Cado Small Business Computers

MANAGEMENT SUMMARY

Cado Systems Corporation, founded in 1973 by ex-Pertec and CMC personnel, made the first delivery in April 1976 of its unique programmable terminal, the System 40. The Cado System 40 was the first computer system designed as an add-on to the Teletype Model 40/2 CRT/printer (AT&T Dataspeed 40/2). Since AT&T is constrained by law from entering the data processing market, Cado's alignment with the highly reliable AT&T peripherals gives Cado a competitive edge over other stand-alone small business systems.

Cado's next announcement came in January 1978 when it introduced the System 20. Using the same CPU as the System 40, the System 20 is configured with a Perkin-Elmer keyboard/CRT and a TI printer in place of the Teletype units and is priced about 20 percent below the System 40.

Six months later Cado introduced multi-terminal, multi-tasking capabilities into both of these systems. The two new systems, the 20/IV and 40/IV, are configured with the same peripherals as their counterparts but with a greatly enhanced CPU. The I/O structure of the /IV systems provides four ports that operate simultaneously. Two of these ports can interface to bisynchronous or asynchronous communications lines. Each of the four ports has its own set of registers, buffers, and pointers allocated to a simple program task and is in effect equivalent to one System 20 or 40. Since each I/O port is separately programmed, up to four CRT's, line printers, and communications lines can be connected in a variety of configurations to meet the specialized needs of each ▷

> Cado Systems has enhanced its initial System 40 product line to include the multi-terminal, multi-tasking System 40/IV and added a new product line, the System 20, that includes the multi-terminal System 20/IV configuration. The Cado Systems 40 and 40/IV are configured with the Teletype Model 40/2 CRT's and printers. The less expensive Systems 20 and 20/IV use Perkin-Elmer CRT terminals and Texas Instruments printers.

CHARACTERISTICS

MANUFACTURER: Cado Systems Corporation, 2730 Monterey Street, Torrance, California 90503. Telephone (213) 320-9660.

DISTRIBUTORS: All Cado hardware and software is available for purchase or lease-purchase from more than 80 authorized agents throughout the U.S. and the world. Lease-purchase agreements, based on the current money market, are arranged through a third-party lending institution. Cado agents and Teletype Corporation assume responsibility for all hardware and software support.

MODELS: System 20, System 20/IV, System 40, and System 40/IV.

DATE OF ANNOUNCEMENT: System 40, first quarter of 1976; System 20, first quarter of 1978; Systems 20/IV and 40/IV, spring of 1978.

DATE OF FIRST DELIVERY: System 40, April 1976; System 20, January 1978; Systems 20/IV and 40/IV, June 1978. ▶
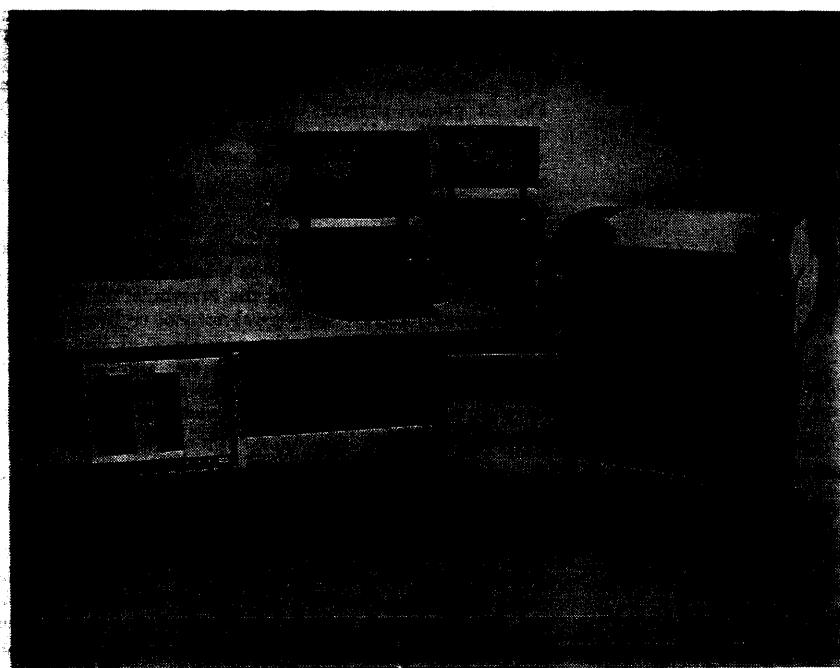
The Cado Database 40/IV packaged system includes the CPU with 20K bytes of memory, two dual-sided, double-density floppy disk units with a total storage capacity of 2.5 megabytes, two Teletype Model 40/2 keyboard/display terminals, and a Teletype Model 40 300-lpm printer. The purchase price is $25,075.

