

Burroughs B 1900 Series

MANAGEMENT SUMMARY

In recent months Burroughs has revamped the B 1900 Series, removing the B 1905, B 1915, B 1955, and B 1985 from major production and substituting three new systems—the single-processor B 1990-CMS and B 1990-SP and the dual-processor B 1990-DP. The B 1990 machines are aimed toward small- and mid-sized organizations running commercial applications in centralized or distributed processing environments.

The B 1990-SP and B 1990-DP are native-mode machines that run under Burroughs' Master Control Program (MCP) operating system. They feature object code and data file compatibility with older native-mode B 1700, B 1800, and B 1900 systems. The two systems feature microprocessor-based peripheral and communications controllers, an independent microprocessor-based telecommunications subsystem with direct memory access, and the Maintenance Access Processor (MAP), an integrated diagnostic subsystem. The MAP allows system failures to be diagnosed either on-site or at a remote Burroughs support center.

The B 1990-SP directly replaces the B 1955, reportedly providing a 25 percent price/performance improvement over its predecessor while occupying half as much space and using less power. The B 1990-SP is packaged in a single cabinet. It features 512KB of main memory, expandable to 2MB, and an 8KB cache memory. An expansion cabinet can be added and the system upgraded to a B 1990-DP through addition of a second processor with 8KB cache; even if the system is not upgraded, the expansion cabinet can be used to house additional peripheral and communications controllers. An expanded B 1990-SP can handle up

Burroughs has revamped the B 1900 Series of commercial systems, removing previous models from major production and substituting the B 1990-CMS, which operates in Burroughs' Computer Management System (CMS) environment, and the native-mode B 1990-SP and B 1990-DP. The native-mode MCP operating system has been enhanced to provide additional operations and database management capabilities and to support more extensive communications facilities.

MODELS: B 1990-CMS, B 1990-SP, and B 1990-DP.

MEMORY: 512KB to 2MB.

DISK CAPACITY: 130MB to 8.6GB.

WORKSTATIONS: Up to, 224 on each model.

PRICE: \$59,300 to \$95,000 (base processor complexes).

CHARACTERISTICS

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

CANADIAN ADDRESS: Burroughs-Canada, 801 York Mills Road, Don Mills, Ontario, Canada M3B1X7. Telephone (416) 445-4030.

DATA FORMATS

BASIC UNIT: The B 1900 Series main memories are addressable to the bit level and utilize no preferred word or



The dual-processor B 1990-DP is the new top-of-the-line model in Burroughs' B 1900 Series. The B 1990-DP runs under the native-mode MCP operating system. It features a 16KB bipolar cache memory and supports 1MB to 2MB of main memory. The B 1990-DP can also support 224 workstations and between 130MB and 8.6GB of on-line disk storage.

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TABLE 1. CHARACTERISTICS OF THE B 1900 SYSTEMS

MODEL	B 1990-CMS	B 1990-SP	B 1990-DP
SYSTEM CHARACTERISTICS			
Date of introduction	3/84	10/83	10/83
Date of first delivery	3/84	10/83	10/83
Operating system	CMS MCP	Native-mode MCP	Native-mode MCP
Upgradable from	—	—	B 1990-SP
Upgradable to	—	B 1990-DP	—
MIPS	—	—	—
Relative performance	—	—	—
MEMORY			
Minimum capacity, bytes	512K	512K	512K
Maximum capacity, bytes	2M	2M	2M
Type	MOS	MOS	MOS
Cache memory	8KB	8KB	16KB
Cycle time, nanoseconds	167	167	167
Bytes fetched per cycle	3	3	3
INPUT/OUTPUT CONTROL			
Number of channels	15	15	15
High-speed buses	—	—	—
Low-speed buses	—	—	—
MINIMUM DISK STORAGE			
	130MB	130MB	130MB
MAXIMUM DISK STORAGE			
	3.2GB	8.6GB	8.6GB
NUMBER OF WORKSTATIONS			
	224	224	224
COMMUNICATIONS PROTOCOLS			
	2780/3780, RJE, Hasp 360-20	2780/3780, RJE, Hasp 360-20, 3270/SNA, 3270/Bisync, BDLC, SDLC	2780/3780, RJE, Hasp 360-20, 3270/SNA, 3270/Bisync, BDLC, SDLC

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

► to 32 communications interfaces, 224 terminals, and 8.6GB of on-line disk storage.

A packaged version of the B 1990-SP, called the B 1990-BP (Business Partner), integrates hardware, system software, and Linc, Burroughs' fourth-generation application development system. The B 1990-BP is intended as a vehicle for small businesses to develop on-line, interactive applications. The basic B 1990-BP includes 1MB of main memory, a 130MB removable pack drive, and a 650 lpm band printer. The B 1990-BP has the same expansion capabilities as the B 1990-SP.

The dual-processor B 1990-DP features 1MB of main memory, expandable to 2MB. The system also includes 16KB of cache memory. The basic system includes an expansion cabinet; like the expanded B 1990-SP, the B 1990-DP can support up to 8.6GB of on-line disk storage, 32 communications interfaces, and 224 workstations.

Burroughs has also added capabilities to the realtime, multiprogramming MCP operating system for the new native-mode computers. The MCP has been rewritten in a new software development language, SDL2; according to Burroughs, the system operations, database management, and data communications functions of MCP have been enhanced. The MCP has been standardized for upward compatibility, allowing resource management functions to be performed in both single- and dual-processor environments. The new version of MCP reportedly enhances the performance of Burroughs' DMS II database management system. The new release also supports Work Flow Language (WFL), the means by which jobs are described and presented to the system; a WFL job can determine at run time which programs are to be run and how they are to be

► byte boundaries that are visible to the rest of the system. Variable instruction and operand lengths permit from 1 to 65,536 bits of data to be addressed with a single instruction, and up to 24 bits can be transferred in parallel between main memory and the processor.

FIXED-POINT OPERANDS: None.

FLOATING-POINT OPERANDS: None.

INSTRUCTIONS: Logic functions are performed by microinstructions that operate on strings of bits. There are 32 defined microinstructions in each B 1900. All current microinstructions are 16 bits in length.

INTERNAL CODE: EBCDIC; other media codes, such as ASCII, can be translated. ASCII is used with the Computer Management System (CMS) software.

MAIN STORAGE

TYPE: N-channel MOS; 64K bits per chip.

CYCLE TIME: 167 nanoseconds for all systems.

CAPACITY: 512KB to 2MB. See Chart A for information on the memory ranges of specific systems.

CHECKING: All models employ error-correcting (EC) main memory. EC detects and corrects all single-bit main memory errors and detects most multiple-bit errors. EC generates a 3-bit check field for each 8-bit byte as it is written, and recomputes the field when the byte is read. If the check bits do not match, the erroneous bit is corrected before data is transmitted to the processor. A modified Hamming code is used by the hardware encoder on each memory board to construct the check field.

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

► **RESERVED STORAGE:** Information unavailable from Burroughs. ►

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▷ run. The revised operating system supports Burroughs On-Line Test (Bolt), a facility for on-line certification of B 1900 systems; it also allows the B 1900 system's standard Operator Display Terminal to be used both as a station for system interaction and control and as a workstation.

The revised MCP also provides more extensive support for communications software. The MCP supports Burroughs Network Architecture (BNA) facilities, which allow the B 1900 to function as a host or a node in a distributed processing network; a new BNA/X.25 capability allows the B 1900 to access Telenet, Tymnet, and other packet switched networks. Two remote workstation programs allow B 1900 systems with printers and terminals to emulate IBM 3270 devices and access host systems using IBM Bisync and SNA/SDLC line disciplines. An IBM 3780/RJE capability also provides B 1900s with facilities for batch communications with IBM and other systems. The native-mode B 1900s can also support Burroughs' B 20 microcomputers as distributed processing nodes.

The B 1900-CMS operates in Burroughs' Computer Management System (CMS) small systems environment, running under the CMS version of MCP and using related CMS software facilities. Reportedly the most powerful member of the CMS family, the B 1900-CMS is object-code compatible with the B 90, B 900, and B 1955-CMS systems, as well as with the older B 80 and B 800 computers; screen-based applications for those systems can be run on the B 1900-CMS without modification.

The B 1900-CMS is a B 1900-SP processor adapted for CMS operations. The primary difference between the native-mode system and the B 1900-CMS is in communications control. The primary communications interface on the B 1900-SP (and on the B 1900-DP as well) is the Multi-Line Control (MLC). On the B 1900-CMS, data communications applications are supported by the Data Communications Processor (DCP) subsystem. Nonetheless, like the native-mode systems, a fully configured B 1900-CMS system can support up to 32 communications interfaces.

