

Burroughs B 2900 and B 3900

MANAGEMENT SUMMARY

UPDATE: *With the announcement of the new Burroughs V Series medium-scale processors earlier this year, Burroughs launched plans to modernize its medium-scale processor line, and phase out its current line of B 2900, B 3900, and B 4900 processors. When the first installments of the new V Series, V 340 and V 380 processors, are delivered toward the end of this year, B 4900 production will be phased out. In the meantime, production and active marketing of the B 2900 and B 3900 processors will continue indefinitely, or until the vendor announces otherwise. To date, Burroughs has not disclosed when the B 2900 and B 3900 will be replaced by new V Series processors. While purchase prices for the current line of B Series processors and peripheral equipment remain unchanged from last year, Burroughs announced increases in lease and maintenance charges. These changes are reflected in the revised price list which follows this report.*

The current B 2900/B 3900 Series processors include the B 2925 with up to two megabytes of memory, the B 3955 with up to five megabytes of memory, and the B 4925 and B 4955 processors which can also be configured with up to five megabytes of memory. Burroughs B 4900 users who need more size and power can upgrade directly to the V Series without having to make major changes to application software. The new series is object-code compatible. However, B 3900 users requiring more computer capacity must first upgrade to a B 4900 before they can upgrade to the current V models. The new V models offer more memory capacity, 256K-bit memory chips, and MCP 1.0, an updated version of the popular Burroughs operating system. (For a complete review of the new V Series refer to the Burroughs New Product Announcement published with the June supplement).

Since Burroughs announced plans to phase out the B 4900 level processors by the end of the year, Datapro has deleted B 4900 coverage from the characteristics section and price list section of this report.

The B 2900 and B 3900 systems feature asynchronous pipelined architecture, which Burroughs calls "micromodular concurrent" architecture. Each central processor is composed of a series of processing elements that can operate concurrently to perform such operations as instruction prefetch and data address calculation, data fetching and manipulation, instruction execution, and independent I/O initiation and transfer. According to Burroughs, the B 3955 provides a 50 percent performance improvement over the B 2925.

The Input/Output Processor (IOP) initiates data transfers between the memory and peripheral subsystems asynchronously and independently of the central processor. The IOP is interfaced to the peripheral subsystems through Data Link Processors (DLPs). Each DLP is an independent

The B 2900 and B 3900 Series are medium-scale computer systems that feature asynchronous pipelined architecture, Data Link Processors that manage I/O operations independently of the central processor, and multiprocessing capabilities.

MODELS: B 2925, B 3955.

CONFIGURATION: From 1 to 4 CPUs, 1 to 5 megabytes of main memory, 6 to 32 DLPs, and up to 288 communications lines.

COMPETITION: Honeywell DPS 7 and DPS 8, IBM 4300 Series, IPL Systems 4400 Series, NCR V8500, and Sperry System 80 and 1100/60.

PRICING: Purchase prices for Central Systems range from \$125,000 to \$198,000.

CHARACTERISTICS

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

MODELS: B 2925, B 3955.

PREVIOUS MODELS: B 4925 and B 4955.

DATE ANNOUNCED: See Table 1.

DATE OF FIRST DELIVERY: B 2925—first quarter 1983; B 3955—fourth quarter 1981.

DATA FORMAT

Memory word size is 48 bits. No fixed word length is used.

MAIN STORAGE

STORAGE TYPE: MOS, utilizing 64K-bit chips.

CYCLE TIME: See Table 1.

CAPACITY: See Table 1.

CHECKING: An error detection and correction scheme is employed that provides for all single-bit errors to be detected and corrected. All double-bit errors are detected.

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

CENTRAL PROCESSOR

The B 2900/B 3900 Series processors employ an asynchronous pipelined architecture utilizing multiple independent processor modules. Under this scheme, some processing steps can be overlapped, including instruction prefetch, address calculations, and data address calculations; data fetch and manipulation; instruction execution; and I/O initiation.

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➤ microprocessor programmed to service a specific category of peripheral devices.

The basic B 2925 system includes one megabyte of main memory, an operator keyboard/display terminal, a DLP base and two 5¼-inch minidisk (diskette) drives. One minidisk drive is used for data loading or unloading. Four DLPs are standard. The B 2925 can be field upgraded to a B 3955.

The basic B 3955 system includes two megabytes of main memory, an operator keyboard/display terminal, two DLP bases, six DLPs, and two 5¼-inch minidisk drives. The system is expandable to five megabytes of main memory and 32 DLPs.

In addition to the uniprocessor configurations specified, the B 2900 and B 3900 systems can be expanded with up to three additional processors to form a loosely coupled multiprocessor system with shared mass storage, peripherals, and communications systems. With the addition of the Shared System Processor (SSP), the operating system, compilers, utilities, program libraries, and data files can also be shared by up to four central processors. The SSP forms part of the I/O subsystem and is physically a DLP with memory cards. Multiprocessor systems can include the previous B 2800 and B 3800 Series systems. The SSP requires a dedicated DLP Base in the host or the expansion cabinet of the B 2900 or B 3900.

The peripheral equipment for the B 2900/B 3900 includes mass storage media with capacities of 5.5 to 542 megabytes, magnetic tape units with data transfer rates of 80K to 200K bytes per second PE and 470K to 1250K bytes per second GCR/PE, line printers with speeds from 650 to 2000 lines per minute, a 30 page/minute nonimpact printer, card readers rated at 300 to 800 cards per minute, and MICR and MICR/OCR readers/sorters rated at 1000, 1625, and 2600 documents per minute.

The B 2900/B 3900 Software Facilities Program includes the Master Control Program (MCP) operating system, NDL, GEMCOS, and a language compiler. The compiler can be Pascal, Cobol, Basic, RPG II, or Fortran.

When the B 3955 was introduced, Burroughs announced a new release of the operating system, MCP IX. MCP IX is functionally compatible with the previous release, MCP VI, and supports the same features. MCP IX has been optimized to take advantage of the B 2925/B 3955 system technology and to increase total system throughput.

COMPETITIVE POSITION

The Burroughs medium-range processor lineup is undergoing a transitional period as the vendor phases out the generation using 64K-bit memory chips and replaces it with 256K-bit machines, fast becoming the new industry standard. The older B 2925 and B 3955 64K-bit machines compete with the Honeywell DPS 7 and DPS 8, the low end of the IBM 4300 Series, NCR V 8500, and the Sperry ➤

➤ The B 2900 and B 3900 systems' functional modules consist of the Memory Interface Control (MIC) module, the Parallel/Serial Interface (PSI) module, the Fetch module, the Math module, the Address Store and Manipulate (ASAM) module, the Master Control Store (MCS) module, the Clock/Timer module, and the I/O Processor (IOP).

The MIC module provides an interface to the memory storage cards. It performs BCD-to-binary conversion on memory addresses and contains the error correction and memory refresh control circuitry.

The PSI module provides a data path between main memory and the CPU, as well as requesting all memory cycles needed by the processor. The PSI module also performs data zone stripping or adding as specified by the various move instructions.

The Fetch module performs all of the functions necessary to resolve the instruction OP codes, variants, and addresses in preparation for execution. This resolution includes modifying the base address when the program base is not equal to zero, performing all address indexing, and resolving all indirect addressing. The Fetch module controls the other modules needed to fetch an instruction.

The Math module is the arithmetic unit of the central processor. It performs all data manipulation specified by an instruction during instruction execution. The Math module contains data buffers capable of storing 256 bytes of data for each operand address. The data storage capability is designed to enhance processor-to-memory interfacing during instruction execution.

The ASAM module stores the memory addresses of operands used by the processor during the execute phase of an instruction. It also performs Base and Limit boundary checking for the processor during both the fetch and execute phases of an instruction.

The MCS module receives an instruction from the Fetch module after all variables are resolved. It sequences all events needed to complete an instruction and controls all other modules involved in the execution of an instruction.

The Clock/Timer module produces the 7-megahertz main system clock used by the central processor and also generates a 7-megahertz clock for use by the MIC. The MIC clock is 180 degrees out of phase with the system clock. The Clock/Timer module also provides a realtime clock function.

The I/O processor (IOP), independently of the central processor, initiates data transfers between main memory and peripheral subsystems. The IOP uses I/O descriptors to manage the entire I/O operation. The IOP is interfaced to the peripheral subsystems through Data Link Processors (DLPs). Each DLP is microprocessor-controlled and is independent of every other DLP.

Multiprocessor configurations of up to four central processors are possible on both B 2900, and B 3900 systems. The multiprocessor configurations can share the CP 3680 Data Communications System, mass storage, magnetic tape units, printers, punched card equipment, and MICR/OCR reader sorters.

