Siemens 7.500 Series

MANAGEMENT SUMMARY

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

Siemens has made the 7.500 family a single, compatible series with one operating system which facilitates a smooth migration path. All of the models are completely compatible with each other and use the same 169 instruction sets as well as the BS2000 operating system.

The 7.531 and 7.536 compete directly against IBM's 4331 Models 1 and 2, respectively, while the 7.541 competes against the larger 4341. The three new top-end models—the 7.551, 7.561, and 7.571 compete against the IBM 3031, 3032, 3033N and the 3033, respectively. The larger Siemens IBM plug-compatible mainframe System 7.800 Series is aimed at existing IBM users, and now extends to exceed the performance of the IBM 3081.

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

The 7.521 and the 7.531 office environment computers are built into a desk enclosure equipped with system keyboard, a second display for interactive applications processing, and a floppy disk drive. Both machines can be operated by non-technical staff. Also intended for use in an office-environment, the 7.536 has a separate operator console.

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

All models, except for the small 7.521 use fast bipolar cache memory to speed up operations. The exact speed and size are shown in the Characteristics table.

Ranging through eight models intended for office-environment or computer-center use, the Siemens System 7.500 Compact Computers provide one of the longest upward migration paths in the industry. All models run under the same BS2000 operating system and are compatible.
MODELS: 7.521, 7.531, 7.536 (office-environment); 7.541, 7.551, 7.552, 7.561, and 7.571 (computer-center envrionment).
MAIN MEMORY: 512KB to 16MB.
DISK CAPACITY: 126MB to 161,280MB.
TERMINALS: No theoretical maximum.
PRINTERS: 600 lpm to 21,000 lpm.
OTHER I/O: Magnetic tape units, card readers, card punches, floppy disk units.
PRICE: CPU prices range from 139,150 DM for the 7.521 to 3,785,600 DM for the 7.571.

CHARACTERISTICS

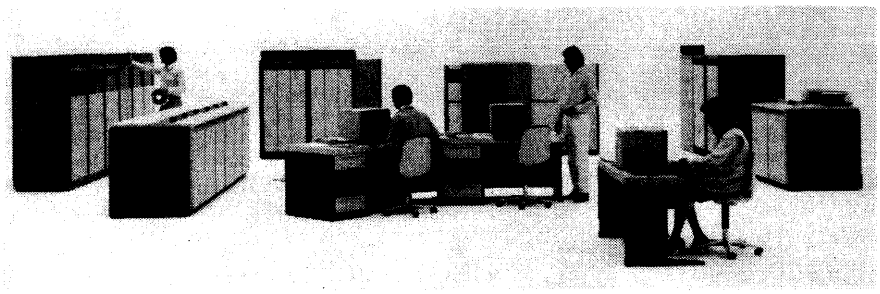
MANUFACTURER: Siemens AG, Bereich Datenverabeitung, Otto/Hahn/Ring 6, Postfach 83 09 51, D-8000 Munchen 83, West Germany. Telephone: (089) 6361. Telex: 521090.

MODELS: System 7.500 Compact Computer office-environment Models 7.521, 7.531, 7.536, and computer-center Models 7.541, 7.551, 7.552, 7.561, and 7.571.

DATE ANNOUNCED: 7.521 and 7.531, April 1979; 7.536, June 1980; 7.541, April 1979; 7.551, 7.561, and 7.571, June 1980; and 7.552, May 1981.

DATES OF FIRST DELIVERY: 7.521, January 1980; 7.531, April 1979; 7.536, April 1981; 7.541, April 1980; 7.551, April 1981; 7.552, July 1981; 7.561, March 1982; 7.571, August 1982.

NUMBER INSTALLED TO DATE: 7.521, 7.531, 7.536 and 7.541 together, over 1300; 7.551, 7.552, 7.561 and 7.571 together, approximately 150.



The System 7.571 is the largest of the eight Siemens 7.500 models, and is approximately as powerful as IBM's 3033 and Siemens' own plug-compatible mainframe 7.872. The basic configuration is composed of the central processing unit, a main memory of four megabytes expandable to 16 megabytes, a cache memory of 64K bytes, and one input/output processor with six block-multiplexor channels. A theoretical maximum of 384 disk drives can be supported.

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TABLE 1. CHARACTERISTICS OF SYSTEM 7.500

MODEL	7.521	7.531	7.536	7.541	7.551	7.552	7.561	7.571
Date of announcement	April 1979	April 1979	June 1980	April 1979	June 1980	May 1981	June 1980	June 1980
Date of first delivery	January 1980	April 1979	April 1981	April 1980	April 1981	July 1981	March 1982	August 1982
Relative performance (370/158 - 3 = 45)	5.8	11	22	33	55	94	130	220
MAIN MEMORY								
Read cycle time, nanoseconds	N/A	N/A	N/A	N/A	N/A	—	N/A	N/A
Minimum capacity, MB	0.5	0.5	2	2	2	4	4	4
Maximum capacity, MB	2	2	4	6	8	8	16	16
Increments, MB	0.5	0.5	1	2	2	2	4	4
CACHE MEMORY								
Capacity, bytes	—	8K	8K	16K	16K	2 x 32K	32K	64K
Read cycle time, nanoseconds	—	240/8 bytes	80/8 bytes	80/8 bytes	80/8 bytes	200/8 bytes	52/8 bytes	52/8 bytes
Hit rate	—	90%	90%	95%	93%	95%	94%	97%
PROCESSING UNIT								
Machine cycle time, nanoseconds	240	240	80-120	80-120	80-120	80-120	52	52
Number of I/O processors	1	1	1	1	1	2	2	2
Bus architecture	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Central operator console	Integrated with CPU	Integrated with CPU	1	1	1	2	1+1	1+1
Add-on auxiliary consoles	—	—	3	3	3	3+3	3+3	3+3
Direct channels for disk storage	4	6	16	—	—	—	—	—
Aggregate data rate, MB/S	1.1	1.74	6	6	16	10.2	28	28
BYTE-MULTIPLEXER CHANNEL								
Number	1	1	1	1	2	2	2	2
Number of trunks available per channel	1 to 3	1 to 5	5	6 to 14	8	8	8	8
Data rate, KB/S	930	930	400	400	400	400	400	400
Trunk data rate, KB/S	20 or 320	20 or 320	280	280	280	280	280	280
BLOCK-MULTIPLEXER CHANNEL								
Number	—	—	2	5	6	4	12	12
Number of trunks available per channel	—	—	2	2	2	2	2	2
Data rate, MB/S	—	—	2	2	2	2	2	2
Maximum number of disk drives	4	6	80	160	192	192	384	384
Teleprocessing Pre-processor	IVR-B Integrated pre-processor	IVR Integrated pre-processor	IVR Integrated pre-processor	CVR Compact pre-processor	CVR Compact pre-processor	CVR Compact pre-processor	DVR Front-end processor	DVR Front-end processor

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

Up to three subconsoles may be attached to the central operator console at distances of up to two kilometers.

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

Main memory ranges from 0.5 megabytes on the two smaller models to 16 megabytes on the two largest models. On the two smaller models, the main memory can be extended in 0.5 megabyte increments to a maximum of two megabytes. The 7.536 memory capacity can be expanded

DATA FORMATS

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

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

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

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TABLE 2. RELATIVE PERFORMANCE OF 7.500 MODELS

MODEL	7.521	7.531	7.536	7.541	7.551	7.552	7.561	7.571
Relative performance								
7.521 = 1	1	2	4	6	9	15	21	35
370/158 - 3 = 45	5.8	11	22	33	58	94	130	220
KOPS	130	240	500	750	1250	—	2700	4500

from two megabytes to four megabytes, and the 7.541 memory can be expanded from two to six megabytes. The minimum capacity on the 7.551 is two megabytes, and four megabytes on the 7.552, 7.561 and 7.571. Memory can be expanded in two megabyte increments to a maximum of eight megabytes (7.551 and 7.552), and in four megabyte increments to a maximum of sixteen megabytes on the 7.561 and 7.571.

