print at a rate of 22 characters per second using a print bar mechanism. The 8100 provides either a 64 or 95-character set, and can print up to 80 characters per line on continuous forms.

8111 REMOTE PRINTER TERMINAL: This unit can print 180 characters per second using a 7 x 7 dot matrix and receive data over a communictions line at up to 7200 bps. The 8111 provides a 68-character set, and can print up to 132 characters per line on either of two continuous forms feeds. An auxiliary 8120 printer can be attached.

8120 PRINTER: This unit can print 180 characters per second using a 7 x 7 dot matrix. The 8120 provides a 68-character set and can print up to 132 characters per line on either of two continuous-form feeds or a single sheet feed. The 8120 can be attached to either the 8111 Remote Printer Terminal or the 815X Display Station.

8121 PRINTER: This unit is similar to the 8120 Printer except that it has a 69-character print set and connects to either the 8112 Printer Controller or the 8161 Display Station.

8415 BATCH PRINTER STATION: This unit includes a printer and controller and can print up to 900 lines per minute. The 8415 provides a 46, 64, or 94-character set, and can print up to 104 characters per line. The 8415 connects to a DUST 3630 or a TRANSDATA 960 and accepts 6-bit BCD-Transcode, 7-bit CCITT No. 5, or 8-bit EBCDIC over a 9600 bps line.

8418 BATCH PRINTER/CARD INPUT STATION: This subsystem includes a printer, a punched card reader, and a controller. The 8418 is identical to the 8415 except that the 8418 has the ability to read standard 80-column cards at up to 667 cpm.

TERMINAL SUBSYSTEMS

TRANSDATA 9660, MODEL DUET 9661: This subsystem for banking and financial institutions has from 128K to 256K of programmable memory, and includes a floppy disk and, optionally, a printer. Up to 10 data lines can be connected to a 9661 subsystem consisting of a 9760 Dialog Station, 8151 or 8161 Display Terminals, or a 8415 Printer Terminal. Network support is provided for point-to-point, star, or ring configurations. Data transfer rates of 600-9600 bps are supported.

9760 DIALOG STATION: This unit is available for use with the DUET 9661, and consists of a keyboard, a visual display screen, and a printer. The keyboard can be either numeric, alphanumeric, or function driven. The visual display is a plasma-type unit with one display line of up to 32 characters or 8 lines of up to 32 characters each. The printer is a journal-type unit capable of printing 100 characters per second. An external Book and Page printer is available that can print up to 100 characters per second. The 9760 is suitable for use as a universal interactive terminal, a counter terminal, or for use in an off-line mode of operation.

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TRANSDATA 920: This subsystem is a Floppy Disk Data Entry System for centralized and decentralized data entry. The TRANSDATA 920 consists of a 9210 Data Entry Station, a 9212 Dual Data Entry Station, a 9230 Data Converter, and a 3170 Floppy Disk I/O Unit.

The machine-readable data medium employed by the TRANSDATA 920 is a floppy disk with a maximum capacity of 1,898 records (246,272 bytes). A record corresponds to a sector and direct access is possible to any sector.

Files may extend over several floppy disks, and a disk may contain data and/or programs, as required.

The operator keyboard is identical to that of a punch/verifier.

For centralized data entry, the 9212 Dual Data Entry Station is used. A display for each of two operators at this dual workstation is used for visually checking keyed data and the current device status, and provides support when updating and verifying. The 9212 display unit provides for viewing of three 40-character lines per operator on a 5.5 x 2.3 inch screen.

For decentralized data entry, the 9210 Data Entry Station is used. The 9210 has a larger screen than the 9212 and provides program-controlled operator guidance. The 9210 can be tailored to meet specific customer requirements by doubling the storage capacity with a second floppy disk drive, by connecting a printer, and by using a communication adapter feature. Both point-to-point circuits and multipoint networks may be configured. The station can also send and receive data in unmanned operation. The 9210 display unit provides for viewing of six 40-character lines on a 5.5 x 3.7 inch screen. Transmission speed is 600, 1200 or 2400 bps in synchronous half-duplex mode using EBCDIC format.

For indirect data transfer to the computer, the 9230 Data Converter is used.

Data written on floppy disks by the data entry stations is read in batches by the 9230 Data Converter and transferred to a computer-compatible magnetic tape. Conversely, the contents of a tape recorded by a computer can be transferred to floppy disk. The autoloader can hold 20 floppy disks. The conversion speed to tape is 1000 records per minute and from tape is 600 records per minute.

During conversion, records may be blocked, unblocked, or reformatted with simultaneous checking for errors.

The prepared tapes can be transported physically to the computer location and read, or, when a communication adapter feature is used, data can be transmitted via a point-to-point circuit to a remote computer. Connection to another 9230 Data Converter or to a 9210 Data Entry Station is also possible. The tape drive handles 10.5-inch reels of magnetic tape recorded at 800 bpi (NRZ) or 1600 bpi (PE).

When fitted with an autocall feature, the data converter can fetch data entered during the day on 9210 Data Entry Stations equipped for data communication.

The 9230 Data Converter can be connected to the TRANSDATA 960 Communication Unit (DUET), the 4666 Communication Controller (DUST), or the TRANSDATA 9210 Data Entry Station.

Transmission speed is 600, 1200 or 2400 bps in synchronous, half-duplex mode using EBCDIC format.

For direct data transfer to the computer, the 3170 Floppy Disk I/O Unit is used (see Mass Storage section in this report).

DATA COMMUNICATIONS

3630 DATA COMMUNICATIONS CONTROLLER: This controller can transfer data to the computer at up to 25,600 characters per second and can handle up to 30 lines at 4800 bps, 16 lines at 9600 bps, or 8 lines at 19,200 bps. Of the limit of 30 lines that can be attached to the 3630, 8 can be used for audio-response units. Data rates of 50 to 19,200 bps are standard and the 3630 can be equipped with an option to accommodate a 50,000 bps line. The 3630 can be connected directly to any System 7.700 Models 7.722 through 7.780.

