

## Burroughs B 4700

### MANAGEMENT SUMMARY

Burroughs announced the B 4700 system on October 20, 1971, and simultaneously began making customer deliveries of the system and its supporting software. This almost unprecedented achievement was possible because (1) the B 4700 is completely program-compatible with the earlier B 2500 and B 3500 systems, and (2) the B 4700 is an improved successor to the B 4500 system, which Burroughs announced in March 1970 but elected not to manufacture. Customers who ordered a B 4500 system will instead receive a B 4700, which is priced the same as the B 4500 and offers a number of worthwhile new features.

The B 4700 extends the successful hardware and software concepts of the B 2500/3500 systems, which Burroughs introduced in 1966, to a considerably higher performance level. The B 3500 system strongly emphasizes dynamic multiprogramming and user-oriented software, and is widely recognized as one of the outstanding business data processing systems in its price class.

The B 4700 preserves all of the B 3500's features, together with more than twice the B 3500's internal speed, greatly improved scientific computing capabilities, provisions for multiprocessor configurations, and several new, high-performance peripheral devices. Thus, the B 4700 shapes up as an impressive contender for the upper-medium-scale computer market, where it will be directly competitive with the IBM System/370 Model 145 and the UNIVAC 9700. Monthly rentals for B 4700 systems will range from about \$11,500 for a small single-processor configuration to \$90,000 for a large system with four central processors.

The B 4700 system adds increased performance, improved peripherals, and multiple-processor capabilities to the user-oriented software and effective multiprogramming that characterize the earlier B 2500/3500 systems. The result is an impressive new contender for the market segment that is currently dominated by the IBM 370/145.

### CHARACTERISTICS

**MANUFACTURER:** Burroughs Corporation, 6071 Second Avenue, Detroit, Michigan 48232.

**MODELS:** B 4700 Data Processing Systems, Models B 4704, B 4711, B 4712, B 4713, and B 4714.

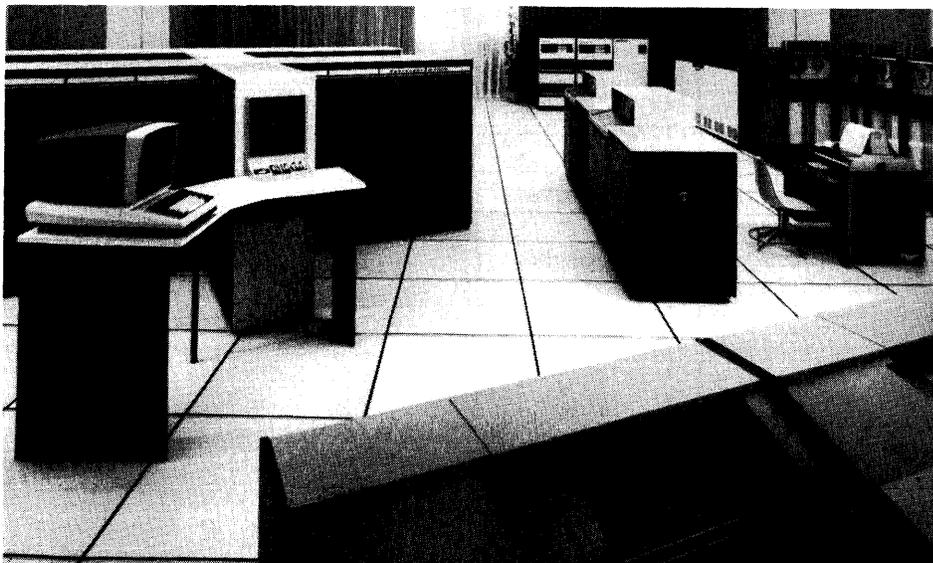
### DATA FORMATS

**BASIC UNIT:** 16-bit word (plus parity bit). Each word can hold two 8-bit bytes or four 4-bit BCD digits. Core storage is addressable by digit position.

**FIXED-POINT OPERANDS:** Can range from 1 to 100 decimal digits or bytes for most instructions. Data in 4-bit format can be either signed (with 4-bit sign digit in leftmost position) or unsigned. Data in 8-bit format is always unsigned.

**FLOATING-POINT OPERANDS:** Consist of a 2-digit exponent and a fraction ranging from 1 to 100 decimal digits in length; the signs of the exponent and fraction each occupy an additional digit position.

The optional Fixed-Length Floating-Point Arithmetic capability provides high-speed arithmetic operations on either "short" or "long" operands. Short operands have an exponent of 2 decimal digits plus sign and a fraction of 8



*This B 4700 Central Processor (left) is equipped with the new B 9340-1 Operator Display Console, which facilitates communication between the system and its operator.*

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➤ Burroughs offers the B 4700 Central System in five basic models which include from one to four central processors. The differentiating characteristics of the five models are summarized in the accompanying table. The same central processor is used in all models, and each processor can be equipped with 100,000 to 500,000 bytes of core storage and up to 20 I/O channels. All models except the low-priced B 4704 include the File Protect Memory, a Burroughs exclusive that provides hardware-level protection against interference when two or more programs and/or two or more processors simultaneously attempt to access the same data record on a head-per-track disk file.

For systems with two or more processors, Burroughs provides software that supports "parallel multiprogramming," with all processors working from the same operating system in disk storage. Each central processor, however, has its own dedicated core storage unit and its own job stream, and each services its own I/O operations. It is not possible for the processors to share a common main storage unit, nor for jobs to be dynamically interchanged among the processors. Within each processor, multiple independent jobs can be processed in multiprogramming fashion, and all processors in a system can jointly access the on-line disk files. Thus, the B 4700 system is particularly well suited for installations where two or more processors, each with its own dedicated workload, must share a common data base. Considerable flexibility is provided for reconfiguring the system resources, through both manual switching and (for disk files and tape drives connected through electronic exchange units) under program control.

The B 4700 has an expanded addressing structure and instruction repertoire which include the B 2500/3500 addressing structure and instruction repertoire as a subset. Thus, a B 4700 can directly execute all programs written for the smaller systems. Internal speed of the B 4700 will average about 2.3 times that of the B 3500 in typical business applications. The specific differences between the B 4700 and the B 3500 can be summarized as follows:

- The B 4700 has a core cycle time of 500 nanoseconds per 2-byte access—twice the speed of the B 3500.
- The B 4700 processor cycling speed has also been doubled, to 4 million cycles per second.
- The B 4700 has a high-speed address memory with a 50-nanosecond access time—again twice as fast as the B 3500.
- The B 4700 uses a "new generation" of CTL integrated circuits and MSI (medium-scale integration) devices for greater speed and economy.
- The B 4700 uses hard-wired circuits to control its logic sequences, whereas the B 3500 uses read-only memory.

➤ decimal digits plus sign. Long operands have an exponent of 2 digits plus sign and a fraction of 16 digits plus sign.

**INSTRUCTIONS:** May consist of from one to four 6-digit and/or 8-digit "syllables," a single 8-digit or 10-digit "syllable," or a single 2-digit "syllable" consisting of an op code only. Each instruction may contain from 0 to 3 memory addresses.

**INTERNAL CODE:** EBCDIC (standard) or ASCII, depending upon the setting of a mode flip-flop.

### MAIN STORAGE

**STORAGE TYPE:** Magnetic core.

**CAPACITY:** From 100,000 to 500,000 bytes per central processor, in 50,000-byte increments.

**CYCLE TIME:** 500 nanoseconds per 1-word (2-byte) access.

**CHECKING:** Parity bit with each byte is generated during writing and checked during reading.

**STORAGE PROTECTION:** Provided by a base register and a limit register. The high-order 3 digits of generated memory addresses are checked to ascertain that they fall within the range defined by these two registers.

### CENTRAL PROCESSORS

**INDEX REGISTERS:** Three 8-digit index registers for each program are stored in reserved core memory locations.

**INDIRECT ADDRESSING:** Can be specified within the first digit of any instruction address field. If so, the indicated memory location is considered to hold the address of the required operand rather than the operand itself. Multi-level indirect addressing to any depth is possible.

**INSTRUCTION REPERTOIRE:** The standard instructions provide for efficient arithmetic, comparison, and data movement operations on variable-length operands in either 4-bit numeric or 8-bit alphanumeric mode. Included are 3-address add, subtract, multiply, and divide commands and 2-address add and subtract commands, as well as convenient edit, search, and translate instructions. No binary arithmetic is possible, but logical AND, OR, and NOT instructions are included.

Floating-point decimal arithmetic is an optional feature.

