Siemens 7.800 Series

MANAGEMENT SUMMARY

UPDATE: *The Siemens 7.800 Series has undergone restructuring, reducing the range from 16 models to 10 models. The most recent additions to the series include the 7.890C and 7.890M models. The models that have been dropped include the 7.865-2, 7.865-3, 7.870-2, 7.872-2, 7.875-2, 7.880-2, 7.881-2, and 7.882-2. Cache memory on the 7.890 models has been increased to 512KB.*

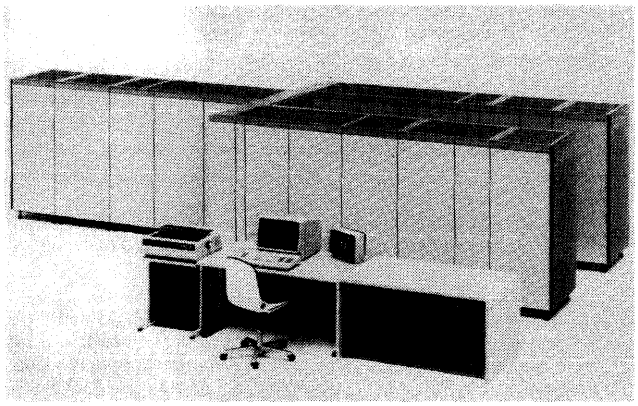
Introduced in October 1978, the Fijitsu-based Siemens 7.800 Series has undergone many evolutions to keep pace with IBM models, with which its computers are compatible, and also to stay competitive with other plug-compatible vendors who offer similar systems, such as Fujitsu-based systems like the ICL Atlas 10 and Amdahl's various models, and Hitachi-based systems from BASF, Olivetti, and NAS.

At present, the series consists of the 7.860 models which include the 7.860E, 7.860L, and 7.860R, and the 7.890 models which include the 7.890C, 7.890D, 7.890E, 7.890F, 7.890L, 7.890M, and 7.890S.

The Siemens 7.800 range was introduced in five phases. The first coincided with the announcement in 1978 of the 7.870, 7.872, 7.880, and 7.882 designed to match the then existing IBM 303X models. A less powerful entry-level model, the 7.865, was announced in February 1980.

Anticipating the arrival of the IBM 4341-2, the 3033S, 3033N, and 3081, Siemens restructured the entire product line in January 1981 and launched the 7.875-2 and 7.881-2 as its second-phase offerings.

The third phase occurred in August 1982, when Siemens introduced its models in the 7.890 family, designated D, E, F, L, and S. The entry level to this part of the 7.800 series is the 7.890D and the top model is the 7.890S. The fourth phase introduced the new entry-level model, the 7.860, in ➢



Pictured is the Siemens 7.890. The 7.800 Series compete with the IBM 4300 and 30XX Series.

The Siemens 7.800 Series comprises 10 Fujitsu-based machines designed to compete with the IBM range spanning the large 4300 models to the 30XX mainframes.

MODELS: Siemens 7.860E, 7.860L, 7.860R, 7.890C, 7.890D, 7.890E, 7.890F, 7.890L, 7.890M, and 7.890S.
CONFIGURATIONS: Single- and dual-processor systems with main memories ranging from 4MB to 128MB and 6 to 64 input/output channels.
COMPETITION: IBM 4300 and 30XX series; BASF 7/7X and 7/8X systems; Amdahl 5800 Series; NAS 6000, 8000, and 9000 systems; ICL Atlas 10 models.
PRICE: The entry-level 7.860E costs approximately DM 767.000; the most powerful model in the series, the 7.890S, is priced from DM 8.900.000.

CHARACTERISTICS

SUPPLIER: Siemens AG, Bereich Datenverarbeitung. Otto-Hahn-Ring 6, Postfach 83 29 40. 8000 Munich 83, West Germany. Telephone (089) 636-1. Telex 528 801.

MANUFACTURER: Fujitsu Ltd., 6-1, Marunouchi 2-chome, Chiyoda-ku, Tokyo, Japan 100. Telephone (03) 216-3211.

COMPANY LOCATIONS: ***Argentina:*** **Siemens SA, Avenida Pte. Julio, A. Roca 516. RA-1067 Buenos Aires;** ***Australia*****: Siemens Ltd., 544 Church St., Richmond, Melbourne, Vic 3121;** ***Austria*****: Siemens AG, Siemenstr. 88-92, A-1210 Vienna. Telephone (0222) 241508;** ***Belgium:*** **Siemens SA, Chaussée de Charleroi 116, B-1060 Brussels. Telephone (02) 536 2111;** ***Brazil*****: Siemens SA, Av. Mutinga 3650, BR-05110 Sao Paulo-SP;** ***Canada*****: Siemens Electric Ltd., 7300 Trans-Canada Hwy., Pointe Claire, Quebec H9R 1C7;** ***Colombia*****: Siemens SA, Carrera 65, No. 11-83, Bogotá-6;** ***Costa Rica*****: Siemens SA, La Uruca, Apartado 10022, San José;** ***Denmark*****: Siemens A/S, Borupvang 3, DK-2750, Ballerup. Telephone (02) 656565;** ***Eire*****: Siemens Ltd., 8 Raglan Rd., Dublin 4;** ***Finland*****: Siemens Osakeyhtiö, Mikonkatu 8, SF-00100 Helsinki 10;** ***France*****: Siemens SA, 39-47 boulevard Ornano, F-93200 Saint-Denis. Telephone (01) 820 6316;** ***India*****: Siemens India Ltd., 134 A, Dr. Annie Besant Rd., Worli, Bombay 400 018;** ***Italy*****: Siemens Elettra S.p.A., Via Fabio Filzi 29, I-20124 Milan. Telephone (02) 252 0441;** ***Japan*****: Siemens K.K., Gotanda Fujikura Bldg., 11-20 Nishigotanda 2-chome, Shinagawa-ku, Tokyo 141;** ***Mexico*****: Siemens SA, Poniente 116, No. 590, Col. Ind. Vallejo, Deleg. Axcapotzalco, 02300 Mexico, D.F.;** ***Netherlands*****: Siemens Nederland n.v., Wilhelmina van Pruisenweg 26, NL-2595 AN, The Hague. Telephone (070) 782782;** ***Norway*****: Siemens A/S, Østre Aker vei 90, N-Oslo 5;** ***Portugal*****: Siemens S.A.R.L., Av. Almirante Reis 65, P-1100 Lisbon 1;** ***South Africa*****: Siemens Ltd., Siemens House, Cnr. Wolmarans & Biccard Sts., Braamfontein 2001, Johannesburg 2000. Telephone (11) 715911;** ***Spain*****: Siemens SA, Orense 2, Madrid 20. Telephone (01) 754 1700;** ***Sweden*****: Siemens Aktiebolag Norra, Stationsgatan 63-65, S-10435 Stockholm. Telephone (08) 989700;** ***Switzerland*****: Siemens Albis AG, Freilagerstr.** ➢