8170 and 8171 MULTIPURPOSE CONTROLLERS: The 8170 and 8171 can connect the 8161 CRT, the 8112 printer terminal, or the 8121 printer to a Siemens 7.000 or 4004 via a multiplexor channel. The 8170 can be connected directly to the channel and data transfer between the terminal subsystem and the channel takes place at up to 230,400 bps. The 8171 is connected via a half-duplex communications line, and can transfer data at 9600-19,200 bps. For either system, up to 32 data stations can be connected.

TRANSDATA 960 DATA COMMUNICATIONS PROCESSORS: Siemens offers a series of six TRANSDATA 960 programmed communications processors that attach to Models 7.722 through 7.780 and range in memory size from 32K to 512K and can handle from 22 to 180 lines ranging in overall throughput speeds from 5 to 25 kilobytes per second. All of the TRANSDATA 960 models have 54 instructions, use 16-bit words, and can accommodate line speeds of 50-50,000 bps. Models 9683-9687 are front-end processors, while Models 9674 and 9675 are used as remote processors. The characteristics of the individual models of the TRANSDATA 960 are detailed in Table IV.

SOFTWARE

Software for the System 7.700 includes the real-memory operating system BS 1000, the virtual-memory operating system BS 2000, nine language processors, utilities, a data base management system, and a variety of applications packages.

BS 1000 OPERATING SYSTEM: This operating system is a real-memory, batch, remote batch, and transaction-processing system control program that is supported on all 7.700 systems except the 7.760, 7.761, and 7.762, and all 4004 models from the 4004/35 upward. BS 1000 was made available for use on the 7.700 series in April, 1975 as Version 1.3. Since then, two other versions have been released—Version 1.4 and Version 1.44. BS 1000 had previously been available on the 4004 as early as November, 1973. Each of up to 14 independent programs may be loaded at any location in main memory for simultaneous execution. Each program must reside in a single block of contiguous memory, and each program is assigned a priority that can be changed during execution. Depending upon the user's requirements, a BS 1000 system can be generated with a minimum resident main memory requirement of 12K bytes.

The principal control system components of the BS 1000 include:

- Executive (EXEC)
- Job Management System
  - —Monitor (MONITR)
  - —SPOOL 1 System
  - —SPOOL 2 System
  - —Job Control System 1 (JCS1)
  - —Resource Management System (RMS)
  - —Job Control System 2 (JCS2)
  - —Data Set Catalog System (DACS)
  - —Job Accounting System (MESACNT)

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- File Control Processor (FCP)
- Telecommunications System (TCS)
- Real Time Control Programs (ASMUS, DIACUP)
- Voice Output System

The main functions of the EXEC are to manage main memory, analyze and service interrupts, schedule I/O, and communicate with the operator through the system console(s). EXEC occupies 12K bytes of main memory as a minimum. An optional System Overlay feature of the EXEC permits system disk overlays to be made resident in main memory in an area that can be 4K to 50K bytes in size.

The Job Management System (JMS) comprises the systems for automatic job execution.

In order to reduce the workload on the operator, the MONITR allows a "job" consisting of several programs to be processed in a job stream. MONITR is always overlaid by the next program to be started so that it does not occupy any memory space during program processing.

SPOOL 1 is used for small-to-medium configurations and supports systems with available main memory of at least 64K bytes. SPOOL 2 is for large configurations and supports systems with available main memory of 128K bytes or larger. Both spoolers support input of jobs and files from local peripherals and intermediate storage and output of print and punch files via local peripherals. In addition, SPOOL 2 also accepts input from remote terminals, supports intermediate storage and output to remote terminals, and reads/writes temporary files via a virtual magnetic tape interface.

SPOOL 2 also offers an extensive function catalog and can support dual systems with the multi-channel switch and two-channel disk controller.

JCS 1 is an integral part of SPOOL 1 and supports FIFO automatic job execution under a 64-class job classification system that assigns any of 3 priorities to an individual job. JCS 2 is intended for use with SPOOL 2 and runs as an internal process that does not require its own time slot. JCS 2 supports up to 10 priority levels.

DACS catalogs and manages data sets by generation dates, assigns proper data sets to user programs, and initializes storage space for disk output, as well as permitting temporary or permanent storage of job variables for interchange between programs.

FCP controls I/O data communications between the CPU and the peripherals.

TCS is analogous to FCP except that it controls communication between the CPU and remote terminals connected to a communcations controller as well as the interconnection of 2 or more CPU's via a data exchange controller. TCS runs in conjunction with SPOOL 2.

Two TCS access methods are available under BS 1000:

- TCS for non-programmable communications controllers (3630),
- TCS-NEA for programmable communication controllers (TRANSDATA 960) and communications front-end processors. TCS-NEA supports communication network configurations.

TCS and TCS-NEA consist of a communication control program and up to 8 user programs.

ASMUS, a real-time control program that runs under BS 1000, supports overlapped (re-entrant) operation of several interactive data terminals and/or remote batch peripherals. ASMUS supports overlapped execution of several active programs by providing segment-reentrant control. User programs with ASMUS can be written in Assembler or COBOL.

DIACUP is an interactive program that supports the writing of up to 137 communication user programs that can be run as subroutines in the same program slot as DIACUP. DIACUP requires a minimum of 4096 bytes of main memory.

The minimum configuration required to run the BS 1000 operating system consists of any System 7.700 CPU with at least 64K bytes of main memory, 1 console, 1 disk storage device connected via a selector channel, 1 card reader, and 1 printer.

