

Burroughs B 90

MANAGEMENT SUMMARY

UPDATE: *Burroughs has dropped the high-end B 90 system from its product line since we last revised this report. The B 96-40 and B 96-41 have both been terminated from the console-based B 90 system. The lone system enhancement has been the addition of a 37.5MB Winchester mass storage device.*

The Burroughs B 90 minicomputer system has been reduced to five models, as Burroughs eliminated the B 96, formerly at the high-end of the B 90 range. These five models all support up to 512KB of main memory. The B 93, now the most powerful member of the B 90 system, supports 160MB of disk storage and up to eight workstations. These 8-bit systems are general-purpose machines, used in small installations.

The new mass storage device announced by Burroughs is the B9493-94, a Winchester integrated disk with 37.5MB of storage capacity. This device has an average seek time of 33 milliseconds and an average access time of 41 milliseconds. The B9493-94 is supported by the B 95 only.

The five models in the B 90 family are the B 91, the B 91S, the B 92, the B 93, and the B 95. The B 91S can be used as a freestanding system, a terminal computer within a data communications network, and as a host computer system. The B 91S processor module houses a 2MHz CPU that employs 64K-bit RAM technology. Minimum main mem- ➤



The B 91S is a console-based system for general business data processing. It has 256KB of main memory and includes a 230-cps console printer with keyboard. The B 91S can be expanded to support 512KB of memory, 154MB of disk storage, and eight workstations.

The B 90 systems are targeted for general-purpose commercial computing in small installations such as local government and banks. The five models feature software and peripheral compatibility with CMS models of the B 1900 system.

MODELS: B 91, B 91S, B 92, B 93, B 95.
MEMORY: 256KB to 512KB.
DISK CAPACITY: 10MB to 160MB.
WORKSTATIONS: Up to 8 on the B 91, B 91S, B 92, and B 93; up to 4 on the B 95.
PRICE: \$14,000 to \$65,000.

CHARACTERISTICS

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

CANADIAN ADDRESS: Burroughs-Canada, 801 York Mills Road, Don Mills, Ontario, Canada M3B 1X7. Telephone (416) 445-4030.

DATA FORMATS

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

FIXED-POINT OPERANDS: Information unavailable from vendor.

FLOATING-POINT OPERANDS: Information unavailable from vendor.

INSTRUCTIONS: The B 90 is an interpreter-based system using variable micrologic. Utilizing the microinstruction set, operand lengths permit from 1 to 256 bytes of data to be addressed with a single instruction, and up to 8 bits to be transferred in parallel between main memory and the processor.

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

MAIN STORAGE

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

CYCLE TIME: 0.5 microseconds per 8-bit fetch, with a 0.015 nanosecond access time.

CAPACITY: Memory ranges from 256KB to 516KB. See Chart A for the capacities of specific systems.

All B 90 systems feature a 4KB Read-Only Memory (ROM) containing routines for loading interpreters and customer confidence routines.

CHECKING: Parity standard.

STORAGE PROTECTION: Address bounds and checks are performed by the interpreters. ➤

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CHART A. SYSTEM COMPARISON

MODEL	B 91S	B 91/B 92	B 93	B 95
SYSTEM CHARACTERISTICS				
Date of introduction	July 1984	October 1979	May 1981	October 1983
Date of first delivery	July 1984	October 1979	May 1981	October 1983
Operating system	CMS MCP	CMS MCP	CMS MCP	CMS MCP
Upgradable from	—	—	—	—
Upgradable to	—	—	—	—
MIPS	—	—	—	—
MEMORY				
Minimum capacity, bytes	256K	256K	256K	256K
Maximum capacity, bytes	512K	512K	512K	512K
Type	MOS	MOS	MOS	MOS
Cache memory	None	None	None	None
Cycle time, nanoseconds	500	500	500	500
Bytes fetched per cycle	—	—	—	—
INPUT/OUTPUT CONTROL				
Number of channels	6-11	6-11	8-11	6
High-speed buses	—	—	—	—
Low-speed buses	—	—	—	—
MINIMUM DISK STORAGE				
	18MB	18MB	18MB	10MB
MAXIMUM DISK STORAGE				
	86MB/154MB	86MB/154MB	160MB	29MB
NUMBER OF WORKSTATIONS				
	8	8	8	4
COMMUNICATIONS PROTOCOLS				
	X.25, SNA, RJE, 2780/3780, BDLC, SDLC, HDLC	X.25, SNA, RJE, 2780/3780, BDLC, SDLC, HDLC	X.25, SNA, RJE, 2780/3780, BDLC, SDLC, HDLC	X.25, SNA, RJE, 2780/3780, BDLC, SDLC, HDLC

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

Memory is 256KB; memory is expandable up to 512KB in increments of 128KB. Also included in the processor module are input/output controllers for storage modules, printers, and data communications ports. The B 91S can be configured with up to two disk subsystems; choices include Burroughs Super Mini-Disk subsystems—1MB single-drive inbuilt (BSMD); 2MB dual drive freestanding (BSMD); and 6MB dual drive inbuilt (BSMD II). Other choices include Burroughs 4.6MB or 9.2MB cartridge disk subsystems or Burroughs fixed disk subsystems of 18.8MB, 19.2MB, 38.6MB, or 77.2MB. The B 91S power module plugs into a conventional wall socket and is connected to the processor and storage modules through cables and push-on, D-type connectors.

The B 91 is essentially a single-station, packaged system that includes 256KB of memory and a 90-cps console matrix printer and keyboard. It can, however, be expanded to support up to 512KB of memory, 86MB of disk storage, and eight workstations.

