Burroughs L 8000 & L 9000 Series

MANAGEMENT SUMMARY

On June 4, 1975, Burroughs removed the wraps from yet another extension to the successful L 8000 Series of keyboard-oriented accounting minicomputers: the L 9000 Series. Along with this move, the company reshuffled the prices and standard configurations of its L 8000 systems, as well as introducing on-line display data entry for all L 8000 and L 9000 models. The three essential aspects of the June 1975 announcement are as follows:

First, the four L 9000 systems, each equipped with a 60-character-per-second console matrix printer, constitute the new high-performance end of the L 8000/9000 family. The new console printer is twice as fast in raw printing speed as that available with any L 8000 model. It also features a very high-speed skip-to-position capability (330 character spaces per second), and is capable of optional "intelligent" bidirectional printing.

Second, users of both L 8000 and L 9000 systems can now enjoy on-line keyboard/display data entry from up to two (at this writing) TD 700 Data Entry Stations. Data entry is to a dedicated magnetic tape cassette station, and can take place concurrently with program execution. This complements other data entry methods, such as cassette preparation on stand-alone Burroughs AE 300 Series Audit Entry Computers.

Third, Burroughs restructured the pricing schemes and redesignated the "packaged" configurations for all of its L Series computers. This move served both to increase the nominal price gap between the top end of the L Series and the bottom end of the B 700 Series (Report ▷

These keyboard-oriented accounting computers, available in numerous models and configurations, extend the performance range of Burroughs' immensely successful L Series while maintaining full compatibility with earlier models. A wide array of magnetic and nonmagnetic ledger and paper forms handlers and input/output equipment is available.

CHARACTERISTICS

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

MODELS: L 8200, L 8300, L 8400, L 8700, L 8800, L 9300, and L 9400 Accounting Computers; L 8500, L 8900, and L 9500 Magnetic Record Computers.

DATA FORMATS

BASIC UNIT: 64-bit word. Each word in memory can hold 15 decimal digits plus sign, 8 alphanumeric characters, or up to 4 instructions. (Note: Memory capacities are usually expressed in 8-bit bytes, with 8 bytes equaling one 64-bit word).

FIXED-POINT OPERANDS: Consist of 15 decimal digits plus sign or 8 alphanumeric characters.

FLOATING-POINT OPERANDS: No provision for floating-point arithmetic.

INSTRUCTIONS: SL3 basic instruction format is 4 digits in length. However, systems with more than 6K bytes (768) words of user memory use SL5 machine instructions with an expanded 6-digit format for instructions that reference ▶

The Burroughs L 9000 Series was introduced on June 4, 1975. Its chief distinction from the L 8000 systems is the twice-as-fast matrix printer, shown on the following page, which operates at 60 cps. L 9000 purchase prices range from $16,990 to $26,990. Shown here is the top-of-the-line L 9542 with an optional line printer and a full complement of four magnetic tape cassette stations.

Burroughs L 8000 & L 9000 Series
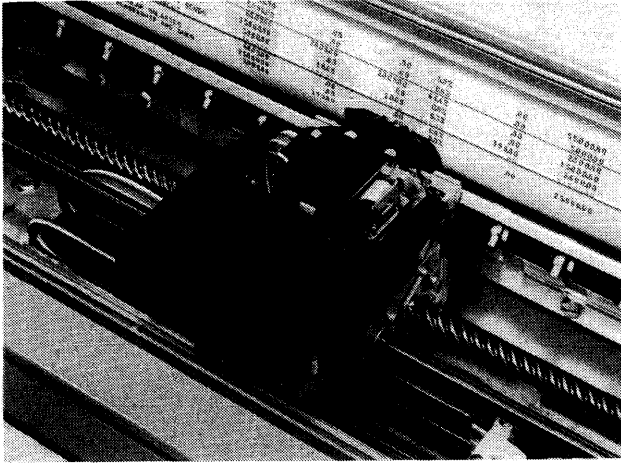
Here's a close look at the matrix printing mechanism featured on the new Burroughs L 9000 systems. It operates at 60 cps and has a skip rate of 330 character spaces per second. With the intelligent bi-directional printing feature (A 7262, $1,000 purchase), the head calculates the optimum print direction for each line and homes to the most significant character position at high speed. Ribbon cassette changing is said to be simple.

▷ M11-112-401), and also to make the L Series price reductions less apparent to customers with systems already installed or on order through a complex set of configuration repackagings and redesignations. The B 700 entry-level price had been lowered in February 1975 in response to the introduction of IBM's System/32 (Report M11-491-601).

The crux of the repricing and reconfigurations amount to these two points: 1) most (but not all) purchase prices for packaged configurations were raised, but a magnetic tape cassette station was made standard on all models and a ledger feeder/stacker was made standard on all MMR (magnetic memory record) models; and 2) in the L 8000 Series, the models whose designations ended in -100 were changed to -700 or to -709 if the configuration was an MMR model. The new prices for these configurations are lower than they would have been when the now-standard "extras" were added to the earlier configurations. Moreover, purchasers can delete the cassette station at a saving of $1,000 and the forms handler at a saving of $2,000.

The resulting -600 and -609 configurations are then less costly than the earlier configurations that didn't have the extras in the first place. But the basic system prices can escalate substantially when expanded memory capacity, auxiliary input/output units, and optional forms-handling facilities are added.