BS 2000 OPERATING SYSTEM: This is a virtual memory operating system that provides significant functional enhancements over BS 1000. BS 2000 was introduced for the 7.700 as Version 2 in December, 1975. Version 3 was introduced in March, 1977, and included improvements in file handling facilities. Version 4, released in August, 1978, includes the Transdata DCM communications access system for simplified programming of time-sharing and batch operations in data networks. This latest version of BS 2000 also provides 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.

BS 2000 can be run on any medium-to-large scale System 7.700 from the Model 7.730 up; as well as the System 4004/151. The essential features of BS 2000 include dynamic memory management for a virtual address space of up to 16 million bytes; concurrent support of local or remote batch processing, multiprocessing of up to 120 tasks, and interactive processing (time-sharing) for more than 100 users under control of a batch-oriented task management system; and real-time operation. BS 2000 treats all programs as either Class I (memory resident) or Class II (pageable). A Class II program can be up to 5 million bytes in length. Users are classified as system administrators, operators, or user/programmers.

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

The Executive performs the following functions:

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

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

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

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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. Virtual memory for Models 7.730 and above is divided into consecutive 64K-byte segments each containing 32 pages.

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

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).

In order to allow users to upgrade from BS 1000 to BS 2000 more easily, Siemens has developed the SIM-BS1000 simulator, which enables BS 1000 to run without modifications under simulated 4004 hardware characteristics in a BS 2000 machine.

LANGUAGE PROCESSORS: A variety of language processors are supported on the System 7.700 under the BS 1000 and BS 2000 operating systems:

Language	BS 1000 (Memory Requirement)	BS 2000
Assembler	yes (34K)	no
Assembler	yes (70K)	yes**
RPG 2	yes (Min. 26K)	no
ALGOL 60	yes (66K)	yes
ANS COBOL	yes (24 or 46K)	yes
FORTRAN IV	yes (56 or 92K)	yes
PL/I	yes (86K)	yes
BASIC	no	yes**
BASICL*	no	yes**
APL	no	yes

*Double-precision version.
**Shareable.

Two versions of the ANS COBOL compiler are available under BS 1000: a basic version that requires 24K of resident main memory; and an enhanced version that requires 46K bytes.

The PL/I compiler offers capabilities that are midway between the IBM D-level and the ECMA level. The Assembler contains an extensive macro capability.

All language processors available under BS 2000 are pageable. All, but BASIC and BASICL produce pageable object modules.

UTILITY ROUTINES: A full set of utilities is available for BS 1000 and BS 2000, including a Sort/Merge program, library maintenance routines, a linkage editor, system service routines, diagnostic routines, debugging aids, test data generators, and peripheral/media conversion routines.

UNIVERSAL DATA BASE MANAGEMENT SYSTEM (UDS): UDS is available for the System 7.700 and System 4004 computers. Minimum requirements are a 128K main memory, a card reader, a printer, and two disk drives. For smaller systems, Siemens offers UDS Variant A, which requires a minimum of 46K of real memory. UDS runs under BS 1000 and BS 2000. UDS interacts with ASMUS for real-time operations when used in conjunction with TCS. The system follows the recommendations of the April 1971 Report of the CODASYL DBTG, the CODASYL COBOL Data Base Facility Proposal of March 1973, and the COBOL JOD for 1975. UDS is functionally upward compatible with Siemens other data base systems: SESAM and PRISMA.

A second version of UDS, introduced in 1978, provides improvements in data access methods, language facilities, and data protection and security provisions. With UDS Version 2, it is possible to directly access records to be read or updated, eliminating the need to read through long record chains to reach a target record. The new version also includes a CALL interface that permits user programs operating with UDS to be written in any programming language (UDS Version 1 supported only COBOL). For rapid system recovery following a breakdown, an on-line transaction security facility has been added to the existing data protection features. For data privacy/security, UDS Version 2 uses a password system.

The major components of UDS are:

- Data Definition Language (DDL)
- Storage Structure Language (SSL)
- Data Base Handler (DBH)
- Data Manipulation Language (DML)
- Interactive Query Language (IQL)
- Service Programs.

GOLEM INFORMATION RETRIEVAL SYSTEM: This system provides access under BS 2000 to the central processor from remote data communications 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, contents, and lengths. Documents are logically divided into segments, and 5-level access codes are used to ensure data access security. Under BS 2000, GOLEM is a pageable program.

APPLICATION PACKAGES

LIDIA: This interactive program development system is designed for non-EDP professionals to provide familiarity with computer operations and programming. Running under BS 2000, LIDIA allows educational programs, computer-aided exercises, applications simulations, and model information systems to be programmed using simplified instructions.

APT, SIEAPT, EXAPT, MAPROS: These programming systems are designed for numeric (or process) control applications. APT (Automatic Programmed Tools) is a basic system for programming assembly machines to operate or manipulate components in two spatial dimensions. SIEAPT

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and EXAPT are extensions of APT with facilities for programming in three dimensions. MAPROS is an input/output macro-instruction system. All of these systems run under BS 2000.

PLAKOS-KE: This system for medium- to large-scale businesses provides facilities for planning and controlling cost accounting. The package includes modules for master file management, transaction file management, performance evaluation (actual costs compared to forecasted costs), and several accounting routines. PLAKOS-KE runs under BS 2000.

DEBAS, SAFIR, FIBAS: These systems provide comprehensive accounting and bookkeeping functions, including accounts payable, accounts receivable, general ledger, etc. DEBAS, SAFIR, and FIBAS are tailored for small-, medium-, and large-scale businesses, respectively. DEBAS runs under BS 1000, and SAFIR and FIBAS run under both BS 1000 and BS 2000.

ISABEL: This OCR-document processing system for financial institutions can be used in conjunction with up to four document-sorting devices. Data read/input, document presorting, data evaluation, error detection, error listing, final document sorting, and data preparation (for output to accounting departments) functions are included. ISABEL runs under BS 2000.