INPUT/OUTPUT

On the three smaller models, disk drives are attached to the Direct Disk Storage Adapter (DDSA). On the larger models, they attach to Block-Multiplexer Channel (BLMUX) trunks. A maximum of four, six, and 16 disk drives can be attached to the 7.521, 7.531, and 7.536, respectively. The data transfer rate of the DDSA is 806K bytes per second. The number of BLMUX trunks available for disk units varies from 10 on the 7.541 to 12 on each of the 7.571's two input/output processors. A maximum of 384 disk drives can be attached.

Each BLMUX can also have 256 devices attached to it. The data rate is 1.6 megabytes/second on the 7.531. On Model 7.541, the data rate on BLMUX 1 and 2 is two megabytes/second; on BLMUX 3 to 5, it is 1.6 megabytes/second. The data rate is 2.0 megabytes/second on the BLMUX of the newer models (7.536, 7.551, 7.552, 7.561, 7.571). Aggregate data rates are shown in Table 2.

Slower peripherals—such as tape drives (except drives having read/write rates of 780 kilobytes/second and 1,250 kilobytes/second, card readers and punches, floppy disk drives, central console workstations, and printers—attach to the trunks of the Byte-Multiplexer Channel (BYMUX).

double-word plus 56 bits of the following double-word are used to represent a 112-bit mantissa (28 hexadecimal or 34 decimal digits).

MAIN STORAGE

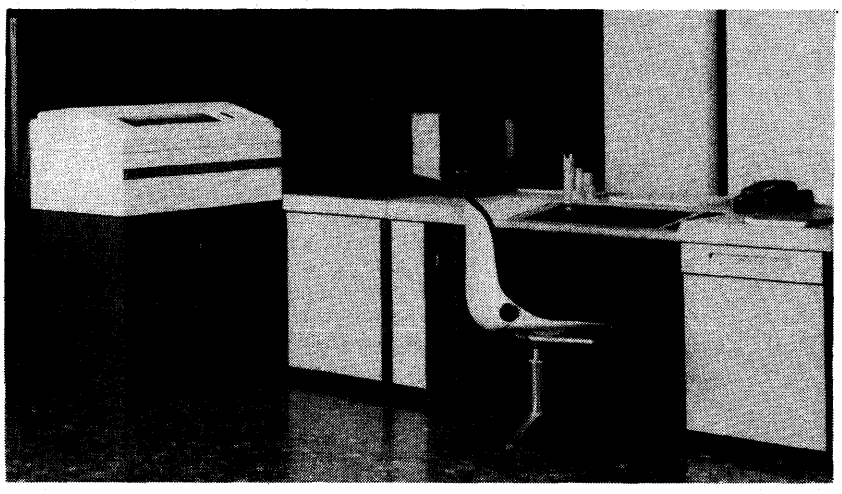
STORAGE TYPE: MOS 64K-bit chips.

CAPACITY: See Characteristics, Table 1.

CYCLE TIMES: See Characteristics, Table 1.

CHECKING: Memory protection, error detection and single-bit error correction are standard on all models. Microprograms continuously perform checking. Automatic instruction retry is standard on all models. The control memory, the registers and all data paths are subject to parity checking. All the data in the memory is checked by an 8-bit Hamming code. One bit errors are corrected while multiple-bit errors are noted on Models 7.521 through 7.522; 2-bit errors are corrected on Models 7.561 and 7.571. There are also error recovery routines built into the BS2000 operating system. Detailed information (four error words) concerning detected machine errors and the internal status of the machine at the time the error was detected is logged automatically by the hardware and stored in main memory.

STORAGE PROTECTION: A main memory access control provides both read and write protection and prevents unauthorized access to main memory or modification of the main memory contents. Storage protection is implemented by dividing main memory into 2K-byte blocks and assigning a 5-bit storage key to each block. Four of these bits specify the actual protection key for a specific block. The fifth bit determines 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.



As the 7.500 Series entry-level model, the 7.521 compact computer comes with 512K bytes of main memory and is built into a desk enclosure with system keyboard/display, floppy disk drive, a direct disk storage adapter, and a 600-line-per-minute printer. The 7.521 can be operated by non-technical staff in an office-environment. □

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A BYMUX permits addressing of up to 256 units, which can operate concurrently in the time division multiplex mode. Subchannel registers for the BYMUX and BLMUX are located in a reserved section of main memory called the shadow memory and are unavailable to the user. The number of BYMUX trunks and data rate for each model are shown in the Characteristics Table.

PERIPHERALS

There are six exchangeable disk drive models with storage capacities ranging from 63 to 300 megabytes and average access times of 37.5 to 42.5 ms. There is also a fixed-disk storage unit with a capacity of 420 megabytes and an average access time of 32.5 ms. Two disk drives with capacities of 63 and 126 megabytes have been designed especially for the 7.500 Series.

Available magnetic tape units (800, 1600, or 6250 bpi) have read/write speeds from 20K to 1,250K bytes per second depending upon model and density used. Units with a recording density of 6250 bpi and read/write speeds of 780 to 1,250 bytes per second can be attached only to the Model 7.537 upwards.

There are three impact printers available with speeds ranging from 600 to 2,000 lines per minute, depending on model and character set. The normal 64-character set used is the OCR-B font. For the Models 7.521, 7.531, and 7.536 one may choose from two printers: 600, or 1,200 lines per minute. The high-speed printer (2000 lpm) and the laser printer (21,000 lpm) are available only on Models 7.541 up.

Card readers (80-column cards) with a reading rate of 660 or 1,000 cards per minute and card punches operating between 100 and 300 cards per minute are available; there is also a 90-column card option.

The "multiple floppy disk" I/O unit compares either one or two stations with a hopper and a stacker. Each can hold up to 17 floppy disks. A standard (256K-byte) floppy disk drive is available for all 7.500 models. A second drive can be attached to the Models 7.521, 7.531, and, using a second operator console, to Models 7.561 and 7.571 as well.

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

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

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

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

CENTRAL PROCESSORS

There are currently eight models in the 7.500 Series. These models can be divided into two classes: office-environment, and computer-center. The 7.521, 7.531, and 7.536 belong to the office-environment classification. The 7.521 and 7.531 have desk-type architecture, and the 7.536 is a free-standing computer with a separate central operator console. The 7.541, 7.551, 7.552, 7.561, and 7.571 have been designed for operation in larger computer-centers with air-conditioning facilities.

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

The two smaller CPUs, the Model 7.521 and Model 7.531, are built into desks. Included as standard on both models are a keyboard, a monitor screen, and a maintenance panel. In addition, each model in its basic configuration offers a 1920-character display terminal for interactive communication.

The larger models, from the 7.536 upwards to the largest 7.571, are physically different from the two smaller models and all have a central operator console for operator-system dialogue.

The dual-processor Model 7.552 permits system operation via two Central Operator Consoles, each of which can support a console printer for logging, a diskette drive for I/O or user data, and up to three subconsoles with screen, keyboard, and optional printer.

All models have virtual addressing capabilities with dynamic address translation. A working space of up to eight or 16 megabytes is available to each user, depending on the model.