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▷ user. The printer can be connected to the CRT or directly to the processor.

Both the System 20 and System 40 use an 8080A microprocessor. The minimum memory capacity of the System 20 is 6K bytes (including 3K PROM), expandable to 10K bytes. The System 40 offers a minimum capacity of 5K bytes (including 2K ROM), expandable to 9K. The 20/IV and 40/IV systems use an 8085A microprocessor with a minimum memory capacity of 20K bytes (4K PROM, 16K RAM) and a maximum of 52K bytes. The /IV processor board includes the four programmable serial I/O ports as standard equipment.

The System 20's basic configuration includes a 1920-character Perkin-Elmer Owl keyboard/CRT terminal, two single-sided, dual-density floppy disk units with 1.23 megabytes of storage, and a TI 810 printer rated at 150 characters per second.

The System 20/IV, an expanded version of the 20, uses the /IV processor and comes with one additional CRT and two dual-sided, dual-density floppy disk units with 2.5 megabytes of storage.

The basic System is available with either two or three disk drives. The smaller configuration includes two single-sided floppy disk drives with 1.23 megabytes of storage and a Teletype Model 40/2 that includes the CRT/keyboard and either an 80-column, 300-lpm or 132-column, 220-lpm printer. The larger version includes a third floppy disk drive for a total of 1.8 megabytes of storage, an additional 4K bytes of RAM memory, an RS-232C interface, and text editing capabilities.

The System 40/IV uses the /IV processor and comes with the same dual-sided disk drives as the 20/IV, two Teletype Model 40/2 keyboard/CRT's, and one Teletype Model 40 printer. (With the 40/IV, unlike the 40, CRT's and printers are considered separate items.)

Each system can be configured with up to three single-sided or three dual-sided floppy disk drives for a maximum storage capacity of 1.8 megabytes (single-sided) or 3.78 megabytes (dual-sided), or with a single cartridge disk unit with a capacity of 19 million bytes.

Cado's communications interface provides data transmission and reception in batch mode in the standard IBM 2770, 2780, and 3780 protocols. An EIA RS-232C interface is provided for direct connection to a data set. Selectable communication speeds up to 9600 bits per second, synchronous or asynchronous, are available. EBCDIC, EBCDIC transparent, ASCII, auto answer, HT, VFU, and reverse channel control are standard.

The Cado System 20 and System 40 are programmed in CADOL I, and the System 20/IV and 40/IV in CADOL II. CADOL (Computer Aided Document Origination Language) is an easily learned English text language that combines program logic coding from BASIC with CADO-designed I/O format and control functions for ▷

▶ NUMBER INSTALLED TO DATE: System 20, over 200; System 20/IV, over 100; System 40, over 600; System 40/IV, over 100.

DATA FORMATS

BASIC UNIT: 8-bit byte.

FIXED-POINT OPERANDS: All arithmetic functions are in fixed-point, binary integer form with 6-byte (47 bits plus sign) precision.

FLOATING-POINT OPERANDS: None.

INSTRUCTIONS: Program instructions are one, two or three bytes (8, 16, or 24 bits) in length. Multiple-byte instructions must be stored in successive locations; the address of the first byte is always used as the address of the instruction. The exact instruction format depends on the particular operation to be executed.

INTERNAL CODE: Binary.

MAIN STORAGE

TYPE: MOS.

CYCLE TIME: Systems 20 and 40—2.5 microseconds/word; Systems 20/IV and 40/IV—1.3 microseconds/word.

CAPACITY: Minimum capacity for the System 20 is 6K bytes (3K PROM and 3K RAM), expandable to 10K bytes (3K PROM and 7K RAM); minimum for the System 40 is 5K bytes (2K ROM and 3K RAM), expandable to 9K bytes (2K ROM and 7K RAM); the /IV systems have a minimum capacity of 20K bytes (4K PROM and 16K RAM), expandable to 52K bytes.

PARITY CHECKING: None.

STORAGE PROTECTION: None.

CENTRAL PROCESSOR

GENERAL: Systems 20 and 40 use the Intel 8080A CPU, while Systems 20/IV and 40/IV use the 8085A.

The 8080A is a complete 8-bit parallel central processing unit. It is fabricated on a single LSI chip using Intel's n-channel silicon gate MOS process. The 8080A contains six 8-bit general-purpose working registers and an accumulator. The six general-purpose registers may be addressed individually or in pairs, providing both single- and double-precision operators. Arithmetic and logical instructions set or reset four testable flags. A fifth flag provides decimal arithmetic operations.