The basic B 1900-CMS system configuration is enclosed in a single cabinet and features 512KB of memory (expandable to 2MB), an 8KB cache memory, and integrated microprocessor-based peripheral and communications controllers. The base system also includes a 130MB removable pack drive and a 650 lpm band printer. An expansion cabinet can be added to accommodate a second processor with an 8KB cache and/or additional peripheral and communications controllers. An expanded B 1900-CMS can support up to 224 workstations and 3.2GB of on-line disk storage.

The B 1900-CMS can operate in native mode as well as in the CMS environment, although not simultaneously. Users who wish to implement such dual operation must obtain the appropriate data communications components for native-mode operation. ▷

▶ **CACHE MEMORY:** All B 1900 Series systems feature a high-speed, bipolar microinstruction cache memory. The processor has the capability to dynamically execute all types of microcode from this memory, which is managed by the hardware on a demand basis. Overlap logic within the system provides for simultaneity of fetch/execute. Cache memory is 8KB on the B 1900-SP and B 1900-CMS, and 16KB on the B 1900-DP.

CENTRAL PROCESSORS

GENERAL: The B 1900 Series processors are multiprocessing systems with virtual memory management. They employ multiple, integrated microprocessors and feature dynamically variable microprogrammed logic and bit-addressable memories. The processors' logic functions are performed by microinstructions that operate on strings of bits. There are 32 defined microinstructions in the B 1900 processors. All current microinstructions are 16 bits in length.

The processors also employ S-language (Secondary-language) instructions, which are software-defined by microprograms. S-language instructions are intermediate instructions equivalent to the machine-language instructions of conventional computers. Each S-language instruction is implemented by a string of microinstructions that interpretively execute 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 1900 programming language, Burroughs has defined an "ideal machine" and developed a specialized microprogram, called an Interpreter, that makes the B 1900 appear to be logically equivalent to that machine. The interpreter executes the instructions which have been generated by the corresponding compiler. These compiler-generated instructions are expressed in an appropriate S-language. The S-language and its Interpreter are oriented toward the characteristics of each programming language.

Under MCP control, it is possible for programs written in two or more languages to run concurrently in a multiprocessing mix. In this case, all of the corresponding Interpreters reside in main or control memory, and the B 1900 switches from one state to another (from a "Cobol machine" to a "Fortran machine," for example) whenever the MCP transfers control from program to program. The Interpreters, S-language code, and user data are all location-independent.

The B 1900-SP and B 1900-DP are native-mode systems; they are object-code compatible with all B 1700 and B 1800 systems, as well as with older native-mode B 1900 systems. The B 1900-CMS operates in Burroughs' Computer Management System (CMS) environment and is object-code compatible with CMS systems, including the B 90, the B 900, the B 1955-CMS, and the older B 80 and B 800. The B 1900-CMS can run in native mode, also, although it cannot support both modes of operation simultaneously. The B 1900-CMS processor is the same as that of the B 1900-SP; the two systems differ principally in configurability and in their data communications control structures. The B 1900-SP processor complex includes: a 6MHz CPU; 512KB of main memory; an 8KB cache memory; an integrated input/output subsystem microprocessor; an independent, microprocessor-based telecommunications subsystem with direct memory access; four communications interfaces on a single quad line adapter; the Multiple Access Processor (MAP), a diagnostic subsystem that permits system failures to be diagnosed either on-site or remotely by Burroughs Field Engineering personnel; and an ET 1100 Operator Display Terminal (ODT). The processor complex is housed in a single cabinet with three available microprocessor ▶

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TABLE 2. MASS STORAGE

MODEL	B 9484-12G	B 9484-51	B 9494-5	B 9494-41
Type	Removable pack	Removable pack	Fixed	Fixed
Controller model	B 1487	B 1487	B 1487	B 1487
Drives per subsystem/controller	8	8	8	8
Formatted capacity per drive, megabytes	252	130	542	402
Number of usable surfaces	19	10	15	16
Number of sectors or tracks per surface	823 tracks	814 tracks	2240 tracks	—
Bytes per sector or track	180/sector	180/sector	180/sector	180/sector
Average seek time	28.5 ms	22 ms	22 ms	28 ms
Average rotational/relay time	8.3 ms	8.3 ms	8.3 ms	—
Average access time	36.8 ms	30.3 ms	30.3 ms	—
Data transfer rate	581KB/sec.	605KB/sec.	605KB/sec.	650KB/sec.
Supported by system models	B 1990-SP, B 1990-DP	B 1990-SP, B 1990-DP, B 1990-CMS	B 1990-SP, B 1990-DP	B 1990-SP, B 1990-DP, B 1990-CMS
Comments	Uses single-phase power			

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

COMPETITIVE POSITION

The B 1900 Series competes in the marketplace for general-purpose commercial systems primarily against Data General's Eclipse Systems, Digital Equipment Corporation's PDP-11 Family, Hewlett-Packard's HP 3000 Series, IBM's System/36 and System/38, and the Sperry System 80.

ADVANTAGES AND RESTRICTIONS

The B 1900 systems have several features that would make them attractive not only to current Burroughs users wishing to convert to newer systems, but also to prospective first-time Burroughs users. To the first group, the B 1990-SP and B 1990-DP provide a compatible native-mode migration path from aged B 1700 and B 1800 systems, as well as from earlier B 1900 systems that have been rendered obsolescent by age or by the revamping of the product line. Application programs and data files can be readily transported from the older systems to the newer ones, as can some peripherals. The B 1990-CMS offers a similar growth path for users of older or smaller CMS systems, such as the B 80, B 800, B 90, B 900, and B 1955-CMS.

To new Burroughs users (and to old ones as well), the B 1990 systems offer a versatile combination of size and power. The systems have low profiles; a system with an expansion cabinet stands only 30 inches high by 22.5 inches wide by 29 inches deep, and could be installed in a departmental environment. In addition, the distributed processing capabilities of the native-mode systems strengthen their suitability for departmental processing. On the other hand, each B 1900 can support up to 224 workstations and up to two disk subsystems, for a maximum of 3.2GB (CMS) or 8.6GB (native-mode) of on-line storage, making it suitable for use as a computer-room engine.

One potential disadvantage is posed by the erratic quality of Burroughs' support. However, the corporation has implemented customer-assisted troubleshooting and re-

positions. The B 1990-SP can be field-upgraded to a B 1990-DP through the addition of a second processor, which can be housed in an expansion cabinet; whether or not the B 1990-SP is upgraded, the expansion cabinet can be added to support additional peripherals.

The B 1990-DP is a dual-processor system housed in two cabinets. The processor complex includes two 6MHz processors, 1MB of main memory, and 16KB of cache memory; otherwise, it shares the features of the B 1990-SP complex, except it provides eight communications interfaces on two quad line adapters and has two available microprocessor positions. In the B 1990-DP, the two processors share a common memory and operate under a master/slave concept. The master processor contains the operating system and executes all system code; it also performs all resource management. While the master processor can also execute user code, the slave processor *only* executes user code. The B 1990-DP master/slave system is queue-driven. If the master is executing user code, the slave may queue its request to the master and interrupt it. Upon completion of the requested work, the master is free to return to the user job it suspended.

The B 1990-CMS processor complex includes a 6MHz CPU with an 8KB cache memory. The complex is housed in a single cabinet with four available microprocessor positions. Like the B 1990-SP, the B 1990-CMS can be expanded to support a second processor and additional peripherals.

CONTROL STORAGE: Information unavailable from Burroughs.

REGISTERS: Information unavailable from Burroughs.

ADDRESSING: Information unavailable from Burroughs.

INTERRUPTS: The B 1900 Series processors use a "soft" interrupt system; interrupt conditions do not cause any automatic hardware actions. Instead, the recognition of interrupt conditions and initiation of the appropriate actions is completely under software control.

OPERATING ENVIRONMENT: The B 1990-SP and B 1990-CMS are 30 inches high, 22.5 inches wide, and 29 inches deep; both weigh 280 pounds. The B 1990-DP is 30 inches high, 45 inches wide, and 29 inches deep; it weighs 560 pounds.

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► mote diagnostic facilities for the new B 1990s; those new features may help to improve the quality of Burroughs' maintenance.

USER REACTION

The 1984 Datapro Computer Users Survey received responses from 143 B 1900 users, whose systems had an average installed life of 39.5 months. Seventy-two users had purchased their systems, fifty-eight leased from and twelve leased from a third party.

One-hundred and thirteen respondents (79 percent) use their systems for accounting/billing applications; one-hundred and three (72 percent) were running payroll/personnel programs. Sixty-six users were running order processing/inventory programs, while fifty-five ran purchasing applications. Thirty-nine users were running sales/distribution applications, thirty were using manufacturing systems, and twenty-five employed educational scheduling/administration packages. Other applications represented were banking, health care/medical, insurance, mathematics/statistics, engineering/scientific, process control, construction/architecture, and petroleum/fuel analysis.