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

The CPU of the Model 7.536 has three hardware components: the 32-bit processing unit, a control unit, and a memory access unit. The microprogrammed control unit monitors and optimizes central processor operations, and the independent memory access control unit makes it possible for program processing and memory traffic to be handled in parallel.

The CPU of the Model 7.541 comprises the central processor, the memory system (main memory, memory access control, and cache memory), and the integrated I/O system

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end processor. The entire range of BS2000 Transdata products can be attached to all the pre- and front-end processors.

Teleprocessing software consists of the "Program System for Teleprocessing and Network Control" (PDN) and programs in the BS2000 operating system.

Siemens considers data security extremely important and has provided a number of ways to protect data and the system. Terminals can be locked by a keyboard switch and can be protected by a badge reader against unauthorized use. In addition, the operating system prevents unauthorized access by making the operator identify himself with an identification code. Another feature prevents memory accesses outside the address space for a particular task and prevents unauthorized access to disk files. A check is made of the user group, user name and password before a user can have access to data in the data base.

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

SOFTWARE

Compilers are available for Cobol, Fortran, PL/1, SPL, Basic, APL, Algol, Pascal and RPG II. Programs can also be written in Assembler.

To simplify system operation, Siemens has modified the BS2000 operating system to provide a more "friendly" interface. Users can operate the system with a set of some 20 commands and can control all important functions with the help of an additional 30 commands.

An innovative training system called "Teachware" familiarizes operators and users with the BS2000 commands. Programmed instructions enable those who are already familiar with computer systems to teach themselves via an integrated video terminal about the System 7.500 and BS2000. An operator can learn at his own pace in a real life environment.

The complete BS2000, with approximately two million instructions, supports all types of operations; i.e., timesharing, transaction processing, and local and/or remote batch processing. It has been designed to cover the entire computer performance range. On the smaller models, BS2000 is customized to meet the exact requirements of the configuration ordered. All 7.500 models permit the customer to choose at system generation the amount of virtual memory per user (one to four megabytes). From a programmer's viewpoint, a major advantage of the BS2000 is its uniform command language in all modes and at all levels of operation.

System 7.500 software tools, application software packages, and the data base/data communications management tools are priced separately. The Universal Transaction Monitor (UTM) provides program management, message commu-

(channel control unit with one byte- and two block-multiplexer channels). The CPU reads and writes eight bytes at a time, while the memory system writes eight bytes and reads four by eight bytes in quadruple streaming. The software-transparent 16K-byte cache is divided into two 8K-byte banks, each with 256 rows of 32 bytes each.

The Model 7.551 has the same architecture, but differs from the older 7.541. The central processor is made up of the 32-bit processing unit, the transfer unit for memory access, and the control unit. Memory traffic and program processing can run in parallel.

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

The Model 7.551 CPU is microprogram-controlled and includes a high-speed control memory. Siemens says the 16K-byte bipolar cache memory provides a hit rate of 93 percent.

The I/O processor of Models 7.536, 7.551, 7.552, 7.561, and 7.571 is a 32-bit microcoded data bus system and is made up of two processors—the command editing unit and the transfer unit—and control units with byte- and block-multiplexer channels. The I/O processor is linked to main memory via memory access control.

The Model 7.552 is a dual-processor model with one main memory, two memory access controls, two cache memories, and two microprogrammed central processors. Each central processor has a channel control unit with two block-multiplexor and one byte-multiplexor channels.

The Models 7.561 and 7.571 have similar architecture, but differ from the smaller models. Their components include the central processor, the input/output processor, and main memory. The central processor is composed of the cache memory, the instruction processor and a control memory, command execution processor, and another control memory linked to the input/output processors (including an edit unit, a transfer unit, and channel control) via the coordinator. The central processor is linked to the main memory via the cache and memory access control. Both the 7.561 and 7.571 use 5-level pipelining.

SERVICE PROCESSOR: An integral part of the 3026-1, 3026-2 and 3020-3 central operator consoles is the service processor (SVP). This separately-powered subsystem is made up of a microprocessor with a 64K-byte main memory and two floppy disk drives (one for the system and one for maintenance) and is housed in the central operator console. The SVP connects to the central processor and the I/O processors via a special interface.

All local maintenance procedures and diagnostic routines are carried out by the SVP, which is also responsible for editing error information, producing messages in clear text, and supporting error recovery when a malfunctioning component or the operating system can no longer perform this task. Remote maintenance is facilitated via the 3026-2 console.

INSTRUCTION REPERTOIRE: The system 7.500 processors all employ the full 7.700 Series set of 169 instructions, including facilities for processing variable length, decimal, and fixed-point binary operands. The floating-point instructions provide single, double, and extended precision. Extended-precision instructions handle operands with a 112-bit mantissa (28 hexadecimal or 34 decimal

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nication, storage management, log file, transaction control, and integrated format control for transaction processing applications.

Via the System 7.500, Siemens is promoting the concept of the "development computer," a problem-solving approach aimed at improving software development productivity during analysis, design, implementation, and maintenance. Emphasis is put on interactive programming and on providing programming hardware at the actual workplace of the engineer, designer, or programmer. Tools available to facilitate software development and maintenance are BYBLOS (design and documentation, Colombus (structured programming), Testmanager and MMS (test and measurement); FMS and David (file management), Cotune and Fortune (program run analysis), GPSP (macroprocessor), Formplag (editing and checking terminal imput), and Doculity (test editing).

Siemens feels that delegating software development tasks to a separate, relatively low cost compact computer guarantees independence from computer-center operations, provides constant availability, and removes the development burden from the production operation.

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

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

COMPETITIVE POSITION

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

As the computer market is far from homogeneous throughout Europe, the Siemens 7.500 faces competition from various vendors. However, one competitor everywhere is IBM, the industry leader. As on previous occasions, Siemens is following its usual marketing strategy of matching models against IBM.

digits) while double precision floating-point instructions handle operands with a 56-bit mantissa. The breakdown of the 169 instructions is as follows: 13 privileged, 21 data transfer, 8 branch, 13 logical, 14 binary, 22 fixed-point, 11 decimal, 51 floating-point, 3 stack, 4 edit, and 9 miscellaneous.

INDIRECT ADDRESSING: Yes.

DYNAMIC ADDRESS TRANSLATION: Virtual addresses of active pages are converted to corresponding real addresses by means of a 2-level translation system based on 2K-byte pages and 32-page (64K) segments. If there is no hit in the Address Translation Memory (ATM), the search continues in the segment and page tables stored in main memory.

The Address Translation Memory (ATM) guarantees a first level hit in the search for a page in 90 to 95 percent of all cases under normal program conditions.

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

REGISTERS: There are no index registers; but there are 434-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.

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

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

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

CACHE MEMORY: The CPU's of all models, except Model 7.521, contain a high-speed cache memory between main memory and the processor. Its function is to buffer instructions and data prior to processing. During each read operation required by the central processor, a check is made as to whether the addressed item of information is present in the cache. In the Model 7.531, the 8K-byte cache is located

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

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

The four top-end models—the 7.551, the 7.552, the 7.561, and the 7.571—compete against the IBM 3031 or 4341 Model 2, 3032, 3033N or 3033S, and the 3033, respectively.

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

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

This range is facing increasing competition from Japanese-based models such as the BASF 7/60 and 7/70. Many manufacturers now produce systems, incorporating advanced technology in the form of microprocessor controlled input/output processors, which are workstation-oriented. These manufacturers include ICL, Ericsson, DEC, Data General and many microcomputer suppliers.