Multiprocessor configurations are also supported by the B X376-95 Shared System Processor (SSP). The SSP enables the capabilities of the operating system, compilers, utilities, program libraries, and data files to be shared by up to four processors. The SSP provides the capability for both read and write access of the same file by different programs executing in one to four central systems. The SSP prevents the erroneous updating of data that may be concurrently accessed from multiple processors. ➤

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TABLE 1. SYSTEM COMPARISON

MODEL	B 2925	B 3955
SYSTEM CHARACTERISTICS		
Date announced		
Date first delivered	First quarter 1983	Fourth quarter 1981
Field upgradable to	3955	—
Relative performance	1.0	1.6
Number of processors	1-4	1-4
Cycle time, nanoseconds	571	571
Word size, bits	48	48
Operating systems	MCP IX	MCP IX
MAIN MEMORY		
Type	64K-bit MOS	64K-bit MOS
Minimum capacity, bytes	1MB	2MB
Maximum capacity, bytes	2MB	5MB
Increment size	1MB	1MB
Cycle time, nanoseconds	—	—
BUFFER STORAGE		
Minimum capacity	Not applicable	Not Applicable
Maximum capacity	—	—
Increment size	—	—
INPUT/OUTPUT CONTROL		
Number of channels:		
Byte multiplexer	—	—
Block multiplexer	—	—
Word	—	—
Other	6-16 DPLs	7-32 DPLs

➤ System 80. The new V Series processors that are scheduled to be delivered in the fourth quarter specifically replace the B 4925 and the B 4955. The V Series models use 256K-bit memory chips, while the extended architecture of the V line includes a 35 percent expansion of the B 4000 instruction set.

The older B 2900/B 3900 Series models feature a maximum memory capacity of five megabytes and range in price from \$125,000 for a basic B 2900 to \$780,000 for a basic B 4955. The new V models specifically targeted to replace the B 4000 Series compare favorably in price and main memory capacity to the older model they will eventually supplant. The V 340 features a minimum of 10 megabytes of memory and lists for \$390,400, compared to B 4925, which comes with a maximum of five megabytes of main memory and sells for \$375,000. The V 380 also comes with a minimum of 10 megabytes of memory and sells for \$702,600, compared to the previous top-of-the-line B 4955 which comes with a maximum of five megabytes of memory and sells for \$780,000.

The B 2900 and B 3900 processors compete with IBM's relatively newer entry-level 4361 processors. The bottom-of-the-line single-processor IBM 4361 Model 3 introduced towards the end of 1984 features between two and four megabytes of main memory and sells for \$56,500. The IBM 4361 Model Group 4 features between 2 and 12 megabytes of main memory and sells for \$135,000. Direct performance comparisons between Burroughs processors and competing machines are difficult to make since Burroughs does not release processor cycle time or MIPS (millions of instructions per second) ratings.

ADVANTAGES AND RESTRICTIONS

Over the years Burroughs has strived to maintain object code compatibility for customers upgrading to newer Burroughs systems. The transition from the B 2900/B 3900/

➤ The B 2900 and B 3900 include a System Maintenance Vehicle (SMV) that enables maintenance personnel to run special diagnostics called maintenance test cases. These test cases consist of data files built from simulated proper functioning of all circuits in all modules of the central processor. When run, the test cases give a circuit-by-circuit comparison of actual operation to the test case file. The test case files are stored on minidisks in the system console.

The SMV consists of a programmable microprocessor, a system maintenance controller, and I/O ports which provide test paths to all system modules. The SMV also loads both operational and diagnostic firmware into the processor modules' control store, controls clock pulses to the system, and emulates maintenance panel functions.

The B 2900/B 3900 Series Systems also monitor their own environmental conditions, including input air cooling and power source. Warning lights, operator messages, and maintenance log entries are part of the monitoring system.

CONTROL STORAGE: Access time to microcode is 45 nanoseconds.

INPUT/OUTPUT CONTROL

Each central processor includes one or two input/output processors (IOPs) that control the movement of data between main memory and the system input/output devices. On all B 2900/B 3900 processors, individual peripheral devices operate under control of Data Link Processors (DLPs), which are associated with each input/output channel. Each DLP is designed to control a particular type of peripheral device and contains one or more record-length buffers to minimize contention for accesses to main memory.

The Data Link Processors are housed in the DLP Base, which contains 34 card positions and a power supply sufficient to handle 8 DLPs. Although the maximum number of DLPs per base is always eight, the exact number that can be housed in one base is determined by the number of cards required by the individual DLPs, as signified by each DLP's numeric suffix. A total of 20 cards per base are available for the DLPs. The DLPs provide high-speed data transfer through record-length buffers of 80 bytes for punched card

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➤ B 4900 Series models to the new V Series should be no exception to this long-standing policy. In announcing the V Series processors, Burroughs disclosed the machines were object-code compatible with the B 4000 processors they will replace. That's the good news. The bad news concerns the B 2000 and B 3000. Until Burroughs announces otherwise, B 2000/B 3000 users wishing to upgrade to the V Series must first upgrade to a B 4000 processor, which, in turn, is upgradable to the V Series. For the moment, B 2000/B 3000 users cannot upgrade directly to the V Series.

A major B 2900/B 3900 Series advantage designed to enhance system throughput is the use of pipelining, which allows the processors to perform concurrently many of the functions that other central processors must perform serially. Pipelining techniques allow the following processing steps to be overlapped: instruction prefetch, program and data address calculations; data fetch and manipulation; instruction execution; and independent input/output initiation and transfer. This technique, according to the vendor, provides for significantly increased processing power.

USER REACTION

Datapro gathered preliminary results from the 1985 computer users' survey to determine what users think about the B 2900 and B 3900 processors. The results were based on responses from 31 B 2900 and 8 B 3900 users. Final results based on a somewhat larger sampling will be available when Datapro releases the fully tabulated results in August.

Ten of the 31 B 2900 respondents use the processors in banking and financial environments, seven use them in manufacturing environments, and four each said they were used for retail and service bureau work, respectively. Other industries represented in the survey include chemical/petroleum, education, health care, government, insurance, and transportation.

B 3900 users responding to the survey said they worked in banking, chemical/petroleum industries, government, insurance, manufacturing, retailing, and transportation. The results gathered in table form below show B 2900 users are generally satisfied with Burroughs hardware, operating system software, and maintenance service. These same users are less impressed with Burroughs' technical support. The following table lists a breakdown of results for each category along with a weighted average.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	18	7	1	0	3.65
Reliability of mainframe	16	11	0	1	3.50
Reliability of peripherals	6	19	2	1	3.07
Maintenance service:					
Responsiveness	11	15	2	0	3.32
Effectiveness	7	16	6	0	3.03
Technical support:					
Troubleshooting	2	18	8	1	2.72
Education	4	19	6	1	2.86
Documentation	3	10	14	1	2.53
Manufacturers software:					
Operating system	22	6	1	0	3.72
Compilers & assemblers	12	15	3	0	3.30
Applications programs	0	15	8	0	2.65
Ease of programming	13	14	2	0	3.37
Ease of conversion	12	12	4	0	3.28
Overall satisfaction	11	16	2	0	3.31

Weighted Average on a scale of 4.0 for Excellent.

➤ equipment, 132 bytes for printers, and five 256-byte buffers for disk pack drives.

The aggregate data rate through the input/output processor is 7 megabytes per second on the B 2900 and B 3900.

SIMULTANEOUS OPERATIONS: One input or output operation on each installed DLP I/O channel can occur simultaneously with computing. Other simultaneous operations are described under the Central Processor section of this report.

CONFIGURATION RULES

The basic B 2925 system includes one megabyte of main memory expandable to two megabytes. One DLP Base and four DLPs are standard. An additional DLP Base and 12 additional DLPs can be configured. DLPs packaged with the system include those for the operator display terminal/diagnostic console, line printer, magnetic tape subsystem, and disk pack drive. A 1 x 8 disk controller is also included. A B 2925 can be field upgraded to a B 3955.

The basic B 3955 includes two megabytes of main memory expandable to five megabytes in one-megabyte increments. Two DLP Bases and a console DLP, operator display DLP, two disk drive DLPs, magnetic tape DLP, line printer DLP, and card reader DLP are standard. A B 3955 can support a maximum of 4 DLP Bases and 32 DLPs. The third and fourth DLP Bases require the Extension Cabinet.

I/O controls or DLPs from the B 2800/B 3800 Series systems are not compatible with the B 2900/B 3900 Series. Peripheral devices on the B 2900 and B 3900 are only restricted by the number of available spaces for DLPs and the number of card spaces per DLP Base. When configuring a system, the number of cards per DLP Base cannot exceed 20 and the number of DLPs per DLP Base cannot exceed 8. The currently available DLPs are given in the Equipment Prices section at the end of this report.