One-hundred and sixteen users (81.1 percent) employed in-house personnel to develop their programs; fifty-one received their programs from third-party suppliers, forty-five used application packages from Burroughs, forty relied on contract programming, and five used custom software developed by Burroughs personnel. Cobol, mentioned by 111 users (78.2 percent), was by far the most popular programming language; RPG followed with 27 users. PL/1 and Fortran were cited by one user each.

Memory capacity on the users' systems ranged from 512KB to more than 2MB. Fifty-one users reported a memory capacity between 512KB and 1MB. Sixty-five users reported memory between 1MB and 2MB, and twenty-seven reported between 2MB and 4MB. Total disk storage ranged from none to more than 4.8GB. One user had no disk storage. Another user had less than 10MB. Three users reported between 10MB and 50MB; six users reported between 50MB and 100MB. Seventy-six users (55.1 percent) had between 100MB and 600MB; thirty-seven had between 600MB and 1.2GB. Thirteen users had between 1.2GB and 4.8GB; only one user reported more than 4.8GB of disk.

The number of local workstations ranged from none to more than 60. One user had no local stations. Thirty users had between one and five local stations; fifty-three reported between six and fifteen, and forty-three reported between 16 and 30. Fourteen users had between 31 and 60 local stations; only two users had more than 60. The number of remote workstations also ranged from none to more than 60. Forty-seven users had no remote stations; thirty-four had between 1 and 5, while twenty-nine had between 6 and 15. Sixteen users reported between 16 and 30 remote stations, eight reported between 31 and 60, and five reported more than 60.

► All three B 1900 systems can operate in regulated office environments. Power requirements are 208/220/230/240 VAC, 50/60 Hz. Each system is equipped with 15 feet of power cord (208 V). The ET 1100 Operator Display Terminal requires a standard duplex outlet (110 V). Power for all peripherals must be separately supplied; it cannot be provided by the mainframe. Power conversion kits for the 206/207 disk drives used on other B 1000 systems are available. These kits convert power from three-phase to single-phase and must be used if users of other B 1000 systems want to connect 206/207 drives to B 1990 systems.

Heat dissipation in the B 1900 central systems ranges from 4800 Btu to 10,800 Btu, depending upon the configuration.

INPUT/OUTPUT CONTROL

I/O CHANNELS: Each B 1900 system supports up to 15 I/O channels.

CONFIGURATION RULES

GENERAL: All models in the B 1900 Series support up to 2MB of main memory and up to 32 communications lines. Main memory can be expanded in 512KB or 1MB increments; users with 512KB memory modules must exchange them to go to the 1MB increment.

For expansion, the B 1900 systems require the addition of microprocessor-based peripheral and communications controllers that Burroughs has designated Types 1 and 2. Type 1 controllers fit in a base cabinet, an expansion cabinet, or both. Type 2 controllers require an expansion cabinet. Type 1 controllers include the B 1487 disk controller (which also incorporates a line printer control), the B 1492 magnetic tape controller, the B 1117 card reader controller, the B 1690 and B 1691 communications controllers, the B 1356 and B 1309 Multi-Line Controls (MLCs), and the B 1990-91 dual processor option. Type 2 controllers include the B 1240 and B 1249 printer controllers and the B 1495-32 magnetic tape controller.

The configuration rules for the different processors are explained in detail in the following paragraphs.

The base cabinet of the B 1990-SP includes an integrated input/output subsystem that supports a 650 lpm or 1250 lpm printer and a disk subsystem with up to eight spindles of fixed and removable disk storage; it also includes a quad line adapter, which features three available lines and one TDI line shared with the ODT. The cabinet also has three microprocessor positions that can be used to plug in dual or quad line adapters or any additional Type 1 peripheral controller. Each added microprocessor occupies one position.

An expansion cabinet can be added to the B 1990-SP, permitting users to add any three of the following four backplanes: a CPU backplane, which permits upgrade to a B 1990-DP through addition of a second processor with 8KB of cache memory; an I/O subsystem backplane, for a line printer and a disk subsystem combining up to eight fixed and removable spindles in any combination; an MLC backplane, for four quad or dual line adapters; and a Type 2 peripheral (also called the I/O extension) backplane, for any three Type 2 peripheral controllers.

As in the B 1990-SP, the main cabinet of the B 1990-DP includes an integrated I/O subsystem that supports a 650 lpm or 1250 lpm line printer and eight fixed and removable disk spindles. The B 1990-DP's main cabinet also contains two quad line adapters. One provides a TDI line shared with the ODT, along with three other available lines. The second permits users to plug in a dual or quad line adapter or any

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Seventy-five users (52.4 percent) reported that they used a database management system; forty-one did not employ one, and twenty-seven said that they planned to install one in 1984. Seventy-two users had a disaster recovery plan, while forty-six did not; twenty-two users planned to implement such a plan in 1984. Only 20 users had integrated office automation functions on their systems; 91 users (65.9 percent) had none, and 27 planned to integrate them in 1984. One-hundred users (72.5 percent) had no communications monitor; thirty-three used one, and five said that they planned to install one in 1984.

The ratings that the users gave their B 1900s are shown in the following table:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	85	51	5	1	3.6
Reliability of system	76	59	4	3	3.5
Reliability of peripherals	45	74	19	4	3.1
Maintenance service:					
Responsiveness	56	75	8	4	3.3
Effectiveness	44	65	28	6	3.0
Technical support:					
Troubleshooting	22	61	41	16	2.6
Education	20	65	43	10	2.7
Documentation	12	53	54	21	2.4
Manufacturers software:					
Operating system	87	49	4	1	3.6
Compiler & assemblers	63	63	13	1	3.3
Application programs	25	56	26	5	2.9
Ease of programming	53	73	8	2	3.3
Ease of conversion	57	51	20	4	3.2
Overall satisfaction	47	81	10	1	3.3

*Weighted Average on a scale of 4.0 for Excellent.

Citing advantages of the B 1900, 120 users gave their systems high ratings for reconfigurability and ease of conversion. Ninety-eight users gave high grades to the ability of their systems to support programs and data transported from other systems. Seventy-eight users praised the ability of their systems to handle transported peripherals and terminals. One-hundred and seven users gave high ratings to the power and energy efficiency of their B 1900s. Ninety-three users reported that their equipment had been delivered on schedule; nine reported delivery ahead of schedule. Another 111 remarked that their software had been delivered on time; nine said that they had received it ahead of time.

The area in which the users were most critical was support. While ratings were generally favorable, 42 users (31.6 percent) rated Burroughs' software and hardware support only fair, while 17 (12.8 percent) rated it poor.

To supplement the assessments provided in the survey, we contacted four respondents in May 1984; each was engaged in a different type of enterprise in a different area of the United States.

The first user, representing a school district in the Northeast, noted that his organization had converted without difficulty from an older Burroughs system and had been able to transport a number of peripherals. Although he was

Type 1 peripheral controller. Two microprocessor slots are available for configuration of additional dual or quad line adapters or Type 1 controllers. The expansion cabinet, standard on the B 1990-DP, includes a CPU backplane for the second processor and permits the configuration of any two additional backplanes from among the I/O subsystem backplane, the MLC backplane, and the Type 2 peripheral backplane.

The basic B 1990-CMS is a configured package that includes a 6MHz processor with 8KB of cache memory, 512KB of main memory, a B 1363 Data Comm Processor, an ET 1100 Operator Display Terminal, a 130MB disk pack, and a 650 lpm band printer. The B 1990-CMS cabinet includes an integrated, microprocessor-based input/output subsystem that supports a 650 lpm or 1250 lpm printer and up to eight spindles of fixed and removable disks. The cabinet also has four microprocessor positions for addition of peripheral and data communications controllers. One position permits addition of a B 1367 DCP-4 Data Comm Processor or any Type 1 peripheral controller. Two others allow any Type 1 peripheral controller to be plugged in. The fourth allows addition of a B 1307 I/O extension backplane. If the B 1487 printer control is used, the main cabinet can support up to 16 data communication lines; if the B 1249 printer control is used in the B 1307 extension, the cabinet will support up to 11 lines.

An expansion cabinet can be added to the B 1990-CMS to support an additional processor and extra peripheral and data communication controllers. The expansion cabinet permits the addition of the following components:

- A CPU backplane, for a second processor with 8KB of cache memory.
- A B 1308 I/O subsystem backplane, for up to eight spindles of disk and one line printer.
- A B 1307 I/O extension backplane, which permits three options. Two are for addition of any Type 2 peripheral controller or a B 1362 DCP-4; the third permits addition of any Type 2 controller or a B 1367 DCP-4 extension. The B 1367 DCP-4 extension permits configuration of a maximum of four lines. Only one B 1307 may be configured on the system.