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TABLE 1. CHARACTERISTICS OF SIEMENS 7.860

MODEL	7.860E	7.860L	7.860R
SYSTEM CHARACTERISTICS			
Date of introduction	July 1983	July 1983	July 1983
Number of central processors	1	2	2
Principal operating systems	BS 3000 MSP; OS/VS1; MVS; VM/370; MVS/SP2		
Purchase price, entry system (CPU) (in DM)	766.800	1.285.200	1.533.600
MAIN STORAGE			
Storage type	MOS	MOS	MOS
Read cycle time, nanoseconds	—	—	—
Write cycle time, nanoseconds	—	—	—
Bytes fetched per cycle	8	8	8
Storage interleaving	4-way	4-way	4-way
Minimum capacity, megabytes	4	8	8
Maximum capacity, megabytes	16	24	32
Increment size, megabytes	4	4, 8	8
Error correcting memory	Standard	Standard	Standard
BUFFER STORAGE			
Cycle time, nanoseconds	—	—	—
Bytes fetched per cycle	32	32	32
Capacity, bytes	32,768	2 x 32,768	2 x 32,768
Time to fetch 8 bytes, nanoseconds	—	—	—
RELOADABLE CONTROL STORAGE			
Capacity	NA	NA	NA
PROCESSING UNIT			
Machine cycle time, nanoseconds	20 ns	20 ns	20 ns
Relative performance level (est.)	—	—	—
Instruction prefetching	Standard	Standard	Standard
Processing unit features			
Clock comparator and CPU timer	Standard	Standard	Standard
Dynamic address translation	Standard	Standard	Standard
Floating-point	Standard	Standard	Standard
Direct control	Standard	Standard	Standard
Instruction retry hardware	Standard	Standard	Standard

response to IBM's introduction of the 4381. The 7.860 is available in three models—the E, L, and R.

The 7.890 family is extremely powerful, with the 7.890F being equal to the IBM 3081KX in performance, and the top model, the 7.890S, comparable to the IBM quadri-processor, the 3084QX.

The fifth phase marked the debut of the 7.890C and 7.890M models and produced the consolidation of the entire line into the 7.860 and 7.890 models.

Siemens AG is one of the five largest electronics and electrical companies in the world. It is divided into six product groups consisting of components, power engineering and automation, electrical installations, communication and information systems, medical engineering, and telecommunications networks and security systems. In addition to the 7.800 Series, computer-associated products include the Siemens-built 7.500 and 7.700 mainframes and a new series of supercomputer vector processors; small business systems; word processing and teleprocessing systems; and peripheral equipment. Sales of electronic products and systems account for approximately half of Siemens' sales.

28, CH-8047 Zürich. Telephone (01) 495 3111; *United Kingdom*: Siemens Ltd., Siemens House, Windmill Rd., Sunbury-on-Thames, Middlesex TW16 7HS. Telephone (09327) 85691; *USA*: Siemens Corp., 186 Wood Av. South, Iselin, NJ 08830; *Venezuela*: Siemens SA, Avenida Don Diego, Cisneros, Urbanización los Ruices, Caracas 1010 A.

MODELS: 7.860E, 7.860L, 7.860R, 7.890C, 7.890D, 7.890E, 7.890F, 7.890L, 7.890M, and 7.890S.

DATA FORMATS

BASIC UNIT: The 8-bit byte. Each byte can represent one alphanumeric character or two BCD digits. Two bytes represent a half-word, four bytes a word, and eight bytes a double-word.

FIXED-POINT OPERANDS: A half-word can represent a 15-bit signed integer; a word can represent a 31-bit signed integer.

FLOATING-POINT OPERANDS: A 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 double-word with a 7-bit characteristic and a 56-bit mantissa. For extended floating-point representation, two 64-bit double-words are used to provide a 7-bit characteristic and a 112-bit mantissa.