The B 92 is a more powerful console-based system. It is packaged with 256KB of memory and a 120-cps console printer, and has greater I/O capability than the B 91 and B 91S. (The B 92 has eight I/O channels, versus six on the B 91.) The B 92 can be expanded to support a maximum of 512KB of main memory, eight workstations, and 154MB of disk storage.

The B 93 is a terminal-based, expandable system similar to the B 91, B 91S, and B 92. The B 93 processor supports a minimum of 256KB of memory and includes eight I/O channels. The B 93 can support a maximum memory of 512KB, disk storage of 160MB, and eight workstations.

The B 95 is packaged with a single 256KB or 512KB memory board, input/output controllers for the disk stor-

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

CENTRAL PROCESSOR

GENERAL: The central processor of each B 90 employs Large Scale Integrated (LSI) circuitry as an aid in improving performance and reducing overall unit size. As part of the LSI design four microprocessors are utilized; the interface between the processor and memory is handled through a signal protocol.

The B 90 processor features dynamically variable microprogrammed logic. The processor's logic functions are formed by a set of elementary operators, called microinstructions, which operate on bit strings up to 256 bytes long. There are 256 defined microinstructions in the B 90. Microinstructions are basically 8 bits long, but they can be extended to 16 or 24 bits. The B 90 has the capability to look ahead while executing microinstructions. This lookahead capability is possible because of the overlapping of microinstruction fetching and execution.

In the B 90, Burroughs has also implemented a microprogram stack to improve the efficiency of repetitive processes, such as subroutines used for I/O interrupt servicing. The microinstruction set contains members capable of multiple counting, a feature that allows repetitive execution.

The processors also employ S-language (Secondary language) instructions as intermediate instructions equivalent to machine-language instructions of conventional computers. Each S-language instruction is implemented by a string of microinstructions that interpretively executes the functions specified by the S-instruction. In most cases, S-instructions specify an operation to be performed, one or more operand addresses, data field lengths, and units of data.

For each B 90 programming language, Burroughs has defined an "ideal machine" and developed a specialized microprogram, called an Interpreter, that makes the B 90 appear to be logically equivalent to that machine. The Interpreter executes the instructions which have been gener-

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➤ age module, and printer and data communications ports. The B 95 processor supports up to six I/O channels. Disk storage ranges from 10MB to 29MB and the system supports four workstations.

Communications protocols supported by the B 90 include X.25, SNA, RJE, 2780/3780, BDLC, SDLC, and HDLC.

All B 90 systems operate under Burroughs' CMS (Computer Management System) environment, which centers around MCP (Master Control Program), a nonpartitioned, multiprogramming operating system. The CMS environment includes a number of collateral software products. One notable facility is CMS Superstart, which provides the B 90 operator with menus that guide use of the system; it also includes facilities for development and maintenance of customized menu systems that link the operating system and applications programs. In addition to CMS Superstart, other CMS products include CMS Reporter and On-line Reporter, CMS Domain, CMS Cande, CMS Automatic Run Control System, CMS On-line Data Entry System, and IBM System/32 to Burroughs CMS Conversion Program.

In addition to the above software, numerous applications packages are available from Burroughs. These include systems designed for medical management, cost accounting, manufacturing systems, and government and education program products.

COMPETITIVE POSITION

What will happen to the B 90 system when Burroughs completes its merger of the Sperry Corporation? This is, perhaps, the biggest question mark for B 90 users and prospective customers.

Currently, the B 90 competes with the IBM System/36, Digital Equipment Corporation's PDP-11, and the NCR Tower. However, the B 90 is losing ground in this race. Burroughs has not made any major enhancements to the B 90 system for several years. Although the B 90 claims large installed base figures, what happens to the B 90 when users decide to replace the system? While the 8-bit B 90 has virtually stayed the same for many years, the competition has greatly increased in the four-to-ten user market. Several supermicrocomputer vendors have made an impact on the market. For example, Altos, Charles River Data Systems, Digital, Plexus, and IBM, just to name a few, have all recently developed supermicrosystems that can do much more than a B 90. Simultaneously, the prices of these supermicrosystems are falling, while the B 90's price is pegged.

So, what will happen to the B 90? Industry sources predict that Burroughs will keep the two companies' mainframe lines separate, but what about a commitment for the mini-computer area? Perhaps, since Burroughs has a Unix-based supermicrosystem, the XE500 Series, which is compatible with Sperry's PCs, the XE500 Series will be retained by Burroughs. This fact gains validation as the XE500 is able to be bridged to Sperry mainframes. Thus, where does the Burroughs B 90 fit in this plan? Unless Burroughs enhances ➤

➤ ated by the corresponding compiler. These compiler-generated instructions are expressed in an appropriate S-language.

The processor also stores Confidence Test Routines (CTRs) in ROM; these routines work with maintenance test routine programs to isolate faults and detect performance degradation.

The B 91, B 91S, and B 92 processors have integral peripheral units built into the CPU housing. These include a printing unit, a keyboard, and a BSMD (Burroughs Super Mini-Disk) or BSMD II floppy disk drive. The system display sits on top of the B 92 CPU housing and is integral only in the sense of its tie-in to the console printer, while the display is physically mounted on the B 91 and B 91S. The differences among the B 91, B 91S, and B 92 are in the size and speed of the inbuilt matrix printer and peripheral expandability. The B 91, B 91S, and B 92 are all two-megahertz processors.

The B 93 is available in a single cabinet that occupies less than five square feet of floor space and includes a two-megahertz processor, eight input/output channels, up to three disk controllers, up to four data communications channels, on-board diagnostics, and a six-megabyte Burroughs Super Mini-Disk II inbuilt disk subsystem.