The Shared System Processor (SSP) permits code and data files residing on mass storage devices to be shared by up to four B X800 or B X900 systems, provided that at least one system is a B 2900 or B 3900. In order to connect the SSP, a port interface adapter is required for each system configuration. If a B 9470 Disk File is shared, a minimum of three storage modules is required for a two-system configuration. The B 2377-6 Disk File Exchange is required for more than two systems and must be housed in a B 2900 or B X800 auxiliary cabinet; it cannot be housed in a B 3955 system. The SSP requires a dedicated DLP Base on the host B 2900/B 3900 system, thus reducing the maximum number of DLPs by eight. On a B 2925 or B 3955, the SSP can reside in the Exchange/Base Cabinet or Extension Cabinet as the fourth DLP Base.

MASS STORAGE

Please refer to Table 2 for disk subsystems supported on the B 2900 and B 3900 systems.

INPUT/OUTPUT UNITS

B 9290-30 INTELLIGENT LASER PRINTING SYSTEM: The 30-page per minute printing system creates images by laser diode with a resolution of 57,600 dots per square inch. Printing is done on two sides of uncoated 8½-by-11 inch plain bond paper in either portrait or landscape format and provides collating and stacking features.

For additional information on magnetic tape drives and printers, please refer to Table 3. For information on card readers and MICR/OCR reader-sorters supported on the B 2900/B 3900 systems, refer to the price list following this report. For information on terminals, refer to Table 4 and the price list.

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➤ User ratings gathered from B 3900 users are somewhat similar to B 2900 user rating results. Again, users were pleased with the B 3900 hardware and operating system, but generally less impressed with Burroughs' technical support. The B 3900 results also show these users were a little less happy with Burroughs' maintenance service. The chart below gives a detailed breakdown of B 3900 survey results along with a weighted average.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	8	1	0	0	3.88
Reliability of mainframe	6	3	0	0	3.66
Reliability of peripherals	4	3	2	0	3.22
Maintenance service:					
Responsiveness	4	4	1	0	3.33
Effectiveness	1	7	0	1	2.88
Technical support:					
Troubleshooting	1	6	3	0	2.80
Education	0	7	2	0	2.77
Documentation	0	5	3	0	2.62
Manufacturers software:					
Operating system	8	1	0	0	3.88
Compilers & assemblers	5	3	1	0	3.33
Applications programs	0	4	2	0	2.66
Ease of programming	5	3	2	0	3.30
Ease of conversion	4	2	1	0	3.42
Overall satisfaction	5	2	1	0	3.50

Weighted Average on a scale of 4.0 for Excellent.

When B 2900 were asked whether their systems performed as expected, 30 said "Yes" and one said "No." When asked whether they would recommend their systems to others, 27 said "Yes," two said "No," and two were undecided." Of the eight B 3900 users surveyed seven said their systems performed as expected and would recommend them to others, while one said his system did not perform as expected and would not recommend it to others. □

➤ COMMUNICATIONS CONTROL

B 874 SYSTEMS AND COMMUNICATIONS PROCESSOR (SCP): The B 874-4 SCP is a microprogrammed front-end communications processor that performs the specialized functions associated with the transmission and reception of data, including error recovery, code translation, line discipline management, and most network control functions. The B 874-4 contains a 4-megahertz processor with 16K bytes of control memory. Also available is a 16K-byte user memory modules, expandable to 96K bytes.

Line adapters available for the B 874 SCP include standard asynchronous/synchronous/binary synchronous, standard two-wire direct connect, automatic dial-out, and Burroughs Data Link Control (BDLC). The B 874 Adapter Cluster will accommodate up to 16 line adapters. Most of the line interface adapters are dual adapters, handling two full-duplex lines, each with different characteristics. The adapter cluster allows data speeds up to 19,200 bits per second per line adapter in an environment of up to 32 half-duplex communications lines or 16 BDLC half-/full-duplex lines. A TTY-compatible line adapter provides data transmission at up to 38,500 bits per second.

The B 874 Network Definition Language (NDL) is available to prepare customized network control programs containing tables, system code, and microprograms for each B 874 SCP. The network control program is compiled on the host processor and loaded from the host system disk to the

communications processor through an MCP command. Also available is the Generalized Message Control System (GEMCOS), a software package designed to generate a custom-tailored Message Control System. GEMCOS is described in more detail in the software section of this report.

The B 874 SCP connects to a B 2900/B 3900 system through the B 3303-90 DLP.

UNILINE DLP: The B X351-90 Uniline DLP provides connection for data sets (with or without automatic dial out), while the B X351-91 provides Burroughs direct interface and two-wire direct connect facilities. The B X351-90 Uniline DLP permits connection between a single processor and one communications line through a data set employing either the Burroughs standard asynchronous or synchronous line procedures. In the asynchronous mode the maximum transmission speed is 9600 bits per second, and in the asynchronous mode the maximum transmission speed is 1800 bits per second.

CP 3682 DATA COMMUNICATIONS SYSTEM: The CP 3682 is a front-end communications system that can simultaneously service up to four Burroughs B 2000/B 3000 host computers. Two models are available: the basic CP 3682 Data Communications System and the CP 3682-01 Redundant Communications System. The CP 3682-01, operating in a "hot standby" mode, assumes control of the network and host interfaces in the event of a CP 3682 failure.

CP 3682 capabilities include on-line network generation and management; control of all line protocol functions such as polling and selecting stations; support for polled, bisynchronous, Teletype, point-to-point, and bit-oriented protocols; user-defined protocols; control character mapping for device-independent application programs; on-line network statistics and monitoring; and queuing of inbound and outbound messages. Optional features include the Remote Diagnostic Facility and the Power Fail Recovery Option, which provides battery backup in the event of an external power failure.

The CP 3682 supports a number of commonly used communications protocols, which Burroughs has grouped into five Protocol Classes. Class 1 protocols include polled protocols such as Burroughs Poll-Select, Lear-Siegler ADM2, NCR 270 variants, NCR 796 variants, and IBM 2260. Class 2 protocols are binary synchronous protocols such as point-to-point (IBM 2780/3780), multipoint (IBM 3270), multipoint inverse (to communicate with IBM hosts), and NCR bisynch transparent (3270 variant). Class 3 protocols include Teletype, TWX, and Bell Vu-Set protocols. Class 4 protocols include point-to-point protocols, such as Burroughs Remote Job Entry (B 761) and Burroughs point-to-point batch mode variant, contention mode variant, and conversational variant. Class 5 protocols include Burroughs Data Link Control (BDLC), ISO High-Level Data Link Control (HDLC), ANSI Advanced Data Communications Control Procedures (ADCCP), and IBM Synchronous Data Link Control (SDLC).

The basic CP 3682 system includes a processor with 512K bytes of memory; a 20-megabyte disk subsystem with interface; a realtime clock; a Dual Channel Port Controller (DCPC); a diagnostic adapter; a diagnostic modem; a system console interface; and a firmware set. A CP 3641-01 system console is required for the first CP 3682 system at each site. Also required are a host interface for each host computer and the CP 3600 Data Communications Software (DCS). If the CP 3682-01 redundant system is added, the CP 3600 Standby Communications Software (SCS) is required. ➤

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TABLE 2. MASS STORAGE

MODEL	B 9484-12 Disk	B 9484-51 Disk	B 9494-5 Disk
Cabinets per subsystem	2 to 16	Up to 8	2 to 16
Disk packs/HDAs per cabinet	1 Removable	2 Removable	1 Fixed
Capacity	252MB	130.4MB	542MB
Tracks/segments per drive unit	—	—	—
Average seek time, msec.	28.5	16	21.7
Average access time, msec.	36.8	25	30
Average rotational delay, msec.	8.3	8.3	8.3
Data transfer rate	1,200,000	605,000	1,200,000
Controller model	B 9387-51 B 9387-52	B 9387-4X	B 9387-51 B 9387-52
Comments	Requires B X304-90 DLP	Requires B X304-90 DLP	Requires B X304-90 DLP

Two types of microprocessor-based communications adapters are available: an eight-line asynchronous adapter and a two-line asynchronous/synchronous adapter. Each adapter requires one I/O port and supports an aggregate data rate of up to 8,000 characters per second. With the eight-line asynchronous adapter, all communications lines must operate at the same data rate and the protocols used must be of the same protocol class. When the two-line synchronous adapter is used, all communications lines must use protocols of the same protocol class, but data rates can vary.