ADVANTAGES AND RESTRICTIONS

The main advantage of the Siemens 7.500 System is that it contains eight compatible models with a wide range of capabilities. This gives considerable flexibility to a user who can upgrade an existing 7.500 computer to a more powerful model without the need for new software or peripherals. The eight models run under one operating system, BS2000 and use the same instruction sets. From the User Ratings section of this report, it appears that most users are satisfied with the Siemens 7.500 line.

USER RATINGS

The 1983 Datapro survey of German computer users brought responses from 54 users of the 7.500 series: three 7.521 users; 17 7.531 users; 19 7.536 users; and 15 7.541 users. The number of systems represented totaled 59. The users rated the systems on a scale of four (Excellent) to one (Poor). The responses are summarized below:

between main memory and the coordinator and reduces access time to 250 ns 90 percent of the time.

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

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

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

The 7.552 has two cache memories (one for each CPU) with four 8K-byte banks for a total of 64K. Each bank is 32 bytes wide with 64 entry locations. While the cycle time is not available, Siemens says the hit rate exceeds 95 percent.

The 7.561 has two 16K-byte banks, or a total cache of 32K bytes. There are 1,024 entry locations of 16 bytes each. The cycle time is 52 nanoseconds, with a hit rate of 94 percent.

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

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

CONTROL MEMORY: On all models, the control memory stores microprograms for controlling the CPU and I/O processor and provides buffers for the channel and function registers. On the 7.521 and 7.531, the microprograms are loaded automatically from floppy disk into the 32K-byte control memory during the initial program loading. Control memory is a reserved portion of main memory. On the Model 7.541, the microprograms are loaded from the floppy disk drive into the writeable control memory (capacity 61K bytes) which is separate from main memory. In order to detect errors which might prevent the operating system from starting, a quick test is made before entering the microprograms. This microprogrammed function test checks the central processor, the control memory, the main memory system, and the I/O system. On Models 7.536, 7.551, 7.552, 7.561, and 7.571, the control memories of the processors are loaded from the shadow memory on demand.

SHADOW MEMORY: Model 7.536 is the smallest of the series provided with a shadow memory. A reserved part of main memory, this area is used to store microprograms for all components of the CPU and to store information on connected peripherals for the I/O processor. Shadow memory is loaded from the diskette drive and also stores information on machine errors, error logout data, and diagnostic routines. Inaccessible to the user, shadow memory occupies about 130K bytes, depending on the system configuration. Each additional 64 attached peripherals require an additional 4K bytes of shadow memory.

OPERATIONAL MODES: There are four processor states:

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

Siemens 7.500 Series

	Excellent	Good	Fair	Poor	WA*
Ease of operation	5	43	7	0	3.15
Reliability of mainframe	24	25	5	0	3.35
Reliability of peripherals	10	31	12	1	2.91
Maintenance service:					
Responsiveness	11	29	13	0	2.91
Effectiveness	6	24	19	1	2.50
Technical support:					
Trouble-shooting	2	26	18	2	2.58
Education	2	24	21	1	2.28
Documentation	1	25	21	2	2.57
Manufacturers software:					
Operating system	11	37	6	0	3.23
Compiler & assemblers	7	39	8	0	3.00
Application programs	2	21	13	2	2.61
Ease of programming	2	36	8	0	2.87
Ease of conversion	2	30	10	0	2.81
Overall satisfaction	3	40	9	0	2.88

*Weighted Average on a scale of 4.0 for Excellent.

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

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

SIMULTANEITY: Memory is interleaved in the 7.521 and 7.531 so that eight bytes are fetched from alternate memory banks resulting in 16 bytes being fetched during a single memory read cycle. Instruction execution is overlapped on Models 7.541 to 7.571 by dividing the central processor into an Instruction Processor and an Execution Processor.

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

The Model 7.536 Input/Output Processor is made up of the following components: an editing unit, a transfer unit, an integrated terminal controller, one byte-multiplexor channel, two optional block-multiplexor channels, and one DDSA. Both the editing unit and the transfer unit are autonomous microprogrammed processors.

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

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

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

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

The I/O system of the 7.552 contains two channel control units with byte- and block-multiplexor channels; the latter are equipped with exchange and intermediate buffers and a buffer control unit. The system does not have an integrated terminal controller nor a DDSA.

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

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

The transfer rate of an individual byte-multiplexor trunk varies from 60 kilobytes/second for 7.521 or from 20 kilobytes/second to 320 kilobytes/second for Model 7.531 depending on the mode of operation; i.e., multiplex or selector. In multiplex mode, several devices can share the same trunk, while in selector mode, only one I/O device can use a trunk. I/O devices attached to individual byte-multiplexor channel trunks may simultaneously perform I/O operations as long as the aggregate data rate is not surpassed.

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

Various speed peripherals connect to the 7.536 by a standard BYMUX, two optional BLMUX's, or by one DDSA; terminal workstations are connected via the integrated terminal controller. Slower peripherals are attached to the BYMUX, faster peripherals to the BLMUX, and disk drives to the DDSA.

The BYMUX on the 7.536 has eight trunks, three of which are taken up by (a) the central operator station, which

includes the 30263 floppy disk I/O, the 30262 console printer, and control screen plus keyboard; (b) the 3336-5 system printer; and (c) an additional optional integrated terminal controller. This leaves five trunks for the slow peripherals. The cumulative rate for the BYMUX is 400 kilobytes per second. The data rate for each trunk is 280 kilobytes per second.

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

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

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

Three more 75414 Block-Multiplexor Channels can be added. Each block-multiplexor channel provides the means of attaching 256 I/O devices that can operate in both multiplex and selector mode. The maximum transfer rate is 2,000 kilobytes/second for channels 1 and 2 and 1,600 kilobytes/second for channels 3 to 5.

Each block-multiplexor channel is fitted with two 16-byte exchange buffers and a 2-byte intermediate buffer. This feature allows parallel servicing of data requests, resulting in optimization of data throughput. In the multiplex mode, I/O operations are divided into blocks. In the selector mode, only a single I/O operation can be performed at one time on a trunk. The total transfer rate of the 7.541 I/O system is 6,000 kilobytes/second.

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

The 7.552 features two channel control units with one byte- and two block-multiplexor channels each. These control units coordinate simultaneous operation between the channels, switching data paths between the two central processors and enabling either to access all peripherals. The BLMUXs have exchange and intermediate buffers to facilitate parallel processing of data requests to main memory and to external devices. The aggregate transfer of the I/O system is 10.2 megabytes per second.

The 75522-2 expands the BYMUX by eight trunks to a total of 16, and the 75524-12 adds eight BLMUX channels with two trunks each, for a total of 16 trunks for fast peripherals.

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

The 7.571 multiplexor configuration is the same as the 7.561, except that six BLMUX's are included as part of the basic configuration.

The data rates of the BYMUX and BLMUX on the 7.536, 7.551, 7.552, 7.561, and 7.571 are all the same: 400 kilobytes per second per BYMUX, 280 kilobytes per second per BYMUX trunk, and two megabytes per second per BLMUX.

The aggregate data rates are: 7.536—six megabytes per second, 7.551—16 megabytes per second, 7.552—two megabytes for each of the first four BLMUX channels; 1.6 megabytes for each additional one, 7.561—16 megabytes per second for one I/O processor, and 7.571—28 megabytes per second for two I/O processors.

CONSOLE I/O: The consoles of the 7.521 and the 7.531 are built into a workstation with an integral system keyboard/display and a floppy disk drive. Another display for interactive processing is optional on the 7.521, standard on the 7.531. The system display provides 12 lines of 80 characters; the optional display provides 24 lines of 80 characters. The larger 7.541 has its own separate 3026-1 central operator console. Models 7.536, 7.551, 7.561, and 7.571 all have their own separate 3026-2 central operator console. With the exception of the 7.521 and the 7.531, up to three subconsoles may be attached.