COMET: This information system for medium- to large-scale businesses provides financial planning and control functions. The system operates on a hierarchical model of the user's business to provide a basis for short- and long-term decision-making. COMET includes facilities for constructing complex simulations of various business situations. The system runs under BS 2000.

IGS: This interactive system allows two-dimensional graphics to be created, manipulated, and stored. Designed for use with a graphic CRT terminal, IGS includes over 100 instructions and runs under BS 2000.

PRICING

Purchase, rental, and maintenance prices for processors with minimum to maximum main memory, main memory extensions, and input/output channel options are included under the processor model headings in the following Equipment Prices chart. Console I/O, peripherals/terminals, mass storage, and data communications equipment prices are listed under separate headings. Software prices are not included in the chart. All prices are in Deutsche Marks (DM).■

EQUIPMENT PRICES*

	Purchase Price DM	Rental** (1-year lease) DM	Rental** (3-year lease) DM	Rental** (4-year lease) DM	Monthly Maint. DM
SIEMENS 7.722 VERSION 2					
Model 7.722-2 Central Processor, 96K Bytes of Main Memory	N/A	N/A	N/A	4,331	N/A
Model 7.722-2 Central Processor, 128K Bytes of Main Memory				4,674	
Model 7.722-2 Central Processor, 160K Bytes of Main Memory				5,017	
Model 7.722-2 Central Processor, 192K Bytes of Main Memory				5,360	
Model 7.722-2 Central Processor, 224K Bytes of Main Memory				5,703	
Model 7.722-2 Central Processor, 256K Bytes of Main Memory				6,046	
Model 7.722-2 Central Processor, 320K Bytes of Main Memory				6,732	
Model 7.722-2 Central Processor, 352K Bytes of Main Memory				7,075	
Model 7.722-2 Central Processor, 384K Bytes of Main Memory				7,418	
Model 7.722-2 Central Processor, 512K Bytes of Main Memory				8,416	
Model 7.722-2 Central Processor, 640K Bytes of Main Memory				9,414	
Model 7.722-2 Central Processor, 768K Bytes of Main Memory				10,412	
First Bytemultiplexor channel (5 connections)				integrated	
First Blockmultiplexor channel				integrated	
Second Bytemultiplexor channel extension				81	
First Blockmultiplexor channel extension				81	
SIEMENS 7.730 VERSION 2					
Model 7.730-2 Central Processor, 96K Bytes of Main Memory	N/A	N/A	N/A	10,625	N/A
Model 7.730-2 Central Processor, 128K Bytes of Main Memory				10,968	
Model 7.730-2 Central Processor, 160K Bytes of Main Memory				11,311	
Model 7.730-2 Central Processor, 192K Bytes of Main Memory				11,654	
Model 7.730-2 Central Processor, 224K Bytes of Main Memory				11,997	
Model 7.730-2 Central Processor, 256K Bytes of Main Memory				12,340	
Model 7.730-2 Central Processor, 320K Bytes of Main Memory				13,026	
Model 7.730-2 Central Processor, 352K Bytes of Main Memory				13,369	
Model 7.730-2 Central Processor, 384K Bytes of Main Memory				13,712	
Model 7.730-2 Central Processor, 512K Bytes of Main Memory				15,084	
Model 7.730-2 Central Processor, 640K Bytes of Main Memory				16,082	
Model 7.730-2 Central Processor, 768K Bytes of Main Memory				17,080	
Model 7.730-2 Central Processor, 896K Bytes of Main Memory				18,078	
Model 7.730-2 Central Processor, 992K Bytes of Main Memory				18,827	
First Blockmultiplexor channel				integrated	
Second Blockmultiplexor channel				702	
First Bytemultiplexor channel				integrated	
Second Bytemultiplexor channel (6 connections)				81	
Second Byte addition				121	

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**Prices include maintenance.
N/A means pricing information was not available.