The B 1990-CMS expansion cabinet allows configuration of up to 20 data communications lines. With any printer control except the B 1240, 17 is the maximum number of data comm lines allowable; with the B 1240, up to 15 lines can be configured. If other printer controls are used in conjunction with the B 1240, 12 is the maximum number of configurable lines; if two B 1240 controllers are used, only 10 data comm lines can be configured.

WORKSTATIONS: The B 1990-SP, B 1990-DP, and B 1990-CMS can support up to 224 workstations each. The ET 1100 Operator Display Terminal on the B 1990-SP and B 1990-DP can function both as a control station for interaction with the operating system and as a workstation.

DISK STORAGE: The B 1990-SP and B 1990-DP support up to 8.6GB of disk storage in a maximum of two subsystems. The following disk drives can be configured through the B 1487 I/O subsystem controller: 252MB B 9484-12G removable pack drive, 130MB B 9484-51 removable pack drive, 542MB B 9494-5 fixed disk drive, and 402MB B 9494-41 fixed disk drive. The B 1990-CMS can handle up to 3.2GB of disk storage in two subsystems; it supports only the B 9484-51 and B 9494-41 drives.

MAGNETIC TAPE: The B 1990-SP, B 1990-DP, and B 1990-CMS all support the 25 ips B 9498 streaming tape drive and the B 9491-4 nine-track PE tape drive through the

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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 9491-4	9	1600	PE	25	40,000
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 9498	9	1600	PE	100 (25 on CMS)	160,000/ 40,000
Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
B 9246-6	650	132	10	6 or 8	3 to 17
B 9246-13	1250	132	10	6 or 8	4 to 17
B 9246-20	2000	132	10	6 or 8	4 to 20
Punched Card Equipment	Columns	Speed Cards/Min.	Input Hopper Capacity	Output Stacker Capacity	Options
B 9115	80	300	1000	1000	51-col. read
B 9116	80	600	1000	1000	51-col. read
B 9117	80	800	1000	1000	51-col. read

▷ satisfied with the reliability of system hardware and software, he was not at all pleased with the support he received from Burroughs. While he said that he had a good relationship with the company's field service representatives, he felt that corporate support was "nonexistent." He complained that Burroughs charges extra for routine notification of software updates; moreover, updates are available only on tape, and his organization has no tape equipment.

Unlike the majority of those surveyed, the first user said that he was uncertain whether he would recommend a B 1900 to a potential user. He stated that Burroughs was marketing the system as state-of-the-art, but its performance in a particular accounting application seemed to belie that claim. While he felt that the performance he received from his B 1900 was good for the price, he was not at all sure that it was optimum. He did indicate a willingness to continue with Burroughs equipment, however, remarking that he hoped to upgrade the processor and add microcomputers to his system's data communications lines in 1984.

The second user sounded a much more positive note. Representing a retail/wholesale firm in the Midwest, she had high praise for the support she received; the nearest Burroughs support facility is within five miles, she said, and she usually receives a response to reported hardware and software problems within two hours. Moreover, the company is "constantly" apprised by Burroughs of changes to hardware and software.

The second user said that her organization's B 1900 serves as a host for distributed processing, with 25 microcomputers on-line in addition to a number of terminals. She said that she felt the B 1900 provided excellent day-to-day performance; the MCP operating system is highly reliable and easy to operate, particularly, she said, as compared to IBM operating systems. She also said that the B 1900 ▷

▶ B 1492 magnetic tape controller. They also support the B 9499 Master Electronic Controller (MEC) subsystem, which supports up to four B 9495-X nine-track PE drives, through the B 1495-32 magnetic tape controller.

The B 1990-CMS can support up to four B 9498 streaming drives or four B 9491-4 drives; if more than one B 9498 drive is configured, each additional drive requires an interconnect cable.

PRINTERS: All three models support the B 9246-6, B 9246-13, and B 9246-20 line printers (650 lpm, 1250 lpm, and 2000 lpm, respectively). The B 9246-6 and B 9246-13 are supported through both the B 1487 I/O subsystem controller and the B 1249 printer controller; the B 9246-20 is supported through the B 1240 printer controller. The B 1990-CMS can support a maximum of two printers.

MASS STORAGE

See Chart B for information on available mass storage devices.

INPUT/OUTPUT UNITS

See Chart C for terminals, Chart D for line printers, and Chart E for magnetic tape equipment.

All three systems also support the B 9115 (300 cpm), B 9116 (600 cpm), and B 9117 (800 cpm) card readers through the B 1117 controller.

COMMUNICATIONS CONTROL

Both the native-mode B 1990-SP and B 1990-DP and the CMS-based B 1990-CMS support 32 communications lines. The communications interfaces on the two sets of systems are different, however.

The principal communications controller on the B 1990-SP and B 1990-DP is the B 1356 Multi-Line Control (MLC). The MLC supports the following protocols:

- B 1690 quad line adapter, with a maximum speed of 19.2K bps per line and a total bandpass of 38.4K bps for all four lines. ▶

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➤ provided a good base for expansion. When the user was contacted, the company was installing a remote printing system in one of its warehouses. Also, the firm's general ledger and accounts payable applications were being rewritten through Burroughs' Linc application generator; the user said that, while Linc has the limitations imposed by a fourth-generation language, she found it to be much easier and more efficient to use than Cobol.

The third user, representing an agricultural firm in the Southwest, expressed unhappiness with the support she had received. She said that her B 1900 had had intermittent operational problems for the first eight months it was installed. No one at the local Burroughs service facility, located two miles away, could solve the problems, and help had to be brought in from Colorado. She charged, moreover, that Burroughs had blamed her company for the problems. Although she said that after a year of installation the system operated reliably and her company is automatically apprised of software updates, she would not recommend the B 1900 because of the low quality of the local support her organization had received from Burroughs.

The fourth user, representing a federal government installation in the Pacific Northwest, was unequivocal in his praise of the B 1900 and of Burroughs' support. He said that the nearest service facility is about 15 miles away; he usually receives a response to a service request within half an hour. If the service representatives cannot come immediately, he said, they inform him when they will arrive. In addition to being prompt, he said, the service technicians are "quite knowledgeable." He said that the MCP operated very efficiently and that the system provided a sound basis for further expansion. At the time he was contacted, the user's organization was adding 16 new terminals to the six it already had installed; some were to be located as far as 330 miles away. He also anticipated adding 11 terminal printers later in 1984.

On the whole, the users surveyed indicated that they were quite pleased with their B 1900 systems. One-hundred and thirty (90.9 percent) said that their systems had done what they had expected; one-hundred and twenty-three (86 percent) said that they would recommend the B 1900 to prospective users. □

- • B 1691 dual line adapter BDLC (Burroughs Data Link Control), half- or full-duplex.
- Dual BDLC line adapter; supports up to two BDLCs and two WE801 autocal units.
- Asynchronous direct connect up to 19.2K bps.
- Asynchronous modem connect up to 19.2K bps.
- Synchronous modem connect up to 19.2K bps.
- TTY asynchronous direct connect or modem connect.
- Bisynchronous modem connect up to 19.2K bps.

Each quad line adapter connected to the MLC provides up to four communications interfaces. Quad line adapter protocols

are determined by microcode software generated by network definition specifications. No hardware changes are required to support different protocols. Different protocols can run simultaneously on each of the adapter's four lines.

On the B 1990-CMS, data communications applications are supported by the DCP (Data Communications Processor) subsystem. Available for the B 1990-CMS are two types of DCP bases, one DCP extension, and four kinds of adapters.

The B 1362 DCP-4 and the B 1363 DCP are intelligent, 8-bit, microprocessor-based data communications processors with 64KB of memory; they directly execute a network controller program generated via the CMS NDL compiler and post compiler. They perform network controller functions, freeing the B 1990-CMS CPU for other processing. Each has a bandpass of up to 60K bps. Up to four lines may be configured per DCP base through two dual adapters; up to 12 lines may be configured through six dual adapters if a B 1367 extension is added. The B 1363 DCP fits in the same backplane used for the MLC in the native-mode B 1990 systems; only one B 1363 can be configured per system. The B 1362 DCP-4 can be used in a B 1990-CMS base or expansion cabinet. In either case, the B 1362 requires the B 1307 I/O extension; only one B 1307 can be configured per system.

Of the four available adapters, the B 1661 TDI dual adapter provides two lines, direct connect only. The B 1662 dual D/S HDX adapter provides two lines, each of which can work in either asynchronous or synchronous mode with a data set; this adapter will not support autocal units. The B 1663 single D/S FDX adapter provides one-line, two-way simultaneous operation in either asynchronous or synchronous mode with a data set; this adapter supports autocal units. The B 1667 TDI/HDX adapter provides two lines, one as B 1661 and one as B 1662.