A number of the standard instructions, including Initiate I/O, are "privileged" and may not be used in normal user-written programs.

**INSTRUCTION TIMES:** Internal performance of the B 4700 ranges from 2 to 2.6 times as fast as the B 3500, depending upon the instruction mix. Therefore, the approximate execution times, for 3-address decimal arithmetic operations on signed 5-digit fields, are 17 microseconds for addition and 97 microseconds for multiplication.

### INPUT/OUTPUT CONTROL

**I/O CHANNELS:** Each B 4700 Processor has 8 or 10 standard channels, depending upon the model (see table), and can accommodate a maximum of 20 channels.

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### CHARACTERISTICS OF THE B 4700 MODELS

	B 4704	B 4711	B 4712	B 4713	B 4714
Number of central processors	1	1	2	3	4
Processor cycle time, nanoseconds	250	250	250	250	250
Number of I/O channels — standard	8	10	18	26	34
Number of I/O channels — maximum	20	20	40	60	80
Minimum core storage capacity, bytes	100,000	100,000	200,000	300,000	400,000
Maximum core storage capacity, bytes	500,000	500,000	1,000,000	1,500,000	2,000,000
Core cycle time, nanoseconds	500	500	500	500	500
Bytes fetched per cycle	2	2	2	2	2
File Protect Memory facility	No	Standard	Standard	Standard	Standard
No. of standard Disk File Exchanges	0	1	1	1	1
No. of standard Disk File Controls	0	1	2	3	4

- ▷ • The B 4700 has a 4-digit parallel adder, whereas the B 3500 uses a 1-digit adder.
- The B 4700 has a redesigned Instruction Fetch process that reduces the number of processor cycles required to execute most instructions.
- The B 4700 offers a new fixed-length floating-point arithmetic capability in addition to the B 3500's variable-length floating-point instructions. A new FORTRAN compiler that utilizes the new instructions will enable the B 4700 to execute most FORTRAN-coded scientific programs from 6 to 20 times as fast as the B 3500—though in this case direct object-program compatibility with the B 3500 will be sacrificed. (An alternative FORTRAN compiler preserves full compatibility.)

Within the B 4700 system, data can be represented in the form of variable-length fields composed of either 8-bit bytes or 4-bit digits. Although the memory word length is two bytes (16 data bits), each 4-bit digit position can be individually addressed. Numeric fields expressed in the 4-bit and 8-bit modes can be combined in decimal arithmetic operations without the need for prior format conversion. No binary arithmetic facilities are included.

The B 4700 central processors operate in either the Normal State or Control State. The Normal State is used for execution of user programs. An interrupt signal causes the processor to enter the Control State and transfer control to the Master Control Program whenever an I/O operation is completed or an abnormal condition is encountered. A group of "privileged" instructions, executable only in the Control State, enable the MCP to initiate I/O operations, control the storage protection registers,

▶ **CONFIGURATION RULES:** One I/O channel is required for each I/O control unit, and each type of peripheral device requires a different control unit. There are two types of I/O channels, designated Type A and Type B. In general, Type A channels are used for the slower I/O devices (card readers, punches, printers, etc.), while Type B channels are required for the faster or more complex peripherals (magnetic tape, disk files, communications, etc.). A maximum of 10 of the I/O channels on each B 4700 Processor may be Type B channels.

**SIMULTANEOUS OPERATIONS:** One input or output operation on each installed I/O channel can occur simultaneously with computing.

**I/O INTERFERENCE:** Only one core storage cycle is required for each unit of I/O data transferred (1 character at a time for Type A channels, and 2 characters in parallel for Type B channels).

#### MASS STORAGE

**HEAD-PER-TRACK DISK FILES:** Burroughs offers five models of its fixed-head disk files, with varying capacities and access times, for use with the B 4700. All models utilize non-interchangeable disks and have a fixed read/write head serving each data track. Various mixes of these models can be included in a single disk subsystem through the use of appropriate control units, electronic units, and Disk File Exchange units. Moreover, a single disk subsystem can include one, two, or four control units, each capable of servicing any of the connected disk files. Simultaneous disk read and write operations can occur in a subsystem with two or more control units.

The B 9370-2 Systems Memory unit provides fast-access storage, primarily for the MCP and other systems software, on a single disk. Data storage capacity is 2 million bytes. There are 100 tracks on each of the 2 disk faces. Each track is divided into 100 segments, and each segment holds 100 data bytes plus a longitudinal parity byte. Average access time is 17 milliseconds, and maximum data transfer rate is 291,000 bytes/sec. The B 9370-2 is connected directly to a Disk File Control; no Disk File Electronic Unit is required. ▶

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▷ set the 6-digit interval timer, and perform other system control functions.

The B 4700 is strongly oriented toward data communications. In addition to the single-line and multi-line communications controls used in the B 2500/3500 systems, B 4700 buyers can choose the new B 4350 Data Communications Processor (DCP). The DCP is an independently programmed "front-end" processor that can control up to 64 lines and presents a "soft" (i.e., programmable) interface capable of accommodating a wide variety of terminals. Multiple DCP's can be used in a B 4700 system. The Burroughs product line also includes an audio response system, CRT display systems, on-line banking terminals, general-purpose terminals, remote peripheral controllers, and remote terminal concentrators.

Burroughs offers an unusually wide choice of peripheral equipment for the B 4700. About the only noteworthy current omissions are an optical page reader and a really fast printer comparable to the 2000-lpm IBM 3211. In addition to the full range of B 2500/3500 peripheral equipment, B 4700 systems can include several important new units that were introduced along with the B 4700:

- A disk pack drive subsystem that stores 121 million bytes on each 11-disk IBM 2316-style pack by recording the data at 200 tracks/inch and 4400 bits/inch—twice the density of the IBM 2314 drives in each direction.
- New magnetic tape units that transfer data at up to 400,000 bytes per second—the highest tape speed currently available from any of the major computer manufacturers.
- New line printers that feature simplified operation and a unique "Forms Self-Align" facility that uses preprinted marks on the edge of the forms in place of the usual tape loop to control the vertical format.
- An Operator Display Console that facilitates operator communications and provides regularly updated displays showing the system's operational status.

B 4700 buyers who need mass storage can choose either head-per-track disk files or disk pack drives. The head-per-track disk files that have been a key element in most Burroughs computer systems for the past decade are still offered in a broad range of capacities and access speeds. Disk pack drives, which were conspicuously absent from the Burroughs product line until late 1970, are now available in two models that provide either two or four times the storage capacity of an IBM 2314 drive. The principal emphasis, however, is still on the head-per-track files, as indicated by the facts that (1) the File Protect Memory capability is applicable only to the head-per-track files, and (2) at least one head-per-track unit is required in ▷

▶ The B 9372-1 Disk File provides 10 million bytes of storage with an average access time of 20 milliseconds. Maximum data transfer rate is 235,000 bytes/sec. Data is recorded in 100-byte segments. The basic B 9372-1 and up to four B 9374-2 Additional 10-Million-Byte Storage Increments can be connected to a B 9371-1 Disk File Electronic Unit (DFEU), and up to 20 DFEU's can be included in a single disk subsystem.

The B 9373-3 Disk File provides 20 million bytes of storage with an average access time of 23 milliseconds. The B 9373-3 includes one DFEU and can accommodate up to four B 9374-3 Additional 20-Million-Byte Storage Increments. Additional DFEU's can be used if desired to increase the number of simultaneous access paths to the disk files.

The B 9373-4 Disk File provides 20 million bytes of storage with an average access time of 40 milliseconds. The B 9373-4 includes one DFEU and can accommodate up to four B 9374-4 Additional 20-Million-Byte Storage Increments. Additional DFEU's can be used to increase the number of access paths.

The B 9375-4 Head-per-Track Memory Bank provides 100 million bytes of storage with an average access time of 40 milliseconds. Data is recorded in 100-byte segments, and maximum data transfer rate is 216,000 bytes/sec. The capacity can be expanded to a maximum of 2 billion bytes per subsystem through the use of B 9376-5 Additional 20-Million-Byte Storage Increments. The Memory Bank prices include one DFEU for each 100 million bytes or fraction thereof. Additional DFEU's can be used to increase the number of access paths.

**FILE PROTECT MEMORY:** This feature, a standard component of the B 4711, B 4712, B 4713, and B 4714 systems, permits multiple programs, residing in either single or multiple processors, to share a common data base stored on Burroughs head-per-track disk files. The feature makes it possible to "lock" specific disk record addresses, thus guarding against the errors that can occur when one program attempts to access a data record while it is being updated by another program.