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TABLE 2. CHARACTERISTICS OF SIEMENS 7.890

MODEL	7.890C	7.890D	7.890E	7.890F	7.890L	7.890M	7.890S
SYSTEM CHARACTERISTICS							
Date of introduction		Aug. 1982	Aug. 1982	Aug. 1982	Aug. 1982		Aug. 1982
Number of central processors	1	1	1	1	2	2	2
Principal operating systems	BS 3000 MSP; OS/VS1; MVS; VM/370; MVS/SP2						
Purchase price, entry system (CPU) (in DM)	2.199.600	3.003.300	4.359.200	5.244.100	7.181.300	8.078.500	8.943.600
MAIN STORAGE							
Storage type	MOS	MOS	MOS	MOS	MOS	MOS	MOS
Read cycle time, nanoseconds	—	—	—	—	—	—	—
Write cycle time, nanoseconds	—	—	—	—	—	—	—
Bytes fetched per cycle	8	8	8	8	8	8	8
Storage interleaving	4-way	4-way	4-way	4-way	4-way	4-way	4-way
Minimum capacity, megabytes	8	8	16	16	16	16	32
Maximum capacity, megabytes	32	32	64	64	64	64	128
Increment size, megabytes	8	8	8, 16	8, 16	8, 16	8, 16	32
Error correcting memory	Standard	Standard	Standard	Standard	Standard	Standard	Standard
BUFFER STORAGE							
Cycle time, nanoseconds	5.5 ns	5.5 ns	5.5 ns	5.5 ns	5.5 ns	5.5 ns	5.5 ns
Bytes fetched per cycle	64	64	64	64	64	64	64
Capacity local buffer/CPU (KB)	16	16	32	64	32	64	64
Capacity global buffer/MCU (KB)	256	256	256	512	512	512	512
RELOADABLE CONTROL STORAGE							
Capacity	—	—	—	—	—	—	—
PROCESSING UNIT							
Machine cycle time, nanoseconds	—	—	—	—	—	—	—
Relative performance level (est.)	—	1.0	1.4	1.8	2.4	—	3.4
Instruction prefetch	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Processing unit features							
Clock comparator and CPU timer	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Dynamic address translation	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Floating-point	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Direct control	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Instruction retry hardware	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Multiprocessor systems							
Tightly coupled	—	—	—	—	Yes	Yes	Yes
Loosely coupled	—	—	—	—	Yes	No	No
Attached processor system	No	No	No	No	No	No	No
Integrated storage control	Yes	Yes	Yes	Yes	Yes	Yes	Yes
I/O CONTROL							
Integrated channels, standard	8	8	16	16	16	16	16
Integrated channels, optional	24	24	24	24	24	24	48
Data rate, bytes per second							
Byte multiplexer	110K	110K	110K	110K	110K	110K	110K
Block multiplexer	3000M	3000M	3000M	3000M	3000M	3000M	3000M

The 7.800 series is marketed in Austria, Belgium, France, Italy, The Netherlands, Sweden, Switzerland, and South Africa.

Software is one of the most significant aspects of all the models in the Siemens 7.800 range. Siemens has not set out to track IBM's offerings, but has allowed users to transfer from IBM to Siemens with relatively little overhead in software changes. The 7.800 Series is software-compatible with the IBM System/370 and 30XX processors running under MVS/SP1, MVS/SP2, VM/SP, MVS/XA, and MVS/370.

INSTRUCTIONS: System 7.800 processors have a superset of the IBM System/370 instruction set. The additional instructions are hardware-implemented machine instructions that combine the functions of a number of instructions to reduce overhead. All models have 193 instructions.

INTERNAL CODE: EBCDIC.

MAIN STORAGE

STORAGE TYPE: N-MOS semiconductor memory composed of 64K-bit chips is used for all models, except the 7.890 which uses 256K-bit chips.

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There are currently two active subranges, the 7.860 and the 7.890, within the 7.800 series. The two other subranges (comprising the 7.865-2, 7.865-3, 7.870-2, and 7.872-2; and the 7.875-2, 7.880-2, 7.881-2, and 7.882-2) are no longer in production. Within a subrange, one machine can be field-upgraded to another, but this is not the case from one subrange to another. The 7.860 models include the 7.860E, 7.860L, and 7.860R. The 7.890 systems (which comprise Models C, D, E, F, L, M, and S) are by far the most powerful within the 7.800 Series.

Across the entire 7.800 family of 10 systems, considerable attention has been paid to optimizing functional efficiency through a mixture of high-speed buffers used as a cache memory, separate input/output processors, pipe-lining techniques on some models, virtual addressing, and the use of a microprogrammed instruction execution unit. Functional efficiency and reliability are assisted by the use of 64K-bit chips and LSI (Large Scale Integration) which have become characteristics of Japanese computers, such as the Fujitsu range on which the 7.800 series is based. Dual systems with multiprocessing and shared memory are standard on some members of the 7.800 range.

The entry-level subrange, comprising the 7.860E, L, and R, competes with the IBM 4381. The 7.860E is termed a Uniprocessor System and contains one Central Processing Unit (CPU), one Main Storage Unit (MSU) with between 4 and 16 megabytes of main memory, one input/output processor, called a Channel Processor (CHP) by Siemens, one Service Processor (SP), one console, and one hard copy printer. The Service Processor manages communications between the operating system and the operator.

The 7.860L is a Dyadic Processor System which contains two CPUs, two MSUs, two CHPs, one SVP, one console, and one 200 cps printer. The MSU has a minimum storage capacity of 8MB which can be increased to 24MB. Two byte multiplexer channels and ten block multiplexer channels are standard on the 7.860L; the two CHPs can optionally support four additional block multiplexer channels.

The 7.860R Multiprocessor System is a duplicated Uniprocessor System and as such comprises two CPUs, two MSUs, two CHPs, two SVPs, two consoles, and two 200 cps printers. The system has a minimum storage capacity of 8MB which can be increased to 32MB. The two CHPs provide a total of 16 channels of which 2 are byte multiplexer channels and 14 are block multiplexer channels.