The single-cabinet B 1990-CMS system can be configured with up to 16 data communications lines. The expansion cabinet can support up to 20 communications lines. If the B 1307 extension is used in the expansion cabinet, up to 32 lines can be configured on a B 1990-CMS system. The maximum number of data communications lines can be limited by the available connectors. The addition of printer controls can reduce the number of configurable communications lines; for further details, refer to the discussion of the B 1990-CMS in the CONFIGURATION RULES section of this report.

The B 1990 systems can run in either native mode or CMS, although not simultaneously; the difference in data communications between the native-mode and CMS groups can place an added burden upon the user who wishes to alternate between the two operating environments. Any user of the packaged B 1990-CMS who wants to run in native mode must procure a B 1356 MLC and required adapters. A native-mode B 1990 user who wants to run under the CMS environment must obtain a B 1363 DCP, which occupies the same processor slot as the MLC, along with a B 1307 I/O extension and a B 1362 DCP-4. It must also be noted that the ODT is connected under native mode to the MLC; under CMS, it connects to the DCP. Thus, the user who wishes to alternate operating modes either must use two ODTs or implement a switch box. Burroughs recommends that prospective users who might want to alternate operating environments should use a B 1990-SP rather than a B 1990-CMS.

SOFTWARE

OPERATING SYSTEMS: The B 1990-SP and B 1990-DP run under the native-mode Master Control Program (MCP) operating system, while the B 1990-CMS runs under CMS MCP. ➤

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► **MCP** is a modular executive system that performs the following principal system control functions:

- Manages all system resources, including the second processor in B 1990-DP configurations.
- Schedules loading and execution of user programs in a multiprogramming environment according to user-assigned priorities.
- Allocates memory areas, processor logic, and peripheral units.
- Schedules and initiates all I/O operations.
- Provides automatic error-handling procedures.
- Creates and maintains a disk program library.
- Handles communications between the system and the operator.
- Provides information on the status of all active jobs upon request.
- Guides compilation of programs written in Cobol, Fortran, Basic, and RPG.
- Handles file opening and closing, physical data management, utility functions, program loading, and program library calls.
- Controls data communications devices.

MCP is written in Burroughs' Software Development Language 2 (SDL2), a high-level systems software language. Whenever MCP is in use, all or part of the SDL2 Interpreter must be resident in memory.

MCP requires a minimum of 28KB of memory plus the memory space required to hold users' programs. Required peripheral equipment includes a display console, dual disk pack drive unit, and line printer.

MCP is embedded in a System Software Facility (SSF) package that includes utilities and related products. There are two SSF packages: SSF1 for the B 1990-SP and SSF2 for the B 1990-DP. Both include: MCP; Sort facility; system utilities; Network Definition Language (NDL); Work Flow Language (WFL), which controls the execution of a set of interrelated programs called tasks; Remote Display (RD) facility, which continually provides updated mix status information on Page 1 of the ODT; Remote Print facility; On-line Command and Edit (Cande); and Burroughs On-line Test (Bolt) facility, which provides on-line certification of the B 1900 system.

CMS MCP, the operating system for the B 1990-CMS, is a comprehensive operating system common to the B 90, the B 900, and other, older Burroughs CMS systems; CMS MCP permits object-code compatibility between the B 1990-CMS and other CMS systems. CMS MCP features the following capabilities: dynamic file and resource management, support for multiprogramming and multiprocessing, memory allocation, virtual memory management, priority scheduling, and I/O control.

CMS MCP supports high-level programming languages, including Cobol and RPG for commercial applications and NDL and MPL II for data communications networking and message handling design, respectively. CMS MCP interfaces to the high-level languages through micrologic interpreters.

Like the MCP for the native-mode systems, CMS MCP is embedded in a System Software Facility package; the SSF

for CMS MCP includes the following components: MCP for B 1000 systems, B 1000 CMS utilities, B 1000 CMS Superstart, CMS Cobol compiler, CMS RPG compiler, CMS MPL II compiler, CMS NDL compiler, and Odesy (On-line Data Entry System)/RPG Edit facility. The CMS SSF requires the B 1362 DCP-4 or the B 1363 DCP.

DATABASE MANAGEMENT SYSTEM: Data Management System II (DMS II) is used by the B 1990-SP and B 1990-DP. DMS II comprises the Data and Structure Definition language (DASDL), which provides for the logical description of data sets or subsets and for mapping the logical data onto physical structures, and a Cobol interface.

DMS II is a logical subset of Burroughs' B 5/6/7000 systems DMS II. The Cobol constructs used in B 1900 Series Cobol programs for accessing the data base are syntactically compatible with those used in B 5/6/7000 Cobol; however, the physical mapping algorithms for structuring the data base records on direct-access storage differ, so that a B 1900 DMS II data base must be reloaded before being transferred to B 5/6/7000 DMS II. The B 1900 DMS II DASDL parameters and DMS statements in Cobol programs are compatible with B 5/6/7000 DMS II, eliminating the necessity of converting DMS II Cobol user programs and user DASDL or the DASDL definition of the data base.

DMS II has an adjunct inquiry facility, DM Inquiry, which provides access to a database from any terminal. DM Inquiry allows the terminal user to interrogate the database description and to extract information from the database. This facility operates through inquiry statements composed of basic functions tied together by English-like connectors. Among other functions, DM Inquiry statements allow the user to list all or part of a database on a terminal, to create a private copy of a portion of the database, to create statement abbreviations, to repeat a previous statement, and to select and name specific records for display. DM Inquiry also has an integrated help capability, which provides guidance on use of the Inquiry facility.

DMS II requires 128KB of memory for operation; the 128KB includes space for MCP, the network controller, and DMS II. Additional users of the same database require 32KB of memory each.

LANGUAGES: The B 1900 Series computer systems support Cobol 68 and Cobol 74, RPG, Fortran and Fortran 77, and Basic.

B 1900 Cobol is a complete implementation of full American National Standards Institute (ANSI) 1974 Cobol, except that the Report Writer module is omitted. Cobol object programs are regarded as a collection of logical segments which can be loaded and executed individually or in groups; programs can be written without the usual limitations imposed by the computer's memory capacity.

The Cobol compiler runs on any B 1900 system. The compiler requires about 40KB of memory. Object programs generated by the Cobol compiler are expressed in an S-language that is oriented toward handling 4-bit digits and 8-bit characters. The Cobol interpreter, required at execution time, occupies about 3KB of memory in addition to the object program's requirements.

B 1900 Cobol includes a queue handling technique and a sort capability that includes a tag search, a restart facility, vertical collating sequence, and tape sorting.

B 1900 Report Program Generator (RPG) is a compiler-driven language. The compiler converts source programs written in the RPG language into object programs that can be executed by B 1900 systems. The compiler permits pro-

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► grams written in IBM RPG, RPG II, or most other versions of the RPG language to be compiled and run with little or no change. As with B 1900 Cobol, RPG programs are automatically segmented during compilation. The RPG compiler runs on any B 1900 system. The compiler requires about 10KB of memory exclusive of MCP. The RPG interpreter occupies about 3KB of memory at execution time in addition to the requirements of the object program.

B 1900 Fortran is compatible with ANSI 1977 Fortran and includes extensions that provide features available in IBM Fortran IV Level II. The Fortran compiler requires about 48KB of memory. Object programs produced by the Fortran compiler are expressed in an S-language oriented toward handling 36-bit words and 72-bit doublewords. The Fortran interpreter, required at execution time, occupies about 3.5KB of memory in addition to the requirements of the object program.

B 1900 Basic generally corresponds to the original Dartmouth Basic (Beginners' All-Purpose Symbolic Instruction Code). Burroughs offers both a batch-mode Basic compiler and an Interactive Basic System for the B 1900 Series computers.

The batch-mode Basic compiler requires a minimum of 12KB of memory, exclusive of MCP requirements. Object programs produced by the Basic compiler are expressed in an S-language oriented toward handling 40-bit (5-character) words. The Basic Interpreter, required at execution time, occupies about 3KB of memory in addition to the requirements of the object program.

The Interactive Basic System accepts commands, program instructions, and data values from users at local or remote terminals. Commands cause the requested functions to be performed immediately. Program instructions are stored for later execution, and data values are entered in response to program requests. The results of each program are routed to the originating terminal. The Basic source language is converted to an internal form that can be executed on a B 1900 system. Text editing and debugging facilities are provided for programming. Burroughs' Interactive Basic language includes all the facilities of ANSI's Minimal Basic, plus enhancements in the following areas: string handling, array handling, mathematical functions, external file handling, and formatted output. The Interactive Basic System requires about 17KB of memory, exclusive of the MCP.

COMMUNICATIONS: Burroughs offers a number of software products for local, remote, and distributed data communications.