The B 95 processor is a two-megahertz module housing the CPU, a single 256KB or 512KB memory board, and input/output controllers for the disk storage module, the printer, and data communications ports. The B 95 processor supports up to six I/O channels.

CONTROL STORAGE: The 4KB ROM on B 90 processors contains cold and warm starts, a basic maintenance test routine, an interrupt analysis routine, and general-purpose routines such as binary-to-decimal conversion and absolute memory address conversion. When the processor must temporarily suspend a task because of a peripheral interrupt, information from processor registers is stored in main memory.

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

ADDRESSING: Information unavailable from vendor.

INTERRUPTS: Both external and internal interrupts are present in the B 90. Internal interrupts can occur on a memory parity error, when the Load Enable button is depressed, or when power is first connected to the system. External interrupts occur when a peripheral device requests attention (active data movement operation required). The B 90 uses an automatic hardware interrupt system; the individual I/O channel notifies the processor when data is ready for processing or transmission.

OPERATING ENVIRONMENT: The B 90 processor unit varies in dimensions according to the model. The B 91 is 39 inches wide, 29 inches deep, and 30 inches high; the B 91S is 39 inches wide, 29 inches deep, and 47.5 inches high; the B 92 is 49.7 inches wide, 29 inches deep, and 30 inches high. The B 93 is 23 inches wide, 29 inches deep, and 30 inches ➤

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CHART B. MASS STORAGE

MODEL	B9480-22	B9481-12	B9493-18	B9493-20	B9493-37	B9493-40
Type	Cartridge	Cartridge	Fixed	Fixed	Fixed	Fixed
Controller model	Integrated	Integrated	Integrated	Integrated	Integrated	Integrated
Drives per subsystem/controller	2	2	1	1	1	1
Formatted capacity per drive, megabytes	4.6	9.2	18.8	19.3	37.6	38.6
Number of usable surfaces	2	2	4	2	8	4
Number of sectors or tracks per surface	200	400	200	—	200	—
Bytes per sector or track	180/sector	180/sector	180/sector	180/sector	180/sector	180/sector
Average seek time	125 ms	80 ms	35 ms	48 ms	35 ms	48 ms
Average rotational/relay time	20 ms	20 ms	20 ms	7 ms	20 ms	7 ms
Average access time	145 ms	100 ms	55 ms	55 ms	55 ms	55 ms
Data transfer rate	193KB/sec.	193KB/sec.	384KB/sec.	384KB/sec.	384KB/sec.	384KB/sec.
Supported by system models	B 91, B 91S, B 92, B 93	B 91, B 91S, B 92, B 93	B 91, B 91S, B 92, B 93	B 91, B 91S, B 92, B 93	B 91, B 91S, B 92, B 93	B 91, B 91S, B 92, B 93
Comments						

CHART B. MASS STORAGE (Continued)

MODEL	B9493-54	B9493-64	B9493-74	B9493-80	B9493-94
Type	Winchester	Winchester	Winchester	Winchester	Winchester
Controller model	Integrated	Integrated	Integrated	Integrated	Integrated
Drives per subsystem/controller	2	1	2	1	2
Formatted capacity per drive, megabytes	9.6	14.4	14.4	77.2	37.5
Number of usable surfaces	—	—	—	4	—
Number of sectors or tracks per surface	—	—	—	—	—
Bytes per sector or track	180/sector	180/sector	180/sector	180/sector	180/sector
Average seek time	—	—	—	48 ms	33 ms
Average rotational/relay time	—	—	—	7 ms	8.33 ms
Average access time	75 ms	95 ms	95 ms	55 ms	41.3 ms
Data transfer rate	625KB/sec.	625KB/sec.	625KB/sec.	384KB/sec.	5MB/sec.
Supported by system models	B 95	B 95	B 95	B 91, B 91S, B 92, B 93	B 95
Comments	Integral 0.7MB floppy		Integral 0.7MB floppy		Integral 0.7MB floppy

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

➤ the system soon, the B 90 and its installed base may dwindle and not be replaced. In its place the XE500 could retain some of the B 90's installed base.

ADVANTAGES AND RESTRICTIONS

An advantage of the B 90 system is that it is a dependable 8-bit system that performs well in general-purpose applications. Numerous software packages are available for banking applications, small government installations, and medical management environments. Another plus for the system is an abundance of vendor-supplied peripherals, including tape drives, workstations, and printers.

The principal disadvantage in the B 90 line lies in the increasing obsolescence of 8-bit systems, which are losing ground to more powerful and comparably priced 16- and 32-bit supermicros. Yet, there is still a viable market for general business applications systems like the B 90 family. The question remains as to how long Burroughs can profitably market, service, and enhance the B 90 line.

USER REACTION

We received no responses for B 90 systems in our 1986 Datapro Computer Users Survey. As a matter of policy, Burroughs does not divulge data about its customers. Thus, Burroughs declined to provide us with a list of users from whom we could obtain assessments of the B 90 systems. □

➤ high. The B 95 processor module measures 6.88 inches wide, 14 inches deep, and 14.25 inches high; it weighs 22 pounds.

Power requirements for the U.S. are 120 VAC +5 percent, -10 percent, at 60 hertz. The system requires 1.35 KVA. The operating environment is from 55 to 104 degrees Fahrenheit, with a humidity tolerance ranging from 10 to 85 percent, noncondensing. Additional air-conditioning above normal office levels is not required, except in extreme operating environments. The processor and standard units integral with the processor dissipate about 4000 Btus of heat per hour.

For the B 91, B 91S, B 92, and B 93, service area and general machine requirements indicate the need for a floor area with about a three-foot clearance around the system. The B 95 requires only that the air vents at the front and rear of the system not be blocked and that a commercial office environment (55 to 90 degrees Fahrenheit at 10 to 80 percent humidity) be provided. The storage and processor modules are connected to the B 95 power supply by D-type connectors; the modules have integral power supply cables operating at a maximum voltage of 12 VDC.