The 8080A has an external stack feature that enables any portion of memory to be used as a last-in/first-out stack to store/retrieve the contents of the accumulator, flags, program counter, and the six general-purpose registers. The 16-bit stack pointer controls the addressing of this external stack. The stack gives the 8080A the ability to handle multiple-level priority interrupts by rapidly storing and restoring processor status. It also provides almost unlimited subroutine nesting.

Separate 16-line address and 8-line bi-directional data buses are used to facilitate interfacing to memory and I/O. Signals to control the interface to memory and I/O are provided directly by the 8080A. Ultimate control of the address and data buses resides with the Hold signal. It provides the ability to suspend processor operation and force the address and data buses into a high impedance state. This permits OR-tying these buses with other controlling devices for direct memory access (DMA) or multi-processor operations. ▶

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION/SPEED	MANUFACTURER
TERMINALS		
4030-5GFO	CRT/keyboard, 96-character ASCII, 31 control characters, 7 x 9 dot matrix, 24 lines, 80 characters per line; line printer, 80 column monocase ASCII, 300 lpm	Teletype 40/2 GFO
4030-5JFO	Same as 4030-5GFO except printer is full ASCII	Teletype 40/2 JFO
4030-5NFO	Same as 4030-5GFO except printer is 132-column, 300 lpm	Teletype 40/2 NFO
4030-5QFO	Same as 4030-5GFO except printer is 132-column full ASCII, 220 lpm	Teletype 40/2 QFO
4030-5OFO	Same as 4030-5GFO CRT/keyboard; no printer	Teletype 40/2 OFO
PE-1200	CRT/keyboard only, 96-character ASCII, includes control characters, 9 x 12 dot matrix, 24 lines, 80 characters per line	Perkin-Elmer Owl
PRINTERS		
40P202/AL	Line printer, 132-column EIA monocase, 300 lpm	Teletype 40
40P202/AG	Line printer, 132-column EIA full ASCII, 220 lpm	Teletype 40
1610-1	RO printer, 45 cps	Diablo
TI-810	Serial printer, 132-column, 96-character set, 150 cps	Texas Instruments

▷ terminal, printer, and disk. Cado upgraded CADOL I to CADOL II by strengthening existing commands and adding new statements. Programs written in CADOL I can be run on any of the Cado systems. The systems also come with a comprehensive set of utilities, including source management, source editor, compiler, library management, disk utilities, and debug monitor.

Cado advertises that its primary goal is to "provide the small business community with cost-effective information processing solutions rather than just information processing tools." The company supports this claim with a wide variety of application programs. First-time users receive a comprehensive financial accounting system that includes sales accounting, accounts payable, accounts receivable, inventory management, payroll, and general ledger. Cado also provides dozens of custom-made application packages for specific businesses such as dental, insurance, auto leasing, credit union, medical, jewelry manufacturing, pharmaceutical, CPA's, beer distribution, and construction.

Cado's success to date has been largely due to its alignment with the Bell peripherals. The company, which shipped its first system in April 1976, is now shipping approximately 150 systems a month. Teletype maintains the hardware for the Systems 40 and 40/IV, and users can even put the Bell components of their systems on their phone bills. But for the first-time user who is on a small budget, the Systems 20 and 20/IV have their own appeal, costing substantially less than their System 40 counterparts. For example, the System 40 costs around $18,000, while the basic System 20 costs $14,000. Final pricing on all of Cado's hardware and software is agent-dependent, and the user can save on the 40 systems by buying the Bell peripherals directly from AT&T. Cado originally directed its sales toward first-time users of small business systems, but with the more powerful /IV systems the company has also entered the distributed processing, word processing, and data communications markets. ▷

▶ The 8085A is a new-generation CPU, and its instruction set is 100 percent compatible with that of the 8080A. Its improved design provides a higher-performance system.

CONTROL STORAGE: The System 20 has 3K bytes of PROM control storage, the System 40 has 2K ROM, and the /IV systems have 4K PROM each.

REGISTERS: There are no registers directly available to the user.

ADDRESSING: The 8080A and 8085A have four different modes for addressing data stored in memory or in registers. In the direct mode, bytes 2 and 3 of the instruction contain the exact memory location of the data item. Register mode specifies the register or register-pair in which the data is located. Register-indirect mode specifies a register pair that contains the memory address where the data is located. In the immediate mode, the instruction contains the data itself, either 8- or 16-bit.