The basic File Protect Memory (FPM) consists of a series of registers and sixteen 40-bit words of memory, permitting simultaneous locking of up to 16 disk record addresses. Up to 7 additional 16-word modules of FPM may be added, for a total capacity of 128 words. The FPM can interface into as many as four Disk File Controls, enabling up to four processors to share a common data base. All processors also share a common MCP residing on disk, a common File Directory, and a common Disk Available Table.

**DISK PACK DRIVES:** Burroughs offers two basic models of disk pack drives for the B 4700 system. Both units feature two independent disk drives per module and either single or dual access control units. Up to 16 drives can be serviced by one control unit. The comb-style access mechanisms, with one read/write head for each disk surface, are driven by magnetic voice-coil head actuator mechanisms.

Error detection and correction are provided by a block-count check byte (a count of "one" bits for each full track or 180-byte segment) and an 11-bit checking word appended to each 90 bytes of user data. All single-bit errors are detected and corrected, and all multiple-bit errors are detected.

The disk pack drives are software-supported by the MCP for I/O operations in either the full-track or 180-byte segment ▶

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▷ every B 4700 configuration for systems software residence. Choosing the most suitable type and model of mass storage for a B 4700 installation will require careful consideration of throughput requirements, processing techniques (random vs. sequential), data security, backup considerations, etc.

Burroughs has taken several steps toward improved reliability and maintainability in the B 4700 system. Special test instructions and new diagnostic software will aid field engineers in pinpointing malfunctions. A new centralized power supply for each processor and its associated core memory and I/O controls will reduce the number of places where malfunctions can occur. Most significantly, the high redundancy possible in multiprocessor B 4700 systems will permit "fail-soft" operation. If one processor fails in a multiprocessor system, the operator can switch the required peripheral devices to another processor and use the MCP's "audit trail" capability to pick up the work load that was being executed by the processor that failed.

The B 4700's compatibility with the B 2500/3500 systems enables it to use all the software that has been developed and refined during the five-year operational history of the smaller systems. This includes the comprehensive Master Control Program, which supervises and controls all of the system's operations, and compilers for COBOL, FORTRAN, BASIC, and RPG—but not for ALGOL or PL/I to date. Most B 4700 installations will select COBOL for their business programming and FORTRAN for scientific applications.

To augment the existing B 2500/3500 software, Burroughs is developing several new software facilities primarily for the B 4700. These include an improved MCP, a new FORTRAN compiler to utilize the B 4700's fixed-length floating-point arithmetic hardware, an improved BASIC compiler, a compiler for the new, machine-oriented Burroughs Program Language (BPL), and a Remote Job Entry system to enable remote batch terminals to access the B 4700.

All software support for the B 4700 is built around the MCP, the integrated operating system that complements the hardware to create an unusually effective environment for multiprogrammed operation. Perhaps the most striking feature of the MCP is the fact that it is truly user-oriented and much easier to understand and use than most of the competitive operating systems. The MCP receives its orders through unusually straightforward messages entered via control cards or the console keyboard. The improved B 4700 MCP, scheduled for release in April 1972, will support shared data bases on head-per-track disk files and yield improvements in operational efficiency.

Though the B 4700 is billed as a member of the Burroughs "700 Systems" computer family, there is no object-level

▶ mode. However, every B 4700 system must also include at least one of Burroughs Head-per-Track Disk Files for systems software residence, and the disk pack drives cannot use the File Protect Memory facility.

The B 9484-3/9485-3/9486-3 Magnetic Actuator Disk Pack Drives are dual-drive units that provide up to 121 million bytes of data storage, 60.5 million bytes per disk pack. Up to 968 million bytes of storage can be provided via a single control unit (16 drives). Average arm movement time is 30 milliseconds, and average rotational delay is 12.5 milliseconds. Data is recorded at 2,200 bits per inch, producing a data transfer rate of 312,500 bytes/second. Data is recorded on an 11-high disk pack, which is physically compatible with the IBM 2316 pack; the packs, however, are not data-compatible with the IBM equivalents. Twenty surfaces are used for data recording.

The B 9484-4/9485-4/9486-4 Magnetic Actuator Disk Pack Drives are dual-drive units that provide up to 242 million bytes of data storage, 121 million bytes per disk pack. Up to 16 drives, or 1.936 billion bytes of storage, can be connected to a single control unit. Average arm movement time is 30 milliseconds, and average rotational delay is 12.5 milliseconds. Data is recorded at 4,400 bits per inch—twice the density of most competitive units—resulting in a data transfer rate of 625,000 bytes/second. Data is recorded on an 11-high disk pack, which is physically compatible with the IBM 2316 pack; the packs, however, are not data-compatible with the IBM equivalents. First deliveries are scheduled for September 1972.

### INPUT/OUTPUT UNITS

**MAGNETIC TAPE CLUSTERS:** Contain two, three, or four tape drives in a single compact cabinet. The feed and take-up reels for each tape drive are mounted on concentric vertical shafts, with the feed reel directly above the take-up reel. Pinch rollers and short vacuum-column buffers are employed. Each of the tape drives has its own drive mechanism, but they share a common power supply and read/write circuitry. Up to eight tape drives (two clusters) can be connected to a Cluster Control. Two of the drives in a cluster can read and/or write simultaneously if two Cluster Controls and an Exchange unit are used.

Burroughs offers numerous models of the Magnetic Tape Clusters, as listed in the Equipment Prices section of this report. All models use standard 1/2-inch tape, can read either forward or backward, and record in IBM-compatible formats at a tape speed of 22.5 or 45 inches per second. The 9381 series units record in 9-track NRZI mode at 800 bpi and transfer data at either 18,000 or 36,000 bytes/sec; these units can alternatively be equipped to operate in the 7-track NRZI mode at densities of 200, 556, or 800 bpi. The 9382 series units record in 9-track phase-encoded mode at 1600 bpi and transfer data at either 36,000 or 72,000 bytes/sec. The 9383 series units are 9-track models that can operate in either the 800-bpi NRZI or 1600-bpi phase-encoded mode, with data transfer rates of either 18/36KB or 36/72 KB.

**B 9390 SERIES MAGNETIC TAPE UNITS:** These units record data on 1/2-inch tape in IBM-compatible formats. Each tape drive is housed in a separate cabinet of the conventional vertical type. Pinch rollers and vacuum-column buffers are employed. Tape can be read in either the forward or reverse direction. Up to 10 free-standing tape drives can be connected to a Tape Control. Simultaneous read/write operations are possible if two Tape Controls and an Exchange unit are employed.

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▷ program compatibility between the B 4700 and the larger B 5700, B 6700, or B 7700 systems. Burroughs, however, strongly recommends programming in COBOL or FORTRAN and provides "filter" programs that facilitate the conversion of COBOL or FORTRAN programs from one Burroughs computer to another.

The B 4700 uses the same byte-oriented data structure, EBCDIC internal code, and magnetic tape formats as the IBM System/360 and 370 computers, but there is no direct program compatibility between them at the machine-language or assembly-language level. Most programs written in ANS COBOL, FORTRAN, or RPG for the IBM computers, however, should be usable on a B 4700 without undue conversion difficulty.

The B 4700 will be marketed as a program-compatible upgrade machine for B 3500 users and—more frequently—as a replacement for IBM System/360 Model 40 and 50 systems and for competitive computers in their price class. For 360/50 users, the B 4700 will deliver substantially higher performance, usually at a saving in cost.

In most sales situations, the B 4700 will be in head-to-head competition with the IBM System/370 Model 145. Burroughs expects the B 4700 to "dramatically outperform the 370/145 in typical user applications." The DATAPRO 70 staff, however, judges the two systems, in equivalent single-processor configurations, to be closely comparable in both performance and price. Therefore, discriminating computer buyers will need to carefully evaluate each system's ability to satisfy their own specific requirements. Among the many factors of importance to potential users, the B 4700's fully bundled support, user-oriented software, and extensive system expansion possibilities make it a system worthy of careful consideration. □

▶ Six models of the free-standing tape units are available, with the following recording modes, tape speeds (in inches per second), recording densities (in bits per inch), and data transfer rates (in bytes or characters per second):

B 9391: 7 tracks; 90 ips; 200/556/800 bpi; 18,000, 50,000, or 72,000 char/sec.

B 9392: 9 tracks; 90 ips; 200/800 bpi; 18,000 or 72,000 bytes/sec.

B 9393-1: 9 tracks; 90 ips; 1600 bpi; 144,000 bytes/sec.