Models of B 90 systems that satisfy all international requirements are also available.

INPUT/OUTPUT CONTROL

Facilities for six I/O channels on the B 91 and B 95, and eight I/O channels on the B 91S, B 92, and B 93, are standard. A channel expander unit allows a single I/O channel to be expanded to four similar channels; thus 11 is the system's channel maximum on the B 92 and B 93. The expander is only one of three types of I/O control used in the B 90. The traditional controller used with the line printers ➤

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► represents the second type. The last type is a combination of a device controller and microprocessor placed between the device and the CPU. This type is utilized where complex control is necessary to provide greater throughput to the processor; the control for the tape cassette drives is an example. All three types of control offer their own identification to the processor, allowing the operating system to call into main memory only the necessary disk-resident I/O control segments.

Processing must cease during I/O command transfers and during transfers of data. During periods of "I/O overhead," such as disk seek, simultaneous operations can occur. All parts of the system other than main memory are considered peripherals, including the operator console.

CONFIGURATION RULES

GENERAL: The B 91 may attach up to two disk controls with freestanding Burroughs SMD (Super Mini-Disk) drives providing up to 4MB of disk storage, Burroughs SMD II drives providing up to 6MB of inbuilt disk storage, removable cartridge disk subsystems up to 18.4MB, and fixed disk subsystems up to 77.2MB. Total disk storage capacity on the B 91 is 86.4MB. Up to eight I/O channels, two of which can be data communications channels, can be configured on the B 91. One freestanding printer rated at up to 650 lpm can also be configured.

The B 91S may attach two disk controls, supporting up to 77.2MB of fixed disk. Memory, from a base 256KB, is expandable to 512KB in 128KB increments. The B 91S allows up to two wide line printer controls and up to two data communications controllers, maximum. It supports eight I/O devices, maximum, and three cable-connected I/O devices, that is, freestanding disks and line printers. (According to the company, data comm lines are not considered cable-connected I/O devices.)

The B 92 may attach up to three disk controls and a total of 154.4MB of disk storage. Total disk capacity can be allocated among several types of disk devices in various combinations. Individual limits for disk devices include Burroughs BSM drives, 6MB (3 two-megabyte freestanding drives); Burroughs BSM II drives, 6MB; removable cartridge disk, 27.6MB; and fixed disk storage, 154.4MB.

The B 92 can have up to 11 I/O channels, four of which can be data communications channels. Up to two freestanding printers rated at 230 cps or 160, 250, 300, 320, 500, or 650 lpm (48-character set) or 64, 250, 300, 375, or 600 lpm (64-character set) can be configured. The B 92 can also be configured with magnetic tape cassette stations. Up to four PE and four NRZI cassette stations or a combination of these stations may be included in the B 92 configuration. A magnetic tape cassette control can handle up to two cassette stations. The B 92 can also support the B9498 Magnetic Tape Streamer for application processing and data file backup, loading, and dumping.

The B 93 has eight input/output channels, expandable to eleven I/Os. The B 93 can support the following components: up to three disk controllers; up to four data communications channels; up to two line printers per system, with speeds up to 650 lpm; up to 154MB of fixed disk storage using disk storage subsystems ranging from two megabytes to 77.2MB; and any combination of up to four cassette stations. The B 93 can also support the B9498 Magnetic Tape Streamer.

The B 95 has six I/O channels, five of which can be used for data communications. It supports 10.3MB and 15.1MB fixed/removable and 14.4MB fixed modular disk subsystems. Two storage modules can be configured, for maximum storage of 28.8MB. The B 95 supports printers with speeds

CHART C. WORKSTATIONS

MODEL	ET 1100
DISPLAY PARAMETERS	
Max. chars./screen	2,080
Buffer capacity	10 pages
Screen size (lines x chars.)	24 x 80 plus 2 status lines
Tilt/swivel screen	Standard
Symbol formation	7 x 9 dot matrix
Character phosphor	Green on black
Total colors/no. simult. displayed	Not applicable
KEYBOARD PARAMETERS	
Style	Typewriter
Character/code set	128 ASCII
Detachable	Yes
Program function keys	10 standard
TERMINAL INTERFACE	TD1, RS-232-C, BDAA (opt.)

of 150 cps and 370, 375/500, and 600 lpm; two printers can be configured.

WORKSTATIONS: The B 91, B 91S, B 92, and B 93 each support up to eight workstations; the B 95 can support up to four workstations.

DISK STORAGE: See above.

MAGNETIC TAPE: See above.

PRINTERS: Up to two system printers can be configured.

MASS STORAGE

See Chart B.

INPUT/OUTPUT UNITS

See Chart C for workstations, Chart D for printers, and Chart E for magnetic tape devices.

COMMUNICATIONS CONTROL

GENERAL: A standard mix of communications network configurations is possible, ranging from a tie-in of one processor to another to various terminal mixes using a variety of communications links. The links may be in-house facilities using data sets or direct connection, or they may use either switched or leased-line telephone facilities. Communications modes may be simplex, half-duplex, or full-duplex, using synchronous, bisynchronous, or asynchronous transmission. Direct connection may be up to 1,000 feet in length using the Two-wire Direct Interface (TDI).

Speeds up to 38,400 bps are possible with the TDI, and, speeds from 19 to 2K bps asynchronous and synchronous/bisynchronous can be achieved, depending on data sets.