Network Definition Language (NDL) is 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. Thus, users' application programs can deal with remote terminals in the same manner as with conventional on-site peripheral devices. After a custom Network Controller has been defined in the NDL syntax, the source statements are processed by the NDL Compiler and converted into the necessary object code and tables. NDL runs under MCP on any B 1900 Series system. NDL requires a minimum of 12KB of memory, exclusive of MCP.

Generalized Message Control System (Gemcos) is a generalized system that uses parameters for generating an installation-tailored Message Control System (MCS). The MCS provides the interface between the network controller and user application programs by decoding and directing incoming messages to the appropriate user program for process-

ing. The system can accommodate user-written code and contains facilities for exchange of data between application programs. Recovery capabilities include dynamic restoration of the network configuration, an audit mechanism for logging specified messages, and a network control command for orderly system shutdown in the event of system failure. The recovery mechanism can be synchronized with DMS II recovery to ensure database integrity. A password security system is provided to control access to the communications network. Gemcos also includes an auxiliary program to permit network commands to be entered into the MCS from a console. In addition, Gemcos provides a transaction translation feature that translates data from the format required by the workstation to the format required by the application program. Gemcos requires a minimum of 24KB of main memory, exclusive of MCP.

Burroughs Network Architecture (BNA) is a set of native-mode software facilities that permits terminals to interact with host CPUs in a network environment and allows implementation of distributed data processing. Through the BNA architecture, Burroughs processors and terminals can be granted access to data bases 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 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 creation, updating, and transfer of data from host to host; and handling of communication with logical points within the network. Network services include: message routing; linking hosts using the Burroughs Data Link Control (BDLC) bit-oriented protocol; and 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 and MCS. BNA requires a BDLC line adapter.

Burroughs Data Link Control (BDLC) is a bit-oriented line control procedure for synchronous transmissions. In BDLC, data is bracketed; bits, rather than whole characters, are used to represent control codes. BDLC is based on High-Level Data Link Control (HDLC), the protocol standard developed by the International Standards Organization (ISO) and the European Computer Manufacturers Association (ECMA), and Advanced Data Communications Control Procedure (ADCCP), the protocol standard developed by ANSI.

System Communication Module (Sycom) provides a mechanism for linking two B 1900, B 1800, or B 1700 computers to permit file transfers, remote execution from the console keyboard, and program communication between the systems. Sycom contains its own data communications handler and operates under MCP control, permitting the Sycom functions to be combined with on-site work in a multiprogramming job mix. Sycom operates in point-to-point mode through a switched or leased communications line. Available features include: auto answer, auto call, EBCDIC transparent and nontransparent, space compression/expansion, and buffer sizes ranging from 405 to 4095 bytes. The Sycom program requires a minimum of 20KB of main memory plus a single-line, dual-line, or multiline communications control with a standard synchronous, binary synchronous, or direct-connect adapter.

Hasp Remote Terminal Program permits a B 1900 Series system to function as a remote batch terminal on-line to ►

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► IBM System/360 or /370 computer systems that utilize the Hasp binary synchronous multileaving protocol. With the Hasp Remote Terminal Program, a B 1900 system can be made functionally equivalent to a standard IBM 360/20 Hasp workstation. Communication between the B 1900 and the central system uses standard IBM binary synchronous line procedures. The transmission code is EBCDIC. Two modes of operation are supported. In the Spool mode, input data from the B 1900 peripheral devices is compressed, blocked, and stored on a disk file for later transmission to the central processor, and data records returned from the central system are stored on disk for subsequent output to printers or card punches. In Direct mode, input data is blocked and transmitted to the central system, and data records returned from the central system are immediately deblocked and routed to the appropriate output devices.

The B 1900 Hasp Remote Terminal Program operates under the MCP operating system, permitting the remote job entry function to be multiprogrammed with local processing. Line speeds of up to 9600 bps are supported over leased or dial-up lines in half-duplex mode. The program requires 32KB of main memory in addition to that required for the MCP.

Two *RJE Terminal Programs* are available. One permits entry to a B 6000/B 7000; the second permits entry to a B 2000/B 3000/B 4000. These programs make a B 1900 appear as a remote terminal to the above systems and enable direct entry to the host computer with printer or punch output returned. Both programs require 24KB of memory.

IBM 3270/SNA Remote Workstation Program enables Burroughs workstations and system line printers to interface to a host system using the IBM 3270 SNA line discipline. The B 1900 system with workstations and line printers appears to the host as an IBM 3274 control unit with 3278 workstations and IBM 328X printer terminals. This program thus lets B 1900 users access an interactive 3270 SNA or NRZ network and lets Burroughs terminals be used as 3270 SNA/SDLC workstations while communicating with the network. The program functions both as a data communications program and as a message control system. The program directly drives the SNA/SDLC line through a BDLC line adapter. I/O is accomplished by the network controller and the network controller's remote file interface.

IBM 3270 Bisync Remote Workstation Program allows Burroughs workstations and system line printers to interface to a host system using the IBM 3270 binary synchronous line discipline. The B 1900 system with workstations and line printers appears to the host system as an IBM 3274 control unit with 3278 workstations and 328X printer terminals. This program lets B 1900 users access interactive 3270 bisync networks and enables Burroughs terminals to be used as 3270 bisync stations. This program is both a data communications program and a message control system. The program directly drives the 3270 binary synchronous line through a bisync line adapter; workstation I/O is accomplished through the network controller and the network controller's remote file interface.

RJE Host System enables the B 1900 to function as a central data processing system for remote workstation systems. Through RJE Host, a user at a remote site can directly enter a job at the remote workstation for execution by the B 1900 host, monitor and control the program through the remote station, and receive all relevant output at the remote site.

UTILITIES: A variety of utilities and aids are offered for the B 1900 systems. The primary utilities are a Disk Sort and a System Sort. The Disk Sort program sorts records into ascending or descending sequence according to specification cards that describe the input and output files, the key field or fields, and various options. The Disk Sort function

can be invoked from within a Cobol or RPG source program. The user can specify either of two sorting techniques; vector replacement (the one most commonly used) or inplace (which minimizes the amount of disk storage space required). The Systems Sort permits sorting and merging on tape or disk. The Systems Sort program requires 3KB of memory for the sort generator, 8KB for the tape, disk, or inplace sort, and 8KB for the merge.

Other B 1900 Series utility routines include: System Loading Procedures, Disk File Copy, Memory Dump, Memory Dump Analyzer, and DM-Pall. The last-named routine is a flexible listing and reproducing program for printing the contents of files and transcribing data from one medium to another.

RELATED PRODUCTS: A number of adjunct products and development aids with specialized functions are available for both the native-mode and CMS B 1900 systems.

Logic and Information Network Compiler (Linc) is an application generator for native-mode B 1900 systems. Linc is used to create on-line, realtime systems that include programs, database descriptions, screen formats, and transaction management facilities. Those elements are generated from a small set of specifications.

On-Line Data Entry System (Odesy), available in both native-mode and CMS versions, is a data entry and validation system using multiple on-line visual display units. It provides a generalized and generative "front end" for existing application packages. It enables future packages to be designed to use its editing facilities and reduces development effort by eliminating conventional input control programs.

Command And Edit (Cande), available in both CMS and native-mode versions, 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 Cande performs file updating and text editing functions. The on-line user has all compilers available, including Cobol and RPG. Cande also provides a recovery system and basic usercode/password security.

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 application programs. Help screens are available to assist the user in screen creation and maintenance.

CMS On-line Reporter, an interactive application aid, is a generalized reporting system that allows nontechnical personnel to create and maintain unique or recurring reports and labels that supplement those normally produced by application systems. CMS On-line Reporter can produce a hard-copy report or display data on the terminal. With On-line Reporter the user creates a dictionary of the fields and files from the data base that will appear in the report, defines how the information is to be ordered, and prints or displays the report. Information can be added or suppressed at run time, and the report can be produced directly or stored on disk for future use.

CMS Domain is a program development aid that 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 and add, delete, maintain, or inquire into records in a disk file.

CMS RGP Edit is a program development aid that combines the main features of Cande with interactive prompting and editing of RPG specifications. ►

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► **APPLICATIONS:** Burroughs offers a variety of application programs for the B 1900 Series. Application areas include government accounting and financial management, commercial business management, wholesale/distribution, manufacturing, health care business management, banking, business planning, and decision support.

OFFICE AUTOMATION: *Text Management System (TMS)* adds word processing and electronic mail to the data processing features of B 1900 systems. Among its facilities TMS includes automatic spelling and automatic formatting features for document layout.

PRICING

POLICY: The B 1900 systems are available for purchase or for lease under a one-year, three-year, or five-year lease agreement. Discounts are available for purchase of multiple units.