B 9393-3: 9 tracks, 150 ips; 1600 bpi; 240,000 bytes/sec.

B 9394-1: 7 tracks; 120 ips; 200/556/800 bpi; 24,000, 66,700, or 96,000 char/sec.

B 9394-2: 9 tracks; 120 ips; 200/800 bpi; 24,000 or 96,000 bytes/sec.

B 9495-5 & B 9495-6 MAGNETIC TAPE UNITS: These high-performance 9-track units record data on 1/2-inch tape

in IBM-compatible phase-encoded mode at 1600 bpi. The B 9495-5 has a tape speed of 200 ips and a data transfer rate of 320,000 bytes/second, while the B 9495-6 has a tape speed of 250 ips and a data transfer rate of 400,000 bytes/second. Both models have a rewind speed of 700 ips, enabling a 2400-foot reel to be rewound in less than 45 seconds. Both drives feature a single vacuum-driven capstan, a sealed tape-path chamber, a power access window, a positive reel latch, automatic tape threading and loading, and "on-the-fly" detection and correction of most errors. A unique "co-axial" hub mounts the feed reel directly in front of the take-up reel, reducing the overall width of the unit to just 24 inches.

A basic B 9495-5 or B 9495-6 subsystem consists of a B 4395-5 Dual I/O Control (which permits simultaneous read/write operations), a B 4495-1 Basic Electronics/Exchange, and up to 8 tape drives. The addition of a B 4495-2 Electronics/Exchange Extension permits the use of a second Dual I/O Control and up to 16 tape drives. B 9495-5 and B 9495-6 Tape Units cannot be intermixed in the same subsystem.

B 9110 CARD READER: Reads 80-column cards serially by column, on demand, at up to 200 cpm. EBCDIC is the standard card code, and BCL or binary cards can also be read. The feed hopper and stacker hold 450 cards each.

B 9111 CARD READER: Reads 80-column cards of either standard or postcard thickness serially by column, on demand, at up to 800 cpm. Can also read 51-, 60-, or 66-column cards. EBCDIC is the standard card code, and BCL or binary cards can also be read. The feed hopper and stacker hold up to 2400 cards each and can be loaded and unloaded while the reader is operating. Optional features permit reading of 40-column Treasury Checks and/or round-holed Postal Money Orders.

B 9112 CARD READER: Reads up to 1400 cpm. Otherwise, has the same characteristics and features as the B 9111 Card Reader described above.

B 9210 CARD PUNCH: Punches and read-checks 80-column cards at 100 cpm. EBCDIC is the standard card code, and BCL or binary cards can also be punched. The feed hopper and single stacker hold 800 cards each. The associated control unit contains a full-card buffer.

B 9212 CARD PUNCH: Punches 80-column cards at up to 150 cpm.

B 9213 CARD PUNCH: Punches 80-column cards at up to 300 cpm. EBCDIC is the standard card code, and BCL or binary cards can also be punched. The feed hopper holds up to 2200 cards, and three program-selectable stackers hold at least 1400 cards each. The associated control unit contains a full-card buffer.

B 9120 PAPER TAPE READER: Reads 5-, 6-, 7-, or 8-level punched tape at 500 or 1000 characters per second. The lower speed must be used for fanfold or metallized Mylar tape. Handles reels either 5.5 or 7 inches in diameter. A standard channel-select plugboard and optional Input Code Translator permit wide flexibility in codes.

B 9220 PAPER TAPE PUNCH: Punches 5-, 6-, 7-, or 8-level tape at 100 characters per second. Handles supply reels up to 8 inches in diameter and 5.5- or 7-inch take-up reels. A standard channel-select plugboard and optional Output Code Translator permit wide flexibility in codes.

LINE PRINTERS: Eight printers of the conventional rotating-drum type provide printing speeds ranging from

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▶ 315 to 1100 lines per minute. All models have a tape-controlled carriage capable of handling continuous forms 5 to 20 inches in width, vertical spacing of 6 or 8 lines per inch, and a standard skipping speed of 25 inches per second. Characteristics of the various models are as follows:

B 9242-1: 860 lpm; 120 or 132 print positions.

B 9242-2: 725 lpm; 120 or 132 print positions; OCR "A" numeric and standard alphabetic character set.

B 9242-3: 725 lpm; 120 or 132 print positions; OCR "B" alphanumeric set.

B 9243-1: 1100 lpm; 120 or 132 print positions.

B 9243-2: 900 lpm; 120 or 132 print positions; OCR "A" numeric and standard alphabetic character set.

B 9243-3: 900 lpm; 120 or 132 print positions; OCR "B" alphanumeric set.

B 9245-5: 300 lpm; 120 print positions; buffered.

B 9245-6: 300 lpm; 132 print positions; buffered.

B 9245-8: 400 lpm; 120 print positions; buffered.

B 9245-9: 400 lpm; 132 print positions; buffered.

The B 9242 and B 9243 models can be equipped with an optional high-speed skipping feature (75 inches per second), a powered forms stacker, and/or a "printer memory" that reduces the demands imposed upon the processor during printing. The B 9245 models are buffered.

**NEW HIGH-SPEED LINE PRINTERS:** Along with the B 4700, Burroughs introduced improved versions of the earlier B 9242 and B 9243 printers described above. Characteristics of the six new models are as follows:

B 9242-11: 860 lpm; 120 or 132 print positions.

B 9242-12: 725 lpm; 120 or 132 print positions; OCR "A" numeric and standard alphabetic set.

B 9242-13: 725 lpm; 120 or 132 print positions; OCR "B" alphanumeric set.

B 9243-11: 1100 lpm; 120 or 132 print positions.

B 9243-12: 900 lpm; 120 or 132 print positions; OCR "A" numeric and standard alphabetic set.

B 9243-13: 900 lpm; 120 or 132 print positions; OCR "B" alphanumeric set.

These new printers incorporate a number of engineering improvements designed to provide increased reliability, print quality, and ease of operation. The changes include new hammer construction, new tractor gears, new power supply, new control knobs, and new end-of-paper sensing device. A new "paper stabilizer" holds the paper motionless during each print cycle by activating six stabilizing arms located below the print station.

The new printers feature a Burroughs innovation called "Forms Self-Align." With this feature, forms are advanced under program control to printed marks on the right-hand edge of the forms, eliminating the need for a format control

tape. The three standard marks are line, field, and end-of-page. The Burroughs Business Forms and Supplies Group offers both stock and custom forms with the required Forms Self-Align markings. A switch allows the operator to select vertical format control by means of either the Forms Self-Align marks or a conventional 12-channel paper tape loop.

**B 9244 TAPE LISTER:** Produces printed listings of documents read by a MICR Sorter-Reader on 6, 12, or 18 adding-machine tapes, each 2.5 inches wide, which can be individually advanced. The B 9244-1 Master Lister has 6 tapes, and one or two 6-tape B 9244-2 Slave Listers can be connected to it. Maximum printing speed is 1565 lpm when printing is restricted to the digits 0 through 9 and six special characters, or 800 lpm when the full 40-character alphanumeric set is used.

**B 9340 CONSOLE PRINTER/KEYBOARD:** A Teletype Keyboard Send/Receive unit, used to provide keyboard input and console printouts.

**B 9340-1 OPERATOR DISPLAY CONSOLE:** Provides console input via a typewriter-style keyboard and output via a CRT display. Has a 960-character buffer and displays up to twelve 80-character lines of data. A B 4700 Processor can be equipped with either a B 9340 Printer/Keyboard, a B 9340-1 Display Console, or both. Multiple-processor systems can have one B 9340-1 Display Console per processor. Software support for the B 9340-1 (which adds 8K bytes to the MCP main storage requirements) interrogates the MCP tables every 10 seconds to determine the system status, formats the information, and displays it on the screen. A log of all console messages is maintained on disk and listed on a line printer upon request.

**MICR READER-SORTERS:** Read MICR-encoded documents at up to 1565 items per minute. Can also operate in demand mode, feeding one document at a time at up to 400 items per minute. Models B 9131 and B 9132 have 13 and 16 pockets, respectively. Both models are also usable for off-line sorting. Optional features include an endorser, validity checking, and an item counter. The B 9130 is a similar, 13-pocket unit designed solely for off-line use.

**B 9134-1 READER-SORTER:** Reads optically and/or magnetically encoded numeric documents at up to 1625 documents per minute. Can handle both types of documents of varying sizes and weights in intermixed fashion. The sorting section is available in modules of 4 pockets each, and is expandable to a maximum of 32 pockets. Can be used either on-line or off-line.