INSTRUCTION REPERTOIRE: For the 8080A and 8085A, the accumulator group instructions include arithmetic and logical operators with direct, indirect, and immediate addressing modes. Move, load, and store instruction groups provide the ability to move either 8 or 16 bits of data between memory, the six working registers, and the accumulator using direct, indirect, and immediate addressing modes.

The ability to branch to different portions of the program is provided with jump, jump conditional, and computed jumps. Also, the ability to call to and return from subroutines is provided both conditionally and unconditionally. The Restart (or single-byte call) instruction is useful for interrupt vector operation.

Double-precision operators such as stack manipulation and double add instructions extend both the arithmetic and interrupt handling capability. The ability to increment and decrement memory, the six general registers, and the accumulator is provided, as well as extended increment and decrement instructions to operate on the register pairs and stack pointer. Further capability is provided by the ability to rotate the accumulator left or right through or around the carry bit.

Input and output may be accomplished using memory addresses as I/O ports or the directly addressed I/O provided for in the instruction set. ▶

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▷ With its multi-terminal, multi-tasking capabilities and Bell peripherals, Cado should be able to hold its own against such competing products as the IBM 5110, System/32, and System/34, the Wang 2200, and the Data General Nova line.

USER REACTION

Ten Cado users, selected from a list of 12 supplied by the vendor, were interviewed during November 1978. Among the users were two office supply companies, a manufacturer's representative, a religious order, two phone companies (already equipped with Dataspeed 40's), a sports equipment wholesaler, a canvas manufacturer, a CPA firm, and a plumbing supply house. With only two exceptions, the users we interviewed were using one or more application programs that had been especially designed for their businesses. Over half were also using Cado's standard general accounting package.

Only one user had more than one Cado system installed. This user had four System 40's that were being used to produce turnkey systems that involved hardware modifications to the communications port in order to attach an additional device, i.e., a reel-to-reel tape unit or a VuSet.

Of the other nine users, four had a System 20, four had a System 40, and one had a System 20/IV. The most popular disk configuration was three single-sided floppies; only two had three dual-sided floppies, and no one had opted for the cartridge disk drive. The average length of time these users had been using their systems was slightly less than one year.

The following table summarizes the ratings given by the Cado users.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	7	3	0	0	3.7
Reliability of CPU	10	0	0	0	4.0
Reliability of peripherals	7	3	0	0	3.7
Maintenance service:					
Responsiveness	5	0	0	1	3.5
Effectiveness	5	1	0	0	3.8
Technical support	4	4	1	1	3.1
Manufacturer's software:					
Operating system	7	2	1	0	3.6
Compiler	5	2	0	0	3.7
Applications programs	4	4	0	0	3.5
Ease of programming	1	2	0	0	3.3
Overall satisfaction	9	0	1	0	3.8

*Weighted Average on a scale of 4.0 for Excellent.

With one exception, these users were very enthusiastic about their systems. The lone exception, a System 40 felt he had been misled as to the capabilities of the system's hardware and software. He rated both the maintenance and technical support poor but felt the problem lay not only with Cado but with the agent and his technical staff. Although dissatisfied with his current system, he stated that he was anxiously awaiting delivery of a 40/IV. ▷

▶ The following special instruction group completes the 8080A and 8085A instruction set: HALT stops processor execution, and the DAA instructions provide decimal arithmetic capability. STC allows the carry flag to be directly set, and the CMC instruction allows it to be complemented. CMA complements the contents of the accumulator, and XCHG exchanges the contents of two 16-bit register pairs directly.

The 8085A has two additional instructions: RIM, read interrupt mask; and SIM, set interrupt mask.

INSTRUCTION TIMINGS: All of the following times are in microseconds for full-word, fixed-point operations, using instructions that reference memory.

	System 20 & System 40	System 20/IV & System 40/IV
Load/Store:	4.5	2.3
Add/Subtract	2.5	1.3
Multiply/Divide	NA	NA
Compare and Branch	9.0	4.7

INTERRUPTS: The 8080A has a built-in capacity to handle external interrupt requests. A peripheral device can initiate an interrupt simply by driving the processor's interrupt (INT) line high. The interrupt (INT) input is asynchronous, and a request may therefore originate at any time during any instruction cycle.

The 8085A has 5 interrupt inputs: INTR, RST 5.5, RST 6.5, RST 7.5, and TRAP. INTR is identical in function to the 8080A INT. Each of three RESTART inputs, 5.5, 6.5, 7.5, has a programmable mask. TRAP is also a RESTART interrupt, except it is non-maskable.

