

Burroughs B 80

MANAGEMENT SUMMARY

With the B 80, Burroughs has brought to the small business computer many of the concepts and much of the sophistication of the company's larger, established B 700 and B 1700 lines. Dynamically variable microprogrammed logic and microprogrammed interpreters are both present in the B 80, as is the Master Control Program, brought to the B 80 with many of the same capabilities featured on the larger Burroughs computers.

The heart of the B 80 is its CPU, which is composed of nine LSI circuits on a board. This CPU was first used in the AE 501 Audit Entry System, the TC 5100 Terminal Computer, and the S 1000 Document Processing Systems. The processor offers 8-bit parallel data paths, overlapping of microinstruction fetching and execution, microinstructions capable of multiple counting (which expedites repetitive operations), and up to 11 separate, buffered control units for handling I/O devices. These features and others add up to an integrated approach to increasing system throughput and efficiency of operation.

Memory is MOS, expandable from a basic 32,768 bytes to 61,440 bytes in 4K, 8K, 12K, or 16K increments. Parity checking is a standard feature, with one parity bit associated with each byte.

Reminiscent of other systems in its class, the B 80 processor is housed in a unit containing a full keyboard, a console printer, a Self-Scan display panel, magnetic tape cassette drives, and the Burroughs Super Mini-Disk (BSM) drives. Provision is made for up to four cassette drives or a combination of up to two BSM drives and two cassette drives.



The B 80, Burroughs' latest entry into the small computer market, is a technically sophisticated machine in a relatively small package. It offers the technology of larger Burroughs computers at highly competitive system prices ranging from \$19,510 to about \$150,000.

CHARACTERISTICS

MANUFACTURER: Burroughs Corporation, Burroughs Place, Detroit, Michigan 48232. Telephone (313) 972-7000.

Burroughs is considered to be one of the strongest competitors in the data processing marketplace, with a broad line of computer equipment spanning the range from small, entry-level systems to very large, multi-user, multiprocessor systems. In addition to data processing equipment, Burroughs also markets magnetic media; business forms and supplies; document counting, encoding, signing, protecting, and disbursing equipment; programmable and nonprogrammable desktop calculators; specialized banking equipment; word processing equipment; facsimile devices; and other related products. Burroughs is international in scope and employs some 50,000 people in more than 120 countries around the globe.

MODELS: Numerous packaged systems based on the same processor, varying in memory size and peripheral complement. For details, see the price list at the end of this report.

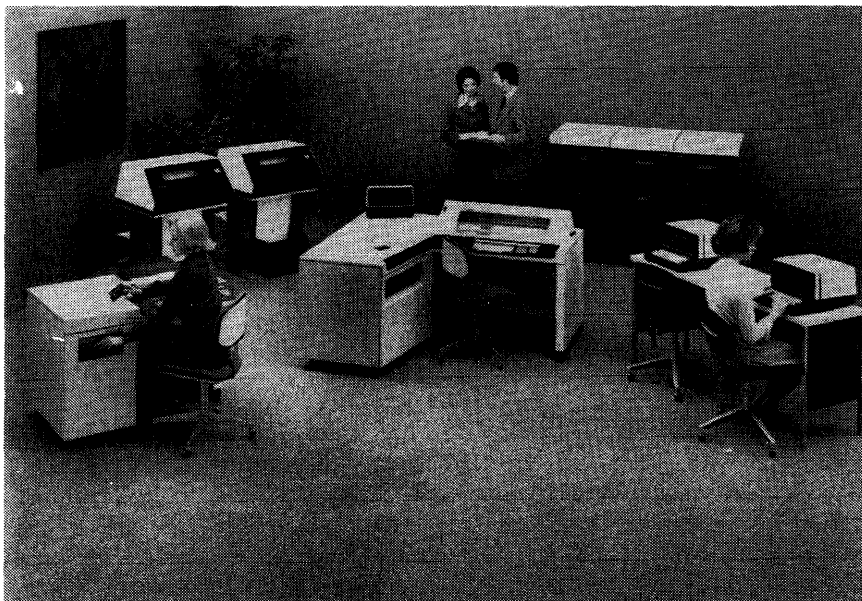
DATE ANNOUNCED: April 28, 1976.

DATE OF FIRST DELIVERY: Fourth quarter 1976.

NUMBER INSTALLED TO DATE: Over 3000 on order.



As this photo demonstrates, it is possible to surround the basic B 80 system (center) with peripheral equipment and data entry subsystems. Starting at the left, you can add one or more AE 501 Audit Entry Data Preparation Systems for off-line data entry; up to two free-standing printers; up to three cartridge disk drives for an on-line capacity of 27.6 megabytes; and multiple input and display terminals.



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▷ The BSM drive is a new double-density floppy drive capable of reading and writing floppy disks on both sides by means of two sets of read/write heads. The BSM is also available in a single or dual stand-alone configuration. The console printer may be either a 60-cps dot matrix printer or a newly developed 180-cps dot matrix printer. The new printer offers three times the speed of the other unit as well as up to three independent pin-feed forms advance units.

Other available peripherals include 160- and 250-lpm free-standing line printers, single or dual ICMD (Industry Compatible Mini-Disk) free-standing floppy drives, three versions of cartridge disk drives, a broad line of CRT display terminals, and up to four data communications channels.

All software for the B 80 is integrated into one system known as the Computer Management System (CMS). Falling under the CMS umbrella are the Master Control Program (MCP) operating system; the higher-level language compilers, COBOL and RPG; the Communications Language Compilers, Network Definition Language (NDL) and Message Processing Language (MPL); the stand-alone utility set; and the eight currently available applications packages. As the price list clearly indicates, all of the B 80 software is separately priced.

The MCP is a full operating system that provides a nonpartitioned multiprogramming environment for up to three programs. Among the features of the MCP are dynamic memory and resource allocation and the virtual memory concept of operation.

In a data communications environment, the B 80 can control its own network of terminals, communicate with other B 80 systems, or serve as a terminal to a larger system. The Network Definition Language is designed to ease the work of a user in implementing or reconfiguring a data communications network. The Message Processing Language provides a method of interface between the NDL and the user's programs. Among the communications protocols available is the new Burroughs Data Link Control (BDLC) procedure.

Currently, the B 80 is available only in the form of "configured" or packaged systems. However, Burroughs has built in considerable latitude, since 16 different configurations are presently being offered, at purchase prices ranging from \$19,510 to \$41,400. These system prices do not include required software or the full set of allowable peripherals. With a full complement of application programs, system software, and optional peripherals, the purchase price can climb to over \$150,000. Besides offering the B 80 on a purchase basis, Burroughs offers several leasing plans with terms of one, three, or five years.