3026-1 CENTRAL OPERATOR CONSOLE: This console for the Model 7.541 includes a video terminal (16 lines of 80 characters), keyboard, and control panel. A 30262 console printer and a 30263 floppy disk unit are optional. The latter can be used to enter relatively small amounts of user data. The console also contains a service processor for IPL, diagnostic IPL, and improved maintenance. The 7.541 system may be enhanced by attaching either the 3025-10 or 3024-10 subconsole to the service processor. Subconsoles may be located up to 10 km from the central processor, and up to three subconsoles may be attached.

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

3026-3 CENTRAL OPERATOR CONSOLE: Required on systems with two I/O processors, this console must be used in conjunction with the 3026-1 or 3026-2 console. It is connected to the common service processor in the 3026-1 or -2 and includes a VDU, keyboard, and modified control panel. A 3026-2 console printer and a 3026-3 diskette unit are optional. To separate service processor messages from system dialog, the VDU switches to split-screen operation; however, the operator can mask the SVP's messages to clear the screen for system dialog. SVP messages are buffered for later retrieval. A scrolling function allows the operator to read forward and backward through message queues.

The 3026-3 can be attached at a distance of up to 50 meters from the 3026-1 or -2 consoles. Up to three 3026-10 subconsoles with monitor screen, keyboard, and optional printer are supported by the 3026-3.

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3026-10 SUBCONSOLE: This console includes a video terminal (24 lines plus one status line, 80 characters per line), a keyboard, and a control panel. The 30262 console printer (90 characters per second) can be attached optionally.

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

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

TELEPROCESSING

All models of the System 7.500 provide for teleprocessing operations. For short distances of up to 2,000 meters, Models 7.531 and 7.536 include as standard equipment, an Integrated Terminal Controller (ITC), which is optional on the 7.521 (ITC B). If both local and remote communications are required, the ITC is replaced by an Integrated Front-End Processor (IFEP). Teleprocessing on Models 7.541, 7.551, 7.552, 7.561, and 7.571 is supported by a Transdata 960 Communication Computer System comprising 968X front-end processors, 967X remote front-end processors, and 966X terminal computers. Control software consists of the Transdata PDN (Program System for Teleprocessing and Network Control) operating system and the DCM (Data Communications Method) access system. The Transdata system makes message-handling transparent to the user.

Transdata terminal computers can be programmed in APS (Application Programming System) or in Cobol 9600, a subset of the System 7.500 Cobol.

Mid-range 7.500 systems use Transdata 9684 or 9687 front-end processors. The large Models 7.561 and 7.571 use the Transdata DVR 9687 front-end processor. All front-end processors support the entire range of Transdata BS2000 devices. Network modules include data transmission facilities, Model 8901/2/3 concentrators, and Model 8906 interface expanders. Terminal sybsystems that can be supported include the Model 810 terminal system with data display terminals, cluster controllers, and printers such as the Model 8112 printer terminal, and the Model 970 terminal system with both terminals and printer terminals.

75218/75318/75368 INTEGRATED TERMINAL CONTROLLER (ITC): An option on the Model 7.521 (ITC B) and standard on Models 7.531 and 7.536, the ITC supports up to four 8160-7 data display terminals or 8112-7 printer terminals at distances up to two km. To expand the number of terminals, a Line Trunk Unit for the ITC permits up to four trunks to be added. Up to three Line Trunk Units may be added, providing a maximum of 16 terminals (12 via the three line trunk units and four via the ITC). To increase the number of terminals on the 7.531 and the 7.536 beyond 16, one 75318/75368 line trunk extension may be added, supporting up to four 8160-7 data display terminals and up to three trunk units, providing a maximum of 16 or more terminals.

75419/75519 COMPACT FRONT-END PROCESSOR (CVR): The CVR's are used for connecting the various terminals and communication facilities of the Transdata range to Models 7.541 and 7.551. There are up to 32 trunks for local terminals (two km) or up to 12 long distance lines. The 96511/12 and 96520/21 block buffers are used for MSV/LSV and HDLC protocols, respectively. Line speeds of up to 9,600 or 48,000 bits per second are possible. The number of long distance lines is reduced when more than 12 local terminals are connected. The standard CVR memory is 256K bytes and can be expanded by 128K bytes.

CONFIGURATION RULES

MODEL 7.521: As the 7.500 Series entry-level model, the 7.521 comes with 512K bytes of main memory, a keyboard with monitor screen, one video terminal, one floppy disk drive, one byte-multiplexor channel with an attachment for the printer, one direct disk storage adapter (DDSA) with two trunks, and a 600-line-per-minute printer.

Main memory can be expanded to two megabytes. Disk drives attach directly to the DDSA trunks and a maximum of four disks can be supported, yielding a mass storage capacity of 1,680 megabytes. It is possible to add three more extension trunks to the byte-multiplexor channel. The basic configuration does not include a terminal controller nor front-end processor. If required, the ITC B or IFEP B can be installed. A maximum of 16 terminals can be connected directly into the system via the ITC B.

As a stand-alone, medium-scale computer, the 7.521 does have its limitations, but when used as a second computer for program and systems development for which it is also intended, the entry-level model is functionally ideal. In addition, the 7.521 is suitable as a node in a network.

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

Main memory can be expanded in 512K increments to two megabytes. A maximum of six disk drives can be supported by the disk storage adapter, yielding a maximum on-line mass storage capacity of 2,520 megabytes. It is possible to add five more extension trunks to the byte-multiplexor channel. Up to 32 display terminals may be supported through the terminal controller.

MODEL 7.536: At the top-end of the office-environment computer class is the Model 7.536. Unlike the 7.521 and the 7.531 compact computers, which have a desk-like design and an integrated central operator console, the 7.536 is a free-standing computer housed in one cabinet with a separate central operator console like the Model 7.541. Nevertheless, it can be used in an office-environment. It is also possible to add three auxiliary consoles.

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

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

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For long distance teleprocessing, the entire range of BS2000 Transdata products can be linked to the integrated front-end processor (IFEP) as on the 7.531. For short distances, up to 2,000 meters, the 7.536 uses the same integrated terminal controller (ITC) as the 7.531, permitting up to 32 display or printer terminals. As an option, two block-multiplexor channels can be added. The maximum total data rate for all channels is six megabytes per second, the same as on the 7.541 and over three times the rate on the 7.531.

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

Main memory can be expanded in two megabyte increments to six megabytes. The byte-multiplexor channel trunks can be expanded to a total of 14, and three more block-multiplexor channels can be added.

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

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

The mass storage devices connect to disk controllers with a maximum of 32 disk units per controller. The disk controllers connect to the block-multiplexor. As there are a maximum of six block-multiplexors and each block-multiplexor can support one disk controller, the 7.551 can theoretically handle up to 192 disk units for a maximum on-line capacity of 80,640 megabytes. The block-multiplexor channel can also address up to 256 devices per channel. A second byte-multiplexor with eight trunks is offered as an option on the 7.551. The byte-multiplexor is used for the slower peripherals. Up to three 3026-10 subconsoles may also be attached up to 2,000 meters away. As with the 7.541, teleprocessing is implemented through the 75519 compact pre-processor and the modular Transdata 960 data communication system. The entire range of BS2000 Transdata products can be added.