PHYSICAL SPECIFICATIONS: The Perkin-Elmer Owl terminal is 21 inches wide, 21 inches high, and 25 inches deep. The TI printer is 25 inches wide, 8 inches high, and 20 inches deep. The AT&T terminal is 17 inches wide, 18.9 inches high, and 25 inches deep. The AT&T printer is 20 inches wide, 10.8 inches high, and 17 inches deep. The control unit for all four systems is 17 inches wide, 13 inches high, and 21.5 inches deep.

Operating environment for all the Cado systems is 10 to 38 degrees C. with 20 to 80 percent relative humidity. Power consumption is 790 watts maximum.

INPUT/OUTPUT CONTROL

I/O CHANNELS: Printers and CRT's operate through programmed I/O up to a maximum rate of 960 bytes per second. A DMA channel transfers data to and from disk at the rate of 1 million bytes per second.

SIMULTANEOUS OPERATIONS: All peripheral devices can be active simultaneously, subject to memory cycling rate and I/O routine execution speeds. On the /IV systems, all four I/O ports can be used simultaneously to interface terminals and printers.

CONFIGURATION RULES: Each Cado system consists of a single systems cabinet that mounts below the table of the operator's station. The CRT/keyboard is placed on the table, and a separate stand is provided for the printer. For the /IV systems, additional stands and tables are available.

The systems cabinet contains the system power supplies, a processor PC board, a serial I/O interface board, and interconnecting cables. Space is also provided for a floppy disk formatter/controller PC board and three floppy disk drives.

The processor board for the Systems 20 and 40 contains an Intel 8080A microprocessor, its control circuitry, the mini- ▶

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▷ The agents seemed to play an important role in just how each user felt about his system. Some users raved that they had never received such superb service, while others felt their agents lacked knowledge about the system, especially the software application packages. One user stated that he and his agent had learned together while setting up his system—"I felt like a guinea pig." A few users had bypassed their agents and were calling Cado directly for help.

These users felt that their systems were extremely easy to operate. Over half had never had any prior experience with computers before buying their systems.

Only three users had actually done any programming in CADOL, and they felt it was an easy language to learn.

Besides ease of operation, the main selling point for these users was Cado's price. One user said, "The price effectiveness of this machine is unbeatable in this area. I shopped around for a year, and nothing IBM, Burroughs, NCR, Olivetti, DG, or Honeywell makes compares with it for price and ease of operation."

Four users could not comment on Cado's maintenance service because they had never had a problem. One of these users had had his system for over a year.

For the most part, the peripherals were equally well received. One user complained that he had experienced a lot of problems with errors on the floppy disks. Another mentioned that it was easy to erase the disks when backing-up. The only other complaint concerned the speed of the Teletype printer: "It is not as fast as advertised."

All in all, these users were more than pleased with their systems. The only regret one user had was that he had not bought one sooner: "I would have saved a lot of time and money."□

▶ mum configuration of system memory (3K PROM, 3K RAM for the System 20; 2K ROM, 3K RAM for the System 40), and a DMA channel. The /IV systems' processor board uses an 8085A microprocessor with a 4K PROM and 16K RAM minimum memory configuration and four programmable serial I/O ports. Each port is programmed to operate in an asynchronous or bisynchronous mode.

Two single-sided, dual-density Shugart SA 800-1 floppy disk units with a total of 1.23 megabytes of storage are standard with the Systems 20 and 40. Two dual-sided, dual-density Shugart SA 850-2 floppy disk units with a total of 2.4 megabytes of storage are standard with the /IV systems.

The System 20 comes configured with a 1920-character Perkin-Elmer Owl keyboard/CRT terminal and a 150-cps TI 810 printer. System 20/IV comes with a second Owl terminal.

The System 40 comes configured with a Teletype Model 40/2 CRT/keyboard and a Teletype Model 40 printer. The System 40/IV comes with a second Model 40/2 CRT/keyboard.

All the Cado systems offer an optional data storage configuration using a front-loading cartridge disk drive with a storage capacity of 19 million bytes. Only one cartridge disk drive per system is allowed.

The /IV systems can be connected in many configurations to meet application requirements. A combination of up to four CRT terminals, line printers, or communications lines may be connected. In a floppy-disk system, two CRT terminals may be used for high-volume entry of file additions or modifications, while a third or fourth CRT terminal may be used for low-volume inquiries. Rigid-disk systems can support four CRT terminals, all of which are being used for high-volume file entries. The line printer may be connected to a CRT terminal or directly to the processor.