With the B 80, Burroughs joins a number of competitive systems which emphasize applications software. These ▷

▶ DATA FORMATS

BASIC UNIT: 8-bit byte with two decimal digits or one character per word. The microinstruction set has no preferred word or byte boundaries that are visible to the rest of the system.

INSTRUCTIONS: The B 80 is an interpreter-based system using variable micrologic. Utilizing the microinstruction set, operand lengths permit from 1 to 256 bytes of data to be addressed with a single instruction, and up to 8 bits to be transferred in parallel between main memory and the processor.

INTERNAL CODE: ASCII; other media codes, such as EBCDIC, may be translated.

MAIN STORAGE

TYPE: MOS RAM, the contents of which are refreshed at intervals of two milliseconds or less.

CYCLE TIME: 1 microsecond per 8-bit batch, with a 450-nanosecond access time.

CAPACITY: All B 80 models have 32,768 bytes of semiconductor memory as standard equipment, expandable to a maximum of 61,440 bytes. Memory expansion can be implemented in increments of 4096, 8192, 12,288, or 16,384 bytes.

CHECKING: One parity bit is associated with each byte and is generated during writing and checked during reading in the memory control unit.

STORAGE PROTECTION: Main storage write operations are permitted only within the limits defined by a base register and a limit register.

RESERVED STORAGE: A variable portion is reserved for microinstruction storage.

CENTRAL PROCESSOR

The central processor of the B 80 is composed of nine LSI chips mounted on one circuit board. Interfacing between the microprocessor and memory requires a protocol of signals, a technique which Burroughs hopes will protect the basic system design against obsolescence.

The CPU is identical in all submodels. The submodels all have certain integral peripheral units built into the processor housing. These include a printing unit, a keyboard, a cassette tape unit, and a 256-character display. The differences between the various submodels center on the type and speed of the printer, the number of magnetic tape cassette drives, and the presence or absence of the Super Mini-Disk drives. The magnetic tape units are used as I/O storage devices and system software loading devices.

The B 80 processor features dynamically variable microprogrammed logic. The processor's logical functions are formed by a set of elementary operators, called microinstructions, which operate on bit strings up to 256 bytes long. There are 256 defined microinstructions in the B 80. Microinstructions are basically 8 bits long, but they can be extended to 16 or 24 bits. The B 80 has the capability to look ahead while executing microinstructions. This is possible because of the overlapping of microinstruction fetching and execution. The overlap improves overall performance by as much as 40 percent. ▶

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PERIPHERALS/TERMINALS

MODEL	DESCRIPTION & SPEED	MANUFACTURER
INTEGRAL WITH PROCESSOR		
System Display	Self-Scan display panel, 256 characters, 8 lines by 32 characters, 64-character set, 5 x 7 dot matrix, red phosphor illumination	Burroughs
Console Printer	Serial impact, 7 x 7 dot matrix, slew rate 5 ips, 150 print positions, 64-character set (96 optional), lateral bidirectional positioning at 160 cps, 15-inch paper; 60 cps	Burroughs
Alternate Console Printer	Serial impact, 7 x 9 dot matrix, slew rate 33 ips, 64-character set (96 optional), lateral bidirectional positioning at 450 cps, 3 pin feeds (upper, optional, 3- to 27-inch paper and 256 print positions; lower left, 3- to 6-inch paper and 50 print positions; lower right, 3- to 18-inch paper and 168 print positions); 180 cps	Burroughs
Magnetic Tape Cassette Drives	2-track, 800 bpi, 282 usable feet, 10 ips, 60 ips rewind, read-after-write, NRZI or PE, microprogrammed controller with two 96-character buffers; 1000 bytes/sec.	Burroughs
PRINTERS		
A 9249-2	Chain, 132 positions, 48-character set (64 or 96 optional), 17-inch paper, slew rate 8.3 ips, 10 characters per inch, optional 12-channel VFU; 160 lpm	Burroughs
A 9249-3	Chain, 132 positions, 48-character set (64 or 96 optional), 17-inch paper, slew rate 8.3 ips, 10 characters per inch, optional 12-channel VFU; 250 lpm	Burroughs
TERMINALS		
TD 700	Self-Scan display/keyboard, 256 characters, 8 lines by 32 characters, 64 ASCII character set, 5 x 7 dot matrix, red phosphor illumination, detachable typewriter-style keyboard; 9600 bps	Burroughs
TD 701/TD 731	Self-Scan display/keyboard, 256/480 characters, 8 lines by 32 characters or 12 lines by 40 characters, 128 ASCII character set, 5 x 7 dot matrix, red phosphor illumination, various keyboards and peripherals; 9600 bps	Burroughs
TD 801/TD 802	CRT display/keyboard, 960/1920 characters, 12 lines by 80 characters or 24 lines by 80 characters, 64 ASCII character set, 5 x 7 dot matrix, detachable keyboard; 9600 bps	Burroughs
TD 830	CRT display/keyboard, 1920 characters plus 80-character system status line, 24 lines (plus system line) by 80 characters, 128 ASCII character set, 5 x 7 dot matrix, various keyboards and peripherals, including serial and line printers, cassette drive, magnetic badge readers; 9600 bps	Burroughs
Other terminals in the Burroughs product line can also be used with the B 80.		

➤ include the IBM System/32, the Datapoint systems, the Basic Four Systems, the NCR 8200, and competitors in both the turnkey and systems house fields which are too numerous to mention.

The B 80 is being sold under the Burroughs Group II product category. The salesmen who sell these products are said to be the most aggressive of all the Burroughs marketing staff. The company's Selected Accounts and Large Accounts sales forces also sell the B 80 and its peripherals as Group VI products. Service is through Burroughs' nationwide and worldwide support network.

Training in applications programs, B 80 hardware, and systems software is being offered through Burroughs training centers worldwide, and is strongly recommended by the company. □

➤ In the B 80, Burroughs has also implemented a microprogram stack to improve the efficiency of repetitive processes, such as subroutines used for I/O interrupt servicing. The microinstruction set contains members capable of multiple counting, a feature that allows for repetitive execution. This feature has a wide spectrum of

application in data streaming, operating system table manipulation, and byte processing operations.