MODEL 7.552: The first dual-processor model in the family, the 7.552 requires a computer-center environment. Main memories of four, six or eight megabytes are available, but the basic configuration is four megabytes with duplicate operator consoles, SVPs, and I/O processors. One BYMUX and two BLMUX channels are standard. The entire range of Transdata BS2000 products can be attached, as can numerous other options, including subconsoles, printers, terminals, and mass storage devices.

MODEL 7.561: Based on a hierarchy of different speed and different size memories as well as two separate input/output processors, the 7.561 offers more or less the same computing power and features as IBM's 3032, 3033N and 3033S, Honeywell's DPS 8/70 mono- and bi-processors and Univac's 1100/82. Siemens also intends to produce bi-processor configurations of the system in the future. The 32K-byte, 52-nanosecond cache memory is larger and faster than those on the smaller models. Each I/O processor handles up to six block-multiplexors and one byte-multiplexor. Each byte-multiplexor channel has up to eight trunks while each block-multiplexor has two for a total of 12 trunks for each I/O processor. The aggregate data rate for both I/O processors is 28 megabytes per second. Each block-multiplexor channel has a maximum data rate of two megabytes per second, and the data rate of the byte-multiplexor is 400K bytes per second, the same as on the other models.

The basic configuration is make up of the central processing unit, a main memory of four megabytes, a cache memory of 32K bytes, and one input/output processor with four block-multiplexor channels and a byte-multiplexor channel. Expansion capabilities include a maximum of 16 megabytes of main memory, six block-multiplexor channels per I/O processor, and a second I/O processor. The mass storage devices attach to the disk controller, which attaches to the block-mulitplexor. Theoretically, the 7.561 can handle up to 384 disk drives.

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

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

The main difference from the 7.561 is that the cache is twice the size (64K), and the basic configuration has six block-multiplexor channels against the four on the 7.561.

MASS STORAGE

Four mass storage devices with capacities ranging from 63 to 420 megabytes are available for use on all System 7.500 models. Two of the disk drives, the 3454 and the 3464, have been produced specifically for the 7.500 Series. The 3468 and the 3470 are also available on the System 7.700. Four additional models, the 3450, the 3455, the 3460, and the 3465, can be attached to Models 7.536, 7.541, 7.551, 7.552, 7.561, and 7.571. The devices are connected either via the trunks of the disk storage adapter on the 7.521, 7.531, or 7.536, or disk controllers on the other models.

For the number of disk units which can be attached to each model, see the Characteristics Table 1.

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

3464 DISK DRIVE: This removable-disk drive has nine recording surfaces with 808 tracks each and a capacity per track of 16,384 bytes for an overall capacity of 126 mega-

bytes. The data transfer rate is 806 kilobytes per second. Average access time is 37.5 ms, and rotational speed is 2400 rpm. The 3464 disk drive connects to all models of the System 7.500.

3468 DISK DRIVE: This removable-disk drive has 19 recording surfaces with 808 (plug 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 all models of the System 7.500.

3470 FIXED-DISK DRIVE: This device has 19 recording surfaces with 1,350 tracks each, including spares, and a capacity per track of 16,384 bytes for an overall capacity of 420,249,600 bytes. The data transfer rate is 806 kilobytes per second, the average access time is 20 ms, and rotational speed is 2400 rpm. Average bit density is approximately 6000 bpi (roughly 240 bits per mm). The 3470 connects to all models of the System 7.500.

3450 DISK DRIVE: This removable-disk drive has 19 recording surfaces with 404 tracks each, and a capacity per track of 13,030 bytes for an overall capacity per spindle of 100,018,280 bytes. The data transfer rate is 806 kilobytes per second, the average access time is 30 ms, and rotational speed is 3600 rpm. The 3450 connects to Model 7.536 and up.

3455 DISK DRIVE: This removable-disk drive has nine recording surfaces with 404 tracks each, and a capacity per track of 19,750 bytes for an overall capacity per spindle of 71,811,000 bytes. The data transfer rate is 806 kilobytes per second, the average access time is 25 ms, and rotational speed is 2400 rpm. The 3455 connects to Model 7.536 and up.

3460 DISK DRIVE: This removable-disk drive has 19 recording surfaces with 808 tracks each, and a capacity per track of 13,030 bytes for an overall capacity per spindle of 200,036,560 bytes. The data transfer rate is 806 kilobytes per second, the average access time is 30 ms, and rotational speed is 3600 rpm. The 3640 connects to Model 7.536 and up.

3465 DISK DRIVE: This removable-disk drive has nine recording surfaces with 808 tracks each, and a capacity per track of 19,750 bytes for an overall capacity per spindle of 143,622,000 bytes. The data transfer rate is 806 kilobytes per second, the average access time is 25 ms, and rotational speed is 2400 rpm. The 3465 connects to Model 7.536 and up.

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

Apart from the standard disk initialization, as used in the Transdata 920 Floppy Disk Data Entry System, floppy disks can also be initialized and processed with variable formats on the 3170. Thus it is possible via the 3170 Floppy Disk I/O Unit to read data stored by various systems on floppy disks into a Siemens System 4004 or 7.700 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. Each I/O station has a 4,096-byte buffer for data storage of one complete track as standard and a stacker capacity of 17 floppy disks. Feed, alignment and stacking of the floppy disks are fully automatic.

The controller is microprogrammed and consists of a fast bipolar LSI microprocessor. The data medium has a standard storage capacity of 1,898 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 4,096 bytes, corresponding to a number of 26 down to one sector per track.

The maximum reading rate is 4,680 records per minute (standard format), and the maximum writing rate is 3,120 records per minute (standard format).

Rotational speed of the 3170 is 360 rpm, with a recording density of 3200 bpi, and an average access time of 242 ms. Data is organized into 77 tracks consisting of 74 data tracks plus three spares. In standard format, there are 26 sectors per track and 128 bytes per sector to give a maximum disk capacity of 242,272 bytes. In variable format there can be 26, 15, 8, 4, 2, or 1 sectors per track and 128, 256, 512, 1,024, 2,048, or 4,096 bytes per sector to give a maximum disk capacity of about 245K to 303K bytes.

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

MAGNETIC TAPE EQUIPMENT

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

3515 AND 3516 MAGNETIC TAPE UNITS: These direct connection devices offer recording densities of 640 bytes per cm (1600 bpi) (PE) and 2,460 bytes per cm (6250 bpi) (GCR) and read/write speeds of 40 or 80 KB/s and 156 or 312 KB/s, respectively, forward tape speeds of 0.64 and 1.27 meters/s, respectively, and rewind speeds of 4.8 meters/s.

3525 AND 3526 MAGNETIC TAPE UNITS: These units connect directly to the 3515 and 3516 MTU's, respectively, each adding one drive with the same characteristics as the 3515 and 3516 MTU's.

3521 MAGNETIC TAPE UNIT: This is a 9-track device that has recording densities of 320 bytes per cm (800 bpi) and 640 bytes per cm (1600 bpi), read/write speeds of 20 and 40 kilobytes per second, a rewind speed of 4.10 meters per second, and a forward tape speed of 0.635 meters per second. A 3511 magnetic tape controller with circuitry for four drives can optionally be incorporated into the 3521 housing.

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

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

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

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

3550 MAGNETIC TAPE DEVICE: This is a 9-track unit that has a recording density of 320 (NRZ) or 640 (PE) bytes per cm (800 or 1600 bpi, respectively), a read/write speed of 120 (NRZ40) or 240 (PE) kilobytes per second, a rewind speed of 10.4 meters per second, and a forward tape speed of 3.8 meters per second. The 3550 connects to a 3510-01, -02, -03, or -04 controller.