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EQUIPMENT PRICES*

		Purchase Price DM	Rental** (1-year lease) DM	Rental** (3-year lease) DM	Rental** (4-year lease) DM	Monthly Maint. DM
SIEMENS 7.738						
738-I	Model 7.738 Central Processor, 512K Bytes of Main Memory	609,800	23,035	23,035	20,893	3,300
738-IH	Model 7.738 Central Processor, 768K Bytes of Main Memory	696,200	25,915	25,915	23,505	3,415
738-J	Model 7.738 Central Processor, 1024K Bytes of Main Memory	782,600	28,795	28,795	26,117	3,530
73805	Main Memory Extension from 512K to 768K Bytes	86,400	2,880	2,880	2,612	115
73808	Main Memory Extension from 768K to 1024K Bytes	86,400	2,880	2,880	2,612	115
73840	Two-Byte Feature	5,843	127	127	115	11
73843	Third Block Multiplexor Channel	33,313	710	710	644	21
73844	Fourth Block Multiplexor Channel	33,313	710	710	644	21
SIEMENS 7.740 VERSION 2						
740-G1	Model 7.740-1 Central Processor, 128K Bytes of Main Memory	1,182,800	25,239	25,239	22,892	2,023
740-GF1	Model 7.740-1 Central Processor, 192K Bytes of Main Memory	1,204,400	28,207	28,207	25,584	2,259
740-H1	Model 7.740-1 Central Processor, 256K Bytes of Main Memory	1,226,000	31,175	31,175	28,276	2,495
740-HG1	Model 7.740-1 Central Processor, 384K Bytes of Main Memory	1,269,200	36,263	36,263	32,891	2,901
740-I1	Model 7.740-1 Central Processor, 512K Bytes of Main Memory	1,312,400	37,703	37,703	34,197	3,076
740-IG1	Model 7.740-1 Central Processor, 640K Bytes of Main Memory	1,355,600	39,143	39,143	35,503	3,251
740-IH1	Model 7.740-1 Central Processor, 768K Bytes of Main Memory	1,398,800	40,583	40,583	36,809	3,426
740-J1	Model 7.740-1 Central Processor, 1024K Bytes of Main Memory	1,485,200	43,463	43,463	39,421	3,776
740-G2	Model 7.740-2 Central Processor, 128K Bytes of Main Memory	1,182,800	25,239	25,239	22,892	2,023
740-H2	Model 7.740-2 Central Processor, 256K Bytes of Main Memory	1,226,000	31,175	31,175	28,276	2,495
740-HG2	Model 7.740-2 Central Processor, 384K Bytes of Main Memory	1,269,200	36,263	36,263	32,891	2,901
740-I2	Model 7.740-2 Central Processor, 512K Bytes of Main Memory	1,312,400	37,703	37,703	34,197	3,076
740-IG2	Model 7.740-2 Central Processor, 640K Bytes of Main Memory	1,355,600	39,143	39,143	35,503	3,251
740-IH2	Model 7.740-2 Central Processor, 768K Bytes of Main Memory	1,398,800	40,583	40,583	36,809	3,426
740-J2	Model 7.740-2 Central Processor, 1024K Bytes of Main Memory	1,485,200	43,463	43,463	39,421	3,776
74015	Main Memory Extension from 128K to 192K Bytes	21,600	2,968	2,968	2,692	236
74019	Main Memory Extension from 128K to 256K Bytes	43,200	5,936	5,936	5,384	472
74016	Main Memory Extension from 192K to 256K Bytes	21,600	2,968	2,968	2,692	236
74017	Main Memory Extension from 256K to 384K Bytes	43,200	5,088	5,088	4,615	406
74018	Main Memory Extension from 384K to 512K Bytes	43,200	1,440	1,440	1,306	175
74010	Main Memory Extension from 512K to 640K Bytes	43,200	1,440	1,440	1,306	175
74011	Main Memory Extension from 640K to 768K Bytes	43,200	1,440	1,440	1,306	175
74012	Main Memory Extension from 768K to 1024K Bytes	86,400	2,880	2,880	2,612	350
74025	Byte Multiplexor Channel Extension	39,770	848	848	769	32
74040	Two-Byte Feature	5,843	127	127	115	11
74045	Second Block Multiplexor Channel	33,313	710	710	644	21
74047	Third Block Multiplexor Channel	33,313	710	710	644	21
74048	Fourth Block Multiplexor Channel	33,313	710	710	644	21
74046	Block Multiplexor Channel Extension	23,575	502	502	455	15
SIEMENS 7.748						
748-J	Model 7.748 Central Processor, 1024K Bytes of Main Memory	1,463,800	52,280	52,280	47,418	6,340
748-JI	Model 7.748 Central Processor, 1536K Bytes of Main Memory	1,636,600	58,040	58,040	52,642	6,570
748-K	Model 7.748 Central Processor, 2048K Bytes of Main Memory	1,809,400	63,800	63,800	57,866	6,800
74805	Main Memory Extension from 1024K to 1536K Bytes	172,800	5,760	5,760	5,224	230
74808	Main Memory Extension from 1536K to 2048K Bytes	172,800	5,760	5,760	5,224	230
74825	Byte Multiplexor Channel Extension	39,770	848	848	769	32
74840	Two-Byte Feature	5,843	127	127	115	11