Burroughs defines S-language (Secondary-language) instructions as intermediate instructions which are equivalent to the machine-language instructions of conventional computers. Each S-language instruction is implemented by a string of microinstructions which interpretively execute the functions specified by the S-instruction. Because the S-instructions are software-defined by the microprograms, the functions they specify can be quite complex. In most cases, S-instructions specify an operation to be performed, one or more operand addresses, data field lengths, and units of data.

For each B 80 programming language, Burroughs has defined an "ideal machine" and developed a specialized microprogram, called an Interpreter, that makes the B 80 appear to be logically equivalent to that machine. The Interpreter executes the instructions which have been generated by the corresponding compiler. These compiler-generated instructions are expressed in an appropriate S-language.

Confidence Test Routines (CTR's) stored in ROM, together with maintenance test routine programs, make fault analysis and performance degradation detection easier for field engineers and customers. This includes both the isolation and analysis of the problem. ➤

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➤ **CONTROL STORAGE:** The 4KB ROM (read-only memory) contains cold and warm starts, a basic maintenance test routine, an interrupt analysis routine, and general-purpose routines such as binary to decimal conversion and absolute memory address conversion. When the processor must temporarily suspend a task because of a peripheral interrupt, information from processor registers is stored in main memory.

REGISTERS: None apparent to users. Internal registers include registers for storage protection, temporary storage areas for data being manipulated by the microprogram and the special-purpose Memory Address Register (MAR), Micro Memory Address Register (μ MAR), and Timing Machine State (TMS) registers. The base and limit registers are used for storage protection, defining the space that may be utilized by the user within main memory. The MAR register is used to address those main memory locations from which data is to be read or written, while the μ MAR register addresses that portion of main memory from which microinstructions are read, and the TMS registers determine the period of time when a microinstruction remains active. Together, these registers control the timing of all processor operations.

An additional address register is contained within the I/O interface and is utilized to determine which of the I/O channels will be transferring data.

INTERRUPTS: Both external and internal interrupts are present in the B 80. Internal interrupts can occur on a memory parity error, when the Load Enable button is depressed, or when power is first connected to the system. External interrupts occur when a peripheral device requests attention. The B 80 uses an automatic hardware interrupt system; the individual I/O channel notifies the processor when data is ready for processing or transmission.

PHYSICAL SPECIFICATIONS: The processor unit, a single desk-size cabinet that houses the cassette tape drives and the serial printer along with the processor, varies in dimensions according to the style of cabinetry. For example, styles B 80 34 and B 80 44 are 67.25 inches wide, 57 inches deep, and 37 inches high. Styles B 80 31 and B 80 41 are 46.69 inches wide, 57 inches deep, and 30 inches high.

Power requirements are 120 VAC + 5 percent, -10 percent, at 60 Hertz. The system requires 2.3 KVA. The operating environment is from 35 to 105 degrees F., with a humidity tolerance ranging from 5 to 95 percent, noncondensing. Additional air conditioning above normal office levels is not required except in extreme operating environments. The system dissipates about 6800 BTU's of heat per hour. Service area and general machine requirements indicate the need for a floor area with about a three-foot clearance around the system.

INPUT/OUTPUT CONTROL

I/O CHANNELS: Facilities for eight I/O channels are standard on the B 80. A channel expander unit allows a single I/O channel to be expanded to four similar channels, yielding a total of 11 as a system maximum. The expander is only one of three types of I/O control used in the B 80. The more or less traditional controller used with the line printers represents the second type. The last type is a combination of a device controller and a microprocessor placed between the controller and the CPU. This type is utilized where complex control is necessary to provide greater throughput to the processor; the control for the tape cassette drives is an example. All three types of control offer their own identification to the processor, allowing the operating system to call into main memory only the necessary disk-resident I/O control segments.

SIMULTANEOUS OPERATIONS: Processing must cease during I/O command transfers and during transfers of data. During periods of "I/O overhead," such as paper skipping on the printer, simultaneous operations can occur. All parts of the system other than main memory are considered as peripherals, including the operator's console.

CONFIGURATION RULES

Each device or subsystem attached to the B 80 requires one I/O channel. Four assignments are standard among all B 80 configurations. These include the operator's console, the console printer, the magnetic tape cassette subsystem, and the disk subsystem. The magnetic tape cassette subsystem can include up to four cassette tape drives (two on models with built-in BSM drives). The disk subsystem can include one dual cartridge disk drive or up to two single and one dual floppy drives of either the Mini-Disk or Burroughs Super Mini-Disk type. The remaining four I/O channels can be expanded to seven through the use of the channel expander. A choice of several peripheral combinations can then be allocated. Up to two additional disk subsystems, two free-standing line printers, and/or up to four dedicated communications lines may be attached. Each dedicated communications line requires its own channel.

MASS STORAGE

B 9489-11 OR -12 BURROUGHS SUPER MINI-DISK (BSM) DRIVES: These floppy disk drives are available either built into the processor cabinet or as a free-standing unit. The '3M subsystem consists of a controller with two 200-character buffers and either a dual BSM drive or one or two single BSM drives. The BSM has the capability of reading and recording on both sides of the floppy disk by means of two sets of read/write heads. Each diskette stores one million bytes, with 180 bytes per sector, 32 sectors per track, and 88 tracks on each side of the diskette. Track density is 64 tracks per inch, with a track-to-track access time of 20 milliseconds per single step and a settling time of 80 milliseconds. Average access time is 266 milliseconds, and the data transfer rate is 45K bytes per second. The BSM is manufactured by Burroughs.

B 9489-17 OR -18 INDUSTRY-COMPATIBLE MINI-DISK (ICMD) DRIVES: These floppy disk drives are available only as free-standing units. The ICMD subsystem uses a controller similar to the one used in the BSM subsystem. A subsystem is composed of a controller and either a dual ICMD drive or up to two single ICMD drives. Unlike the BSM drive, ICMD drives read only one side of the diskette. Each diskette stores 243K bytes of data, with 128 bytes per sector, 26 sectors per track, and 77 tracks per diskette, including three alternates. Track-to-track access time is 20 milliseconds per single step, and settling time is 10 milliseconds. Average access time is 343 milliseconds, and the data transfer rate is 31K bytes per second. The ICMD is manufactured by Burroughs.

A 9480/A 9481 DUAL CARTRIDGE DISK SUBSYSTEM: Provides low-cost random-access data storage on removable single-platter cartridges. Three dual-drive models are available:

Model	Capacity, bytes	Ave. Access Time
9480-12	4.6 million	80 milliseconds
9480-22	4.6 million	145 milliseconds
9481-12	9.2 million	100 milliseconds

Each drive accommodates one disk cartridge and has two read/write heads, one serving the top and one the bottom recording surface of the cartridge. The disk cartridge is 15 inches in diameter, 1.5 inches high, and weighs 5 pounds. The two drives are "stacked" so that the unit occupies less ➤

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▶ than five square feet of floor space. Data is recorded in 180-byte segments.