**B 9410 PERIPHERAL SWITCHING UNIT:** Permits B 4700 peripheral devices to be manually switched between two control units, which may be connected to different central processors. (The B 9410 will generally be used for card readers, printers, and other low-speed I/O devices; electronic Exchange units permit magnetic tape units and disk files to be shared by two or more processors.)

### COMMUNICATION DEVICES

**SINGLE-LINE CONTROL:** Provides a connection between a single Type B I/O channel and a single communications line. Contains a one-character buffer. Requires an appropriate line adapter, which determines transmission rate, code sensitivity, and character structure. Numerous adapters permit half-duplex communication with a wide range of equipment over dialed, leased, or directly connected lines at speeds of 74.2 to 2400 bits per second. ▶

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► **MULTI-LINE CONTROL:** Permits the connection of multiple simultaneously-operating communications lines to a pair of Type B I/O channels. Requires an appropriate line adapter for each line. The basic Multi-Line Control houses up to 4 line adapters. Optional 8-line extensions permit a total of up to 36 lines to be connected. A "scratchpad" memory holds control information and provides a one-character buffer for each line. Numerous adapters permit half-duplex communication with a wide range of equipment over dialed, leased, or directly connected lines at speeds of 74.2 to 2400 bits per second.

**B 4350 DATA COMMUNICATIONS PROCESSOR:** The DCP is a small stored-program computer that performs the specialized functions associated with the transmission and reception of data, including editing, line discipline, and line handling. The basic DCP has 16,384 bytes of 500-nanosecond core storage, expandable in 4096-byte increments to a maximum of 32,768 bytes. The basic DCP includes a Multi-Line Control capable of interfacing up to 16 communications lines; this capacity can be expanded in 16-line increments to a maximum of 64 lines. An appropriate line adapter is required for each line. Multiple DCP's can be used in a B 4700 system to handle more lines and/or provide increased reliability. Moreover, each DCP can be connected to multiple B 4700 central processors. Data is transferred between the DCP and the central processor at the rate of 30,000 bits per second.

**AUDIO RESPONSE SYSTEM:** Provides responses, in recorded human-voice form, to digital inquiries from push-button telephones. Accommodates up to 128 lines, in 2-line increments. Spoken words or phrases are recorded on film wrapped around a revolving drum. The drum contains 63 audio tracks, each capable of storing either one phrase (up to 1.5 seconds in length), the same word recorded three times, or three different words. The Audio Response Generator is used in conjunction with a Multi-Line Control.

### SOFTWARE

**MASTER CONTROL PROGRAM:** The principal component of Burroughs software support for the B 4700 is the MCP, a modular operating system that schedules and controls all operations of the system. The MCP requires from 27K to 50K bytes of core storage, up to 400K bytes of disk storage, at least one magnetic tape unit, a card or paper tape reader, and a console typewriter or display console. A high-speed trace option adds another 7.5K bytes to the core requirements, and support for the B 9340-1 Operator Display Console requires another 8K bytes. In its largest version, the MCP handles all standard peripherals plus MICR and multi-line data communications, controls up to 80 simultaneous programs, and accommodates up to 80 I/O devices and an 80-request I/O queue.

The MCP performs the following principal functions: (1) schedules the loading and execution of user programs in a multiprogramming environment; (2) allocates core storage and relocates user programs as necessary to achieve efficient storage utilization; (3) schedules and initiates all I/O operations; (4) services all interrupts and attempts recovery from I/O errors; (5) provides I/O control functions such as blocking, buffering, file opening and closing, data communications control, etc.; (6) loads program segments or overlays upon request; (7) creates and maintains disk program libraries in symbolic and/or machine-language form; (8) establishes communication between the system and its operator via the console typewriter, display console, and control cards; (9) provides dump, trace, and checkpoint/restart facilities; and (10) maintains a system log.

The MCP handles batch-mode jobs entered both locally and from remote terminals, as well as data communications and time-sharing jobs. Programs are loaded and executed in a sequence determined by their assigned priorities and memory requirements. Jobs of equal priority are processed on a first-in/first-out basis, and a time-slicing technique is used to insure equal access to the central processor for all programs of equal priority. Top-priority jobs can cause lower-priority jobs to be rolled out to disk to make the required core storage available. When the end of a job is reached, the remaining programs in core storage are compacted to maximize the contiguous core area available for loading and initiating one or more new programs.

To schedule I/O operations, the MCP maintains tables that show the status of each I/O unit and the priority of each I/O request awaiting initiation. Disk files can be processed either sequentially or randomly.

Early B 4700 systems will use the B 2500/3500 MCP. An improved MCP, scheduled for delivery in April 1972, will be enhanced through addition of the following new features:

- A "STOQUE" capability will permit completely asynchronous transfers of information between programs. For example, the MCP can build queues of messages for later processing by programs which are not core-resident while the messages are being received.
- Shared-disk capabilities will support the File Protect Memory hardware, assuring data integrity when multiple programs and/or processors share a common data base on head-per-track disk files.
- Improved input/output handling routines will use straight-line code in place of the previous generalized routines for greater I/O efficiency.
- Operational efficiency will be further enhanced, according to Burroughs, through improvements in the directory management and searching techniques and in system message handling.
- An audit trail capability will facilitate recovery from hardware or software failures.

**COBOL:** Two COBOL compilers are available for operation under the MCP. Both versions offer the same language facilities, but the larger one provides faster compilation and higher limits on the number of data names, procedure names, and pictures that can be used. The smaller compiler, called simply "COBOL", requires 17K bytes of core storage and 190K bytes of disk storage; the larger one, "COBOL L", requires 30K bytes of core and 240K bytes of disk (in addition to the MCP requirements). Both compilers can accept source-program input from cards, paper tape, and/or magnetic tape.

The B 4700 COBOL language is generally consistent with American National Standard COBOL and includes most of its facilities, although the Report Writer module has not been implemented. Effective (though nonstandard) language facilities are included for the control of data communications. MICR sorter-readers, and multi-tape listers.

The COBOL Cross-Reference Utility System accepts COBOL source programs as input and generates convenient flowcharts and/or cross-reference listings that show where each data name, internal program switch, and special register is used. ►

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► **FORTRAN:** The existing B 2500/3500 FORTRAN compiler can be used without change on the B 4700. It requires 27,000 bytes of core storage (in addition to the MCP requirements) and a card or paper tape reader and line printer. Also required is 200,000 bytes of disk storage for the compiler, plus 340,000 bytes of working storage for each 1000 source-program cards. The language conforms with American National Standard FORTRAN.

A new FORTRAN compiler, designed to take advantage of the fast fixed-length floating-point arithmetic facilities of the B 4700 Processor, is scheduled for delivery in April 1972. The language level of the new compiler is classified as FORTRAN IV Level H and includes the full ANS FORTRAN language plus a number of extensions. Burroughs expects FORTRAN programs which use the fixed-length floating-point facilities to run at 6 to 20 times the internal speed of the same programs on the B 3500.

**BASIC:** Burroughs offers two different compilers for the BASIC language, a Core-Sharing version and a Batch version. Core-Sharing BASIC provides interactive compilation of programs entered from remote terminals. Batch BASIC compiles source programs entered via a card reader. Both versions implement a language that generally corresponds to the original Dartmouth BASIC system, and both provide immediate execution of successfully compiled programs.

A new BASIC compiler, scheduled for delivery in March 1973, will support a larger number of users, allow larger program sizes, and include new functional capabilities.

**REPORT PROGRAM GENERATOR:** For users accustomed to programming in the IBM 360/20 RPG language, Burroughs offers a software tool called COFIRS (COBOL From IBM RPG Specifications). COFIRS accepts 360/20 RPG source statements and generates a COBOL source program reflecting the RPG program logic, which is then compiled and executed. Although COFIRS was developed primarily to facilitate conversions from the 360/20, Burroughs maintains that it can also be used effectively on a continuing basis by RPG-oriented installations.

An earlier Burroughs Report Program Generator for the B 2500/3500 systems is available to B 4700 users but is no longer being actively supported. The earlier RPG is not compatible with IBM RPG specifications and was de-emphasized when it became apparent that most B 2500/3500 installations had elected to program exclusively in COBOL.

**ASSEMBLERS:** Assembler Language is the symbolic programming language used to write machine-oriented programs for the B 2500, B 3500, and B 4700. The Advanced Assembler requires 11K bytes of core storage and at least 90K bytes of disk storage (in addition to MCP and working-storage requirements), plus card or paper tape reader and printer. Magnetic tape may be used for input and/or output if desired.