The Systems 40 or System 40/IV systems cabinet with disk storage is available for field installation on any existing Teletype Model 40/2 terminal.

MASS STORAGE

SHUGART SA 800-2: A single-sided, dual-density floppy disk unit with a capacity of 631,000 bytes of storage. The format is 77 tracks per surface, 32 sections per track, and 256 data bytes per sector. The average access time is 260 milliseconds, track-to-track seek time is 8 milliseconds, and average rotational delay is 83 milliseconds. The drives and their necessary controller electronics mount within the systems cabinet.

SHUGART SA 850-2: A dual-sided, dual-density floppy disk unit with a capacity of 1,261,568 bytes. The format is 77 tracks per surface, 32 sectors per track, and data bytes per sector. The average access time is 91 milliseconds, track-to-track seek time is 3 milliseconds, and average rotational delay is 83 milliseconds.

PERTEC D-3482: A moving-head, front-loading, cartridge disk drive, with three fixed disks and one removable cartridge providing a total of 19 megabytes of storage. Average access time is 52 milliseconds, track-to-track seek time including head settling time is 10 milliseconds, and average rotational delay is 12.5 milliseconds. Only one cartridge disk drive is allowed in a system. Cartridge disk systems require a separate electronics cabinet for mounting the drives, power supplies, and controller.

INPUT/OUTPUT UNITS

See the Peripherals/Terminals table.

COMMUNICATIONS CONTROL

The data communications interface provides the capabilities for remote data transmission and reception in batch mode. A standard EIA RS-232C interface is provided for direct connection to a data set.

Data transmission is supported in half-duplex mode, either synchronous or asynchronous. Asynchronous bit rates are jumper-selectable at 110, 150, 300, 600, 1200, 2400, 4800, or 9600 bits per second. Synchronous communication speeds can be controlled by a modem clock or an internal clock with jumper-selectable rates of 1200, 2400, 4800, or 9600 bps. Auto answer and reverse channel controls are also provided as standard equipment.

SOFTWARE

OPERATING SYSTEMS: The Cado operating system for the Systems 20 and 40 is a single-user system designed to provide for forms processing and data entry in a real-time operator environment. Communication to a central computer or report preparation must be accomplished in batch mode when the terminal is not in use for data entry. ▶

▶ The Cado/IV operating system is designed to support four independent user programs operating in a real-time operator environment. User program memory is divided into four equal (2K-byte) independent partitions that are controlled by a memory address switching technique. Each partition contains the registers, buffers, and pointers allocated to a single program task. Program overlays selected by each of the program tasks are loaded into a 10-page program pool that is shared by all users and managed by the system. Each user program can be executed from separate program segments, or multiple user programs can be executed from a single program segment in the program pool.

Primary entry stations (CRT's) are permanently assigned to one partition each, starting at system turn-on. Other I/O devices, such as readers or printers, are connected to I/O ports but are not assigned to partitions. These devices are then available to be assigned upon program request for specific tasks.

Memory partitions that do not have CRT's assigned to them are available to accept background processing tasks. The system provides the capability for any program to initiate a background task executing without a CRT in a free partition.

All Cado systems execute user programs in an interpretive mode from function commands produced by the source language compiler. The run-time interpretive mode of the systems provides a degree of independence between user source language and individual system configuration. The function command produced by the compiler occupy one byte of program space each, and several commands also require one or more bytes of control or modification parameters. The compact command structure allows for a relatively large amount of program functionality in a small amount of program space. It also allows for a compact and efficient interpreter, since syntax errors are detected at compile time rather than at run time.

Arithmetic functions of add, subtract, multiply, and divide are performed on an eight-byte-wide arithmetic stack. Numeric variables are supported as two's-complement, fixed-point, binary integers with a maximum precision of six bytes. The use of an eight-byte arithmetic stack helps to prevent overflow conditions from occuring on intermediate results in expression evaluation.

Variable relationship conditions of less than, less than or equal, equal, not equal, greater than or equal, and greater than are supported between either numeric or alphanumeric variables. Mixed-mode relationships are not supported.

Data entry and printout functions are controlled by the terminal monitor, which includes the following instructions.

● Position the cursor.

● Set and clear tab stops.

● Define field characteristics.

● Display fixed or variable information.

● Accept and display keyboard input with field content and format control.

The terminal monitor also provides field editing and program control.

The entry of numeric fields is controlled by field size and decimal point format. The system allows up to 14 digits in a numeric field, with up to 7 digits to the right of the decimal point. The system automatically zero-fills to the

specified decimal format if the operator terminates a numeric entry prior to completing the format. Alphanumeric field entry is controlled only by field length. Alphanumeric variables are automatically terminated by flagging the last character with a "Field End" bit. Alphanumeric variables that contain no characters are carried as a single "Null" byte.