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

3557 HIGH DENSITY MAGNETIC DEVICE: This 9-track unit has a recording density of 640 (PE) or 2,460 (GCR) bytes per cm (1600 or 6250 bpi, respectively), a read/write speed of 200 (PE) or 780 (GCR) kilobytes per second, a rewind speed of 12.2 meters per second, and a forward tape speed of 3.18 meters per second. Up to eight 3557's connect to a 3513 controller.

3559 HIGH DENSITY MAGNETIC DEVICE: This 9-track unit has a recording density of 640 (PE) or 2,460 (GCR) bytes per cm (1600 or 6250 bpi, respectively), a read/write speed of 320 (PE) or 1,250 (GCR) kilobytes per second, a rewind speed of 16.2 meters per second, and a forward tape speed of 5.1 meters per second. Up to eight 3559's connect to a 3513 controller.

PRINTERS

There are four series of line printers (including one with four models) which can be attached to the System 7.500 with speeds ranging from 600 lines per minute on the slowest printer to 21,000 lines per minute on the laser printer.

The Model 3336 line printer is standard on the 7.521 to 7.551; the Model 3340 printer is optional with the 7.521, 7.531 and 7.536 while on the 7.541, 7.551, 7.552, 7.561 and 7.571 any of the printers may be optionally used. Additional printers are attached via the byte-multiplexor channel.

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

3340 PRINTER: This device is a chain-driven unit that can print either 136 or 160 characters per line, using a character set of 48, 64 or 106 characters. Using the 48-character chain, the print speed is 1,170 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 six or eight lines per inch. Powered forms stacking and a forms feed are available as optional features 33401 and 33410, respectively. Forms feed is standard on submodels -12 and -14.

Submodels 3340-11 and -12 have one forms feed and can accept forms from 52 to 555 mm in width. Submodels 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 submodels can format pages from 8 to 16 inches in length.

3343 PRINTER: This device is a chain-driven unit that can print either 132 or 136 characters per line, using a 48-, 64-, or 96-character set. Using the 48-character chain, the print speed is 2,000 lines per minute; with the 64-character chain, the print speed is 1,630 lines per minute. Horizontal spacing (print density) is 10 characters per inch, and vertical spacing is six or eight lines per inch. Powered forms stacking and a forms feeder are standard. The 3343 can accept forms from 102-508 mm in width, and can format pages from 8-14 inches in length.

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

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

The 3352 can accept forms from 165-400 mm in width and can format pages from 8-14 inches in length. Paper is advanced at a uniform speed of 0.74 m per second no matter how many lines are advanced at once.

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

The optional forms overlay feature can be incorporated to allow frequently printed data such as headings, footings, and logotypes to be printed on forms by projecting an image on the drum during the printing process.

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PUNCHED CARD EQUIPMENT

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

3150-01 CARD READER: This unit operates at 1000 cpm. The card input hopper can hold 1,200 cards, and two 1,200 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 3,000-card capacity input hopper.

3150-03 CARD READER: This unit operates at 660 cpm. The card input hopper can hold 1,200 cards, and two 1,200 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 1,200-card input hopper and two 1,100-card output stackers. A 31601 binary punching feature is available as an option.

SOFTWARE

Software for the System 7.500 includes the BS2000 virtual memory operating system, nine language processors, data management systems, tools for software development, and a variety of application software packages.

BS2000 OPERATING SYSTEM: All System 7.500 models use BS2000 as their operating system. BS2000, a virtual memory operating system, was first introduced in December 1975. Since then it has been developed, improved, and enhanced to include the Transdata DCM communications access system for simplified programming of time-sharing and batch operations. The version of BS2000 used on the 7.500 models lets first-time users operate the system using only 20 commands. Important functions can be utilized with the help of an additional 30 commands. This version of BS2000 also offers improved data/program security, on-line maintenance routines, a more efficient system/user interface, and "evening routines" that permit concurrently running programs to be synchronized so that data can easily be exchanged among them.

The essential features of BS2000 comprise dynamic memory management, concurrent support of local or remote batch processing, multi-processing, and interactive processing (time-sharing) for multiple users under control of a time-slice-oriented management system.

Under BS2000, real memory is divided into pages of 2,048 bytes each. Virtual memory is divided into consecutive segments of 65,536 bytes, each containing 32 pages. BS2000 combines two pages to form a 4,096-byte page. Page tables define the relationship between real and virtual memory at any moment in time. These tables are continuously updated and monitored for pages which are not being used frequently. Based on this, the page management system then allocates real memory to new pages.

There are two main types of programs under BS2000: privileged and non-privileged routines. The Control System is privileged and consists of the Executive, the Data Management System, the Teleprocessing System, and System Services. Non-privileged routines consist of language processors, utility routines, and user programs.

The Executive performs the following functions:

- Handling console I/O;
- Processing user command language;
- System accounting, spooling; and
- 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 2,048-byte pages.

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

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

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

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

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

Virtual memory is subdivided into six 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 percent 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 (400/151).

LANGUAGE PROCESSORS: Nine languages are available on the System 7.500. They are RPG II, Algol 60, ANS '74, Cobol, Fortran IV, PL/1, Basic, APL, Pascal, and SPL.

UDS Compact: UDS Compact is a compact version of the Siemens UDS data base handler which is based on the

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

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

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

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

UDS Compact runs under BS2000 versions 5.1 and 6.0 and requires at least 500K bytes of main memory.

SESAM Compact: A linear data base system, SESAM Compact provides interactive procedures for data base initialization and maintenance; interactive data base processing; a CALL interface which permits user programs to be written in RPG, Cobol, and other high level languages; and password at the record field level. For public sector use, a compatible Data Base Interface (KLDS) has been developed.

GOLEM INFORMATION RETRIEVAL SYSTEM: This system provides access to the system from remote terminals. GOLEM uses a flexible, interactive, conversational language for data access that includes features for browsing, specification of descriptor ranges, etc. GOLEM also supports simultaneous terminal operations for multiple application programs, and can handle stored data in variable formats. Documents are logically divided into segments, and 5-level access codes are used to ensure data access security. Under BS2000, GOLEM is a pageable program.

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

Model 7.521 uses UTM-B1 while all other models use UTM-B3. UTM is run under BS2000 from release 5.1 and requires 50K bytes of main memory.

SOFTWARE TOOLS

BYBLOS is a documentation system which can be used throughout system development. BYBLOS is a text processing system, a data base and a data dictionary/directory. Its objective is to assist in the documentation of a project, its performance, system architecture, its data, and its program/module specifications. BYBLOS requires 850 pages and runs under BS2000 version 5.1. It can be used interactively or in batch mode.

Colombus, a tool for structured programming, facilitates the conception and the development of programs. It provides automatic structural representation (structural lists and structograms). Colombus comes in three versions, Colombus-COB for Cobol, Colombus-FOR for Fortran and Colombus-ASS for Assembler. All three can be run on the System 7.500. The Cobol Colombus requires 153 pages while the Assembler Colombus requires 132 pages; Colombus-FOR requires 117 pages.

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

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

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

Cotune and Fortune are used for fine tuning programs written in Cobol and Fortran, respectively. Fortune requires 48 pages while Cotune requires 135 pages.

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

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

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

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

APPLICATIONS SOFTWARE

DIFIB is an interactive accounting system.

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

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

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

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batch mode and requires 100 to 150 pages. It costs about DM 16,150.