For the 9480-12, average head positioning time is 60 milliseconds, average rotational delay is 20 milliseconds, and data transfer rate is 193K bytes per second. The 9480-22 has an average head positioning time of 125 milliseconds, an average rotational delay of 20 milliseconds, and a data transfer rate of 193K bytes per second. The 9481-12 has an average head positioning time of 60 milliseconds, an average rotational delay of 20 milliseconds, and a data transfer rate of 193K bytes per second. The controller for the dual cartridge subsystem is similar to the one used for the BSM. The controller contains two 200-character buffers. The A 9480/A 9481 subsystem is manufactured by Burroughs.

INPUT/OUTPUT UNITS

See Peripherals/Terminals table for units other than the system keyboard and the AE 501, which are described below.

KEYBOARD: The B 80 keyboard is used by the operator to enter data and control the system's functions. It consists of a typewriter-style keyboard (59 keys), 24 program select keys, a ready request key, and four keys for special functions such as changing the sign of data being entered. These special keys are coupled with the 13-key numeric keyboard. The keyboard is adapted from the one utilized in the Burroughs L series, TC 5100, and AE series.

AE 501 AUDIT ENTRY DATA PREPARATION SYSTEM: The AE 501 was announced by Burroughs in September 1975. Consisting of a processor with up to 28K bytes of semiconductor memory, one or two magnetic tape cassette drives, an electronic keyboard, a serial matrix printer, and one asynchronous or synchronous data communications line, the AE 501 is designed for use with the Burroughs Business Management Systems (BMS) library. The system edits, validates, and captures ready-to-process data on magnetic tape cassettes for batch transmission to the computer. Errors are detected and corrected at the point of original entry. The AE 501 simultaneously prints an audit journal to assist the operator and to permit subsequent auditing.

The processor is implemented in large- and medium-scale integrated circuits and is the same one as used in the B 80, the TC 5100 Terminal Computer, and the S 1000 Document Processing Systems. Data movement is byte-serial, 8-bit-parallel and is moved one byte at a time from the processor to one of four dedicated I/O channels.

One byte of information can be moved within the processor between the processor, the memory, and the I/O channels in 1 microsecond. The memory is modular in 4K-byte increments and consists of 4K bytes of ROM (read-only memory) used for interpreter bootstrap (cold start) and permanent customer confidence programs, plus up to 28K bytes of RAM (random-access memory) available for interpreter and user storage.

Up to two magnetic tape cassette stations can be housed in the AE 501 system. Storage capacity per 300-foot cassette is 204,800 characters. Read/write speed is 10 inches/second, search speed is 30 inches/second, and rewind speed is 60 inches/second. Approximate time to load the full memory capacity is 60 seconds.

The electronic keyboard consists of an alphanumeric typewriter keyboard, a separate 10-key numeric keyboard, and special function keys. The keyboard includes an upper row of 16 program select keys to implement various

program options. The printer uses a 64-character set and prints at 60 characters/second. A 150-position print line is standard, and spacing is 6 lines per inch. The unit is equipped with a single pin-feed device for handling forms from 3 to 16.75 inches wide. It is capable of handling fanfold, single, or multiple-part forms with folds from 3.5 to 12 inches apart.

The AE 501 can communicate in either the asynchronous or synchronous mode with a central computer or another terminal over leased or switched lines, via a Two-wire Direct Interface (TDI) at up to 1000 feet, or via a Burroughs Direct Interface (BDI) at up to 15,000 feet. The line protocols available with the AE 501 include Burroughs Basic Mode, Point-to-Point Batch, and the new bit-oriented Burroughs Data Link Control procedures.

COMMUNICATIONS CONTROL

A standard mix of communications network configurations is possible, ranging from a tie-in of one processor to another, to various terminal mixes using a variety of communications links. The links may be in-house facilities using data sets or direct connection, or they may use telephone facilities of either the switched or leased-line type. Communications modes may be simplex, half-duplex, or full-duplex, using either synchronous or asynchronous transmission. Direct connections may be up to 1000 feet in length using the Two-wire Direct Interface (TDI) or 15,000 feet using the Burroughs Direct Interface (BDI). The Concatenate/Wrap-around/Modem interface (CWM) permits EIA RS-232C and CCITT V.24 or V.26 usage for B 80 communications. The TDI, BDI, and CWM interfaces all allow concatenation in normal or group pool environments under control of an appropriate multipoint line procedure. Among the protocols available are the new Burroughs Data Link Control, Burroughs Basic Mode, and Point-to-Point Batch.

ASYNCHRONOUS DATA COMMUNICATIONS CONTROLLER (ADC): Provides versatility of control through alteration ability both by hardware adjustment and by system software control. Through hardware adjustment by a field engineer, the number of data bits may be set at five, six, seven, or eight; the number of stop bits selected at one or two; odd parity or parity control by software selection set; and a high/low transmission and receive rate fixed by oscillator crystal and jumper wire selection. The CWM, TDI and BDI interface boards can be used with the ADC. Bit rates up to 1800 bps can be handled through data sets, and up to 9600 bps through direct connection. The available transmission and reception rates, in bits per second, are listed in the following table.

153.6KHz Crystal		57.6KHz Crystal	
High	Low	High	Low
9600	4800	3600	1800
4800	3200	1800	1200
3200	2400	1200	900
2400	-	900	-
4800	2400	1800	900
2400	1600	900	600
1600	1200	600	450
1200	-	450	-
2400	1200	900	450
1200	800	450	300
800	600	300	225
600	-	225	-
1200	600	450	225
600	400	225	150
400	300	150	112
300	-	112	-

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► Systems software selection can indicate whether or not to generate and check parity (parity mode) or replace the parity bit with a data bit from the 8-bit I/O data highway (transparent mode). Software also selects one of the two rates fixed by the hardware setting.

SYNCHRONOUS DATA COMMUNICATIONS CONTROLLER (SDC): Provides data rates up to 9600 bps in half-duplex transmission mode or up to 4800 bps in full-duplex mode. The SDC is alterable by systems software for no parity, even parity, or odd parity, and for no block checking or longitudinal redundancy check (LRC) block checking. The CWM can be used with the SDC.