A variety of communications protocols is available (asynchronous, synchronous, bisynchronous, and bit-oriented). Burroughs Data Link Control (BDLC) is a bit-oriented line control procedure for synchronous transmissions. BDLC is based on High-Level Data Link Control Procedures (HDLC), the protocol standard developed by the International Standards Organization (ISO) and by the European Computer Manufacturers Association (ECMA), and Advanced Data Communications Control Procedures (ADCCP), the protocol standard developed by the American National Standards Institute (ANSI). ►

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CHART D. PRINTERS

MODEL	B9246-6D	B9249-30	B9249-37	B9249-375
Type	Band	Line	Line	Line
Speed	450-600 lpm	300 lpm	270 lpm	375 lpm
Bidirectional printing	—	—	—	—
Paper size	3-17 inches	3-17 inches	3-17 inches	3-17 inches
Character formation	Band	Chain	Chain	Chain
Horizontal character spacing (char./inch)	10	10	10	10
Vertical line spacing (lines/inch)	6 or 8	6 or 8	6 or 8	6 or 8
Character set	48, 64, 96	64	48, 64	64
Controller/Interface	Integrated	Integrated	Integrated	Integrated
No. of printers per controller/interface	1	1	1	1
Printer dimensions, in. (h x w x d)	43.7 x 33.6 x 30.3	40.5 x 30 x 24.5	40.5 x 30 x 24.5	40.5 x 30 x 24.5
Graphics capability	No	No	No	No

CHART D. PRINTERS (Continued)

MODEL	B9249-4	B9249-50	B9251
Type	Line	Chain	Serial
Speed	350 lpm	375/500 lpm	230 cps
Bidirectional printing	—	—	Yes
Paper size	3-17 inches	—	3-17 inches
Character formation	Chain	Chain	Dot matrix
Horizontal character spacing (char./inch)	10	—	10, 12.5, 16.7
Vertical line spacing (lines/inch)	6 or 8	6 or 8	6 or 8
Character set	64	64/48	96
Controller/Interface	Integrated	Integrated	Integrated
No. of printers per controller/interface	1	—	1
Printer dimensions, in. (h x w x d)	40.5 x 30 x 24.5	—	10.9 x 27.9 x 19.5
Graphics capability	No	No	No

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

► SOFTWARE

OPERATING SYSTEM: The *Master Control Program (MCP)* is the only operating system offered by Burroughs for the B 90. It is conceptually similar to the MCP offered on the larger B 1900 Systems.

Designed as a comprehensive operating system, the MCP provides the following functions: operator communications; multiprogramming; virtual memory techniques; dynamic resource allocation; input/output control; maintenance of a library of files; shared index and sequential file handling; reentrant code; and print spooling from system and terminal printers. The system display (or, alternatively, the console printer on the B 91, B 91S, and B 92) serves as the communications device between the operator and the MCP.

Multiprogramming under the B 90 MCP takes place without partitioning. During I/O operations, the processor is free and thus able to handle the processing of a second program. The virtual memory concept is implemented by breaking up programs into a variable number of segments consisting of I/O functions, constant data, variable data, and executable logic code. Program segmentation is determined at compilation time, with the compiler building a dictionary for each program. When a program is to be executed, only those segments necessary for execution are brought into main memory.

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

In I/O control, the MCP handles physical I/O and the programmer takes care of logical I/O. Among the processes

of physical I/O handled by the MCP are locating files, data transfers, error monitoring, buffer management, label handling, and automatic retry on detection of an error.

MCP also contains a Multiple Terminal Operator Display System (ODS) feature for any B 90 system terminal-oriented environment. It provides System Control Language (SCL) facilities to any (and more than one) remote or locally connected station designated in the Network Definition Language as ODS-capable; the operator can initiate sorts and other functions, direct printer backup facilities, and interrogate the mix from the designated station.

The MCP is an integral part of the B 90 Computer Management System (CMS), which also includes high-level language compilers, utility routines, and related CMS products.

DATABASE MANAGEMENT SYSTEM: B 90 systems do not use a DBMS.

LANGUAGES: Under the B 90 MCP, both Cobol and RPG are supported. (For data communications environments, the Network Definition Language and Message Processing Language are also supported; these languages are discussed under COMMUNICATIONS.)

COMMUNICATIONS: *Network Definition Language (NDL)* is a special-purpose, parameter-driven programming tool that enables users to define and generate customized Network Controller programs for data communications applications.

Message Processing Language II (MPL II) is a high-level, parameter-driven compiler language used to generate Message Control Systems (MCS) for data communications networks.

UTILITIES: A comprehensive set of utility routines is available for the B 90. The following are some of the utilities provided: ►

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- ▶ • **Cold Start** is a set of programs involved in the initial loading of system software into disk storage. Separate programs handle disk initialization, disk copying, and disk loading of the system software.
- **List Directory** generates a listing of file parameters, such as record size, block size, creation date, last access, and file type of a particular file or group of files.
- **Copy** provides a means to change file attributes while copying a file or parts of a file.
- **List** provides a hexadecimal and/or alpha printout of a file or parts of a file.
- **Modify** allows the user to change file name, device type, and file size for a file as referenced by a particular program.
- **Sort/Merge** sorts a data file on specified keys and maintains key files as necessary. An index file can be created or sorted, a data file can be sorted, and a merge can be executed to combine up to 16 ordered files into one.

RELATED CMS PRODUCTS: Related CMS products include CMS Superstart, CMS Reporter and On-line Reporter, CMS Domain, CMS Cande, CMS (Automatic Run Control System), CMS RPG-Edit, and CMS (On-line Data Entry System). These products are discussed in the following paragraphs.

CMS Superstart is an interactive menu management facility that permits users without any programming experience to create and maintain a customized menu structure that links daily operations and applications programs.