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EQUIPMENT PRICES*

		Purchase Price DM	Rental** (1-year lease) DM	Rental** (3-year lease) DM	Rental** (4-year lease) DM	Monthly Maint. DM
SIEMENS 7.748 (Continued)						
74843	Third Block Multiplexor Channel	42,153	965	965	875	75
74844	Fourth Block Multiplexor Channel	42,153	965	965	875	75
74845	Fifth Block Multiplexor Channel	42,153	965	965	875	75
74846	Sixth Block Multiplexor Channel	42,153	965	965	875	75
SIEMENS 7.755						
755-I	Model 7.755 Central Processor, 512K Bytes of Main Memory	2,405,400	62,544	62,544	56,727	4,976
755-IH	Model 7.755 Central Processor, 768K Bytes of Main Memory	2,491,800	71,194	71,194	64,573	5,680
755-J	Model 7.755 Central Processor, 1024K Bytes of Main Memory	2,578,200	74,074	74,074	67,185	6,040
755-JI	Model 7.755 Central Processor, 1536K Bytes of Main Memory	2,751,000	79,834	79,834	72,409	6,760
755-K	Model 7.755 Central Processor, 2048K Bytes of Main Memory	2,923,800	85,594	85,594	77,634	7,480
755-KI	Model 7.755 Central Processor, 2560K Bytes of Main Memory	3,096,600	91,354	91,354	82,858	8,200
755-KJ	Model 7.755 Central Processor, 3072K Bytes of Main Memory	3,269,400	97,114	97,114	88,082	8,920
755-KJI	Model 7.755 Central Processor, 3584K Bytes of Main Memory	3,442,200	102,874	102,874	93,307	9,640
755-L	Model 7.755 Central Processor, 4096K Bytes of Main Memory	3,615,000	108,634	108,634	98,531	10,360
75501	Main Memory Extension from 512K to 768K Bytes	86,400	8,650	8,650	7,846	704
75502	Main Memory Extension from 768K to 1024K Bytes	86,400	2,880	2,880	2,612	360
75503	Main Memory Extension from 1024K to 1536K Bytes	172,800	5,760	5,760	5,224	720
75504	Main Memory Extension from 1536K to 2048K Bytes	172,800	5,760	5,760	5,224	720
75505	Main Memory Extension from 2048K to 2560K Bytes	172,800	5,760	5,760	5,224	720
75506	Main Memory Extension from 2560K to 3072K Bytes	172,800	5,760	5,760	5,224	720
75507	Main Memory Extension from 3072K to 3584K Bytes	172,800	5,760	5,760	5,224	720
75508	Main Memory Extension from 3584K to 4096K Bytes	172,800	5,760	5,760	5,224	720
75525	Byte Multiplexor Channel Extension	39,770	848	848	769	32
75543	Third Block Multiplexor Channel	42,153	965	965	875	75
75544	Fourth Block Multiplexor Channel	42,153	965	965	875	75
75545	Fifth Block Multiplexor Channel	42,153	965	965	875	75
75546	Sixth Block Multiplexor Channel	42,153	965	965	875	75
75540	Two-Byte Feature	5,843	127	127	115	11
SIEMENS 7.760						
Model 7.760 Central Processor, 2048K Bytes of Main Memory		N/A	N/A	N/A	66,675	N/A
Model 7.760 Central Processor, 2560K Bytes of Main Memory					71,219	
Model 7.760 Central Processor, 3072K Bytes of Main Memory					75,763	
Model 7.760 Central Processor, 3584K Bytes of Main Memory					80,307	
Model 7.760 Central Processor, 4096K Bytes of Main Memory					84,851	
Model 7.760 Central Processor, 5120K Bytes of Main Memory					93,939	
Model 7.760 Central Processor, 6144K Bytes of Main Memory					103,027	
Model 7.760 Central Processor, 7168K Bytes of Main Memory					112,115	
Model 7.760 Central processor, 8192K Bytes of Main Memory					121,203	
First Bytemultiplexor channel (8 connections)					integrated	
Second Blockmultiplexor channel					integrated	
Bytemultiplexor channel extension					1,172	
Third to Sixth Blockmultiplexor channel					1,334	
Second Byte addition					162	
SIEMENS 7.761						
Model 7.761 Central Processor, 2048K Bytes of Main Memory		N/A	N/A	N/A	98,175	N/A
Model 7.761 Central Processor, 3072K Bytes of Main Memory					107,263	
Model 7.761 Central Processor, 4096K Bytes of Main Memory					116,351	
Model 7.761 Central Processor, 5120K Bytes of Main Memory					125,439	
Model 7.761 Central Processor, 6144K Bytes of Main Memory					134,527	
Model 7.761 Central Processor, 7168K Bytes of Main Memory					143,615	

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EQUIPMENT PRICES*

	Purchase Price DM	Rental** (1-year lease) DM	Rental** (3-year lease) DM	Rental** (4-year lease) DM	Monthly Maint. DM
SIEMENS 7.761 (Continued)					
Model 7.761 Central Processor, 8192K Bytes of Main Memory	N/A	N/A	N/A	152,703	N/A
Bytemultiplexor channel (8 connections)				integrated	
Bytemultiplexor channel extension				1,172	
Second Byte addition				162	
Second Blockmultiplexor channel				integrated	
Third to Eighth Blockmultiplexor channel				1,334	
SIEMENS 7.762					
Model 7.762 Central Processor, 2048K Bytes of Main Memory	N/A	N/A	N/A	108,917	N/A
Model 7.762 Central Processor, 3072K Bytes of Main Memory				118,005	
Model 7.762 Central Processor, 4096K Bytes of Main Memory				127,093	
Model 7.762 Central Processor, 5120K Bytes of Main Memory				136,181	
Model 7.762 Central Processor, 6144K Bytes of Main Memory				145,269	
Model 7.762 Central Processor, 7168K Bytes of Main Memory				154,357	
Model 7.762 Central Processor, 8192K Bytes of Main Memory				163,445	
Second Bytemultiplexor channel (8 connections)				integrated	
Bytemultiplexor channel extension				1,172	
Second Byte addition				162	
Fourth Blockmultiplexor channel				integrated	
Fifth to Twelfth Blockmultiplexor channel				1,334	
SIEMENS 7.770					
Model 7.770 Central Processor, 2048K Bytes of Main Memory	N/A	N/A	N/A	115,343	N/A
Model 7.770 Central Processor, 4096K Bytes of Main Memory				135,519	
Model 7.770 Central Processor, 6144K Bytes of Main Memory				151,695	
Model 7.770 Central Processor, 8192K Bytes of Main Memory				169,871	
First Bytemultiplexor channel (8 connections)				integrated	
Bytemultiplexor channel extension				2,270	
Second Byte addition				284	
Fourth Blockmultiplexor channel				integrated	
Fifth and Sixth Blockmultiplexor channel				1,987	
Second Input/Output Processor				18,449	
Additional Processor				3,612	
SIEMENS 7.780					
Model 7.780 Central Processor, 2048K Bytes of Main Memory	N/A	N/A	N/A	129,050	N/A
Model 7.780 Central Processor, 4096K Bytes of Main Memory				147,226	
Model 7.780 Central Processor, 6144K Bytes of Main Memory				165,402	
Model 7.780 Central Processor, 8192K Bytes of Main Memory				183,578	
First Bytemultiplexor channel (16 connections)				integrated	
Bytemultiplexor channel extension				2,270	
Second Byte addition				284	
Sixth Blockmultiplexor channel				integrated	
Second Input/Output Processor				21,851	
Additional Processor				3,612	

CONSOLE I/O

3020	Central Operator Console with Display	53,915	1,378	1,378	1,250	128
3021	Central Operator Console with Teletype	46,740	1,272	1,272	1,154	193
3020-10	Sub-Console with Display	28,700	742	742	673	86
3021-10	Sub-Console with Teletype	23,063	636	636	577	150
30220	Operator's Chair	390	—	—	—	—
3030	Console Printer	21,156	530	530	481	139
3023	Central Operator Console with Printer	54,284	1,484	1,484	1,346	203
30230	Floppy Disk Drive for 3023 Operator Console	19,250	550	550	499	55
3023-10	Sub-Console with Printer	30,607	848	848	769	161
3033-01	Console Printer	28,700	742	742	673	150
3024	Central Operator Console	74,770	1,782	1,782	1,616	355
3024-10	Sub-Console	51,400	1,277	1,277	1,158	202