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

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

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

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

EQUIPMENT PRICES

The following are CPU prices only:

7.521	139,150 DM purchase price
7.531	158,800 DM purchase price
7.536	171,702 DM purchase price
7.541	468,212 DM purchase price
7.551	611,812 DM purchase price
7.552	1,758,107 DM purchase price
7.561	2,265,600 DM purchase price
7.571	3,785,600 DM purchase price

		Purchase Price Exclud. Maint. (DM)
	The basic Model 7.521 configuration includes 512 KB of main memory, a display console, a 600 line-per-minute line printer with 132 columns, one floppy disk drive, a byte-multiplexer channel, two direct disk drive adaptors (PDA) for a maximum of four 63–, 126–, 300–, or 420–MB disk drives	139,150

Model 7.521

	The basic Model 7.521 configuration includes 512 KB of main memory, a display console, a 600 line-per-minute line printer with 132 columns, one floppy disk drive, a byte-multiplexer channel, two direct disk drive adaptors (PDA) for a maximum of four 63–, 126–, 300–, or 420–MB disk drives	139,150

Extensions

75210–X	Main memory expansion of 512 KB	18,163
75212–X	First to third byte-multiplexer channels, each	5,060
75214–X	First and second disk drive adaptor expansions, each	3,045
75211–3	Second floppy disk drive	11,139
75211–5	Console printer, 90 characters per second, 80 columns per line	19,096
75218	Integrated terminal controller (IDS) with four local connection points for printer 8122	8,710
75218–20	IDS adaptor with four connection points (possible maximum of 16)	2,418
75219	Integrated data transmission front-end processor (IVR) for connection to the Transdata spectrum of products including four local connections and 128 KB of memory	25,197
75219–31, –32	IVR memory expansions of 64 KB, each	4,509
75219–20	IVR line adaptor unit for printers 8112–7	2,418
75212–34, –35	Connection for printer 3336–5, 3337	33,100
75212–36	Connection for printer 3340	1,209

Model 7.531

The basic Model 7.531 configuration includes 512 KB of main memory, a display console, a 1920-character display station, a 600-line-per-minute line printer with 132 columns, one floppy disk drive, an integrated terminal controller (IDS) with three free local connection points for display workstations 8160–7 or printers 8122, two direct disk drive adaptors (PDA) for a maximum of six 63–, 126–, 300–, or 420–MB disk drives, and a byte multiplexer channel.

Extensions

75310–X	Memory expansion of 512 KB to a maximum of 2048 KB, each	18,163
75312–X	First to fifth byte-multiplexer channels, each	5,060
75314–X	First to fourth disk drive adaptors (PDA), each	3,045
75311–3	Second floppy disk drive	11,139
75311–5	Console printer, 90 characters per second, 80 columns	19,096
75318–20	Integrated display station adaptor (IDS) with four local connection points (possible maximum of 16 connections), each	2,418
75318–50	Integrated display station adaptor (IDS) for connection of 16 display stations (possible maximum of 32 display stations)	20,037
75319	Integrated data transmission front-end processor (IVR) for connection to the Transdata spectrum, with 128 KB and four local connections	19,351
75319–31, –33	IVR memory expansion of 64 KB to a maximum of 384 KB, each	4,509

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		Purchase Price Exclud. Maint. (DM)
75319–20	IVR line adaptor for four display stations 8160–7, 8162–7 or printer 8112–7	2,418
75319–50	IVR local line adaptor for connection of 16 display stations	20,037
75312–34, –35	Connection for printers 3336, 3337	33,100
75312–36	Connection for printer 3340	1,209

Model 7.536

The basic Model 7.536 configuration includes 2048 KB of main memory, a display console with service processor and control display, a 600 line-per-minute line printer with 136 columns, a byte-multiplexer channel, direct disk drive adaptors (PDA) for a maximum of four 3454, 3464, 3468 or disk drives, printer connection to byte-multiplexer channel, integrated terminal controller (IDS) for connection of four printers — 171,702

Extensions

75360–X	Main memory expansion of 1 MB to a maximum of 4 MB	36,325
75364–X	First and second byte-multiplexer channels, each	16,550
75364–X	Direct disk drive adaptors (four each) (PDA), each to a maximum of 16	15,656
75368–20	IDS line adaptor unit	2,478
75368–50	IDS local line adaptor expansion	20,037
75369	Integrated data transmission front-end processor (IVR) for connection to the Transdata spectrum of products including four local connections and 192 KB of memory	41,589
75369–X	IVR memory expansions of 64 KB, each to a maximum of 384 KB, each	4,509
75369–20	IVR line adaptor unit	2,418
75369–50	IVR local adaptor expansion	20,037
75362–34, –35	Connections for printers 3336, 3337	33,100
75362–36	Connection for printer 3340	1,209

Model 7.541

The basic Model 7.541 configuration includes 2 MB of main memory, a console with display, a console printer with service processor, a 600 line-per-minute line printer with 132 columns, one byte-multiplexer channel and two block-multiplexer channels — 468,212

Extensions

75410-X	Main memory expansion of 2 MB (possible maximum of 6 MB), each	72,650
75414-3	Third block-multiplexer channel	16,550
75414-4	Fourth block-multiplexer channel	14,482
75412-5	Fifth and sixth block-multiplexer channels, each	14,482
75412-16	Second byte-multiplexer channel	84,384
75412-1	Expanded byte-multiplexer channel	42,192
75412-36	Connection for printer 3340	1,209
75412-37	Connection for printer 3343	2,418
75412-39	Connection for laser printer 3352	5,060

Model 7.551

The basic Model 7.551 configuration includes 2 MB of main memory, a console with service processor and control display, a 600 line-per-minute line printer with 136 columns, one byte-multiplexer channel and three block-multiplexer channels — 611,812

Extensions

75510–X	2 MB memory expansions to a maximum of 8 MB, each	72,650
75512–16	Second byte-multiplexer channel	84,384
75514–4	Fourth block-multiplexer channel	14,482
75512–34, –35	Connections for printers 3336-5, 3337, each	33,100
75512–36	Connection for printer 3340	1,209
75512–37	Connection for printer 3343	2,418
75512–39	Connection for laser printer 3352	5,060

Model 7.552

The basic Model 7.552 configuration includes 4 MB of main memory in dual processor architecture, two consoles with service processors and control displays, one byte-multiplexer channel each and two block-multiplexer channels, each — 1,758,107

Extensions

75520-X	Main memory expansions of 2 MB to a maximum of 8 MB, each	72,650
75522-16	Byte-multiplexer channel expansions	84,384

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		Purchase Price Exclud. Maint. (DM)
75524-X	Fifth and sixth block-multiplexer channels, each	16,550
75524-X	Seventh and eighth block-multiplexer channels, each	14,482
75524-X	Ninth to twelfth block-multiplexer channels, each	10,344

Model 7.561

The basic Model 7.561 configuration includes a 4 MB main memory, one byte-multiplexer channel (connection for a maximum of eight adaptors and 256 devices) and four block-multiplexer channels (connection for a maximum of eight adaptors and 256 devices) 2,265,600

Extensions

75610-X	4 MB main memory expansion to a maximum of 16 MB, each	225,000
75616	Second I/O processor	261,311
75614-X	Third to sixth block-multiplexer channels, each	27,017
30263	Floppy disk I/O unit	19,828

Model 7.571

The basic 7.571 configuration includes 4 MB of main memory, one byte-multiplexer channel (for a maximum of eight adaptors and 256 devices) and six block-multiplexer channels (for a maximum of twelve adaptors and 256 devices) 3,785,600

Extensions

75710-X	4 MB main memory expansion to a maximum of 16 MB, each	225,000
75716	Second I/O processor	261,311
75714-X	Third to sixth block-multiplexer channels, each	27,017
30263	Floppy disk I/O unit	19,828