The CP 3682 system can be expanded to 25 I/O ports by the addition of the I/O Expansion Unit. Further expansion, to a maximum of 41 I/O ports, is accomplished by adding the I/O Port Extender. Of the total of 41 I/O ports, 36 can be used for communications interfaces. The number of line adapters cannot exceed 8 on an entry-level CP 3682, 22 on a CP 3682 with the I/O Expansion Unit, or 36 on a CP 3682 with the I/O Expansion Unit and the I/O Port Extender. A maximum CP 3682 configuration supports up to 288 asynchronous multidrop lines or 72 synchronous multidrop lines, up to 1,500 terminal stations, and up to 2000 transaction types. However, when the number of terminals in the network exceeds 400, a 256K-byte memory module must be added. The CP 3682 transfers data to the host computer at a rate of 40,000 characters per second.

The table-driven CP 3600 DCS software enables users to modify, control, and monitor networks on-line. It also includes an integrated message control system that provides five-level message security, dynamic and fixed message routing, on-line forms generation, and simultaneous servicing of up to four host processors. Message control system files, forms files, and application data save areas are stored in CP 3682 memory or on the CP 3682 disk.

Existing Network Definition Language (NDL) applications will run on the CP 3682 with little or no modification, according to Burroughs. NDL applications can run concurrently with the CP 3682 resident message control system. Support for Burroughs program products that currently require a B 874 communications processor, such as GEMCOS and CANDE, is also available.

SOFTWARE

The Software Facility Program is required for all B 2900 and B 3900 systems. The package includes the MCP operating system, utilities, Basic GEMCOS, B 874 NDL, Medium Systems NDL, and a choice of one compiler. These programs are described in the paragraphs that follow.

MASTER CONTROL PROGRAM: The principal component of Burroughs software support for the B 2900 and B 3900 Series systems is the MCP, a modular operating system that schedules and controls all operations of the systems. The MCP requires from 14K to 50K bytes of main memory, up to 400K bytes of disk storage, at least one

magnetic tape unit, a card reader, and a console typewriter or display console. A high-speed trace option adds another 7.5K bytes to the main memory requirements.

MCP IX, released in 1981, is the currently available version of the MCP for the B 2900 and B 3900 systems. MCP IX is functionally compatible with the earlier MCP VI and supports the same functions. However, MCP IX has been optimized to take advantage of the B 2925/B 3955 technology and to increase system throughput.

The MCP multiprogramming executive can supervise the execution of up to 99 concurrent jobs. Under MCP, user programs can be divided into a resident portion that must be resident in main memory for program execution and a series of overlayable segments that can be brought into main memory only when required for program execution. The compiler builds a segment dictionary reflecting the program organization and computes the memory requirements for containing the resident portions of the program plus the minimum main memory space required for accommodating the largest single overlayable segments of the program. During program execution, the MCP uses the segment dictionary to locate required program segments either in main memory or on disk. When adequate main memory space is available, the MCP's overlay segments are allowed to remain in main memory until the space is required by another program. MCP IX also provides a virtual memory management capability that allows the use of programs that exceed the size of the physical main memory.

The MCP performs the following principal functions: 1) schedules the loading and execution of user programs in a multiprogramming environment; 2) allocates main memory 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 ensure access to the central processor for programs of equal priority. Top-priority jobs can cause lower-priority jobs to be rolled out to disk to make the required main memory available. When the end of a job is reached and other jobs are waiting, the remaining programs in main

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TABLE 3. INPUT/OUTPUT UNITS

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed Inches/Sec.	Transfer Rate, Bytes/Sec.
B 9495-8	9	1600	PE	50	80,000
B 9495-82	9	1600	PE	75	120,000
B 9495-83	9	1600	PE	125	200,000
B 9495-24	9	1600	PE	200	320,000
	9	6250	GCR	200	1,250,000
B 9495-32	9	1600	PE	75	120,000
	9	6250	GCR	75	470,000
B 9495-33	9	1600	PE	125	200,000
	9	6250	GCR	125	780,000
Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
B 9246-6	650 lpm	132	10	6 or 8	4 to 20 in. wide
B 9246-12	1250 lpm	132	10	6 or 8	
B 9246-21	2000 lpm	132	10	6 or 8	

memory are compacted to maximize the contiguous memory area available for loading and initiating one or more new programs.

Other significant MCP features are: 1) a "STOQUE" capability that permits asynchronous transfers of data between programs; 2) a 3-level priority system that permits assignment of separate priorities for scheduling, processing, and memory utilization; 3) a 3-level logging system that provides an Operator Display Terminal Log of all system messages, a Maintenance Log showing the performance of each system component, and a Run Log that facilitates cost distribution and system audits; 4) ability to relocate the MCP modules in main memory; and 5) ability to overlap MCP I/O operations (such as opening files) with computing.

MCP has comprehensive facilities for accumulating data on the utilization of system resources by each executing user program. The program logs central processor utilization, peripheral use by type, and system overhead factors such as load-dumps, print-backup, and pseudo-reader, for each job executed. The log file can be analyzed by the TABS program to prepare billing reports for computer usage.

Optional modules within MCP include the Data Communications Processor Control (DCP) module, the Data Management System II (DMS II) module, and the Shared Systems Processor (SSP) module.

The DCP module controls all communications between the B 874 Systems and Communications Processor and the active Message Control System (MCS). The DMS II module is a data management facility provided to establish logical relationships between data. (DMS II is discussed elsewhere in this section.) The SSP module provides the capability for concurrent access, both read and write, of the same file by different programs executing in one to four central systems. Protection from erroneous updating of data by independently functioning processors is also provided by the SSP module.

COBOL: The most recently released Burroughs Cobol compiler is based on Cobol 74 and includes all the facilities of full American National Standard Cobol, including the Sort and Segmentation modules. Source-language program debugging facilities, data communications constructs, and a number of other useful extensions are also included. The EBCDIC, BCL, and ASCII character sets are supported. The compiler accepts a Cobol source program and generates a machine-code object program which is placed in disk storage, ready for execution. The compiler automatically

divides all object programs into logical, relocatable segments.

Also available for the B 2900/B 3900 systems is a Cobol 68 compiler, which is compatible with the older American National Standard Cobol 68 language.

FORTRAN: The Fortran 66 compiler provides extended language facilities which are compatible with IBM Fortran IV Level H, includes the full ANS Fortran language plus numerous extensions, and is upward-compatible with the Fortran compilers for the larger B 5900, B 6900, and B 7900 systems. The compiler requires 45K bytes of main memory and makes use of the fixed-length floating-point arithmetic instructions, extended addressing capabilities, and 4-digit adders of the processors to achieve significantly higher object program execution speeds. A Fortran 77 compiler is also available.

BASIC: B 2900/B 3900 Basic is an industry-standard implementation of the Basic language that generally corresponds to the original Dartmouth Basic.

RPG II: A full implementation of the RPG II language with extensions for data communications and DMS II database management.

BURROUGHS PROGRAM LANGUAGE (BPL): BPL enables assembly language 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 machine-dependent coding.

NETWORK DEFINITION LANGUAGE (NDL): A special-purpose programming tool that enables users to define and generate customized Network Control programs for data communications applications. The Network Controller handles line disciplines, buffer management, message queuing, and auditing, 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 with conventional on-site peripheral devices. After the programmer defines the 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 for the B 874

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TABLE 4. TERMINALS

MODEL	ET 1100	TD 830	MT 985	SR 110	PT 1500
DISPLAY PARAMETERS					
Max. chars./screen	—	—	—	—	—
Screen size (lines x chars.)	12/24 x 40/180 plus	25 x 80	26 x 80	25 x 80	29 x 80
Symbol formation	7 x 9 dot matrix	5 x 7 dot matrix	7 x 11 dot matrix	7 x 9 dot matrix	9 x 12 cell
Character phosphor	p39 green	White	Green	P4 white	P31 green
Total colors/no. simult. displayed	—	—	—	—	—
KEYBOARD PARAMETERS					
Style	Typewriter	Typewriter, data entry	Typewriter, data entry	Typewriter, data entry	Typewriter
Character/code set	128 ASCII	128 ASCII	128 ASCII	128 ASCII	—
Detachable	Std.	Std.	Std.	Std.	Std.
Program function keys	10 physical, 20 logical	—	—	16 Std.	10 Std.
OTHER FEATURES					
Buffer capacity	10 pages	2,000 characters	2,000 characters	2,000 characters	4 pages
Tilt/swivel	Std.	No	No	Std.	Std.
Graphics capability	—	—	—	—	—
TERMINAL INTERFACE	RS-232-C, TDI	RS-232-C	RS-232-C	RS-232-C	RS-232-C, RS-422

► **Systems and Communications Processor.** The NDL compiler requires a minimum of 90K bytes of main memory.