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EQUIPMENT PRICES*

		Purchase Price DM	Rental** (1-year lease) DM	Rental** (3-year lease) DM	Rental** (4-year lease) DM	Monthly Maint. DM
CONSOLE I/O (Continued)						
30243	First Floppy Disk Drive for 3024 Operator Console	19,250	550	550	499	55
3025	Central Operator Console	48,000	1,132	1,132	1,027	145
3025-10	Sub-Console	22,700	535	535	485	52
30241	Printer Controller for 3024 Operator Console	6,000	207	207	188	34
PERIPHERALS/TERMINALS						
3160	Card Punch, 100-290 cpm	63,448	1,641	1,378	—	300
31601	Binary Punching Feature for 3160 Card Punch	523	16	13	—	5
3150-01	Card Reader, 1000 cpm, 1200-card Hopper	60,988	1,571	1,320	—	262
3150-02	Card Reader, 1000 cpm, 3000-card Hopper	66,215	1,710	1,436	—	284
3150-03	Card Reader, 660 cpm, 1200-card Hopper	46,176	1,235	1,037	—	235
31501	Binary Read Feature for 3150-03 Card Reader	1,324	36	30	—	5
31502	Ticket/Stub Card Feature for all Card Readers	993	25	21	—	5
31503	Mark Read Feature for 3150-01 and 02 Card Readers	8,538	214	180	—	32
31504	Automatic-End-of-File Feature for all Card Readers	579	16	13	—	5
31505	90-Column Card Feature for all Card Readers	1,194	32	27	—	5
3170	Floppy Disk I/O Unit	70,500	1,845	1,550	—	95
31701	Floppy Disk Initialization Feature for 3170 Unit	1,125	30	25	—	5
31702	Variable Block Length Feature for 3170 Unit	4,275	113	95	—	10
31703	Dual I/O Station Expansion Feature for 3170 Unit	34,600	917	770	—	40
3336	Drum Printer, 436-600 lpm	76,700	2,609	2,191	—	438
3340-11	Chain Printer, 960-1170 lpm, Single Forms Feed	157,600	4,739	3,981	—	923
33410	Powered Forms Feed Feature for 3340-11 Printer	2,870	82	69	—	11
3340-12	Chain Printer, 960-1170 lpm, Single Forms Feed	159,400	4,792	4,025	—	933
3340-13	Chain Printer, 960-1170 lpm, Dual Forms Feed	186,900	5,545	4,658	—	1,067
33411	Powered Forms Feed Feature for 3340-12 and 13 Printers	4,613	126	106	—	21
3340-14	Chain Printer, 960-1170 lpm, Dual Forms Feed	189,400	5,621	4,722	—	1,089
33401	Powered Forms Feed Feature for 3340-14 Printer	6,600	179	150	—	35
3343	Chain Printer, 1630-2000 lpm	337,358	8,644	7,261	—	1,883
3352-01	Laser Printer	635,800	17,202	14,450	—	1,600
33520	CPU-Channel Switch Feature for 3352 Laser Printer	24,200	655	550	—	60
33521	Forms Overlay Feature for 3352 Laser Printer	44,000	1,190	1,000	—	120
33522	Extended Character Set for 3352 Laser Printer	8,800	238	200	—	25
33523	Page Memory Extension for 3352 Laser Printer	24,200	655	550	—	60
33525	Stack-Assembly Feature for 3352 Laser Printer	1,250	43	36	—	6
3262-01	Document Reader, 100-150 documents/minute	136,440	3,768	3,165	—	268
3262-02	Document Reader, 50-75 documents/minute	86,250	2,003	1,683	—	182
3570	Magnetic Tape Unit, 2 Drives, 6-Drive Controller, 30KBS	108,297	3,424	2,876	—	449
3571	Magnetic Tape Unit, 2 Drives, 6-Drive Controller, 60KBS	128,336	4,070	3,419	—	546
3530	Magnetic Tape Device, 2 Drives, connects to 3570 MTU	30,668	940	790	—	134
3531	Magnetic Tape Device, 2 Drives, connects to 3571 MTU	38,074	1,206	1,013	—	161
3570-03	Channel Extension for 3570 MTU	77,280	2,438	2,048	—	316
3571-03	Channel Extension for 3571 MTU	90,610	2,873	2,413	—	385
3540	Magnetic Tape Device, 60/120KBS	57,380	1,830	1,537	—	342
3550	Magnetic Tape Device, 120/240KBS	77,767	2,391	2,008	—	375
3554	Magnetic Tape Device, 160/320KBS	84,335	2,560	2,150	—	375
3510-01	Magnetic Tape Controller	88,232	2,940	2,470	—	193
3510-02	Magnetic Tape Controller	205,615	6,094	5,119	—	257
3510-03	Magnetic Tape Controller	176,464	5,880	4,939	—	289
3510-04	Magnetic Tape Controller	239,194	7,000	5,880	—	439
3512-01	Magnetic Tape Controller	88,232	2,940	2,470	—	193
3512-02	Magnetic Tape Controller	205,615	6,094	5,119	—	257
3512-03	Magnetic Tape Controller	176,464	5,880	4,939	—	289
3512-04	Magnetic Tape Controller	239,194	7,000	5,880	—	439
3513	Magnetic Tape Controller	114,599	3,857	3,240	—	445
35103	Two-Byte Feature	5,246	172	145	—	20
35112	Channel Switch	17,366	571	480	—	20
35111	Buffer Extension	1,990	65	55	—	10
35116	Controller Coupler I	23,517	773	650	—	45
35117	Controller Coupler II	45,225	1,488	1,250	—	85
3557	High-Density Magnetic Tape Device, 1600/6250 bpi, 200/780KBS	77,306	2,494	2,095	—	280
3559	High-Density Magnetic Tape Device, 1600/6250 bpi, 320/1250KBS	91,328	2,946	2,475	—	365
35506	1600-bpi Recording Density Feature	3,240	107	90	—	20
3511	Magnetic Tape Controller	47,500	1,488	1,250	—	130
3521	Magnetic Tape Unit, 800/1600 bpi, 20/40KBS	27,740	869	730	—	100
3523	Magnetic Tape Unit, 800/1600 bpi, 40/80KBS	32,300	1,012	850	—	126