SOFTWARE

OPERATING SYSTEM: The Master Control Program (MCP) is the only operating system offered by Burroughs for the B 80. It is conceptually similar to the MCP offered on the larger B 1700 systems.

The *Master Control Program* is an integral part of the B 80 Computer Management System (CMS). This system consists of the MCP, a Data Control System (DCS), high-level language compilers, utility routines, a Data Bridging System, and Business Management System application programs.

Designed as a comprehensive operating system, the MCP provides support for operator communications, multiprogramming, virtual memory techniques, dynamic resource allocation, input/output control, and maintenance of a library of files. The system display (or, alternatively, the console printer) serves as the communications device between the operator and MCP. On systems equipped with the 180-cps printer, the lower left feed, with its 50 print positions, serves primarily as a hard-copy recording device for all operator communications. Both data input requests and error notification can be handled.

Multiprogramming under the B 80 MCP takes place without partitioning. During I/O operations, the processor is free and thus able to handle the processing of a second program. The virtual memory concept is implemented by breaking up programs into a variable number of segments consisting of I/O functions, constant data, variable data, and executable logic code. Program segmentation is determined at compilation time, with the compiler building a dictionary for each program. When a program is to be executed, only those segments necessary for execution are brought into main memory.

Dynamic resource allocation under the MCP maintains resource-available files which are constantly updated. The factors affecting these files are the identities of the programs currently running and the segments of each program, memory assignments and available space, peripheral assignments and available units, disk files and file space available, and program priority.

I/O control is fairly conventional, with the MCP handling physical I/O and the programmer taking care of logical I/O. Among the processes of physical I/O handled by the MCP are locating files, data transfers, error monitoring, buffer management, label handling, and automatic retry on detection of an error.

The MCP requires 10K bytes of main memory and an additional memory block for each active non-disk peripheral on the system. At least 10K bytes of disk storage are required for a swapping disk area.

LANGUAGES: Under the B 80 MCP, both COBOL and RPG are supported. For data communications environments, the Network Definition Language and Message Processing Language are also supported.

The *B 80 COBOL* language is an essentially complete implementation of full American National Standard COBOL 74, except that the Report Writer module is not implemented. COBOL object programs are regarded as a collection of logical segments which can be loaded and executed individually or in groups, meaning that programs can be written without the usual limitations imposed by the computer's memory capacity.

The COBOL compiler runs on any B 80 processor with at least 48K bytes of main memory, console printer, and disk drive. Object programs generated by the COBOL compiler are expressed in an S-language that is oriented toward efficient handling of 4-bit digits and 8-bit characters. The COBOL Interpreter, required at execution time, occupies about 6K bytes of memory in addition to the object program's requirements.

The *B 80 Report Program Generator (RPG)* is a compiler-driven language. The compiler converts source programs written in the widely used RPG language into object programs that can be executed by B 80 systems. The compiler permits programs written in IBM RPG or RPG II, or in most other versions of the RPG language, to be compiled and run with little or no change. RPG programs are automatically segmented during compilation, so programs can be written without the usual limitations imposed by the computer's memory capacity. The RPG compiler runs on any B 80 processor with at least 48K bytes of main memory plus a console printer and disk drive. The RPG Interpreter occupies about 6K bytes of memory at execution time in addition to the object program's requirements.

Network Definition Language (NDL) is a special-purpose, parameter-driven programming tool that enables users to define and generate customized Network Controller programs for data communications applications. These programs are executed when required by the NDL Interpreter. The Network Controller program handles line disciplines, buffer management, message queuing, character translation, and automatic retries, and supervises the flow of messages between user-coded programs and remote terminals. This enables the user's application programs to deal with remote terminals in the same manner as conventional on-site peripheral devices.

After the programmer defines his custom Network Controller in the NDL syntax, the source statements are processed by the NDL Compiler and converted into the necessary object code and tables. Various line disciplines may be programmed in NDL and are stored as reusable library routines, known as request sets. Standard request sets for many line procedures are available from Burroughs. NDL runs under MCP on any B 80 system with at least 48K bytes of main memory. NDL will be available beginning in December 1976.

Message Processing Language II (MPL II) is a high-level, parameter-driven language for generating installation-tailored Message Control Programs. The Message Control Program provides the interface between the Network Controller and user application programs by decoding, validating, and directing incoming messages to the appropriate user program for processing. This program can also record all processed messages on secondary storage for audit purposes and place messages intended for terminals out of service in temporary storage on disk.

DATA CONTROL SYSTEM (DCS): Provides data handling capabilities which can be divided into four distinct elements. The first, interactive entry and prompting, is a transaction-oriented element designed to accept data from the B 80 keyboard or via magnetic tape cassettes. Characteristically, this data is from Audit Entry sources. ►

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► The second element allows the operator to build and maintain files. DCS takes care of this function automatically after the operator specifies the file name, whether the file is to be created or changed, what records are to be affected, and what fields are to be entered. A third element provides a basic reporting and inquiry capability without the requirements of writing a separate report program. The final element enables the entry and storage of program source statements for later compilation. DCS requires up to 12K bytes of user memory.

UTILITIES: At present, 12 stand-alone utilities are available for the B 80:

- *Cold Start* is a set of programs involved in the initial loading of systems software into disk storage. Separate programs handle disk initialization, disk copying, and disk loading of the systems software.
- The *Tape Library Utility* performs four functions. Both the Add and Load functions write files from cassette tape to disk. Load also eliminates identically named files. Dump writes files from disk to cassette tape.
- *Interrogate Disk Directory* determines whether or not a file or group of files is present on tape or disk.
- *List Directory* generates a listing of file parameters such as record size, block size, creation date, last access, and file type of a particular file or group of files.
- *Analyze Disk Space Assignment* produces a printed analysis of disk space utilization.
- *Remove Disk Files* deletes specified file names from the disk directory.
- *Copy* provides a means to change file attributes while copying a file or parts of a file.
- *List* provides a hexadecimal and/or alpha printout of a file or parts of a file.
- *Edit* is a utility for the keyboard creation and maintenance of source programs on disk.
- *Modify* allows the user to change file name, device type, and file size for a file as referenced by a particular program.
- *File Squash* removes all deleted records from a data file on disk.
- *Sort/Merge* sorts a data file on specified keys and maintains key files as necessary. An index file can be created or sorted, a data file can be sorted, and a merge can be executed to combine up to 16 ordered files into one.

BURROUGHS DATA BASE BRIDGING SYSTEM: Provides a method of converting files utilized on the Burroughs L Series and other manufacturers' systems into a proper format for B 80 disk storage. The system is a series of programs that use magnetic tape cassettes as the medium for data transfer.