The Assembly Language programmer normally uses a fixed-format coding sheet whose arrangement corresponds closely with the 3-address format of the B 4700 machine instructions. If the programmer chooses, he can code in a Free-Form Assembly Language which is translated into the regular Assembler format by the Free-Form Translator and then assembled in the usual manner. The Advanced Assembler provides numerous macro and pseudo operations, including data communications control macros. Facilities such as blocking, label checking, and comprehensive error recovery procedures are provided by the MCP.

A new Burroughs Program Language (BPL) Compiler, scheduled for delivery in April 1972, will allow B 4700 programmers to code in a higher-level language that permits complete control of all machine-level facilities, including instruction modification, indexing, incrementation, and character or bit manipulation. Data declarations are required, and facilities for macro instructions and program segmentation are provided. Burroughs emphasizes that BPL is not a COBOL or FORTRAN replacement language, but a replacement for the Assembler for programs that require extensive modification of instructions.

**UTILITY ROUTINES:** A Sort Program Generator accepts parameters entered by the user and generates disk or tape sort programs tailored to meet his specific requirements. It can also utilize the "intrinsic sort" capability of the MCP to perform immediate sorts without generating specialized programs. When disk units are used to hold the work files, either a tag sort or a full-record sort can be performed. For tape sorting, from 3 to 8 tape units can be used. A merge capability permits from 2 to 8 properly sequenced input files to be combined into a single output file.

Disk-FORTE is a file management system that enables a user to structure up to 99 files on either disk packs or head-per-track disk files and establish as many as 20 relations between any two of these files. The files may have any of four distinct types of organization: indexed sequential, random, indexed random, and unordered. Appropriate search strategies are used to access the data records in each type of file. "Pointers" can be defined to establish chaining and linking network structures among the files. Disk-FORTE generates COBOL source code which is compiled along with the user's application programs.

The CANDE (Command and Edit) program enables users at remote terminals to enter symbolic programs as permanent disk files, compile and execute the programs, load and update previously created symbolic programs, and perform various other operations. A single copy of the CANDE program in core storage can handle up to 99 remote compilations.

The Network Definition Language (NDL) enables B 4700 users to generate customized data communications control programs. The user can either insert his own COBOL logic for message control functions or use a standard Message Control System (MCS). The NDL generator runs on a B 4700 and produces communications control programs for execution by both the B 4700 Central Processor and the B 4350 Data Communications Processor (if used).

DMPALL is a general information transfer routine that can print the contents of any card, disk, magnetic tape, or paper tape file or transcribe a file between any two types of hardware devices. The file ID, record length, blocking factor, and/or parity can be altered during the transcription process.

The Source Language Library Maintenance system facilitates the maintenance of source-language programs residing on magnetic tape files. The system provides facilities for either temporary or permanent program changes, for test compilations and executions, and for program listings.

The Time Analysis and Billing System (TABS) utilizes the MCP-created system log to analyze and disburse the costs of the computer and related services. The system consists of 7 daily programs, a Cost Distribution program that can be run at any time, and 2 optional monthly programs.

Burroughs offers a number of conversion programs designed to assist users in converting from other Burroughs and IBM ►

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computers to the B 4700 system. Translation programs are available to facilitate conversions from: (1) Burroughs B 500 or B 5500 COBOL to B 4700 COBOL; (2) Burroughs B 300/B 500 Basic or Advanced Assembler to B 4700 Assembler; (3) IBM System/360 RPG to B 4700 COBOL; and (4) IBM 1400 Series Autocoder or SPS to B 4700 COBOL. Also available are simulators that enable a B 4700 to execute certain object programs written for Burroughs B 300/ B 500 or IBM 1401/1440/1460 computers.

**APPLICATION PROGRAMS:** The steadily expanding array of Burroughs applications software for the B 2500/3500/4700 systems currently includes the following facilities:

- Advanced Linear Programming System (ALPS)
- Assist (integrated statistical system)
- Burroughs Hospital Administrative System (BHAS)
- Burroughs Inventory Control System (BICS)
- Burroughs Numerical Control System (ADAPT)
- Burroughs On-Line Order Entry System
- Commercial Bank Item Processing System
- Central Information File System
- Commercial Loan Accounting System
- Demand Deposit System
- Federal Reserve Bank Item Processing System
- GASP (FORTRAN-based discrete-change simulation language)
- Installment Loan System
- On-Line Financial System (savings and loan)
- Personal Trust System
- Production Control System (PCS)
- Project Oriented Management Information System (PROMIS)
- Time Deposit System.

### PRICING

**EQUIPMENT:** The following systems are representative of the types of B 4700 systems that are likely to be commonly installed and are supported by the standard Burroughs software. All necessary control units and exchange units are included in the indicated prices. The quoted rental prices are for the basic one-year lease and include equipment maintenance.

**BASIC TAPE/DISK SYSTEM:** Consists of 100K B 4704 Central System with 8 I/O Channels, Console Printer and

Keyboard, B 9370-2 Systems Memory (2 million bytes), B 9382-14 Four-Drive Magnetic Tape Cluster (36KB), B 9242-11 Printer (860 lpm), B 9111 Card Reader (800 cpm), and B 9212 Card Punch (150 cpm). Monthly rental and purchase prices are approximately \$11,500 and \$530,000, respectively.

**TYPICAL TAPE/DISK SYSTEM:** Consists of 250K B 4711 Central System with 10 I/O Channels and Floating-Point Arithmetic option, Operator Display Console, B 9370-2 Systems Memory (2 million bytes), B 9375-4 Head-per-Track Memory Bank (100 million bytes), eight B 9393-1 Magnetic Tape Units (144KB) and two tape controls, B 9243-11 Printer (1100 lpm), B 9112 Card Reader (1400 cpm), and B 9213 Card Punch (300 cpm). Monthly rental and purchase prices are approximately \$24,300 and \$1,144,000, respectively.

**DUAL-PROCESSOR TAPE/DISK SYSTEM:** Consists of B 4712 Central System (2 processors, each equipped with 400K bytes of core memory, Floating Point Arithmetic, and an Operator Display Console), 18 I/O channels, B 9373-3 Head-per-Track Disk File (60 million bytes), six-drive B 9485-4 Disk Pack Drive subsystem with dual control units (726 million bytes), eight B 9495-6 Magnetic Tape Units (400 KB) with dual control units, two B 9243-11 Printers (1100 lpm), two B 9112 Card Readers (1400 cpm), and two B 9213 Card Punches (300 cpm). Monthly rental and purchase prices are approximately \$55,900 and \$2,620,000, respectively.

**SOFTWARE AND SUPPORT:** Burroughs has not "un-bundled" the B 4700 system to date, so the equipment prices listed above include all of the Burroughs software described in this report and all normal educational courses and professional assistance.

**CONTRACT TERMS:** The standard equipment lease agreement includes equipment maintenance and entitles the customer to unlimited use of the equipment. The standard agreement covers maintenance of the equipment for eight consecutive hours a day, Monday through Friday.

In addition to the standard 1-year lease, Burroughs offers 3-year and 5-year leases for the B 4700 system at prices 7 and 11 percent lower, respectively, than the 1-year lease prices. ■