GENERALIZED MESSAGE CONTROL SYSTEM (GEMCOS): This software system generates an installation-defined message control system (MCS) that manages a transaction-oriented communications network, provides security, handles transaction routing, controls message formatting, and provides a transaction processing interface for applications programs. All transaction terminals in the network are controlled by the GEMCOS-created MCS and interfaced to the applications programs and the database. Thus, GEMCOS enables users to develop transaction processing application programs independently of the network environment. The input to GEMCOS is coded in the Transaction Control Language, a descriptive, free-form language that uses key words to describe both the network environment and the requirements for message routing, message formats, access control, recovery, etc. Alternatively, a user-developed Message Control System can be written in Cobol or the Burroughs Program Language (BPL).

COMMAND AND EDIT LANGUAGE (CANDE): This time-sharing Message Control System enables multiple users at remote terminals to create programs or data files, compile and execute programs, edit and alter programs or files, search files, send messages to other terminals, and perform a variety of other functions. Files created through CANDE can be saved and used later by the same user or by other users to whom access is granted. CANDE provides the capability for interactive program development and testing concurrently with the execution of applications programs. It also provides effective control of the access, security, and charging functions in a computer time-sharing network.

ON-LINE DATA ENTRY SYSTEM (ODESY): A sophisticated data entry and validation system using multiple on-line visual display units. It provides a generalized and generative "front end" for the existing application packages. It enables future packages to be designed to use its extensive editing facilities and thus reduce development effort by virtually eliminating conventional input control programs. Because of these editing facilities, ODESY is able to produce batches of essentially error-free data for input to application programs.

REPORTER II: This is a report writer designed to simplify the retrieval, analysis, and reporting of information maintained in computer files. Reporter II accepts report specifications coded in a free-form report description language and generates a Cobol program tailored to produce the required report. The system can retrieve input data from multiple

files and/or DMS II databases, select data based on a wide range of criteria, perform arithmetic and statistical functions, sort data in ascending or descending order according to multiple keys, control access through a password system, produce automatically formatted reports, and create one or more files of extracted data for subsequent processing or reporting.

In addition to the basic (RP2) version, Reporter II is available in an Advanced version, an Audit version, and an On-Line version. Reporter II (Advanced) adds the capabilities for generation of multiple reports in one pass through the input data, creation of summary-only (matrix) reports, and controlled formatting for special reports or preprinted forms. Audit-Reporter extends the Reporter II system by providing auditors with effective software tools for testing and evaluating the records produced by an EDP system. The OnLine Reporter is an optional module that can be added to any of the three preceding systems to provide an on-line mode of operation that enables users at remote terminals to enter, generate, compile, and execute report programs.

LOGIC AND INFORMATION NETWORK COMPILER (LINC): This fourth generation programming language generates complete, on-line, realtime systems, including programs, database descriptions, screen formats, transaction management, and network management. It is designed to do so with only one set of English-like specifications. The system includes the LINC Definition Language (LDL), a high-level, nonprocedural, business-oriented language used to identify and define the user's needs. LDL allows for a single system specification without regard to actual program and application construction and provides full syntax checking. It includes both the systems and data definitions and is used to define the report and inquiry requirements. The LINC System Generator takes the defined specifications and produces the programs required to establish, maintain, and report against the business data. LINC optimizes the generated systems to the host Burroughs system, and eliminates redundant programming code and data elements as well as data and logic inconsistencies. The system provides for multiple independent accounting periods, support for batch programs, provisions for data integrity and security, transaction entry in any sequence, full on-line, realtime inquiry and maintenance of data, and an on-line "help" function.

DATA MANAGEMENT SYSTEM II (DMS II): This comprehensive database management system is integrated with the MCP operating system and uses MCP facilities for accessing records in the database to achieve greater runtime efficiency. Through the MCP facilities, the DMS II

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database can be accessed by applications programs operating in multiple processing environments, such as batch, remote job entry, time-sharing, and transaction processing. DMS II incorporates a Data And Structure Definition Language (DASDL) that provides for the logical description of data in sets or subsets and for mapping the logical data into physical structures. A variety of retrieval methods is supported, including indexed sequential, random, and ordered lists. The latter method creates indices that require small amounts of disk storage and permits very fast searches.

DMS II permits multiple indices to be established for accessing a file, and each file can be accessed by any of the available access methods to provide retrieval of information by different applications programs. Cobol and RPG II interfaces are provided. When multiple programs are accessing the database, DMS II provides lockout protection at the record level to prevent simultaneous updating of a record. The DMS II audit trail captures a record of all database maintenance functions to facilitate automatic recovery.

DMS INQUIRY: This optional extension of DMS II provides an easy-to-use language that enables non-EDP personnel to access the database via remote terminals. Users can "browse" through information stored in the database and retrieve it either serially or randomly, without the delays normally associated with programming and debugging an inquiry program.

BURROUGHS NETWORK ARCHITECTURE (BNA): A set of software designed to enhance the interaction of terminals with host CPUs in a network environment. BNA is also designed to facilitate a move into distributed data processing. Through the BNA architecture, Burroughs processors and terminals can be granted access to databases throughout a network, job tasks and information files can be transferred from one point to another, and data processing resources available in a network can be shared among participants regardless of location. BNA is designed to work with existing Burroughs terminal networks and with the Global Memory multiprocessing facility available on Burroughs large-scale processors. BNA depends on logical links rather than physical links, relying on network tables maintained in the host processors for routing. All routing is through host mainframes. Services provided by BNA include those designated host and those designated network. Host services include coordination of communication between tasks being executed at various hosts; control of the creation, updating, and transfer of data from host to host; and handling of communication with logical points within the network. Network services perform message routing, linking hosts using the Burroughs Data Link Control (BDLC) bit-oriented protocol. Network services also permit connection of Burroughs processors to packet-switching services using X.25 procedures. Links can also be established to non-Burroughs machines using currently available software such as NDL.

BURROUGHS DATA LINK CONTROL: Until the adoption of BDLC, a bit-oriented line control procedure for synchronous transmissions, Burroughs' protocol was Basic Mode, a character-oriented line control procedure. In the Basic Mode protocol system, the user data was "enveloped" or bracketed by line control characters before transmission.

In BDLC, the data is bracketed with a lesser number of characters because bits, rather than whole characters, are used to represent the control codes. This reduction in non-information control data transmitted with user data is significant despite the addition of transmission error detecting control bits.

BDLC is based on High-Level Data Link Control Procedures (HDLC), the protocol standard developed by the International Standards Organization (ISO) and the European Computer Manufacturers Association (ECMA), and

Advanced Data Communications Control Procedures (ADCCP), the protocol standard developed by the American National Standard Institute (ANSI). It is Burroughs' intention to maintain BDLC compatible with the bit-oriented protocols of selected competitors (such as IBM's SDLC).

In networks using BDLC, one device, a processor, operates as a Primary Station. All other devices, whether processors or terminals, function as Secondary Stations. (This arrangement is referred to as the Unbalanced Configuration.) Any line can be full- or half-duplex, switched or nonswitched, analog or digital. In the point-to-point arrangement, the Primary Station is at one end of a communications line, and a Secondary Station is at the other end. In the multipoint arrangement, the Primary Station is at one end of the line and two or more Secondary Stations are connected to the line. A device can function as a Secondary Station on one line and as a Primary Station on another line. Such an arrangement can occur when a given Secondary Station has one line to a Primary Station and another line to devices that are not connected to that Primary Station.

The Primary Station controls the establishment of links for data transfer, controls the actual data transfer, and controls error recovery operations. The Secondary Stations can operate in the Normal Response Mode (NRM) or in the Asynchronous Response Mode (ARM). In the Normal Response Mode, the Secondary Station cannot initiate transmissions. Specific permission to transmit and/or respond to a command must be given to the Secondary Station by the Primary Station. Once given permission, a Secondary Station can transmit up to seven frames (messages) without requiring additional permission. In an optional version of BDLC, up to 127 frames can be transmitted without requiring additional permission.

In the Asynchronous Response Mode, the Secondary Stations can initiate transmission without permission from the Primary Station. In this mode, Secondary Stations on a multipoint line must contend with each other to obtain a link for transmission. In the NRM, the Primary Station polls each station and thereby assures each station equal opportunity for link establishment.

WORK FLOW MANAGEMENT: Implemented with the Work Flow Language (WFL), a free form English-like language for managing the flow of job streams, priorities, and resource allocation in a Burroughs multiprogramming environment. WFL can implement work flow control functions including task initiation, task termination, task attributes, file attributes, file equation, control statements, declarations, and printout control. WFL provides job-streaming capabilities by specifying the execution sequence of interrelated programs as serial or parallel.