The main function of the Channel Processors is to conduct data to the peripherals that are attached directly to them. Each Channel Processor (CHP) services both block and byte multiplexer channels. Each of the processors has a maximum of eight channels. The various permutations of byte and block multiplexer channels that can be attached to these Channel Processors can be found in the Characteristics section of this report under Input/Output Control. An optimizing feature of CHPs is the availability of an address translation facility which reduces the workload on the operating system when virtual addresses are used in pro-

CAPACITY: See Characteristics table.

CYCLE TIME: See Characteristics table.

CHECKING: Error detection and single-bit error correction are standard on all models. If an error is detected and corrected during a data transfer from main memory to the buffer memory, the corrected data is then automatically written back to main memory to eliminate the error.

STORAGE PROTECTION: Each 2KB block of memory has a 7-bit key that includes a 4-bit access code, a reference bit, an alteration bit, and a write-protection bit.

CENTRAL PROCESSORS

There are two CPU models in the 7.800 series: the 7.872 CPU, the smaller of the multiprocessor systems, and the 7.880 CPU, representing the top of the Siemens 7.800 range.

The 7.872 CPU consists of a common main storage unit, two main storage access controllers, two central procesors, and two I/O processors. It is operated from two consoles/service processors. The processors are run under the control of a single operating system with common pools of main storage and peripherals as a closely coupled microprocessor system. Increase in throughput is achieved by balanced multiprogramming which allows the workload to be shared by two autonomous processing systems. A central processor can directly access any I/O processor, and thus any peripheral device. This feature allows the processing performed in the other central processor to be uninterrupted by input/output operations.

Due to the doubling of all the system's main components, the multiprocessor system offers greater reliability than a uniprocessor configuration. The maintenance or failure of one of the processors will normally not interfere with the continuation of the entire operation by the second processor.

The main storage unit (MSU) of the 7.872 consists of 16K-bit semiconductor chips implemented in MOS technology. Its total capacity can be expanded in 1MB increments from 2MB to 8MB. Since the entire storage unit is divided into independent storage banks, parallel processing can be performed in several storage areas, thus reducing access times. The main storage access controllers (MACs) control the data flow between the MSU and the central processors.

The two central processors each comprise two major components, the Storage Control Unit (SCU) and the Instruction Execution Unit, that operate autonomously and increase system efficiency by workload sharing. The SCU contains the hardware address translation feature, through which the majority of all virtual addresses can be translated into real addresses without time-consuming storage accesses. The SCU also contains the high-speed buffer (HSB) or cache.

Data and instructions are passed for instruction processing and execution from the HSB to the instruction execution unit. For increased throughput, the instruction following the one currently being executed is preprocessed (prefetch facility), allowing two instructions to be simultaneously processed. Instruction execution is performed in arithmetic gates composed of LSI circuits operating at switching speeds of 0.7 ns.

The instruction set includes 193 instructions that provide enhanced system control facilities and additional arithmetic operations. In addition to decimal and floating-point arithmetic, floating-point arithmetic with single, double, and extended precision is available. The instructions are implemented as a series of microprograms.

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grams destined to be used by a CHP. This facility is available only on BS 3000 MSP-controlled 7.800 systems.

The second subrange includes 7.890C, 7.890D, 7.890E, 7.890F, 7.890L, 7.890M, and 7.890S. The single-processor 7.890C and 7.890D have a main memory range of 8MB to 32MB, while the Model/E, which is an upgraded Model D, starts with a minimum of 16MB bytes, extendable to 64MB. The Model F is, in essence, an upgraded E with twice the local and global buffer storage capacity. Models L, M, and S are dual-processor systems.

All the 7.890-level machines are based on the Fujitsu Model M380. They have not only the pipelining used on the middle 7.800 subrange, but also have 31-bit real addressing which is needed for MVS/XA implementation, in addition to cache memory, common throughout the 7.800 range.

The 7.890 Models C, D, E, F, L, and M can be equipped with up to three Channel Processors, giving 24 channels, while the 7.890S can support a total of six Channel elements, resulting in a total of 48 channels.

Siemens has developed the BS 3000 MSP operating system for use on the 7.800 Series. It has been designed to handle a broad variety of user requirements on large-scale operating systems. The architecture of the BS 3000 MSP enables the hardware resources to be fully utilized. Batch and online functions can be accommodated by the operating system. It offers multivirtual storage management of 2GB per user and supports up to 1,536 virtual adress spaces. BS 3000 MSP can also support monoprocessors and mulitprocessors with more than one CPU and CHP (Channel Processor).

Software is also available for database management, programming aids, and telecommunications.

The 7.800 range has interface compatibility with the comparable IBM System/370 and 30XX. The 7.800 can be integrated into a hardware and software network with IBM systems.

COMPETITIVE POSITION

The 7.800 competes with the IBM 30XX and 4300 Series. The entry-level 7.860 offers comparable performance levels with the IBM 4381. Specifically, the 7.860E and the 4381 Model 2 are similar; however the Model E sells for approximately 25 percent less than the IBM machine. The top subrange, the 7.890, competes against the 308X; the 7.890F is as powerful as the 3081KX, while the top model, the 7.890S, is comparable to the 3084QX.

Other PCM competitors include the Fujitsu-based Amdahl 580, the Hitachi-based BASF 7/7X and 7/8X, and the NAS Advanced Systems 6000, 8000, and 9000 Series.

The 7.880 CPU incorporates advanced data systems technology and an innovative systems architecture that result in fast internal processing speeds and throughput. In the 7.880, extensive use has been made of LSI circuits. The logical gates involved have switching times of 0.7 nanoseconds.