## Burroughs B 4700 EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
<b>PROCESSORS AND MAIN STORAGE</b>				
B 4704	Central Processor and 8 I/O Channels	117,600	245	2,450
B 4711	Central System, including Processor, 10 I/O Channels, Disk File Control & Exchange, File Protect Memory, and Auxiliary Power Cabinet	196,032	417	4,084
B 4712	Central System, including 2 Processors, 18 I/O Channels, 2 Disk File Controls & 1 Exchange, File Protect Memory, and Auxiliary Power Cabinet	328,080	686	6,835
B 4713	Central System, including 3 Processors, 26 I/O Channels, 3 Disk File Controls & 1 Exchange, File Protect Memory, and Auxiliary Power Cabinet	467,040	955	9,730
B 4714	Central System, including 4 Processors, 34 I/O Channels, 4 Disk File Controls & 1 Exchange, File Protect Memory, and Auxiliary Power Cabinet	606,000	1,224	12,625
B 4098	Optional Independent Auxiliary Power Cabinet (for File Protect Memory and/or Disk File or Magnetic Tape Exchange units)	12,000	10	250
B 4099	Floating-Point Arithmetic feature	7,200	10	150
B 4301	Additional Type A I/O Channel	3,360	10	70
B 4302	Additional Type B I/O Channel	4,560	10	95
B 4342	Console (standing-level; required with all systems)	1,440	—	30
B 4340	Console Printer Control	6,480	15	135
B 9340	Console Printer and Keyboard	2,640	15	55
B 4341	Operator Display Console Control	10,800	19	225
B 9340-1	Operator Display Console	9,548	32	217
B 4010	Core Memory; 100,000 bytes	206,400	80	4,895
B 4015	Core Memory; 150,000 bytes	246,400	110	6,920
B 4020	Core Memory; 200,000 bytes	286,400	155	8,050
B 4025	Core Memory; 250,000 bytes	384,400	200	9,050
B 4030	Core Memory; 300,000 bytes	487,200	260	10,150
B 4035	Core Memory; 350,000 bytes	572,400	320	11,550
B 4040	Core Memory; 400,000 bytes	621,600	365	12,950
B 4045	Core Memory; 450,000 bytes	679,200	410	14,150
B 4050	Core Memory; 500,000 bytes	714,200	440	15,250
<b>HEAD-PER-TRACK DISK FILES</b>				
B 9370-2	Systems Memory; 2 million bytes, 17 msec	21,600	90	450
B 9372-1	Disk File; 10 million bytes, 20 msec	44,000	115	850
B 9373-3	Disk File; 20 million bytes, 23 msec	88,800	205	1,850
B 9373-4	Disk File; 20 million bytes, 40 msec	66,690	205	1,350
B 9374-2	Additional Disk File Increment; 10 million bytes, 20 msec (max. of 4 per B 9372-1)	31,200	100	650
B 9374-3	Additional Disk File Increment; 20 million bytes, 23 msec (max. of 4 per B 9373-3)	36,000	125	500
B 9374-4	Additional Disk File Increment; 20 million bytes, 40 msec (max. of 4 per B 9373-4)	24,170	90	450
B 9375-4	Memory Bank; 100 million bytes, 40 msec	163,360	495	3,150
B 9376-5	Additional Increment; 20 million bytes, 40 msec (max. of 20 per B 9375-4)	32,670	85	575
B 9371-1	Disk File Electronic Unit (DFEU) for B 9372-1	31,200	80	650
B 9371-6	Additional DFEU for B 9374-3 (optional)	31,200	80	650
B 9371-11	Additional DFEU for B 9374-4, 9375-4, & 9376-5 (optional)	31,200	80	650
B 4371	Systems Memory Control	9,600	12	200
B 4373	Disk File Control	16,080	12	335
B 4375	Disk File Combination Control	19,200	12	400
B 4471	Basic Disk File Exchange, N1 x N2 (up to 4 x 20 with appropriate adapters)	9,600	10	200
B 4471-5	Control Adapter (for N1 side; up to 4 allowed)	2,400	3	50
B 4471-6	DFEU Adapter (for N2 side; up to 20 allowed)	1,440	1	30
B 4471-7	Exchange Extension (for over 10 DFEU's)	7,200	10	150
B 4473	Disk File Exchange, 1 x 2	4,080	10	88
B 4376	File Protect Memory (16 40-bit words)	31,200	108	650
B 4376-1	FPM Disk File Control Adapter (1 required per control; max. of 4)	2,880	9	60
B 4376-2	FPM Memory Module (16 40-bit words;	3,600	12	75
<b>DISK PACK DRIVES</b>				
B 9484-3	Dual Drives; 121 million bytes total	48,000	120	1,000
B 9484-4	Dual Drives; 242 million bytes total	74,400	186	1,550
B 9485-3	Dual Drives; 121 million bytes total; simultaneous data access	57,600	145	1,200
B 9485-4	Dual Drives; 242 million bytes total; simultaneous data access	84,000	210	1,750

\* Rental prices include equipment maintenance.

## Burroughs B 4700 EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
<b>DISK PACK DRIVES (cont)</b>				
B 9486-3	Dual Drive Increment for B 9484-3 or B 9485-3; 121 million bytes	33,600	100	700
B 9486-4	Dual Drive Increment for B 9484-4 or B 9485-4; 242 million bytes	67,200	165	1,400
B 9486-45	Single Drive Increment for B 9484-4 or B 9485-4; 121 million bytes	38,400	100	800
B 4380-1	Single Control for B 9484-3	86,400	100	1,800
B 4380-2	Dual Control for B 9485-3	98,400	120	2,050
B 4383-1	Single Control for B 9484-4	88,800	105	1,850
B 4383-2	Dual Control for B 9485-4	100,800	125	2,100
B 9483-5	Control Expansion Adapter (permits up to 16 drives on B 4383-1 or -2)	38,400	100	800
B 9974-1	Disk Pack; certified at 200 tracks/inch for B 9484-3, 9485-3, or 9486-3 drives	575	—	25
B 9974-4	Disk Pack; certified at 200 tracks/inch for B 9484-4, 9485-4, or 9486-4 drives	690	—	30
<b>MAGNETIC TAPE UNITS</b>				
B 9381-12	2-Station Cluster; 800 bpi, 18KB	25,200	175	525
B 9381-13	3-Station Cluster; 800 bpi, 18KB	26,960	195	570
B 9381-14	4-Station Cluster; 800 bpi, 18KB	32,160	235	680
B 9381-22	2-Station Cluster; 800 bpi, 36KB	33,600	200	700
B 9381-23	3-Station Cluster; 800 bpi, 36KB	43,200	230	900
B 9381-24	4-Station Cluster; 800 bpi, 36KB	52,800	260	1,100
B 9382-12	2-Station Cluster; 1600 bpi, 36KB	29,760	200	620
B 9382-13	3-Station Cluster; 1600 bpi, 36KB	34,320	235	715
B 9382-14	4-Station Cluster; 1600 bpi, 36KB	40,560	270	845
B 9382-22	2-Station Cluster; 1600 bpi, 72KB	34,800	225	725
B 9382-23	3-Station Cluster; 1600 bpi, 72KB	45,600	260	950
B 9382-24	4-Station Cluster; 1600 bpi, 72KB	56,400	295	1,175
B 9383-12	2-Station Cluster; 800/1600 bpi, 18/36KB	30,720	225	640
B 9383-13	3-Station Cluster; 800/1600 bpi, 18/36KB	36,000	265	750
B 9383-14	4-Station Cluster; 800/1600 bpi, 18/36KB	43,200	305	900
B 9383-22	2-Station Cluster; 800/1600 bpi, 36/72KB	36,000	250	750
B 9383-23	3-Station Cluster; 800/1600 bpi, 36/72KB	48,000	290	1,000
B 9383-24	4-Station Cluster; 800/1600 bpi, 36/72KB	60,000	330	1,250
B 9391	Magnetic Tape Unit; 7 tracks, 18/50/72KC	27,600	165	575
B 9392	Magnetic Tape Unit; 9 tracks, 72KB	27,600	165	575
B 9393-1	Magnetic Tape Unit; 9 tracks, 144KB	19,440	145	405
B 9393-3	Magnetic Tape Unit; 9 tracks, 240KB	24,960	155	520
B 9394-1	Magnetic Tape Unit; 7 tracks, 24/66/96KC	31,200	170	650
B 9394-2	Magnetic Tape Unit; 9 tracks, 96KB	31,200	170	650
B 9495-5	Magnetic Tape Unit; 9 tracks, 320KB	29,760	165	620
B 9495-6	Magnetic Tape Unit; 9 tracks, 400KB	34,080	190	710
B 4381-11	Cluster Control; 800 bpi, 18/36KB	24,720	12	515
B 4381-12	Cluster Control; 1600 bpi, 36/72KB	25,200	15	525
B 4381-14	Dual Cluster Control; 800 bpi, 18/36KB	36,000	30	750
B 4381-15	Dual Cluster Control; 1600 bpi, 36/72KB	43,200	30	900
B 4381-16	Dual Cluster Control; 800/1600 bpi; 18/36/72KB	45,600	30	950
B 4391-3	Tape Control; 7 tracks, 18/50/72KC	25,440	15	530
B 4391-4	Tape Control; 7 tracks, 24/66/96KC	25,680	15	535
B 4393-1	Tape Control; 9 tracks, 72KB	25,440	15	530
B 4393-2	Tape Control; 9 tracks, 144/240KB	12,000	15	250
B 4393-3	Tape Control; 9 tracks, 96KB	25,680	15	535
B 4395-5	Dual Tape Control; 9 tracks, 320/400KB	54,000	40	1,125
B 4480	Cluster Exchange; 2 x 8, 7-track	9,600	10	200
B 4481	Cluster Exchange; 2 x 8, 9-track	9,600	10	200
B 4490	Magnetic Tape Unit Exchange; 2 x 10, for B 9391, 9392, 9394-1, & 9394-2	12,000	10	258
B 4493-1	Common Electronics Exchange; 1 x 8, for B 9393 series only	19,920	45	415
B 4493-2	Common Electronics Exchange; 2 x 8, for B 9393 series only	39,840	90	830
B 4495-1	Basic Electronics/Exchange; 2 x 8, for B 9495 series only	14,400	75	300
B 4495-2	Electronics/Exchange Extension; extends B 4495-1 to 4 x 16	24,000	85	500
B 4680-1	7-track NRZ Control Adapter for B 4381-11, -14	2,400	10	50
B 9980	Unit Designate Switch for B 9381 series Tape Clusters	480	1	10
B 9989	7-track NRZ Station Adapter for B 9381 series Tape Clusters	2,400	10	50

\* Rental prices include equipment maintenance.