FUNCTIONAL LOGICAL ANALYSIS OF MACHINE EFFICIENCY (FLAME): FLAME is a performance evaluation tool designed to measure both hardware and software performance. FLAME collects raw data at specified intervals and writes it out to magnetic tape or disk for subsequent processing by the FLAMER report program. Additional program modules provide supplementary reports, report summaries, special versions of the System Run Log, disk utilization analyses, and realtime monitoring of the B 2900/B 3900 systems.

UTILITY ROUTINES: A Sort Program Generator accepts parameters entered by the user and generates disk or tape sort programs tailored to meet 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.

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► **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 compilations and executions, and for program listings.

The Time Analysis and Billing System (TABS) utilizes the MCP-created system log to analyze computer usage and disburse the costs of the computer and related services according to a hierarchy of charge numbers. The system consists of a series of daily programs that analyze central processor, peripheral, and main memory utilization, multi-programming performance, and the total number of program executions and use time accumulated by each charge number. A monthly billing report reflects the total dollar value of computer services by charge number and prorates the charges for utility services based on the percentage use of the system. A computer charge summary provides a summary of accumulated month-to-date charges per account number for production runs, compilers, program testing, and use of program utilities.

Standard Utility functions provided with MCP include library maintenance, system log maintenance, conversion of data files from one format or media to another, and set/change program priorities for processor, memory, and scheduling before or during program scheduling and execution.

APPLICATION PROGRAMS: Among the applications programs available from Burroughs are:

APT III (Numerical control)

BHAS II (Burroughs Hospital Administration System)

BHIPS (Burroughs Hospital Information Processing System)

BIPASS (Burroughs Inventory Planning, Analysis, and Simulation System)

BPS (Business Planning System)

DIS (Distribution Information System)

GBMS (General Business Management System)

Infostats (forecasting and statistical analysis)

PCS (Production Control System)

SCHOLASTIC System

THRIFT (Savings and Loan Package)

TMS (Text Management and Electronic Mail System)

IPS (Item Processing System)

Total Banking System

PRICING

CONTRACT TERMS: The B 2900 and B 3900 systems are available for purchase or for lease under a 1-year, 3-year, or 5-year lease agreement. The standard lease agreement entitles the customer to unlimited use of the equipment and

includes full-time equipment maintenance coverage (24 hours/day, 7 days/week). The standard maintenance agreement for purchased systems covers maintenance of the equipment for nine consecutive hours per day on Monday through Friday only; extended maintenance coverage is available at higher rates.

All maintenance charges listed in this report are for "metro 1" (city) districts.

All lease plans may include purchase options that allow 50 percent of the rental paid during the first 36 months to be applied toward the purchase price at any time during the lease period.

SOFTWARE: All software is unbundled. Program Products for the B 2900/B 3900 systems are offered under either an Unlimited-Time License Plan, for a one-time charge or 12 monthly payments followed by an annual maintenance fee, or a Limited-Time License Plan, with monthly payments.

TECHNICAL SUPPORT: Various support package options are provided for under the Program Product Service Agreement. The availability of a particular service package depends on the product. Four services packages are available providing different levels of service. Software Product Support (PSA 1) is for users who will not require on-site program product problem assistance. Extended Software Product Support (PSA 2) is for users who will require on-site program product problem assistance. Centralized Software Product Support (PSA 3) covers selected program products needing only telephone-type service. Basic Software Product Support (PSA 5) is applied to certain products for which telephone and on-call services are not generally available.

EDUCATION: Users can obtain the necessary training by paying for individual courses. The currently available courses range from 1 to 10 days in length, cost \$200 to \$1,950 for each attendee, and fall into the following broad categories: Systems Support, Operations, Languages, Environmental (database and data communications), and Applications.

EQUIPMENT: Listed below are typical B 2900 and B 3900 configurations. All necessary control units and exchange units are included in the indicated prices. The quoted rental prices are for a one-year lease and include maintenance service.

B 2925 SYSTEM: Consists of a B 2925 Central System (CPU with one megabyte of main memory, operator display terminal, two minidisk drives, DLP Base, and four DLPs) plus one B 9387-51 Disk Controller, one 542-megabyte B 9494-51 Fixed-Disk Drive, one 80KBS B 9495-45 Magnetic Tape Subsystem, one 300-cpm B 9115 Card Reader, and one 650-lpm B 9246-6 Line Printer. The purchase price is \$214,174.00, monthly maintenance is \$988.80, and monthly rental is \$9,230.00.

B 3955 SYSTEM: Consists of a B 3955 Central System (CPU with two megabytes of main memory, operator display terminal, two minidisk drives, two DLP Bases, and six DLPs) plus one 9387-42 Disk Controller, two 542-megabyte B 9494-51 Fixed-Disk Drive (1084 megabytes total), four 120KBS B 9495-82 Magnetic Tape Units with B 9499-51 Master Electronic Exchange, one 600-cpm B 9116 Card Reader and one 2000-lpm B 9246-21 Line Printer. The purchase price is \$468,132.00, monthly maintenance is \$2,516.00, and monthly rental is \$23,363.00. ■

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EQUIPMENT PRICES

		Purchase Price (\$)	Monthly Maint.* (\$)	1-Year Lease** (\$)	5-Year Lease** (\$)
PROCESSORS AND MAIN MEMORY					
B 2925	Central System; includes CPU with one megabyte of main memory, I/O processor, operator display with keyboard, 2 mini-disk drives for system maintenance, Data Link Processor (DLP) Base, console DLP, disk drive DLP, magnetic tape DLP, and line printer DLP	125,000	412.00	5,399	3,843
BP-2-SYS	Business Partner Basic System includes all of the components of the B 2925 Basic System with an additional one-megabyte of main memory, a 1 x 8 disk controller and the following software: System Software Facility, GEMCOS, DMS II, DMS II Inquiry and LINC	231,000	531.00	10,673	8,173
B 3955	Central System; includes CPU with 2 megabytes of main memory, I/O processor, operator display with keyboard, 2 mini-disk drives for system maintenance, 2 DLP Bases, console DLP, 2 disk drive DLPs, magnetic tape DLP, line printer DLP, and card reader DLP	198,000	591.00	10,914	7,757
B 2009-1MB	One-megabyte Memory Increment for B 2925	12,000	58.50	568	423
B 3009-1MB	One-megabyte Memory Increment for B 3955	12,000	70.20	718	590
B 2900 OPTIONS					
B 2905-91	Additional DLP Base; one allowed	10,500	29.40	417	349
B 2095-95	Exchange/Base Cabinet; can house a B 2377-6 Disk File Exchange, an additional DLP Base, or a Shared System Processor	26,251	57.90	1,032	853
B 9361-23	Operator Display	3,098	26.40	133	122
B 2376-95	Shared Systems Processor DLP	12,601	34.80	532	455
B 2376-92	Host Interface Adapter for B 2800 DLP to SSP-DLP	2,588	32.80	115	104
B 2376-93	Host Interface Adapter for B 3800 DLP to SSP-DLP	2,588	32.80	115	104
B 2376-94	Host Interface Adapter for B X900 DLP to SSP-DLP	2,588	32.80	115	104
B 2373-90	5N Disk File DLP	4,620	34.50	198	173
B 2304-90	Disk Drive DLP	4,620	23.30	194	169
B 2395-90	80KB PE Magnetic Tape DLP	4,043	23.30	169	151
B 2395-91	120/200KB PE Magnetic Tape DLP	4,043	23.30	169	151
B 2395-92	470-1250/120-320KB GCR/PE Magnetic Tape DLP	4,620	34.50	198	173
B 2395-93	NRZ Magnetic Tape DLP	4,043	46.80	178	156
B 2247-91	Line Printer DPL for B9247-13/16	5,175	23.30	156	138
B 2247-93	Line Printer DLP for B9247-14/15	5,175	23.30	156	138
B 2246-95	Line Printer DPL for B9246-21	5,175	65.40	172	154
B 2246-94	Line Printer DPL for B9246-6H/12	5,175	46.80	164	146
B 2110-90	B 9115/B 9116/B 9117 Card Reader DLP	2,888	23.30	126	106
B 2137-90	B 9137/B 9190 Reader-Sorter	8,409	31.30	339	295
B 2138-90	B 9195/B 9138 Reader-Sorter	9,702	34.50	345	301
B 2341-9	Operator Display DLP	4,232	31.70	178	156
B 2303-90	B 874 DLP	3,396	23.30	144	128
B 2368-90	CP 3680 DLP	4,620	53.20	167	150
B 2351-94	Universal Uniline DPL-3	3,676	34.50	157	135
B 3900 OPTIONS					
B 3905-91	Additional DLP Base	10,500	29.80	442	371
B 3095-95	Extension Cabinet	26,251	67.50	1,095	907
B 9361-23	Freestanding Operator Display	3,098	26.40	133	122
B 3376-95	Shared Systems Processor DLP	12,601	44.90	536	459
B 3376-95	Host Interface Adapter; B 2800 to SSP DLP	2,588	32.80	115	104
B 3376-92	Host Interface Adapter; B 3800 to SSP DLP	2,588	32.80	115	104
B 3376-94	Host Interface Adapter; B X900 to SSP DLP	2,588	32.80	115	104
B 3373-90	5N Disk File DLP	4,620	34.50	198	173
B 3304-90	Disk Drive DLP	4,620	23.30	194	169
B 3304-91	Block Level Transfer Disk DLP	4,620	38.60	243	175
B 3393-90	NRZ Magnetic Tape DLP-3	4,043	23.30	169	151
B 3395-91	80/120/200KB PE Magnetic Tape DLP	4,043	23.30	178	156
B 3395-92	470/1250/120-320KB GCR/PE Magnetic Tape	4,620	34.50	198	173
B 3395-93	NRZ Magnetic Tape DLP	4,043	46.80	178	156
B 3247-91	Line Printer DLP for B9247-13/16	5,175	23.30	156	138
B 3247-93	Line Printer DPL for B9247-14/15	5,175	23.30	156	138
B 3246-94	Line Printer DLP for B9246-6H/12	5,175	46.80	164	146
B 3246-95	Line Printer DLP for B9246-21	5,175	50.10	151	133
B 3110-90	B 9115/B 9116/B 9117 Card Reader DLP	2,888	23.30	126	106
B 3137-90	Document Processor DLP for B9190/9137	8,409	34.50	345	301
B 3138-90	Document Processor DLP for B9138/9195	9,702	34.50	397	345
B 3303-90	B 874 DLP	3,396	23.30	144	128
B 3368-90	CP 3680 DLP	4,620	50.70	162	145
B 3351-94	Universal Uniline DLP-3	3,676	34.50	157	135
B 3341-9	Operator Display DLP-4	4,232	19.70	174	152