CMS Reporter and **On-line Reporter** are generalized reporting systems that allow nontechnical personnel to create and maintain unique or recurring reports and labels that supplement those normally produced by applications systems. CMS Reporter is a console-based system that produces hard copy reports; it is used only on the B 91, B 91S, and B 92. CMS On-line Reporter is a terminal-based version for the B 93, and B 95; it can produce a hard copy report or display data on the terminal.

CMS Domain provides an interactive method for specifying and developing file maintenance and inquiry programs through a terminal. With Domain, the user can create a disk file, add, delete, or maintain records in a disk file; or inquire into records in a disk file.

CMS Command and Edit (Cande) provides generalized file preparation, on-line programming, editing, and updating in an interactive terminal-oriented environment. Cande runs in conjunction with NDL. The NDL-generated network controller performs all data communications-related functions, while performing file updating and text editing functions. The on-line user has all compilers available including Cobol, RPG, and MPL. Cande also provides a recovery system.

CMS Automatic Run Control System (CMS) enables the automatic execution of sequences of commands and programs and is used with commands and programs that are repetitive in nature (job streams). No operator intervention is required under normal circumstances once a job stream is initiated using CMS.

CMS On-line Data Entry System is a data entry and validation system using multiple on-line visual display units. It provides a generalized and generative "front end" for existing applications packages. It enables future packages to be designed to use its editing facilities and thus reduce development effort by eliminating conventional input control programs.

CHART E. MAGNETIC TAPE EQUIPMENT

MODEL	B9498
TYPE	Streaming
FORMAT	
Number of tracks	9
Recording density, bits per inch	1600
Recording mode	PE
CHARACTERISTICS	
Controller model	Integrated
Drives per controller	4
Storage capacity, bytes	37M
Tape speed, inches per second	100
Data transfer rate, units per second	160KB/40KB
Streaming technology	Yes
Start/stop mode; speed	Yes; 25 ips
Switch selectable	No

OFFICE AUTOMATION: The *Word Management System (WMS)* provides integrated data processing and word processing capabilities for Burroughs B 90 systems utilizing Computer Management System (CMS) operating software and ET 1100 workstations. WMS is designed to utilize information from data processing files for incorporation in letters and office documents. WMS is a shared logic system which runs concurrently with data processing applications.

APPLICATIONS: Burroughs offers a variety of applications programs for the B 90 series. Applications areas include government accounting and financial management, commercial business management, wholesale/distribution, manufacturing, health care business management, banking, business planning, and decision support.

PRICING

POLICY: Burroughs offers the B 90 for purchase or lease. In addition to the basic one-year lease, Burroughs offers three-year and five-year leases at a discount of approximately 10 percent. Discounts for purchase of multiple units are available.

SUPPORT: The standard equipment lease agreement includes remedial maintenance service during any continuous nine-hour period from 7 a.m. to 6 p.m., Monday through Friday, excluding Burroughs-recognized holidays. Additional extra-shift charges are billable for maintenance coverage 24 hours per day, seven days per week.

Burroughs software technical assistance, for installation support and beyond, is available to B 90 users at prices determined by the type of service provided. Installation support varies from one day for some application modules to more than 10 days for certain complete systems. Hardware installation support for purchased systems is billed according to the type of service provided.

Applications software prices quoted in the price list below are for a single, initial license payment with a monthly license fee. Also shown are prices for annual Product Service Agreements (PSA), which are charged separately from the aforementioned product charges. There are two types of PSAs. PSA-1 provides telephone support, while PSA-2 provides both telephone support and assistance on-site in diagnosing and reporting of problems.

TRAINING: Customer education for applications programs is charged at specific per-course rates. Some modules require one day, while complete systems may require up to 17 days. Courses on hardware and software are available, as are other courses on subjects from Introduction to Program-

Burroughs B 90

► Training to CMS Cobol. Training is recommended by Burroughs.

Training is available at major centers throughout the United States and worldwide.

TYPICAL CONFIGURATIONS: Sample configurations for the Burroughs B 90 systems are shown below. Complete equipment and software prices follow these configurations.

B 91-SP5 PACKAGED SYSTEM: \$21,000

CPU
512KB memory
230-cps console printer
Operator Display System (ODS)
77.2MB fixed disk drive
1MB mini disk
Data comm power pak
TDI kit
Printer and ODS controls

TOTAL PURCHASE PRICE: \$21,000

B 93-CSY PROCESSOR COMPLEX: \$20,999

CPU
128KB memory board
Fixed disk control
3/6MB mini disk
18.8MB fixed disk drive
375/500 lpm character set
Data comm power pak
One B9249-375 375-/500-lpm printer 6,750
One N9251-1 printer control and cable 495
Eight ET 1100 workstations 15,560

TOTAL PURCHASE PRICE: \$43,804

B 95-SYS PROCESSOR COMPLEX: \$3,900

CPU
Power supply
Disk control
Dual data comm power pak
Dual cable operator/TDI kit
One B4256-4 256KB memory board 1,517
One B9493-54 10.3MB fixed disk module 1,590
One B9251 230-cps matrix printer 3,487
Two ET 1100 workstations 3,890