## Burroughs B 4700

### EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (1-year lease)*</u>
<b>OTHER INPUT/OUTPUT UNITS</b>				
B 9110	Card Reader; 200 cpm	8,400	40	175
B 9111	Card Reader; 800 cpm	16,250	83	325
B 9112	Card Reader; 1400 cpm	21,600	126	450
B 4110	Card Reader Control	3,360	8	70
B 9117	Card Counter (for B 9111 or 9112)	240	—	5
B 9118	Postal Money Order feature (for B 9111 or 9112)	1,440	5	30
B 9119	40-Column Read Switch (for B 9111 or 9112)	190	—	—
B 9212	Card Punch; 150 cpm	20,640	105	430
B 9213	Card Punch; 300 cpm	25,440	135	530
B 4212	Card Punch Control	3,360	8	70
B 4610	BCL-BCL Translator (for B 4212)	960	5	20
B 9120	Paper Tape Reader; 500-1000 cps	16,000	70	300
B 4120	Paper Tape Reader Control	3,360	8	70
B 9926	Input Code Translator (for B 4120)	6,960	10	145
B 9220	Paper Tape Punch; 100 cps	15,300	65	260
B 4220	Paper Tape Punch Control	3,360	8	70
B 9928	Output Code Translator (for B 4220)	6,850	10	130
B 9242-11	Printer; 860 lpm, 120 positions	50,400	190	910
B 9242-12	Printer; 725 lpm, 120 positions; OCR A numerics plus std. alpha	50,400	190	910
B 9242-13	Printer; 725 lpm, 120 positions; OCR B alphanumeric character set	50,400	190	910
B 9243-11	Printer; 1100 lpm, 120 positions; OCR A numerics plus std. alpha	55,900	212	1,015
B 9243-13	Printer; 900 lpm, 120 positions; OCR B alphanumeric character set	55,900	212	1,015
B 9245-5	Printer; 300 lpm, 120 positions	24,000	135	500
B 9245-6	Printer; 300 lpm, 132 positions	25,920	145	540
B 9245-8	Printer; 400 lpm, 120 positions	28,800	140	600
B 9245-9	Printer; 400 lpm, 132 positions	30,720	150	640
B 4240	Printer Control (when using B 9943 Printer Memory or B 9245 series Printers)	4,800	10	100
B 4242	Printer Control (when not using B 9943 Printer Memory)	4,800	10	100
B 9940	High-Speed Slew (for B 9242/9243 Printers)	3,000	20	60
B 9941	12 Additional Print Positions (for B 9242/9243 Printers)	2,000	10	40
B 9943	Printer Memory (for B 9242/9243 Printers)	4,800	10	100
B 9945-8	8-Lines-per-Inch Printing (for B 9245 Printers)	415	—	—
B 9244-1	Master Tape Lister; 1565 lpm	67,500	325	1,350
B 9244-2	Slave Tape Lister; 1565 lpm	32,500	200	650
B 4244	Lister Control	4,800	10	100
B 9130	MICR Reader-Sorter; 1565 dpm, 13 pockets	90,720	500	1,890
B 9131	MICR Reader-Sorter; 1565 dpm, 13 pockets	91,200	500	1,900
B 9131-1	MICR Reader-Sorter; 1000 dpm, 13 pockets	57,600	450	1,200
B 9132	MICR Reader-Sorter; 1565 dpm, 16 pockets	105,600	615	2,200
B 9134-1	MICR/OCR Reader-Sorter; 1625 dpm, 4 pockets	49,200	325	1,025
B 4130	MICR Reader-Sorter Control (for B 9130, 9131, 9131-1, & 9132)	6,480	15	135
B 9932	Endorser (for B 9131, 9131-1, & 9132)	9,000	50	200
B 9933	Extended Sort Control (for B 9130, 9131, & 9131-1)	2,400	15	50
B 9937	Validity Checking (for B 9130, 9131, 9131-1, / 9132)	450	—	10
B 4130-1	Reader-Sorter Control (for B 9134-1; MICR only)	6,240	15	130
B 4130-2	Reader-Sorter Control (for B 9134-1; MICR/OCR)	9,360	15	195
B 9932-1	Endorser (1625 dpm; for B 9134-1)	9,000	50	200
B 9935-1	Expansion Feature (for over 16 pockets on B 9134-1)	4,800	10	100
B 9935-2	Four-Pocket Module (pockets 5-16 on B 9134-1)	14,400	35	300
B 9935-3	Four-Pocket Module pockets 17-32 on B 9134-1)	14,400	35	300
B 9938-1	Multi-Track E-13B Feature (for B 9134-1)	18,000	55	375
B 9938-4	Numeric OCR A Feature (for B 9134-1)	31,200	98	650
B 9938-5	Numeric OCR B Feature (for B 9134-1)	31,200	98	650
B 9938-9	Dual Read Option (for B 9134-1)	7,200	25	150
<b>DATA COMMUNICATIONS</b>				
B 4350-1	Terminal Control for CTU	10,800	15	225
B 4350-2	Central Terminal Unit (for On-Line Banking Subsystem)	39,600	100	825
B 4351	Single-Line Control	8,160	14	170
B 4353	Basic Multi-Line Control	23,040	30	480
B 4354	8-Channel Extension for B 4353	7,200	10	150
B 9950	Audible Alarm for CTU	480	1	10
B 4650-1	CTU Adapter for B 4350-1 (first)	2,180	5	48
B 4650-2	Additional CTU Adapter for B 4350-1 (9 max.)	1,870	5	40
B 4651	Typewriter Inquiry Station Adapter	1,920	5	40
B 4652-1	TWX/Remote Typewriter Adapter	1,920	5	40
B 4652-2	TWX/Remote Typewriter Adapter with ADO	2,640	10	55

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**EQUIPMENT PRICES**

		<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (1-year lease)*</u>
<b>DATA COMMUNICATIONS (cont)</b>				
B 4653-1	B 2500/3500/4700 Adapter	3,264	10	68
B 4653-2	B 2500/3500/4700 Adapter with ADO	3,840	10	80
B 4656-1	IBM 1030 Adapter	3,360	10	70
B 4657	Model 35 Adapter for 8A1 Selective Call Service	1,920	5	40
B 4662	Model 28 Adapter for 83B3 Service	2,640	5	55
B 4663	Audio Dual Line Adapter (for B 4354)	4,800	10	109
B 4665-1	Burroughs Std. Adapter – Direct Connect	2,640	5	55
B 4665-2	TU-100 Direct-Connect Line Adapter	1,440	5	30
B 4665-5	Burroughs Std. Adapter – Asynchronous	3,264	7	68
B 4665-6	Mixed B-606/TC-700 Line Adapter	2,400	5	52
B 4665-7	TU-100 Modem-Connect Line Adapter	1,680	7	35
B 4665-10	Burroughs Std. Adapter – Synchronous	3,840	7	80
B 4665-15	Automatic Dial-Out for B 4665-5 & -10	720	1	15
B 4665-16	Speed Adapter, for up to 1800 bps on B 4665-1 & -5	720	1	15
B 4665-17	Speed Adapter, for up to 2400 bps on B 4665-1	1,440	1	30
B 4665-18	Speed Adapter, for up to 4800 bps on B 4665-1 & -10	1,920	3	40
B 4665-19	Speed Adapter, for up to 9600 bps on B 4665-1	2,400	3	50
B 9350	Typewriter Inquiry Station	2,640	12	55
B 4355-1	Voice Response Generator	37,200	31	795
B 9955-1	Audio Recording (Special)	2,575	–	–
B 9955-2	Audio Recording (Library)	750	–	–

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