The Main Storage Unit (MSU) of the 7.880 consists of 16K-bit semiconductor chips effected through MOS technology. Its total storage capacity can be expanded in 2MB stages from 2 to 16MB. Modularly constructed, the 7.880 supports parallel processing in a number of storage areas.

Data flow between the MSU and other system components is controlled by the Main Storage Access Controller (MAC).

The central processor includes three principal autonomous components: Storage Control Unit, Pipeline Unit, and Instruction Execution Unit. The Storage Control Unit manages the data traffic between the central processor and the MSU. This unit contains the hardware address translation feature and the high-speed buffer (HSB) or cache. The HSB has a capacity of 64KB and can operate at the same cycle time as the central processor. Whenever the MSU is accessed, four 8-byte blocks are transferred to the HSB, resulting in a high degree of probability that the next time the data is requested, it will already be held within the buffer.

The Pipeline Unit regulates instruction throughput, supporting multilevel instruction processing. This feature enables the preprocessing of the instructions following those currently being executed. At any one time, up to 5 instructions can be at various stages of processing. If the processor recognizes a branch instruction when decoding an instruction, the subsequent instruction and the instruction located at the probable branch destination address are preprocessed.

The Instruction Execution Unit (EXU) handles operands for instruction execution. In addition to the registers used for storage of information, the EXU also contains the entire arithmetic logic. The 7.880, with its high-speed multiplication and addition facilities, can be well-suited for scientific applications. The instruction set includes 193 instructions to provide enhanced system control facilities and additional arithmetic calculations.

REGISTERS: All models have sixteen general-purpose, 32-bit registers; sixteen (to avoid adjacent numbers) 32-bit control registers; and four 64-bit floating-point registers.

INSTRUCTION REPERTOIRE: The System 7.800 instruction set is comprised of 193 instructions that include privileged, logical/compare, branch, shift, special, decimal, fixed-point, floating-point, and character string handling instructions. The floating-point instructions have single, double, and extended precision.

CACHE MEMORY: All System 7.800 models have a buffer memory of 16K, 32K, or 64K bytes. The 7.890 models also have a global cache of 256KB or 512KB. Data is transferred from main memory to the buffer 32 bytes at a time (four blocks of 8 bytes each), and from the buffer to the CPU 4 or 8 bytes at a time.

CONTROL STORAGE: The 7.860 models have 8K 96-bit words of reloadable control storage; the 7.890 models are microcoded.

DYNAMIC ADDRESS TRANSLATION: The smaller processors can support 15 virtual memory spaces of 16 megabytes each, and the larger models can support up to 128 virtual memory spaces of 16 megabytes each. Virtual addresses (composed of an 8-bit segment number, a 4-bit page

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ADVANTAGES AND RESTRICTIONS

In addition to the normal advantages associated with products from plug-compatible mainframe vendors, the Siemens 7.800 Series offers many fine features. It's a versatile range that can handle both business and scientific applications. Scientific tasks can be implemented through the Instruction Execution Unit, with which both the 7.880 and 7.782 are equipped, that has the capability of performing high-speed arithmetic functions.

Distinct advantages are offered by the BS 3000 MSP operating system. Many IBM program products and IBM-compatible application programs from software houses can run on the BS 3000 MSP without alterations. Compatiblity with IBM software has been achieved in data sets, job control language, and commands. In addition, the software provided by Siemens for database management, data communications, and telecommunications affords the user a broad spectrum of useful packages.

Siemens has added enhanced and new compilers to the series, such as Fortran 77, that increase the throughput of the overall system and facilitate its user friendliness.

The 7.872 and 7.880 CPUs are designed with features that greatly reduce access time to the majority of instructions and data. The pipeline unit of the 7.880 also regulates throughput and supports multilevel processing. A great deal of time is saved through the branching technique employed by the 7.880. Peripherals are attached to the 7.872 and 7.880 through an input/output processor that operates independently of the CPU. The work load on the operating system is reduced when virtual addresses are used in channel programs through the incorporation into the I/O processor of its own address translation feature. Both the 7.872 and 7.880 support parallel processing in many storage areas.

An additional benefit can be derived from the Service Processor (SVP), which has been incorporated into the 7.872 and 7.880 CPUs. The SVP simplifies the operation and maintenance of the computer. It can access all system components through a special interface and offers online maintenance and diagnostic routines. These programs are loaded from two disks integrated in the SVP. The SVP reduces operator workload by taking over functions that used to be performed manually.

USER REACTION

The 1984 Datapro Survey of German Users of Computer Systems brought responses from users of six Siemens 7.800 computers, with an average length of installation of 24 months. The Siemens 7.800 received outstanding responses to the questions, "Did the system do what you expected it to do?", and "Would you recommend the system to another user?" Both questions elicited 100 percent affirmative responses from the six users.

Also of note is the fact that the entry for Reliability of Mainframe received a perfect score of 4.0.

number, and a 12-bit displacement number) are translated by hardware in the Storage Control Unit. To reduce the need to fetch tables from memory, a translation look-aside buffer holds information on those most recently used (up to 512) pages. A segment table origin stack is used to keep track of the virtual space to which each page belongs.

COMPATIBILITY FEATURES: The 7.800 series is software-compatible with the IBM System/370 and 30XX processors running under MVS/SP1, MVS/SP2, VM/SP, MVS/XA, and MVS/370.

Memory on the 7.860E, 7.860L, and 7.860R is four-way interleaved, and the Storage Control Unit fetches 8 bytes at a time from each memory block, transferring 32 bytes at a time to the cache memory. Interleaving on the larger 7.890 models depends on installed capacity and can be up to 8 by 16-way interleaving.