TOTAL PURCHASE PRICE: \$14,384

EQUIPMENT PRICES

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly lease, 1-year (\$)	Monthly lease, 3-/5-year (\$)
PACKAGED SYSTEMS AND PROCESSORS					
B 91-S	B 91-S System includes 2MHz CPU, 230-cps console printer, (2) 256KB memory, Operator Display System (ODS), ODS controls, 1/4.6/18.8/37MB fixed disk or 3/6/40/80MB fixed disk, printer controller, Data Comm Power Pak, and TDI kit	18,000	—	—	—
B 91-PK1	B 91-PK1 System includes 2MHz CPU, 90-cps matrix printer, (2) 256KB memory, ODS, ODS controls, (2) disk controls, 1MB 4.6 cartridge, 18.8/37 fixed cont., printer controller, Data Comm Power Pak, TDI kit, 1MB super mini-disk drive, and 18.8MB fixed disk	14,650	228.00	—	—
B 91-PK2	B 91-PK2 System includes 2MHz CPU, 90-cps matrix printer, (4) 512KB, ODS, ODS controls, 1MB 4.6 cartridge, 18.8/37 fixed cont., 3/6MB 20/40/80 fixed cont., printer controller, Data Comm Power Pak, TDI kit, 1MB super mini-disk drive, and 38.6MB fixed disk	23,260	385.00	—	—
B 91-SP5	B 91-SP5 System includes 2MHz CPU, 230-cps console printer, (4) 512KB memory, ODS, ODS controls, 1MB, 4.6 cartridge 18.8 fixed cont., 3/6, 40/80MB fixed cont., printer controller, Data Comm Power Pak, TDI kit, 1MB mini-disk, and 77MB fixed disk	21,000	310.00	—	—
B 92-256	B 92-256 System includes 2MHz CPU, 120-cps matrix printer, (2) 256KB memory, ODS, ODS control, 1/4.6/18.8/37MB fixed disk or 3/6/40/80MB fixed disk, printer controller, Data Comm Power Pak, TDI kit, and tape streamer	16,115	96.00	833	792/792
B 93-CSY	B 93 System includes 2MHZ CPU, (2) 256KB memory, 8 I/O channels, disk control, controller for 18.8MB fixed disk, printer control, 3/6 inbuilt, 18.8MB fixed disk, 375/500 lpm 64/48 channel set, Data Comm Power Pak, and TDI kit	20,999	376.00	454	411/411
B 95-SYS	Includes Processor Complex, 2MHz processor, power supply, disk control, Dual Data Comm Power Pak, and choice of Dual Cable Operator/TDI or Dual Cable operator 25 ft. D.S.	3,900	45.50	401	341/341

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		Purchase Price (\$)	Monthly Maint. (\$)	Monthly lease, 1-year (\$)	Monthly lease, 3-/5-year (\$)
B 91-C I/O EXPANSION KITS					
H9108-1	I/O Expansion Kit	3,151	3.50	104	99/99
H9108-2	I/O Expansion Kit	4,200	3.50	137	131/131
MEMORY OPTIONS					
BD4128	2MHz, 128KB	1,575	31.00	142	128/128
BD4128-K	2MHz, 128KB (field add-on)	2,190	29.00	142	128/128
BD4022-64	64KB memory module	1,418	37.00	69	64/64
B4256-4	2MHz, 256KB memory module	1,517	6.50	93	89/89
B4512-4	2MHz, 512KB memory module	3,008	11.00	184	176/176
INBUILT MINI-DISK OPTIONS					
B9489-1	1MB Inbuilt BSMD (B 91, B 92 only)	1,003	41.00	55	48/47
B9489-21	3/6MB BSMD II Inbuilt	3,150	55.00	262	224/210
CONSOLE/CPU OPTIONS					
N4305	I/O extender	568	6.00	24	22/22
BD7760	B 92 second pinfeed option	839	9.50	37	33/33
H7751	B 91S second pinfeed option	—	5.00	—	—
CONSOLE/SPO OPTIONS					
B9356-01	Operator Display	2,101	30.00	139	124/126
H9356	CRT Control (B 91)	—	8.00	—	—
N9356	CRT Control (B 92)	—	9.00	—	—
B9356-98	B 91 top cover	—	—	—	—
TIME OF DAY CLOCK					
N2357	Time of Day Clock	987	9.00	40	37/37
H2357	Time of Day Clock	895	7.50	38	35/35
DATA COMMUNICATIONS					
H2356-25	Data Comm Power Pak	850	7.50	36	32/32
N2356-25	Data Comm Power Pak	937	7.00	38	35/35
N2356-35	Dual Data Comm Power Pak	992	11.50	35	32/32
H2356-1	Asynchronous line adapter, 1200/1800 bps	651	5.50	29	27/27
H2356-2	Asynchronous line adapter, 1800 bps	940	7.50	40	37/37
N2356-2	Asynchronous line adapter, 1800 bps	940	8.00	40	37/37
H2356-6	TDI line adapter, 9600 bps	649	5.50	29	27/27
N2356-6	TDI line	649	5.00	29	27/27
H2356-18	Synchronous/bisynchronous line adapter	1,082	8.50	44	40/40
N2356-18	Synchronous/bisynchronous line adapter	1,082	8.50	44	40/40
H2358		109	—	6	5/5
MASS STORAGE					
H9300	1MB BSMD/cartridge/fixed disk control for B9489-1/11/12; B9493-18; B9480-22; B9481-12	1,040	8.00	44	40/40
H9400	Fixed disk control-B9493-20/40/80 (B9489-21)	1,040	8.00	44	40/40
N9300	1MB BSMD cartridge/fixed disk controller for B9489-11/12; B9493-18/37; B9480-22	1,040	9.00	44	40/40
N9350	SSG disk control	840	9.00	44	42/42
N9400	Fixed disk control-B9493-20/40/80	1,092	9.00	44	40/40
N9444	B 90 disk control and cable-B9489-44	1,838	8.00	103	86/86
N9450	Disk Control-B9493-74	1,092	7.50	65	55/55
H9500	Control for ICMD-B9489-17	1,565	12.00	63	58/58
N9500	Control for ICMD-B9489-17	1,643	13.50	64	59/59
B9480-22	4.6MB dual cartridge disk drive	4,000	141.00	253	229/232
B9481-12	9.2MB dual cartridge disk drive	7,500	212.00	502	450/458
B9489-1	BSMD drive master, 1MB mini-disk	1,003	41.00	55	48/47
B9489-11	BSMD drive master, 1MB	2,626	52.00	137	116/116
B9489-12	BSMD drive master and slave, 2MB	4,006	103.00	207	180/180
B9480-24	4.6MB cartridge drive w/h or N9300	4,040	70.00	279	248/248
B9489-17	243KB ICMD drive, freestanding	2,100	40.00	127	113/113
B9481-13	9.2MB cartridge w/h or N9300	6,815	120.00	513	455/455
B9489-21	3/6 Inbuilt	3,150	55.00	262	224/210
B9489-44	700KB, 5 1/4-inch floppy disk drive	5,775	40.50	337	288/288
B9493-18	18.8MB fixed drive	5,775	111.00	353	314/304
B9493-20	19.3MB fixed disk drive	10,000	87.00	525	465/465
B9493-37	37.6MB fixed drive	8,925	135.00	605	564/574