The Cado systems are designed to operate interactively with a random-access data base stored on disk. The data base system converts the physical disk space addressing of drives, tracks, and sectors into a logical information addressing structure of files, records, and fields.

LANGUAGES: Programs may be created for the Cado systems using CADOL I (Systems 40 and 20) or CADOL II (Systems 20/IV and 40/IV). The /IV systems will accept programs written in either CADOL I or CADOL II. CADOL (Computer Aided Document Origination Language) is an English text language that extracts the coding form and arithmetic functions from BASIC and incorporates Cado-designed I/O format and control statements for serial I/O devices and disk data files.

COMMUNICATIONS SOFTWARE: Data communications control procedures are performed under the direction of the Cado Binary Synchronous Communications package, a turnkey set of parameterized programs that provide transmission and software compatibility with IBM 2770, 2780, and 3780 terminals. The CADO BSC package is table-driven via diskette-resident tables. Multiple sets of option tables and operational sequences can be user-defined to execute a variety of similar functions for different applications.

Cado BSC operates in batch mode only in a point-to-point, half-duplex arrangement and executes data transfers between disk and line, with automatic BSC generation and checking of the transferred data in the on-line mode. All other functions, such as multiple record packing, code translation (internal Cado code is ASCII), and space compression, are performed off-line. Cado BSC assumes that all data to be transmitted is stored in communications format, just as Cado BSC stores received data.

Cado BSC maintains three files on disk: the Comm Data File, the Trace Data File, and the System Control File. The Comm Data File is essentially a communications buffer reserved for formatted data to be transmitted, or for received data. The Trace Data File, a user-selectable option, contains trace information for each message (transmission and reply). The System Control File contains all file information, table parameters, and control information required to operate Cado BSC. The diskette location and extent of each of these files are user-defined.

UTILITIES: Program generation on a Cado system can be performed using a package of utility programs supplied with the system on a disk labeled "program generation." The package includes an editor to enter and modify programs in "source" (i.e., the untranslated text that makes up the programs), other source management programs, and a compiler to translate source into "object," which is in the form of an intermediate language (IL). IL can be subsequently "run" in the computer through the use of an interpreter program. A Debug Monitor is provided to aid in the process of getting a program to run correctly.

APPLICATION PROGRAMS: Cado Systems, through its agents, offers more than 60 application software packages. Most of these are of third-party origin. They range from general accounting programs to packages for specific industries. The prices of all application software are established by the individual agents. A list of these programs is given below. ▶

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▶ **Systems 20 and 20/IV**

Accounts Payable
Accounts Receivable
Direct billing Accounts Receivable
General Ledger
Inventory
Job Management
Payroll
Purchasing
Sales Order Entry

Bancado Certificate of Deposit
Bancado Checking Account
Bancado Commercial Loan
Bancado Installment Loan
Bancado Mortgage Loan
Bancado Savings Accounting
Furniture Inventory
Lumber Wholesalers Direct Billing

Systems 40 and 40/IV

Accounts Payable
Accounts Receivable
Bill of Materials
Direct Billing Accounts Receivable
General Ledger
Interactive Sales Accounting
Inventory
Job Management
Project Management
Payroll
Purchasing
Sales Agent
Sales Order Entry
Text Editor

Automotive Lease Fleet Management
Bancado Certificate of Deposit

Bancado Checking Account
Bancado Commercial Loan
Bancado Installment Loan
Bancado Mortgage Loan
Bancado Savings Accounting
Contractors Job Accounting
Client Accounting With Accounts Receivable
CPA Client Accounting
Dental Office Management
Employment Agency Personnel Accounting
Independent Insurance Agency Management
Manufacturer's Representative Sales/Inventory Management
Moving and Storage
NEMRA Sales Accounting
NEMRA Order Entry And Inventory Control
Newspaper Accounting
Nursing Home Pharmacy
Pharmacy Label Generation
Pharmacy System (Retail)
Political Party Financial Contribution
Political Party Membership And Mailing
Property Management (Real Estate)
Travel Agencies (Group Travel)
Time And Disbursement Processing (CPA/Lawyer)
Time Billing For Professionals
Warehouse Accounting

PRICING

POLICY: The Cado systems are available for purchase or third party lease. A purchased System 40 or 40/IV processor can be added to Teletype 40/2 equipment rented from the Bell System. End-user sales are handled through Cado-contracted agents. Maintenance and installation are provided by Cado agents, as well as by Teletype Corporation if the installation uses Bell equipment.