INPUT/OUTPUT CONTROL

CONSOLE I/O: Each processor is equipped with a console that includes a color display, a keyboard, and disk drives. The Service Processor, which is integrated in either the processor or the console, handles operator communications with the system and also runs diagnostic programs. To simplify communications, the operator can use a light pen to select operations from lists displayed by the system.

3805 CONSOLE: This desktop unit contains a three-color display with 80 lines of 27 characters, a single operator keyboard, and two diskette drives for loading microcode and software. A 3803-60 hard copy printer is included. One 3805 is needed with the 7.860E and 7.860L, while the 7.860R uses two 3805 consoles and two 3803-60 printers.

3809 CONSOLE: This desk-sized unit contains one display with keyboard and three diskette drives, and a printer. These are used for loading microcode, loading diagnostic software, and for storing maintenance information. A hard copy printer is also a standard fitting. One 3809 is used with all 7.890 models except the 7.890S, which uses two consoles and two printers.

I/O CONTROL: Peripherals are attached to 7.800 systems via independent Channel Processors (CHPs), which support both byte-multiplexer and block-multiplexer channels and which include their own dynamic address translation hardware for channel commands. The channel interface is designed according to IBM channel interface specifications. A 7.860E system has one CHP with one byte-multiplexer and seven block-multiplexer channels. The 7.860L has two CHPs, and a total of 2 byte-multiplexer and 10 block-multiplexer channels. Four optional block-multiplexer channels can be added into the system. The 7.860R contains two CHPs with 2 byte-multiplexer and 14 block-multiplexer channels. Byte multiplexers have a transfer rate of 40 kilobytes per second (200 kilobytes per second total in burst mode); block multiplexers, 2.0 or 3.0 megabytes per second; and the file controller, 1198 kilobytes per second. The total transfer rate of the CHP is 14 megabytes per second.

The 7.890 models have one CHP, containing one, two, or three channel elements, depending if the system is intended to run under the Siemens operating system BS 3000 MVP, or under IBM operating systems, such as MVS. The permutations of these elements and details of channels can be seen from the table of "Characteristics of the Siemens 7.890.

MASS STORAGE

FIXED DISKS—MODEL 3848: There are 4 variations of the 3848 fixed disk. They are: the 3848-AD4, with a capacity of 2.5GB; the 3838-BD4, with a capacity of 2.5GB; the

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The ratings received by the 7.800 Series, based on a scale of 4.0 for Excellent, 3.0 for Good, 2.0 for Fair, and 1.0 for Poor, are listed in the following table.

	Weighted Average
Ease of Operation	3.00
Reliability of Mainframe	4.00
Reliability of Peripherals	3.83
Maintenance Service:	
Responsiveness	3.33
Effectiveness	3.00
Technical Support:	
Troubleshooting	2.33
Education	2.50
Documentation	2.50
Manufacturer's Software:	
Operating System	3.00
Compilers & Assemblers	3.00
Applications Programs	2.67
Ease of Programming	2.40
Ease of Conversion	2.50
Overall Satisfaction	3.00 □

3848-AE4, with a capacity of 5.0GB; and the 3848-BE4, with a capacity of 5.0GB.

MAGNETIC TAPE UNITS

Siemens currently offers IBM-compatible tape drives with recording densities of 800, 1600, or 6250 bpi.

3854 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 3854 connects to all models via a 3850-1, -2, -3, or -4 controller.

3857 HIGH-DENSITY MAGNETIC TAPE DEVICE: This 9-track unit has a recording density of 640 (PE) or 2460 (GCR) bytes per cm (1600 or 6250 bpi, respectively), a read/write speed of 200 (PE) or 781 (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 magnetic tape devices can be connected to all models via a 3850-1, -2, -3, or -4 controller.

3859 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 magnetic tape devices can be connected to all models via a 3850-1, -2, -3, or -4 controller.

PRINTERS

38051 CONSOLE PRINTER: Two of these units can be connected to the 7.860R. They offer printing speeds of 200 characters per second.

3809 OPERATOR CONSOLE WITH CONSOLE PRINTER: One console printer is attached to the 7.890D and offers a printing speed of 200 characters per second.

CONSOLE PRINTER 3803-90: Two are offered per system for use with the 7.890S, with speeds of 200 characters per second.

3833 PRINTER: A chain printer, the 3833 can print at rates up to 3,500 lines per minute when equipped with a 16-character set and 2,000 lines per minute with a 48-character set. Other sets available have 60, 63, and 120 characters, providing maximum printing rates of 1,477 to 1,060 lines per minute, respectively. Lines can be 132 or 136 characters long, or optionally, 150 characters long. Printing is 10 characters per inch at 6 or 8 lines per inch. An optional two-channel adapter allows the printer to be switched between two 7.800 systems. Character chains are packaged in interchangeable cassettes.

PUNCHED CARD UNITS

3815 CARD READER: This unit reads 80-column cards at up to 1,250 cards per minute. The hopper holds 2,000 cards and each of the two stackers holds 1,800 cards. The unit can be optionally equipped to read mark sense cards and cards containing both punches and marks. A two-channel option also is available.

3816 CARD PUNCH: This unit punches 80-column cards at up to 250 cards per minute and has a 2,000-card hopper, two 1,000-card stackers, and a 200-card reject pocket. The unit can be optionally equipped to print up to 25 lines of up to 64 characters each on cards as it punches them. A two-channel option also is available.