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		Purchase Price (\$)	Monthly Maint. (\$)	Monthly lease, 1-year (\$)	Monthly lease, 3-/5-year (\$)
MASS STORAGE (Continued)					
B9493-40	38.6MB fixed drive	14,280	117.00	657	584/584
B9493-9K	9MB to 18MB disk upgrade	1,050	12.50	50	44/45
B9493-40K	40MB to 80MB disk upgrade	3,676	26.00	125	112/119
B9493-54	9.6MB/700KB disk module	1,590	43.50	286	245/245
B9493-64	Two 8.6MB fixed disks	3,150	40.50	259	222/222
B9493-74	14.4MB/700KB disk module	3,675	45.50	302	259/259
B9493-80	77MB fixed disk drive	17,036	139.00	734	650/650
B9494-41	400MB fixed disk	24,832	129.00	1,619	1,460/1,318
B9493-94	37.5MB/700KB disk	7,920	56.25	—	—
MAGNETIC TAPE UNITS					
B9497-5	Magnetic tape cassette control	1,654	15.00	65	59/59
B9497-15	PE freestanding cassette drive	1,774	20.00	82	71/72
BD9800	Tape streamer control	1,359	9.50	48	45/45
B9498	Magnetic tape streamer	7,875	49.00	331	292/292
PRINTERS					
N9250	N9250 Control	680	8.30	35	33/33
B9246-6D	650-lpm line printer with ODEC interface	15,435	205.00	611	529/529
B9249-30	300-lpm printer	6,300	101.00	417	374/374
B9249-37	375-lpm printer, OCR sound reduct	6,500	101.00	440	391/391
B9249-50	375/500-lpm printer, 64/48 character set	6,750	124.00	450	401/401
B9249-375	375/500-lpm printer, 64/68 character set	6,750	124.00	462	400/400
B9251	230-cps matrix printer	3,487	35.00	127	112/112
B9252	150-cps matrix printer	1,295	—	—	—
B9349-2	160-lpm printer	4,500	105.00	285	255/255
B9349-3	250-lpm printer	5,500	118.00	375	334/334
B9349-4	350-lpm printer	6,500	131.00	510	453/453
WORKSTATIONS					
ET 1100	Ergonomic workstation with 14-inch display and keyboard	1,945	20.33	105	88/79

SOFTWARE PRICES

		Initial Payment (\$)	Monthly License Fee (\$)	Annual Product Service Agreements	
				PSA-1 (\$)	PSA-2 (\$)
SYSTEM SOFTWARE					
CM90SSF	System Software Facility; includes:	2,850	135	260	542
CM90MCP	MCP for B 90 Systems	—	—	—	—
CM90UTL	B 90 CMS Utilities	—	—	—	—
CM90SST	B 90 CMS Superstart	—	—	—	—
CM90CDE	CMS Cande	—	—	—	—
AC90BCP	ACSYS SYS Software	2,500	115	—	—
CM90ACA	B 90 ACSYS SYS & MCP	5,000	225	—	—
CM90COB	CMS Cobol Compiler	1,200	50	55	100
CM90RPG	CMS RPG Compiler	1,200	50	55	100
CM90MPL	CMS MPL II Compiler	1,200	50	60	110
CM90NDL	CMS NDL Compiler	1,200	60	50	110
CM90TEI	Terminal Entry B 90, TDS Cont MCS, Cande, and ODES Y	1,200	50	75	139
DEVELOPMENT AIDS					
CM92DOM	CMS Domain System	2,200	100	139	287
CM92REP	CMS Reporter	2,200	100	139	287
CM92RPO	CMS On-line Reporter	2,200	100	139	287
CM92INQ	CMS Inquiry	1,000	45	68	123
CM92GMC	CMS GEMCOS (Generator)	3,000	135	161	297
CM90GMB	GEMCOS (Basic Module)	1,000	45	46	83
CM90GMT	GEMCOS (TCL Compiler)	1,000	45	49	89
CM90GMF	GEMCOS (Formatting Module)	600	30	32	59
CM90DES	MTS Data Entry System	2,500	115	142	262

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**Annual Product
Service Agreements**

		Initial Payment (\$)	Monthly License Fee (\$)	PSA-1 (\$)	PSA-2 (\$)
CONVERSION AIDS					
CS92SL9	B700 SL7 Cobol to B 92 CMS Cobol	1,000	—	—	—
CM90CON	IBM System/32 to B 90 conversion	1,000	—	—	—
OFFICE AUTOMATION SYSTEMS					
B92WMS	Word Management System	3,500	160	214	427 ■