SUPPORT: The standard lease agreement entitles the customer to unlimited use of the equipment and includes full-time equipment maintenance coverage 24 hours a day, seven days a week, including Burroughs-recognized holidays. The standard maintenance agreement for purchased systems covers maintenance of the equipment for nine consecutive hours per day between 7 a.m. and 6 p.m. 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. Super city rates (e.g., New York or Chicago) are five percent higher. Rates outside a metro area (10 miles from city) are 20 percent higher.

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.

Program products for the B 1900 systems are offered under either an unlimited-time license plan with a full or 12-month initial payment, or a limited-time license plan with monthly payments. Also available for the program products are annual Product Service Agreements (PSAs), which are charged separately from the aforementioned product charges. There are two types of PSAs. PSA-1 provides telephone support, while PSA-2 provides telephone and field support as well as remedial software releases to correct reported problems.

On-site and remote support for B 1900 systems is available through Burroughs support centers. In addition, Burroughs has established a customer-dependent troubleshooting procedure called the Customer Fault Isolation System (CFIS). This system provides a customer-executable diagnostic test routine through which a B 1900 operator can identify impending hardware and software problems. The operator can then contact a Burroughs Customer Service Engineer who can diagnose and deal with the problem on-site. The Customer Service Engineer can in turn receive diagnostic support from the remote Burroughs facility through a modem hookup; the modem must be obtained and installed by the customer.

TRAINING: Customer education is charged at specific per-course rates. The currently available hardware and software courses range in length from one day to more than two weeks and fall into the following broad categories: Systems Sup-

port, Operations, Languages, Environments (data base and data communications), and Applications. Training is available at major centers throughout the United States and worldwide.

TYPICAL CONFIGURATIONS: Typical B 1900 configurations are shown in the following tables.

The following is a typical B 1990-CMS configuration:

B 1990-CMS basic system; includes:	\$ 70,000
B 1920-CP 6 MHz CPU, 8KB cache	
B 1165 512KB main memory unit	
B 1487 I/O subsystem controller	
B 1363 Data Comm Processor	
B 1661 TDI dual adapter	
ET 1100 Operator Display Terminal	
B 9484-51 130MB removable pack drive	
B 9246-6 650 lpm band printer	
Three ET 1100 ergonomic workstations	5,685
Total Price	\$ 75,685

The following is a typical B 1990-SP configuration:

B 1990-SP system; includes:	\$64,300
B1965CP 6 MHz CPU, 8KB cache	
B 1165 1MB main memory unit	
ET 1100 Operator Display Terminal	
B 1487 I/O subsystem controller	
B 1356 Multi-Line Control	
B 1690 quad line adapter	
B 9484-12G 252MB removable pack drive	30,000
B 9494-5 542MB fixed disk drive	33,000
B 9246-13 1250 lpm band printer	42,500
Twelve ET 1100 ergonomic workstations	22,740
Total Price	\$192,540

The following is a typical B 1990-DP configuration:

B 1990-DP basic system; includes:	\$95,000
B 1995CP dual 6 MHz CPU, 16KB cache	
B 1990-92 expansion cabinet	
B 1165 1MB main memory unit	
ET 1100 Operator Display Terminal	
B 1487 I/O subsystem controller	
B 1356 Multi-Line Control	
Two B 1690 quad line adapters	
B 1307 I/O extension backplane	
B 1308 I/O subsystem backplane	
B 1165 1MB main memory increment	10,000
B 1487 disk subsystem controller	15,990
Twelve B 9494-5 542MB fixed disk drives	396,000
B 9246-6 650 lpm band printer	14,700
B 1240 printer controller	9,450
B 9246-20 2000 lpm train printer	69,300
B 1492 magnetic tape controller	2,335
Two B 9498 streaming tape drives	15,750
Forty-eight ET 1100 ergonomic workstations	90,960
Total Price	\$719,485

Burroughs B 1900 Series**EQUIPMENT PRICES**

		Purchase Price (\$)	Monthly Maint.* (\$)	Monthly Lease**		
				1-Year (\$)	3-Year (\$)	5-Year (\$)
▶ BASIC SYSTEMS						
B 1990-CMS	Basic B 1990-CMS system. Includes: B 1920CP 6MHz CPU; B 1165-512 512KB memory unit; B 1487 I/O subsystem controller; B 1363 data comm. processor; B 1661 TDI dual adapter; ET 1100 operator display terminal; B 9484-51 130MB disk pack drive; B 9246-6 650 lpm printer.	70,000	567.00	4,340	3,756	3,318
B 1990-BP	Basic B 1990 Business Partner system. Includes: B 1965CP 6MHz CPU; B 1165-1MB 1MB memory unit; B 1487 I/O subsystem controller; B 1356 multiline control; two B 1690 quad line adapters; ET 1100 operator display terminal; B 9484-51 130MB disk pack drive; B 9246-6 650 lpm printer; B 1990-SFI software facility; B 1990-DMZ Data Management System II; B 1990-GPT GEMCOS; B 1990-DMI DM Inquiry; B 1990-CBI Cobol 74; B 1000-LNC Logic and Information Network Compiler (LINC). The software products are subject to additional, annual Product Service Agreement (PSA) charges of \$2,474 for PSA1 or \$4,948 for PSA2.	122,000	746.00	6,846	5,829	5,067
B 1990-SP	Basic B 1990 single processor system. Includes: B 1965CP 6MHz CPU; B 1165-512 512KB memory unit; ET 1100 operator display terminal; B 1487 I/O subsystem controller; B 1356 multiline control; B 1690 quad line adapter.	59,300	369.00	3,511	3,017	2,646
B 1990-DP	Basic B 1990 dual-processor system. Includes: B 1995CP dual 6MHz CPU; B 1990-92 expansion cabinet; B 1165-1MB 1MB memory unit; ET 1100 operator display terminal; B 1487 I/O subsystem controller; B 1356 multiline control; two B 1690 quad line adapters; two backplanes chosen from among the following three: B 1307 I/O extension backplane; B 1308 I/O subsystem backplane; or B 1309 multiline backplane.	95,000	748.00	5,498	4,706	4,112
SYSTEM OPTIONS						
B 1990-65	Expansion kit. Includes B 1990-92 expansion cabinet, B 1307 I/O extension backplane, and B 1308 I/O subsystem backplane	25,000	55.92	1,333	1,125	969
B 1990-91	Dual processor kit	40,000	279.08	2,413	2,080	1,830
ADD-ON MAIN MEMORY						
B 1165-512	512KB memory increment	5,000	32.42	295	253	222
B 1165-1MB	1MB memory increment (requires exchange of 512KB increment)	10,000	64.92	599	516	453
MASS STORAGE						
B 1487	Disk pack control for B 9484-126, B 9484-51, B 9494-5, and B 9494-41 drive	15,990	51.33	875	742	642
B 9484-12G	Removable disk pack drive; 252MB (cannot be used on B 1990-CMS)	30,000	120.00	1,430	1,192	1,070
B 9484-51	Dual disk pack drive; 130.4MB	21,000	147.00	840	758	689
B 9494-5	Fixed disk drive; 542MB (cannot be used on B 1990-CMS)	33,000	105.00	1,615	1,345	1,210
B 9494-41	Fixed disk drive; 360/402MB	21,500	96.40	1,099	988	889
MAGNETIC TAPE UNITS						
B 1492	Control for B 9491-4 and for B 9498 streaming tape unit	2,335	28.42	158	139	124
B 1495-32	Control for B 9495 PE magnetic tape units	3,781	28.30	112	110	103
B 9491-4	Nine-channel, 40KB PE magnetic tape unit	12,000	89.70	548	458	444
B 9491-5	Add-on drive for B 9491-4	4,500	83.40	425	380	351
B 9495-8	Nine-channel, 80KB, 1600 bpi PE magnetic tape unit; requires B 9499-33/-34/-35 Master Electronic Controller (MEC)	11,551	149.00	478	434	395
B 9495-45	80KB PE magnetic tape subsystem; includes one B 9495-8 and one B 9499-33 MEC	17,860	139.00	607	550	502

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NC—No charge.