TERMINALS

3886 DISPLAY TERMINAL SYSTEM: This consists of a controller (3884), four choices of display, and separate keyboard (3886-2, 3886-4, 3886-3, and 3886-5), together with options such as a light pen attachment (38802), pass reader (38803), needle printer (3888), and line printer (3889). The actual displays are divided into two groups: the 3886-2 and 3886-4 which each have 24 lines of 80 characters and a 25th line for functions and operating communications; and the color models 3886-3 and 3886-5 which are identical with the other two models, except that they can display green, white, and red for graphic data. There are various keyboard options.

3888 PRINTER TERMINAL: The 3888-3 Printer Terminal is connected as an independent terminal to the 3884 Controller. Equipped with a 1,920-character buffer, to match the characteristics of the display terminals, the 3888 prints at up to 180 lines per minute. The unit prints at 10 characters per inch, 136 characters to the line, and 6 or 8 lines per inch using a 63-character set.

3889-1/-3 PRINTER TERMINAL: The 3889-1 printer terminal is connected as an independent terminal to the 3884 cluster controller. Printing speed is 230 lines per minute. Character spacing is 10 characters per inch with 136 characters per line and 6 or 8 lines to the inch. The 3889-1 uses a 96-character set, and has a data buffer of 4096 bytes.

DATA COMMUNICATIONS

3893-3 COMMUNICATIONS CONTROL PROCESSOR: A programmable subsystem with between 256KB and 512KB of memory which can support up to 352 asynchronous or synchronous half-duplex lines. The processor uses the IBM 3705-II instruction set and supports the BSC and HDLC/SDLC protocols. Data is transferred in burst mode via a channel adapter and either a byte or block multiplexer channel.

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SOFTWARE

BS 3000 MSP OPERATING SYSTEM: Functionally equivalent of and compatible with IBM's MVS/SP operating system, BS 3000 MSP supports 31-bit real and virtual addressing schemes, supporting batch, interactive, and multiuser jobs in a multiprogram environment composed of multiple virtual storage spaces. Each job can have up to two gigabytes of virtual memory, supporting up to 1,536 virtual address spaces.

The 31-bit addressing feature of BS 3000 MSP supports faster DASD input/output operations and also improves system throughput. The 31-bit addressing support feature of the Advanced Functions-Job Entry Subsystem (AF-JES) and its extension increases the user's addressable real storage from 16MB to the system's maximum storage capacity, which is up to 128MB.

BS 3000 MSP consists of the following components: Supervisor; TSS (Timesharing) and JES (Job Entry) subsystems; language processors; and utility programs.

The Supervisor can be divided into the following components: recovery management analysis and recovery of hardware faults and minor system software errors; task management and filing of address spaces and tasks; job management for handling operator commands and jobs in batch mode; data management for the management of space, passwords, catalogs, and access methods such as SAM, PAM, DAM, ISAM, EXCP, and VSAM; resource management control of response time and system throughput; and virtual storage management of main and background storages.

Compatibility with IBM software has been implemented in source, object, and load modules; data sets, job control language, and commands; functions in common with OS/MVS; the execution of IBM license program products and programs developed for use under MVS; and coexistence within an IBM System/370 hardware and software environments.

Additional products of the BS 3000 MSP include JES/E (Job Entry Subsystem/Extended), an alternative spool system to JES that offers hierarchical support of loosely interconnected systems; AOF/OPF (Advanced Operation Facility/Operation Procedure Facility), a system that acts with the assistance of operator commands to react automatically to system events not usually signaled to the operator; JCM (Job Control Macros), user-friendly sequences written, allowing JCL procedures to be nested with JCM; RACF (Resource Access Control Facility), a feature that supports data security measures; DSCF, a DASD space control facility; and PDL/PDA, a performance data logger and performance data analyzer; DSISD (Data Set Integrity for Shared DASD), a software protection for loosely interconnected BS 3000 MSP systems; Job Control Macros, a JCL extension; and AOF (Advanced Operation Facility), a new central component which supports unattended operation when fully utilized.

The BS 3000 MSP also supports a new generation of database and communications software.

DATABASE/COMMUNICATIONS SOFTWARE: The database/communications software product AIM (Advanced Information Manager), is based on CODASYL standards and offers a range of advanced functions. Closely interlaced with the BS 3000 MVP, AIM can be fully integrated into the teleprocessing concept, FNA. When used together, the database section of AIM (AIM-DB) and the data communications portion (AIM-DC) appear as an integrated unit. The flexibility of the design of AIM-DB allows it to be used solely as a batch database system. In the same manner, AIM-DC can be used as an independent data communications monitor.

The most recent announcement, AIM/RDB, a relational database feature, enables users to develop new applications more easily than with a conventional database. Operating under AIM, AIM/RDB is designed so that all data is organized into tables. Through this structure, users can quickly determine the relationships between data elements. Users can use interactive or batch methods with this system. AIM/RDB also offers an interface that allows user programs to handle tables as files by using READ/WRITE statements. The system can be used for personal databases or for shared use by multiple users. An additional feature is the capability of AIM/RDB to redesign current, nonrelational data sets generated by SAM into relational databases.

AIM/VSAM offers exclusive control and recovery of VSAM data sets when a database/data communications system is developed under AIM. It can assist in the development of applications programs.

PROGRAMMING AIDS: The Application Development and Management System (ADAMS) combines and controls various functions needed for the development and control of application programs. ADAMS incorporates the Programming Facility for Display Users (PFD), Generalized Program Editing and Management Facilities (GEM), Cobol, TestCobol, Linkage Editor, Hyper Cobol, and AIM/DB Utility. It also includes such functions as data description information management and program information management. These functions are linked automatically through parameters. ADAMS includes a dictionary that contains program information and data description information for developed application programs.