*Maintenance rates are for nine hours, five days per week.

**Lease prices include 24-hour, 7-day maintenance.

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		Purchase Price (\$)	Monthly Maint.* (\$)	1-Year Lease** (\$)	5-Year Lease** (\$)
MASS STORAGE					
B 9484-12G	Disk Pack Drive; 252 megabytes	30,000	120.00	1,430	1,070
B 9484-51	Dual Disk Pack Drive; 130.4 megabytes	21,000	159.00	860	709
B 9387-41	Controller for B 9484-41 or B 9484-51 drives; 1 x 8	20,000	78.90	1,371	1,290
B 9387-42	Controller for B 9484-51 and B 9484-41 drives; 2 x 8	30,000	184.00	1,906	1,628
B 9387-51	Controller; 1 x 8	15,000	63.00	687	517
B 9387-52	Controller; 2 x 8	20,000	94.60	913	683
B 9387-24	4 x 16 Disk Exchange	20,000	60.00	900	675
B 9387-26	6 x 16 Disk Exchange	30,700	90.00	1,380	1,035
B 9387-28	8 x 16 Disk Exchange	41,400	120.00	1,860	1,395
B 9387-30	2X Expander	10,700	15.00	480	360
B 9494-5	Fixed Disk Drive; 542 megabytes	33,000	105.00	1,615	1,210
MAGNETIC TAPE UNITS					
B 9495-88	Magnetic Tape Unit; 80 KBS, 501 IPS, PE only	11,551	165.00	495	412
B 9495-45	Magnetic Tape Subsystem; consists of B 9495-88 tape unit and B 9499-33, 1 x 4	17,860	145.00	617	512
B 9499-14S	PE, PE/NRZ Controller; 50 IPS; 1 x 4	11,465	44.50	421	324
B 9499-14M	PE, PE/NRZ Controller; 75 IPS; 1 x 4	19,100	132.00	745	633
B 9499-14H	PE, PE/NRZ Controller; 125 IPS; 2 x 8	19,100	132.00	745	573
B 9499-18S	PE, PE/NRZ Controller; 50 IPS; 1 x 8	12,350	44.50	451	353
B 9499-18M	PE, PE/NRZ Controller; 75 IPS; 1 x 8	21,060	132.00	786	605
B 9499-18H	PE, PE/NRZ Controller; 125 IPS; 1 x 8	21,060	132.00	786	605
B 9499-28S	PE, PE/NRZ Controller; 50 IPS; 2 x 8	14,465	97.40	537	419
B 9499-28M	PE, PE/NRZ Controller; 75 IPS; 2 x 8	51,240	288.00	2,138	1,260
B 9499-28H	PE, PE/NRZ Controller; 125 IPS; 2 x 8	51,240	288.00	2,138	1,260
B 9499-2XM	PE, PE/NRZ Controller; 75 IPS; 2 x 16	53,940	288.00	2,247	1,450
B 9499-2XH	PE, PE/NRZ Controller; 125 IPS; 2 x 16	53,940	288.00	2,247	1,450
B 9499-3XM	PE, PE/NRZ Controller; 75 IPS; 3 x 16	83,310	425.00	3,330	2,280
B 9499-3XH	PE, PE/NRZ Controller; 125 IPS; 3 x 16	83,310	425.00	3,330	2,280
B 9499-4XM	PE, PE/NRZ Controller; 75 IPS; 4 x 16	110,200	563.00	4,362	3,005
B 9495-82	Magnetic Tape Unit; 120 KBS, 75 IPS, PE only	18,100	152.00	734	576
B 9495-83	Magnetic Tape Unit; 200 KBS, 125 IPS, PE only	22,447	173.00	926	724
B 9999-4H	NRZ Option; 75/125 IPS	788	7.40	32	27
1NRZ	NRZ Control Module	2,731	43.30	97	81
B 9495-24	Magnetic Tape Unit; 1250/320KBS, 200 IPS, GCR	36,225	259.00	1,294	1,152
B 9495-32	Magnetic Tape Unit; 470/120KBS, 75 IPS, GCR	21,736	175	908	649
B 9495-33	Magnetic Tape Unit; 780/200KBS, 125 IPS, GCR/PE	24,917	185.00	1,032	736
B 9499-21	GCR/PE Controller; 1 x 8	42,634	249.00	1,473	1,183
B 9499-22	GCR/PE Controller; 2 x 8	85,288	495.00	2,954	2,356
B 9499-23	GCR/PE Controller; 3 x 8	127,899	746.00	4,416	3,538
B 9499-24	GCR/PE Controller; 4 x 8	170,553	994.00	5,878	4,716
B 9499-42	Electronic Exchange for B 9499-22; 2 x 16	7,751	25.90	281	219
B 9499-43	Electronic Exchange for B 9499-23; 3 x 16	9,680	34.50	365	302
B 9499-44	Electronic Exchange for B 9499-24; 4 x 16	11,356	34.50	427	340
B 9999-3	Dual Host Switch	5,624	20.30	182	149
CARD READERS					
B 9115	Card Reader; 300 cpm, 80 column	8,608	77.80	353	276
B 9116	Card Reader; 600 cpm, 80 column	11,372	109.00	472	369
B 9117	Card Reader; 800 cpm, 80 column	12,952	134.00	536	420
PRINTERS					
B 9246-6	Band Printer; 650 lpm	14,700	186.00	559	483
B 9246-12	Train Printer; 1250 lpm	42,500	399.00	1,600	1,325
B 9246-21	Train Printer; 2000 lpm	69,300	687.00	3,169	2,569
B 9290-30	Intelligent Laser Printing System; 30 pages/minute	65,000	698.00	4,013	3,201
READER-SORTERS					
B 9190-1	Document Processor; 1000 dpm, 4 pocket base; includes MICR E13B, basic off-line sort, 12 pockets, and control interface	76,662	972.00	3,959	3,364
B 9190-2	Document Processor; 1625 dpm, 4 pockets; requires one control interface and at least one character recognition module	47,205	893.00	2,929	2,539
B 9990-10	Four-Pocket Module; pockets 17 to 20	23,550	131.00	934	804
B 9990-11	Four-Pocket Module; pockets 21-32	17,450	82.70	614	524
B 9990-21	MICR E13B; Single Read	16,973	85.30	604	519
B 9990-22	MICR E13B; Double Read	46,695	169.00	1,740	1,510
B 9990-90	4A Control or DLP Interface	2,085	5.60	111	94
B 9990-91	3A Control Interface	1,752	5.30	71	52
B 9990-4X	Impact Endorser with Digital Advance; 1 & 2, 3 & 4, 5 & 6	15,905	108.00	642	557

*Maintenance rates are for nine hours, five days per week.