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EQUIPMENT PRICES*

		Purchase Price DM	Rental** (1-year lease) DM	Rental** (3-year lease) DM	Rental** (4-year lease) DM	Monthly Maint. DM
PERIPHERALS/TERMINALS (Continued)						
34104	Two-Channel Switch	31,285	818	687	—	41
34105	Two-Channel Switch	31,285	818	687	—	41
34608	Two-Controller Feature	12,300	378	318	—	11
34505	Two-Controller Feature	12,300	378	318	—	11
MASS STORAGE						
3440	Disk Drive, 55 megabytes	47,253	1,287	1,081	—	375
3413	Disk Controller	132,225	3,370	2,831	—	257
34102	Two-Channel Switch	20,823	623	523	—	75
3455	Disk Drive, 72 megabytes	39,865	1,405	1,180	—	110
34515	Double Density Conversion Feature	26,075	643	540	—	40
3414-03	Disk Controller	169,250	4,480	3,763	—	321
3416-03	Disk Controller	147,359	4,194	3,523	—	301
3416-13	Disk Controller	178,360	5,099	4,283	—	370
3465	Disk Drive, 144 megabytes	52,440	2,048	1,720	—	150
3414-04	Disk Controller	179,500	5,000	4,200	—	321
34114	Mixed Drive Feature	11,245	298	250	—	21
3416-04	Disk Controller	157,393	4,714	3,960	—	301
34116-08	Mixed Drive Feature	11,245	298	250	—	21
34108-08	Mixed Drive Feature	11,245	298	250	—	21
3416-14	Disk Controller	188,394	5,619	4,720	—	370
34116-16	Mixed Drive Feature	14,394	381	320	—	26
34108-16	Mixed Drive Feature	14,394	381	320	—	26
3468	Disk Drive, 300 megabytes	94,484	3,101	2,605	—	190
3470	Fixed-Disk Drive, 420 megabytes	97,980	3,167	2,660	—	364
3416-05	Disk Controller	246,053	7,381	6,200	—	301
34117-08	Mixed Drive Feature	24,700	655	550	—	40
34123-08	Mixed Drive Feature	24,700	655	550	—	40
34127-08	Mixed Drive Feature	24,700	655	550	—	40
3416-15	Disk Controller	277,054	8,286	6,960	—	370
34117-16	Mixed Drive Feature	27,849	738	620	—	45
34123-16	Mixed Drive Feature	27,849	738	620	—	45
34127-16	Mixed Drive Feature	27,849	738	620	—	45
34700	Two-Controller Feature	2,320	71	60	—	5
3450	Disk Drive, 100 megabytes	88,458	2,082	1,749	—	407
34500	Two-Controller Feature	12,300	378	318	—	11
3414-01	Disk Controller	185,935	4,922	4,134	—	321
3416-01	Disk Controller	175,135	4,636	3,894	—	301
3416-11	Disk Controller	209,325	5,540	4,654	—	370
3460	Disk Drive, 200 megabytes	117,875	3,092	2,597	—	407
34600	Two-Channel Switch	12,300	378	318	—	11
3414-02	Disk Controller	209,715	5,552	4,664	—	321
3416-02	Disk Controller	198,915	5,267	4,424	—	301
34106-08	Mixed Drive Feature	11,245	298	250	—	21
34107-08	Mixed Drive Feature	11,245	298	250	—	21
3416-12	Disk Controller	233,105	6,171	5,184	—	370
34106-16	Mixed Drive Feature	14,394	381	320	—	26
34107-16	Mixed Drive Feature	14,394	381	320	—	26
DATA COMMUNICATIONS						
3630	Data Communications Controller	64,165	1,375	1,375	—	102
3630-80	Expansion Cabinet	15,990	334	334	—	16
36301	Control Character Expansion Feature	14,760	307	307	—	16
36313-01	Telegraph Buffers	6,458	138	138	—	11
36313-02	Telegraph Buffers	6,458	138	138	—	11
36323-02	Telegraph Buffer Connection Module	—	—	—	—	—
36313-03	Telegraph Buffers	7,524	160	160	—	11
36323	Telegraph Buffer Frame	—	—	—	—	—
36315-01	Asynchronous Telephone Line Buffers	14,043	295	295	—	16
36315-02	Asynchronous Telephone Line Buffers	15,478	323	323	—	16
36325	Asynchronous Telephone Line Buffer Connection Module	—	—	—	—	—
36317-01	Synchronous Telephone Line Buffers	24,088	506	506	—	27
36317-02	Synchronous Telephone Line Buffers	24,805	519	519	—	27
36317-03	Synchronous Telephone Line Buffers	24,088	506	506	—	27
36317-04	Synchronous Telephone Line Buffers	24,805	519	519	—	27
36327	Synchronous Telephone Line Buffer Connection Module	—	—	—	—	—

*All prices have been estimated by Datapro from publicly available information and have not been approved by Siemens.
**Prices include maintenance.

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