APPLICATION SOFTWARE: Six packages currently available for the B 80 are described in the following paragraphs. Most are products originally developed for and extensively tested on the B 700 Series computers. Additional application program products are scheduled for release in the near future. These include products in the areas of contractor accounting, retail accounting, and education.

Commercial Business Management System II (CBMS II) is aimed at a wide range of businesses including industrial distributors, electrical and electronic distributors, hardware distributors, appliance distributors, paper merchants and office suppliers, paint and chemical distributors, and plumbing, heating, and air conditioning distributors. CBMS II is composed of seven modules, written in COBOL and each available separately or as a complete package.

The Accounts Receivable (A/R) module, which can be interfaced with the Invoicing and General Ledger modules, can be run as either an open item or balance forward system. Reports in the module include Trial Balance, Age Analysis, Periodic Activity, Customer Account Status, and Sales and Profit Analysis.

The Invoicing module is designed as a post billing system and can be interfaced with the Accounts Receivable and Inventory modules. Invoicing provides reports on Product Sales Analysis and Sales Analysis by Customer and Sales Representative. Both of these reporting areas cover cost of sales to date, sales to date, and gross profit and percentage of profit. A choice of fixed or user-specified invoice formats is available. The module provides a costed invoice with many features including flexible pricing with up to five prices per billing item.

The Inventory Control module can be interfaced into the Invoicing module to provide inventory stock updating. Reports are produced on Current Inventory Status; Stock Valuation at average and replacement cost; Stock Take Work Sheet (for physical inventory); Buyer's Guide listing quantity on hand, available, reserved, on order, and shipped to date, as well as unit cost; and Current Inventory for up to six locations. The function of all these reports is to enable a user to establish and maintain optimum stock levels versus return on investment.

The Inventory Management Analysis module presents comprehensive management reports on Comparative Return on Investment, Turnover on Current Stock, Potential Excess Stock, Ranked Sales Analysis by product, and Buyers' Guide, based on previous year's information and other statistics.

The Payroll module allows exceptions to standard payroll items via operator entry. Complete accounting from time card to General Ledger is performed with one handling of the input data. Reports available include Cost Center Analysis, Employee Status, and Deduction Registers as well as the traditional payroll reports.

The Accounts Payable (A/P) module produces Purchase Journal, Cash Disbursements Journal, Periodic Liability Forecast, Cash Requirements, Transaction Inquiry, and others. The reports are designed to enable the controller of a business to effectively manage liabilities, cash disbursements, and the associated General Ledger distribution. A/P can interface with General Ledger.

The General Ledger module is designed to provide a comprehensive control and reporting system. The ability of this module to interface with other CBMS II modules provides a good avenue for transaction information. More than 10 major report types are produced, including Master File Trial Balance, Activity Trial Balance, Balance Sheet and Income Statement Trial Balance, Current Period Activity, Variable and Floating Budget Reports, Comparison Reports, and Chart of Accounts.

CBMS II is designed to operate in 12K bytes of user memory. The Invoicing, A/R, and General Ledger modules of CBMS II will be available by October 1976. The remaining modules will be available by December 1976.

B 80 Manufacturing BMS Production Control System I (PCS I) is a four-module system written in COBOL. It ►

Burroughs B 80

► serves to standardize and centrally maintain product engineering information. The system features both explosion and implosion type reports.

The Bill of Material module allows the user to create and maintain Item Master and Product Structure files and to produce several reports in the Explosion and Where-Used categories. These reports may be either single-level, indented, or summarized.

The Work Center and Routing module serves to create and maintain the Work Center and Routing files as well as to produce listing reports by item number or work center.

The Stock Status and Costing modules both require the Bill of Material module as a prerequisite. Eight transaction types are utilized to produce Stock Status and Daily Inventory Activity Reports in the Stock Status module. The Costing module computes labor, set-up, overhead, material, and total costs and reports on them.

PCS I requires a 32K-byte B 80 with 4.6 megabytes of cartridge disk storage. A line printer, magnetic tape cassette drive, and audit entry system are optional. Availability is scheduled for October 1976.

B 80 Credit Union Business Management System performs all the normal accounting and record-keeping functions required for federal and state-chartered credit unions. The system relies heavily on keyboard entry transaction posting to maintain a current status on all accounts. Eleven different types of transactions can be keyboard-entered. These include five types for loans and four types for deposits and withdrawals. Automatic posting of dividend payments, payroll share deposits, interest rebates, payroll loan payments, and share-to-loan transfers occurs during batch processing. Automatic payroll deductions and dividend payments eliminate much repetitious preparation of transactions. Up to 20 different loan types and up to 99 loans per member can be handled. The system requires a minimum B 80 with either single or dual cartridge disk drives or single or dual BSM drives. The Credit Union System, with full capability for inquiry and audit entry, will be available during the first quarter of 1977.

B 80 Budgetary Accounting System (BAS) is a three-module system designed to run on a minimum B 80 system with either BSM or cartridge disk drive. The General Fund Accounting Module maintains an updated financial history. The Appropriation Processing module maintains an updated history of the authorized expenditures. The Revenue Processing Module maintains an updated history of budgeted source revenue. BAS maintains complete audit trails and descriptions of each general fund transaction. The system maintains 22 separate disk files. BAS is written in COBOL and became available in September 1976.

B 80 Hospital BMS—Burroughs Hospital Administration System II (BHAS II) is designed as a four-module system. The A/P, Payroll, and General Ledger modules are adopted to meet hospital requirements from the generalized BMS modules of the same name which were previously described. The Patient Accounting module includes census and statistical accounting and reporting as well as complete accounting for inpatients, outpatients, and accounts receivable. BHAS II is written in COBOL and can run on any configured B 80 system. Availability of all modules will be with initial machine deliveries.

B 80 Bank Business Management System is written in COBOL. Modules will become available later in 1976.

The Demand Deposit Accounting module allows transactions to be entered via keyboard or cassette tape. New account information, stop payments, and holds can be entered via keyboard. A daily trial balance and itemized customer statements are provided, with all exceptions noted.

The Savings Deposit Module accommodates passbook or statement accounts with flexibility for specifying rates, computing earnings, paying earnings, and computing early withdrawal account status. Reports are provided on the customer, management, and operational levels.