ADAMS can be purchased as ADAM/B or ADAM/D. ADAM/B is designed for file users and ADAM/D is designed for database users. Each shares the same functions, except that ADAM/B's data description information includes general file information, while ADAM/D's data description information includes data on schemas, subschemas, and general files.

The Programming Facility for Display Users (PFD) performs various display-related functions to facilitate program development and to manage interactive applications programs. Using PFD's interface, users can edit, compile, and link-edit source programs online through the terminal, thereby eliminating the need for cards and line printer output.

The Generalized Program Editing and Management Facilities (GEM) collect and output information on program development and management for progress reports. GEM maintains a history of updated individual modules and programs. Its data compression function sustains efffective use of disk storage; its direct input function controls GEM libraries. When used in combination with PFD, GEM serves as a full screen editor.

The Interactive Programming Facilities (IPF) are a set of programming tools that allow various high-level programming languages to use TSS functions interactively for online program development. Its full-screen input/output processing feature generates logical screens not limited to physical screen size. It can also display multiple logical screens simultaneously.

SCREEN MANAGER supports line-oriented TSS commands and user programs to make use of the full screen function of the Siemens 3880 display. Additional features of SCREEN MANAGER include screen splitting and shifting, program function key definitions, highlighting, and alarm setting. It can also generate a TSS session history.

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ADDITIONAL COMMUNICATIONS SOFTWARE: A teleprocessing system, FNA (Free Network Architecture), can handle all the components in a complex network, providing the same features as SNA, but with many extensions, such as the design of heterogeneous networks, support for remote job entry stations, and support for graphic screens.

The hardware required for FNA includes host processors, communications controllers, data terminals, and connecting paths for linking the components.

MSNF (Multi-System Network Facility) can be used in conjunction with the system control program modules and VTAM to support message transmission between two or more domains. Domains are interpreted as the self-contained portion of a network that includes the functional elements of the SSCP (Systems Services Control Point) in a 7.800 computer, along with resources such as lines, control units, terminals, and programs.

Network Control Program-G (NCP-G) performs in the communication control processor and controls transmission equipment such as modems and network controllers. NCP resources can be reconfigured dynamically without disturbing online job processing or regenerating the network. It is equipped with an HDLC test line feature.

VTAM-G Multiple System Networking Facility allows users to transmit da ta between their application programs or terminals and other host system application programs or terminals.

PRODUCTIVITY AIDS: INTERACT consists of a group of programs that can be operated interactively by the user. It provides data in table format and allows the user to specify a series of processing events, such as data input, retrieval, editing, and output through the use of the tables displayed on the screen.

QUERY is a program that allows the user to retrieve or modify various files and databases for SAM, VSAM, and AIM. It can generate a subfile by sequentially outputting data sets that meet the retrieval criteria. Reports can also be generated through QUERY.

LANGUAGES: Hyper Cobol is a Cobol programming language processor that provides functional units used in common by many Cobol programs, enabling the programmer to generate a program by combining these units. The tester for Cobol programs (TESTCOB) allows the user to debug Cobol programs interactively during program execution in a TSS environment. Fortran 77 offer high-speed compilation, debugging, and program runs. It can also handle interactive jobs and work with relational databases. The Fortran 77 Address Extension Option (Fortran 77 AE) enables programmers to use the 2GB virtual address space. Through the use of this option, large volumes of data can be processed that could not be accommodated by the conventional address space of 16MB. Additional language processors include Testfort 77, Dock/Fortran 77, SSL II, PL/1, TestPL1, APL, Algol, Basic, Pascal, and Lisp.

SERVICE/SUPPORT

REMOTE DIAGNOSTICS: A Siemens service engineer at a service center can directly access a user's 7.800 system through the Siemens Teleservice System MART (Maintenance Assistance by Remote Teleprocessing) using a Teleservice terminal.

MAINTENANCE: The basic contract covers support and services between 0700 and 1800 Monday to Friday excluding public holidays.

TRAINING: 7.800 system operating courses can be run at a Siemens center or in-house. Siemens centers are located throughout Germany, Austria, and Switzerland, as well as in Belgium, Denmark, France, Italy, The Netherlands, Sweden, and Spain. Training courses paid for separately by the user include service of the 7.800, and software installation and operation, and vary in length from three days to two weeks.

PRICING

System 7.800 is available for purchase, lease, and rental. Listed below are examples of basic prices for each model.

EQUIPMENT PRICES

Models	Purchase Price (DM)	1-Year Rental (DM)	2-Year Rental (DM)	Monthly Maint. (DM)
7.860E with 4MB main memory	766.800	51.070	42.900	1.750
7.860L with 8MB main memory	1.285.200	87.020	73.100	2.400
7.869R with 8MB main memory	1.533.600	102.140	85.800	3.500
Additional 4MB main memory	100.000	3.570	3.000	200
7.890C with 8MB main memory	2.199.600	155.700	130.800	8.980
7.890D with 8MB main memory	3.003.300	213.287	179.151	10.740
7.890E with 16MB main memory	4.359.200	263.813	221.603	13.830
7.890F with 16MB main memory	5.244.100	294.000	246.960	15.290
7.890L with 16MB main memory	7.181.300	391.125	328.545	18.980
7.890M with 16MB main memory	8.078.500	436.600	366.700	20.880
7.890S with 32MB main memory	8.943.600	538.125	452.025	21.860
Additional 8MB main memory	262.500	13.787	11.571	790
Additional 16MB main memory	525.000	27.563	23.153	1.580
Additional 32MB main memory	1.050.000	55.125	46.305	3.160