EQUIPMENT: The following are typical system prices. Final pricing of all Cado hardware and software is agent-dependent.∎

EQUIPMENT PRICES

PACKAGED SYSTEMS

		Purchase Price	Monthly Maint.
System 20	Database 20 processor with 6K bytes of memory; two 631,000-byte floppy disk units; Owl keyboard/display terminal; 150-cps TI 810 printer; 48-inch desk and printer stand	$13,995*	—
System 20	Same as above with 6 financial accounting software application packages	17,000	—
System 20/IV	Database 20/IV processor with 20K bytes of memory; two 1.26-megabyte dual-sided floppy disk units; two Owl keyboard/display terminals; 150-cps TI 810 printer; 48-inch desk and printer stand; 6 financial accounting software packages	19,845*	—
System 40 (2-drive)	Database 40 processor with 5K bytes of memory; two 631,000-byte floppy disk units; Teletype Model 40/2 CRT and 300-lpm printer; 48-inch desk and printer stand	17,500*	$130
System 40 (3-drive)	Database 40 processor with 5K bytes of memory; three 631,000-byte floppy disk units; Teletype Model 40/2 CRT and 300-lpm printer; additional 4K RAM; text editing keytops; RS-232C communications interface; 48-inch desk and printer stand	19,900	154
System 40/IV	Database 40/IV processor with 20K bytes of memory; two 1.26-megabyte dual-sided floppy disk units; two Teletype Model 40/2 keyboard/display terminals; Teletype Model 40 300-lpm printer; 48-inch desk and printer stand	25,075	—

PROCESSORS

		Purchase Price	Monthly Maint.
20-01	Database 20 Processor; requires 1 to 3 single or dual diskette drives	5,000	40
20-04	Database 20/IV Multi-Processor; requires 1 to 3 single or dual diskette drives	7,000	50
20-08	Database 20/IV Multi-Processor; requires cartridge disk drive	7,000	50
40-01	Database 40 Processor; requires 1 to 3 single or dual diskette drives	5,000	40
40-02	Database 40 Vertical Processor; requires 1 to 3 single or dual diskette drives	5,000	40
40-05	Database 40 Processor; requires cartridge disk drive	5,000	40
40-04	Database 40/IV Multi-Processor; requires 1 to 3 single or dual diskette drives	7,000	50
40-08	Database 40/IV Multi-Processor; requires cartridge disk drive	7,000	50

* Quantity discount available. Average discount for 12 to 25 systems is 15 percent; over 25 systems, 23 percent.

** Includes both keyboard/CRT and 300-lpm printer.

Cado Small Business Computers

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
MEMORY/PROCESSOR OPTIONS			
RAM: 4K bytes		895	7
RAM; 32K bytes		1,800	15
RAM; 48K bytes		3,600	30
Multi-processor conversion kit		3,995	10
MASS STORAGE⌐			
85-1010	Floppy disk drive; single-sided, dual-density; 631,000 bytes	1,495	10
85-1011	Dual floppy disk drive; 1.26 megabytes; dual-sided, dual-density	1,995	15
85-1021	Cartridge disk drive; 19 megabytes	14,495	140
TERMINALS/PRINTERS			
4030-5GFO	Teletype Model 40/2 GFO; 80-column monocase ASCII; 300 lpm**	7,790	60
4030-5JFO	Teletype Model 40/2 JFO; 80-column full ASCII; 220 1pm**	7,790	60
4030-5NFO	Teletype Model 40/2 NFO; 132-column monocase ASCII; 300 lpm	8,990	70
4030-5QFO	Teletype Model 40/2 QFO; 132-column full ASCII; 220 lpm**	8,990	70
4030-5OFO	Teletype Model 40/2; CRT/keyboard only	4,795	25
PE-1200	Perkin-Elmer Owl terminal; CRT/keyboard	2,850	25
40P202/AL	Teletype Model 40 printer; 132-column EIA monocase; 300 lpm	3,995	45
40P202/AG	Teletype Model 40 printer; 132-column EIA full ASCII; 220 lpm	3,995	45
1610-1	Diablo RO printer; 45 cps	3,995	26
TI-810	Texas Instruments 810 printer; 150 cps	2,635	26
COMMUNICATIONS			
85-1006	RS-232C communications; standard with 3-disk System 40	NC	6

* Quantity discount available. Average discount for 12 to 25 systems is 15 percent; over 25 systems, 23 percent.

** Includes both keyboard/CRT and 300-lpm printer.