The Loan Accounting module has capabilities to process installment loans, commercial loans, and mortgage-type loans as well as add-on, discount, and participation loans. Amortization schedules and other loan reports are produced. Loan processing includes interest accrual, loan payment distribution, and unearned interest calculation on prepared loans. Loan inquiry, new account step-up, file maintenance, and transaction entry can all be performed via keyboard.

The Mortgage Loan module provides a complete inquiry profile as well as the necessary function for required reporting, processing loan payments, and disbursing monies for taxes and insurance. An Accrual Accounting system is an integral part of the module.

The Audit Entry Proof module provides direct keyboard entry, balancing, and automatic disk sorting of all transactions into application sequence. Cash letters and a proof journal can be produced.

The General Ledger module produces a comprehensive statement of financial condition. The posting routine requires only a single entry of account data to update all affected records and management reports.

PRICING

POLICY: Burroughs offers the B 80 for purchase or lease. In addition to the basic one-year lease, Burroughs offers three-year and five-year leases at a discount of approximately five percent.

The standard equipment lease agreement includes equipment maintenance and permits use of the equipment during one 8-hour period per day. Additional extra-shift charges are billable for maintenance coverage on a 24 hours/day, 7 days/week basis. Burroughs software technical assistance, for installation support and beyond, is available to B 80 users at a price of \$225 per day. Installation support varies from one day, for some applications modules, up to 14 for the B 80 Bank BMS complete system. Hardware installation support for purchased systems is billable at \$225 per day. Two days are usually the maximum requirement.

Application software prices quoted in the price list are for an unlimited-time license plan for each designated CPU. Besides this plan, two limited-time (3-to-5-year) plans are available. The first involves an initial payment and an annual fee, while the second involves the same annual fee but divides the initial fee into 12 monthly installments.

Customer education for application programs is charged at the rate of \$100 per day. Some modules require one day, while complete systems may require up to 17 days. Courses on the B 80 hardware and software include operator self-study, priced at \$150, and nine other courses on subjects from Introduction to Computers (2 days) through Introduction to the B 80 (5 days) to B 80 COBOL (10 days). All cost \$100 per day. Training is recommended by Burroughs.

Training, at the time of this release, was available at nine major centers throughout the United States, including Philadelphia, Syracuse, Detroit, Atlanta, Chicago, Dallas, Los Angeles, San Francisco, and Pasadena. Other major centers offering worldwide training include London, Paris, Rio de Janeiro, Sydney, Tokyo, Toronto, Amsterdam, Johannesburg, Stockholm, and Mexico City.

EQUIPMENT: The following typical system prices include ►

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all required control units and adapters. The lease prices include equipment maintenance.

B 80 MINI-DISK SYSTEM: CPU with 32K bytes of MOS memory, a 60-cps console printer, one magnetic tape cassette drive, a 256-character system display, two BSM drives, system software, customer training, and two days of hardware installation support. Purchase price is \$23,110; one-year lease price is \$720 per month; and monthly maintenance charge is \$134.02.

B 80 CARTRIDGE DISK SYSTEM WITH TD DISPLAY: CPU with 32K bytes of MOS memory; a 60 cps console printer; one magnetic tape cassette drive; a 4.6-megabyte, 145-millisecond cartridge disk drive; a 256-character system display; a 160-lpm, 132-position printer; a two-wire direct connect interface; a TD input/display system; poll/select procedure; system software; customer training; and two days of hardware installation support. Purchase price is \$43,050; one-year lease price is \$1,188 per month; and monthly maintenance charge is \$230.77. ■

EQUIPMENT PRICES

PACKAGED SYSTEMS

All configured systems below are built around the same B 80 processor, which includes 32K bytes of MOS memory, 4K bytes of ROM, variable micrologic, system display panel, eight I/O ports, on-board diagnostics, 8-bit parallel data movement, and overlap of fetch and execution of micro-instructions. All systems include one magnetic tape cassette drive and a 256-character system display.

		Purchase Price	Annual Maint.	Rental (1-year lease)*	Rental (3-5-year lease)*
B 80 31-111	Specified system including 60-cps matrix printer, 15-inch single pinfeed forms handler, and two BSM drives	\$ 19,510	\$ 1,608.20	\$ 650	\$ 618
B 80 31-113	Specified system including 60-cps matrix printer, 15-inch single pinfeed forms handler, two BSM drives, and an A 9249-2 160-lpm printer	27,010	2,440.40	900	855
B 80 34-111	Specified system including 180-cps matrix printer, 25.6-inch dual pinfeed forms handler, and two BSM drives	22,010	1,788.20	734	697
B 80 34-113	Specified system including 180-cps matrix printer, 25.6-inch dual pinfeed forms handler, two BSM drives and an A 9249-2 160-lpm printer	29,510	2,620.40	984	935
B 80 41-311	Specified system including 60-cps matrix printer, 15-inch single pinfeed forms handler, and A 9480-22 4.6-megabyte, 145-ms cartridge disk drive	27,900	1,862.00	775	736
B 80 41-411	Specified system including 60-cps matrix printer, 15-inch single pinfeed forms handler, and A 9480-12 4.6-megabyte 80-ms cartridge disk drive	29,400	1,906.60	817	776
B 80 41-511	Specified system including 60-cps matrix printer, 15-inch single pinfeed forms handler, and A 9481-12 9.2-megabyte, 100-ms cartridge disk drive	31,400	2,177.80	872	828
B 80 41-313	Specified system including 60-cps matrix printer, 15-inch single pinfeed forms handler, A 9480-22 4.6-megabyte, 145-ms cartridge disk drive, and A 9249-2 160-lpm printer	35,400	2,544.40	983	934
B 80 41-413	Specified system including 60-cps matrix printer, 15-inch single pinfeed forms handler, A 9480-12 4.6-megabyte, 80-ms cartridge disk drive, and A 9249-2 160-lpm printer	36,900	2,588.80	1,025	974
B 80 41-513	Specified system including 60-cps matrix printer, 15-inch single pinfeed forms handler, A 9481-12 9.2-megabyte, 100-ms cartridge disk drive, and A 9249-2 160-lpm printer	38,900	2,660.00	1,081	1,027
B 80 44-311	Specified system including 180-cps matrix printer, 25.6-inch dual pinfeed forms handler, and A 9480-22 4.6-megabyte, 145-ms cartridge disk drive	30,400	1,892.20	844	802
B 80 44-411	Specified system including 180-cps matrix printer, 25.6-inch dual pinfeed forms handler, and A 9480-12 4.6-megabyte, 80-ms cartridge disk drive	31,900	1,936.60	886	842
B 80 44-511	Specified system including 180-cps matrix printer, 25.6-inch dual pinfeed forms handler, and A 9481-12 9.2-megabyte, 100-ms cartridge disk drive	33,900	2,207.80	942	895
B 80 44-313	Specified system including 180-cps matrix printer, 25.6-inch dual pinfeed forms handler, A 9480-22 4.6-megabyte, 145-ms cartridge disk drive and 9249-2 160-lpm printer	37,900	2,724.40	1,051	1,000
B 80 44-413	Specified system including 180-cps matrix printer, 25.6-inch dual pinfeed forms handler, A 9480-12 4.6-megabyte, 80-ms cartridge disk drive, and A 9249-2 160-lpm printer	39,400	2,768.80	1,094	1,039
B 80 44-513	Specified system including 180-cps matrix printer, 25.6-inch dual pinfeed forms handler, A 9480-12 4.6-megabyte, 100-ms cartridge disk drive, and A 9249-2 160-lpm printer	41,400	2,840.00	1,150	1,093
B 80 XX-XOX	Delete 256-character system display	-1,000	-153.40	-40	-37