Burroughs B 1900 Series

EQUIPMENT PRICES

		Purchase Price (\$)	Monthly Maint.* (\$)	Monthly Lease**		
				1-Year (\$)	3-Year (\$)	5-Year (\$)
▶ MAGNETIC TAPE UNITS (Continued)						
B 9495-82	Nine-channel, 120KB, 1600 bpi PE magnetic tape unit; requires B 9499-50/-51/-52 MEC	18,100	135.00	705	601	547
B 9495-83	Nine-channel, 200KB, 1600 bpi PE magnetic tape unit; requires B 9499-50/-51/-52 MEC	22,447	154.00	895	769	693
B 9498	Magnetic tape streamer	7,875	44.60	305	269	274
B 9499-33	1 x 4 Master Electronic Controller (MEC) for B 9495-8	11,465	41.20	415	352	318
B 9499-34	1 x 8 MEC for B 9495-8	12,350	41.20	445	423	347
B 9499-35	2 x 8 MEC for B 9495-8	14,465	90.10	525	452	407
B 9499-50	1 x 4 MEC for B 9495-82	19,100	127.00	736	624	564
B 9499-51	1 x 8 MEC for B 9495-82/-83	21,060	127.00	777	660	596
B 9499-52	2 x 8 MEC for B 9495-82/-83	51,240	266.00	2,102	1,660	1,224
LINE PRINTERS						
B 1240	Control for B 9246-20 printer	9,450	26.90	338	305	282
B 1249	Control for B 9246-3, -6, and -13 printers	1,448	18.40	65	64	65
B 9246-6	650 lpm band printer (50-ft. cable standard)	14,700	182.00	551	475	423
B 9246-13	1250 lpm band printer (50-ft. cable standard)	42,500	420.00	1,635	1,470	1,360
B 9246-20	2000 lpm train printer, 2A interface (50-ft. cable standard)	69,300	693.00	3,180	2,870	2,580
PUNCHED CARD EQUIPMENT						
B 1117	Control for B 9115, B 9116, and B 9117 card readers	2,215	38.75	167	149	135
B 9115	Card Reader; 300 cpm, 80-column	8,608	73.30	344	305	267
B 9116	Card Reader; 600 cpm, 80-column	11,372	103.00	460	409	357
B 9117	Card Reader; 800 cpm, 80-column	12,952	126.00	521	463	405
TERMINALS						
ET 1100	Ergonomic workstation with 14-inch display and keyboard	1,895	122.00	105	88	79
B 1310	Operator display terminal (ODT) table	500	—	25	21	18
DATA COMMUNICATIONS						
Native-mode-only Controllers (B 1990-SP and B 1990-DP)						
B 1356	Multi-Line Communications Control (MLC); supports up to 16 lines	9,770	14.75	510	429	368
B 1309	MLC backplane	665	408.00	40	34	30
Native-mode-only Adapters (B 1990-SP and B 1990-DP)						
B 1690	Quad line adapter (Async, Sync, Bisync)	5,775	15.08	311	263	227
B 1691	Dual line adapter (BDLC)	5,110	26.83	296	253	221
BDLC Cables (B 1990-SP and B 1990-DP)						
B 1061-23	RS-366 BDLC cable	NC	NC	NC	NC	NC
B 1061-32	RS-232-C BDLC cable	NC	NC	NC	NC	NC
B 1061-66	RS-423 BDLC cable	NC	NC	NC	NC	NC
CMS-only Components (B 1990-CMS)						
B 1362	CMS DCP-4 base	5,400	92.20	354	265	241
B 1367	CMS DCP-4 extension	4,500	67.60	284	210	190
B 1661	Terminal Direct Interface (TDI) dual adapter	500	41.50	33	26	23
B 1662	Dual half-duplex data set adapter	1,600	41.50	66	60	58
B 1663	Single full-duplex data set adapter	1,600	41.50	66	60	58
B 1664	Single full-duplex SDLC data set adapter	1,600	41.50	66	60	58
B 1667	TDI/half-duplex adapter	1,680	21.70	102	75	67

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ASYNCHRONOUS DATA SETS (Freestanding)						
TA 1203	1200 bps switched line data set; optional autodial capability and 600 bps operation	1,012	8.40	33	32	32
TA 1801	1800 bps data set operating over leased lines with no line conditioning required; speeds to 1200 bps over switched lines with manual dial/answer	1,063	8.90	34	33	33
SYNCHRONOUS DATA SETS (Freestanding)						
TA 2403	2400 bps switched line data set, operating over switched lines with auto answer capability; 1200 bps operation and autodial capability optional	1,675	15.30	87	83	82
CABLES						
B 1060-25	25-ft. modem cable	138	—	7	6	5
B 1060-50	50-ft. modem cable	174	—	8	7	6
B 1498-25	B 9498 streamer cable	NC	NC	NC	NC	NC
B 1491-25	B 9491 mag. tape cable	NC	NC	NC	NC	NC
B 9484-11K	206 cable kit; required to convert 206 drive from three-phase to single-phase	240	—	12	10	9
B 9494-11	207 cable kit; required to convert 207 drive from three-phase to single-phase	240	—	12	10	9

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SOFTWARE PRICES

		Unlimited Time Plan		Annual Product Service Agreements		
		Full Init. Pymt. (\$)	12-Mo. Init. Pymt. (\$)	Ltd. Time Plan/Mo. License Fee (\$)	PSA-1 (\$)	PSA-2 (\$)
SYSTEM SOFTWARE						
All system software prices include Installation Planning Service.						
B 1990 System Software						
B 1990 SF1	Software Facility for single-processor configurations; includes: MCP II, Sort, system utilities, Network Definition Language (NDL), Work Flow Language, Remote Display (RD), Remote Print, On-Line CANDE (Command and Edit), Burroughs On-Line Test (Bolt)	5,550	533	172	297	594
B 1990 SF2	Software Facility for dual-processor configurations; contains same features as B 1990 SF1	7,500	720	235	405	810
B 1990 SMC	Supervisory MCS	4,000	384	125	126	252
B 1990 MCG	Gemcos Basic	3,000	288	94	120	240
B 1990 GPB	Gemcos Basic and UPL	4,000	384	125	126	252
B 1990 MCA	Gemcos Advanced	4,000	384	125	126	252
B 1990 GPA	Gemcos Advanced UPL	6,000	576	188	189	378
B 1990 MCT	Gemcos Total	6,000	576	188	189	378
B 1990 GPT	Gemcos Total and UPL	8,000	768	250	252	504
B 1990 MCF	Gemcos Format Generator	8,000	768	250	252	504
B 1990 DE2	Odesy (On-line Data Entry System)	6,121	587	191	267	533
B 1990 DM2	Data Management System II (DMS II)	10,000	959	313	435	870
B 1990 DM1	DM Inquiry	1,650	159	52	120	240
B 1990 BAS	Basic	3,630	349	113	120	240
B 1990 COB	Cobol	3,630	349	113	120	240
B 1990 FOR	Fortran	3,630	349	113	120	240
B 1990 RPG	RPG	3,630	349	113	120	240
B 1990 CBI	Cobol 74	2,723	262	76	120	240

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SOFTWARE PRICES

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► SYSTEM SOFTWARE (Continued)

B 1990 FRI	Fortran 77	4,356	418	121	120	240
B 1990 BAI	Interactive Basic	2,723	262	76	120	240
B 1990 PWR	Power/RJE 3780	1,430	138	45	120	240
B 1990 HAS	Hasp-RJE	1,430	138	45	120	240
B 1990 R61	B 6/7000 RJE	1,359	131	43	120	240
B 1990 R41	B 2/3/4000 RJE	1,359	131	43	120	240
B 1990 SYC	Syst. Comm. (Sycom)	3,967	381	124	125	250
B 1000 EBS	IBM 3270 Bisync	3,250	312	110	120	240
B 1000 ESN	IBM 3270 SNA	3,250	312	110	120	240

CMS B 1000 System Software (B 1990-CMS only)

CM1000 SSF	System Software Facility; includes B 1000 MCP, B 1000 CMS utilities, and B 1000 CMS Superstart	2,850	—	100	205	410
CM1000 COB	CMS Cobol Compiler	900	—	28	33	65
CM1000 RPG	CMS RPG Compiler	900	—	28	33	65
CM1000 MPL	CMS MPL II Compiler	990	—	28	36	71
CM1000 NDL	CMS NDL Compiler	990	—	28	36	71
CM1000 DE2	Odesy/RPG Edit	1,150	—	33	50	100

CMS B 1000 Development Aids (B 1990-CMS only)

CM1000 DOM	CMS Domain System	1,950	—	87	102	203
CM1000 RPO	CMS On-line Reporter	1,950	—	125	102	203
CM1000 INQ	CMS Inquiry	800	—	38	47	93
CM1000 GMC	CMS Gemcos Generator	2,500	—	115	105	210
CM1000 GMB	Gemcos (Basic Module)	700	—	33	30	59
CM1000 GMT	Gemcos (TCL Compiler)	750	—	36	32	63
CM1000 GMF	Gemcos (Formatting Module)	500	—	24	21	42
CM1000 DES	MTS Data Entry System	2,200	—	83	93	185
CM1000 SYC	Sycom	750	—	36	32	63
CM1000 RJE	RJE	665	—	24	28	56
CM1000 R32	IBM 3270	990	—	35	42	83
CM1000 HSP	360/20 Hasp	990	—	35	42	83
CM1000 R37	IBM 2780/3780	990	—	35	42	83 ■