**Lease prices include 24-hour, 7-day maintenance.

Burroughs B 2900 and B 3900

READER-SORTERS (Continued)

		Purchase Price (\$)	Monthly Maint.* (\$)	1-Year Lease** (\$)	5-Year Lease** (\$)
B 9990-53	Modular Non-Impact Endorser	38,000	295.00	1,243	1,075
B 9990-4X	Impact Endorser, No Digital Advance; 1 & 2, 3 & 4, 5 & 6	15,285	103.00	621	532
B 9990-60	Duo-Duplex Microfilm	74,100	795.00	4,363	3,622
B 9990-70	Off-Line Sort Package	6,235	54.10	200	180
B 9990-25	Short Document Feature (51 Column Cards)	1,220	1.90	39	33
B 9990-26	Short Document Feature (One Required Per Four Pocket Module)	535	1.90	21	18
B 9195-20	Document Processor; 20 pockets	348,414	3,722.00	13,859	11,811
B 9195-24	Document Processor; 24 pockets	378,669	3,998.00	14,933	12,724
B 9195-28	Document Processor; 28 pockets	405,795	4,274.00	16,020	13,651
B 9195-32	Document Processor; 32 pockets	434,382	4,553.00	17,105	14,580
B 9995-72	Additional Memory; 4K bytes	9,999	29.10	422	350
B 9995-53	Modular Non-Impact Endorser	48,013	532.00	1,426	1,258
B 9995-60	Duo-Duplex Microfilm	92,812	1,109.00	4,931	4,003

TERMINALS

ET 1100	Workstation with keyboard; 14" screen; RS-232-C/TDI Data Communications	1,945	20.33	105	79
ET 1101	Workstation with Keyboard; 14" screen; BDAA Data Communications	1,945	20.33	105	79
ET 2251	Color Terminal Workstation with Keyboard; 14" screen; bit-mapped graphics; 512K-bit RAM BDAA data communications	4,495	34.00	286	230
TD 830	Data Entry Terminal; RS-232-C, TDI	3,289+	—	—	—
PT 1500	Terminal for XE550	1,695	264.00	—	—
MT 985	Data Entry, Typewriter Terminal	2,395	—	—	—
SR 110	Data Entry, Typewriter Terminal	1,695	—	—	—

COMMUNICATIONS EQUIPMENT

B 874-4	System and Communications Processor includes 4-megahertz processor and 16K bytes of control storage, integrated host interface, and 32-line adapter cluster	23,200	252.00	1,515	1,177
B 32-2	16K bytes of user memory	2,521	41.10	116	105
B 74-1	Memory Expansion Module for B 874 systems greater than 32K bytes	5,550	96.00	227	193
B 74-5	Dual Host Switch for B 874-4 processor	2,794	32.20	101	84
B 74-7	BDLC Feature for B 874-4 processor	1,849	17.20	67	56
B 551-1	Direct Connect Dual Line Adapter, two-wire; maximum data rate 9600 bps	2,006	10.80	56	46
B 551-2	Direct Connect Dual Line Adapter, TTY-compatible; maximum data rate 300 bps	1,234	10.80	46	41
B 551-3	Direct Connect Dual Line Adapter, Balanced Differential Interface; maximum data rate 19,200 bps	1,644	10.80	58	53
B 551-6	Synchronous/Asynchronous Data Set Dual Line Adapter; maximum data rate 9600 bps	1,234	10.80	46	41
B 551-7	BDLC Single Line Adapter for B 874-4; maximum data rate 9600 bps	1,481	15.10	55	48
B 551-12	Synchronous/Asynchronous Single Line Adapter with addressing; maximum data rate 9600 bps	1,029	10.80	41	35
CP3682	Data Communications System; includes processor with 512K bytes of memory; 20MB disk subsystem with interface, real-time clock, Dual Channel Port Controller (DCPC), diagnostic adapter, diagnostic modem, console adapter, firmware set and system cabinet	53,822	648.00	2,920	2,344
CP3682-01	Redundant Data Communications System; includes second CP 3682 system plus CP 3643-01 Dual Port Interface Unit with cable, CP 3644-01 Dual System I/O Interface Unit with cable, CP 3645-01 I/O Expansion Cabinet, and CP 3646-01 I/O Port Extender	52,225	566.00	2,789	2,239
CP3610	Add-On Memory Module; 256K bytes	9,323	112.00	432	348
CP3610-02	Upgrade Memory Module; 512 K bytes	12,698	88.20	585	470
CP3610-03	Add-On Memory Module; 256K bytes	9,323	60.90	429	345
CP3610-04	Add-On Memory Module; 512K bytes	11,115	67.20	511	410
CP3620-01	Host Interface Unit	2,626	18.70	118	97
CP3630-01	Eight-Line Microprocessor-Based Asynchronous Communications Adapter	5,408	37.40	250	201
CP3631-01	Two-Line Microprocessor-Based Synchronous/Asynchronous Adapter	2,416	22.50	112	90
CP3631-02	Single-Line Microprocessor-Based Synchronous Adapter with RS422 Cable	2,706	24.50	126	102
CP3631-03	Single-Line Microprocessor-Based Synchronous Adapter with V.35 Cable	3,104	24.50	144	116

*Maintenance rates are for nine hours, five days per week.

**Lease prices include 24-hour, 7-day maintenance.

Burroughs B 2900 and B 3900

COMMUNICATIONS EQUIPMENT (Continued)

		Purchase Price (\$)	Monthly Maint.* (\$)	1-Year Lease** (\$)	5-Year Lease** (\$)
CP3632-01	Direct Connect Interface Unit	368	2.50	20	12
CP3633-01	Automatic Calling Unit Adapter	1,260	8.70	49	38
CP3640-02	Diagnostic Modem	688	5.30	33	27
CP3641-01	System Console	3,151	31.20	119	98
CP3641-02	Console Adapter	1,588	31.20	114	93
CP3643-01	Dual Port Interface with cables	2,941	31.20	114	93
CP3644-01	Dual System I/O Interface Unit with cables	3,833	35.00	145	119
CP3645-01	I/O Port Expansion Cabinet with CP 3646-01 I/O Port Extender	21,001	198.00	830	646
CP3646-01	I/O Port Extender with Dual Channel Port Controller	18,271	182.00	688	562

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**Lease prices include 24-hour, 7-day maintenance.

SOFTWARE PRICES

		Unlimited Time Plan		Limited-Time Plan	
		Initial Charge		Annual License Fee (\$)	Monthly License (\$)
		Single Payment (\$)	12 Monthly Payments (\$)		
SSF	Software Facilities Program; includes MCP, MCB, NDL, B 874 NDL, and one compiler	25,410	2,437	4,828	847
SSF	Software Facilities Program for B 2900 and B 3900; includes MCP IX, utilities, Burroughs Programming Language, Software Management System, one compiler, and one data communications option	25,000	2,398	—	834
CBV	Cobol 68 Compiler	NC	NC	NC	NC
COB	Cobol 74 Compiler	3,630	349	690	121
RPG	RPG II Compiler	3,630	349	690	121
BAS	Basic Compiler	3,630	349	690	121
FTV	Fortran Compiler (IBM Level H compatible)	3,630	349	690	121
BPL	Burroughs Programming Language	NC	NC	NC	NC
TAB	TABS Analysis System	NC	NC	NC	NC
CE1	CANDE	2,475	238	470	83
DE2	ODESY	6,121	587	1,163	219
MCA	GEMCOS Advanced	14,157	1,358	2,690	506
MCT	GEMCOS Total	18,202	1,746	3,458	651
RP2	Reporter II Basic	9,163	879	—	328
RPO	On-Line Reporter	1,349	130	256	49
AUD	Audit Reporter	19,741	1,894	—	706
ARP	Advanced Reporter II	14,439	1,385	—	516
DM2	Data Management System II (DMS II)	13,200	1,266	2,508	440
LNC	LINC	72,000	6,900	13,200	2,900
DM1	DMS II Inquiry	3,300	317	627	110
WFL	Work Flow Management System	1,815	175	345	61
MC7	Message Control System Generator	3,249	312	1,188	117
FLM	FLAME Monitor	2,640	254	502	220
CP 3680 Software					
CP 3600 DCS	Data Communications Software for CP 3680	11,000	—	2,090	330
CP 3600 SCS	Standby Communications Software for CP 3680-01	5,500	—	1,045	165