SYSTEM OPTIONS

A 9355	256-character system display	1,990	122.00	55	—
BD 9355	Controller for A 9355	500	31.40	15	—
BD 7762	Additional pinfeed device for 180-cps printer	500	NC	15	—
BD 7766	60-cps printer media present detector	100	NC	5	—
BD 7767	180-cps printer media present detector	100	NC	5	—

MEMORY

BD 4016-4	Additional 4K bytes of MOS memory	900	54.80	30	—
BD 4016-8	Additional 8K bytes of MOS memory	1,500	109.60	50	—
BD 4016-12	Additional 12K bytes of MOS memory	2,000	164.40	65	—
BD 4016-16	Additional 16K bytes of MOS memory	2,500	219.20	80	—

* Rental prices include equipment maintenance.

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EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Annual Maint.</u>	<u>Rental (1-year lease)*</u>	<u>Rental (3-5-year lease)*</u>
MASS STORAGE					
B 9480-11	Single free-standing BSM	\$ 3,200	\$ 305.00	\$ 89	—
B 9489-12	Dual free-standing BSM	5,000	305.00	139	—
BD 9489-11	BSM controller	600	64.80	20	—
B 9489-17	Single free-standing ICMD	3,200	265.00	89	—
B 9489-18	Dual free-standing ICMD	5,000	265.00	139	—
BD 9489-17	ICMD Controller	600	64.80	20	—
A 9480-22	Dual-cartridge disk drive; 4.6 megabytes, 145 ms	9,500	714.00	274	—
A 9480-12	Dual-cartridge disk drive; 4.6 megabytes, 80 ms	11,900	758.40	342	—
A 9481-12	Dual-cartridge disk drive; 9.2 megabytes, 100 ms	14,900	1,029.60	502	—
BD 9480	Dual-cartridge disk controller	600	64.80	20	—
MAGNETIC TAPE EQUIPMENT					
A 9490-21	Magnetic tape cassette drive	1,640	92.00	55	—
PRINTERS					
A 9249-2	Chain printer; 160 lpm	9,900	1,000.80	293	—
A 9249-3	Chain printer; 250 lpm	13,400	1,344.00	392	—
BD 9249	Printer controller	600	31.40	15	—
TERMINALS					
TD 700	Self-Scan 256-character display and keyboard	4,150	—	115	—
TD 701/TD 731	Self-Scan 256- or 480-character display and keyboard	3,635	—	115	—
TD 801/TD 802	CRT 960- or 1920-character display and keyboard	5,000	—	130	—
TD 830	CRT 2000-character display and keyboard	4,285	—	135	—
COMMUNICATIONS EQUIPMENT					
All controllers below include BD 4551-2 DataComm Adapter					
BD 2356-2	Asynchronous data set controller	600	64.80	25	—
BD 2356-5	Burroughs direct interface	700	64.80	30	—
BD 2356-6	Two-wire direct interface	600	64.80	25	—
BD 2356-7	Synchronous data set controller	1,000	64.80	40	—
BD 2356-3	Burroughs Data Link Control (BDLC) controller	1,000	64.80	40	—

* Rental prices include equipment maintenance.

SOFTWARE

		<u>Initial Payment (one-time)</u>	<u>Monthly Lease or License Fee</u>
CM 80 MCP	Master Control Program for the B 80	\$2,500	or \$ 70
CM COB	Computer Management System COBOL compiler		25
CM RPG	Computer Management System RPG compiler		25
CM MP2	Computer Management System MPL compiler		50
CM NDL	Computer Management System NDL compiler		50
CM DC1	B 80 Data Control System		15
CM 80 UTL	B 80 Utilities for Computer Management System	540	or 15
Commercial Business Management System II (CBMS II):			
B 80 CRO	Accounts Receivable	960	48
B 80 CIO	Invoicing	600	30
B 80 CCO	Inventory Control	500	25
B 80 CMO	Inventory Management	500	25
B 80 CPO	Payroll	640	32
B 80 CGD	General Ledger	440	22
B 80 CYO	Accounts Payable	560	28
B 80 CIB	CBMS II Package; all modules	4,000	200
B 80 Manufacturing BMS Production Control System I (PCS I):			
B 80 MC1	Bill of Material Processor	500	25
B 80 MG1	Stock Status	420	21
B 80 ME1	Work Center and Routing	500	25
B 80 MJ1	Costing	350	18
B 80 MA1	PCS I Package; all modules	1,700	85
B 80 Credit Union Business Management System:			
B 80 CU5	Credit Union System	1,555	78
B 80 Budgetary Accounting System:			
B 80 M07	Budgetary Accounting System	630	38
B 80 Hospital BMS: Burroughs Hospital Administrative System II (BHAS II):			
B 80 HAF	Patient Accounting System	805	40
B 80 HAK	Hospital Payroll System	735	37
B 80 HAM	Hospital Accounts Payable	280	14
B 80 HAP	Hospital Accounts Payable	280	14
B 80 HAB	BHAS II Package, all modules	2,100	105
B 80 Bank Business Management System:			
B 80 BD2	Demand Deposit Accounting	560	28
B 80 BS2	Savings Deposit Accounting	560	28
B 80 BL2	Loan Accounting	1,120	56
B 80 BN2	Mortgage Loan Accounting	256	13
B 80 BK2	Audit Entry Proof	460	23
B 80 BG2	General Ledger Accounting	330	16
B 80 B02	Bank BMS Package; all modules	2,895	145