Other price adjustments included a $300 reduction in the price of a 2KB MOS memory unit, similarly reduced prices on add-on cassette stations, and a slashing of the price of the line printer controlled by two-thirds on purchase and about one-half on rental. Conversely, in line with general economic trends, the annual maintenance fees for the computers appear to have increased by about 40 percent with the June 1975 announcement. ▷

▶ memory. Arithmetic instructions are of the one-address "add-to-accumulator" type. All instructions are decimal in nature. SL5 memory reference instructions have a 16-bit (2-byte) address specification field and an 8-bit (1-byte) operation code.

INTERNAL CODE: ASCII.

MAIN STORAGE

STORAGE TYPE: Dynamic MOS (metal-oxide semi-conductor).

CYCLE TIME: 1.5 microseconds. (Memory access times will average 1.2 microseconds, but the rate of access is 3.0 microseconds, the same as the central processor's machine cycle time.)

CAPACITY: 4,096 to 49,152 bytes of user memory, in 2,048-byte increments; plus 8,192 to 16,384 bytes of microprogram memory (MPM). The basic processor and console require 8,192 bytes of MPM, and additional MPM is automatically furnished with each additional peripheral device. Minimum user memory capacity is 6K bytes for Magnetic Record Computers and 4K bytes for all other models. The A 2011 or A 2012 Extended Memory Potential feature is required for total user memory capacities in excess of 16K or 40K bytes, respectively.

CHECKING: Parity check on each 8-bit byte.

STORAGE PROTECTION: None.

CENTRAL PROCESSOR

GENERAL: One particularly interesting feature that is standard on all L 8000 and L 9000 systems is an automatic power failure/automatic restart capability. At the time of a power failure, an interrupt is generated that causes activation of a cassette recording device in the processor that operates under battery power. Battery power is then used to copy the contents of memory and the status of all registers to the cassette. Upon resumption of normal power, the memory and register contents are automatically restored from the cassette.

The following entries refer to the "S-level" machine, which provides program compatibility with the earlier Burroughs L and TC series computers. The S-level machine is, in fact, a "soft" processor whose functions are implemented through standard microprograms.

CONTROL STORAGE: 8K bytes of memory used for the basic Interpreter function of translating or "interpreting" the S-level object program code at execution time, causing the execution of the M-level microinstructions; not user-accessible.

REGISTERS: No user-accessible registers, except for index registers, are provided. Accumulators are set up by programs in user memory.

INDIRECT ADDRESSING: Yes, in SL5 instructions via an indirect branch instruction.

INDEXING: Four index registers are provided. Indexing is specified by a "Modify" instruction which immediately precedes the instruction to be modified.

INSTRUCTION REPERTOIRE: Approximately 650 instructions are defined at the hardware or microprogram ("M") levels in approximately 70 functional categories. These hardware instructions are activated by 190 SL3 or 257 SL5 commands at the user or source ("S") level. These ▶

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	SPEED
MAGNETIC TAPE		
A9490-25	Cassette station (includes controller); 12.5 ips, 800 bpi; 860 (256-character) records	1KC/sec
A1495	Industry-compatible; 12.5 ips, 9-track, 800 bpi	10 KBS
PUNCHED PAPER TAPE		
A9122-1	Reader, 5-8 channel	40 cps
A9222-1	Punch, 5-8 channel	40 cps
PUNCHED CARD		
A9114-1	Reader, 80-column	200 cpm
A9418-2	Reader/Punch/Data Recorder, 80-column	200/45/45 cpm
A9119-1	Reader, 96-column	300 cpm
A9419-2, -6	Reader/Punch/Data Recorder, 96-column	300/60/60 cpm
LINE PRINTERS		
A9249-1	132 positions, 48/64 characters	85 lpm
A9249-2	132 positions, 48/64 characters	160 lpm
A9249-3	132 positions, 48/64 characters	250 lpm
DATA ENTRY MODULE		
TD 701-1	256-character screen	—

▷ The high points of L 8000 Series history to date have been: 1) the announcement of the series in October 1972, 2) the extension of the series top end with the L 8800 and L 8900 models in the latter part of 1974, and 3) the L 9000 announcement in June 1975.

The various L 8000 and L 9000 models are characterized by two basic distinctions, each of these with refinements. The two primary distinctions are: 1) width of the forms handler, either 15½ or 26 inches, corresponding to 150 or 255 print positions; and 2) whether or not the unit can use magnetic stripe ledger cards. The forms handler refinements are whether the forms feed is manual, available in front or rear feed, or automatic. The magnetic ledger refinements are the use of either one 352-digit record track or a pair of tracks per form for a 704-digit record capacity.

Additionally, three console printer speeds are available, depending on the model. L 8200's, L 8300's, L 8400's, and L 8500's have a 20-character-per-second (cps) ball printer mechanism. On L 8700's, L 8800's, and L 8900's, the speed of the console ball printer is 30 cps. On L 9000's, the speed is raised to 60 cps by the new matrix printer.

A point of paramount importance is the fact that all L 8000 and L 9000 systems are completely program-compatible. The full range of more than 45 Burroughs Business Management Systems (BMS) programs is available for the L 8000/9000 Series. The L 9000 systems are available now, with deliveries scheduled for 60 to 90 days after receipt of order. ▷

▶ commands can be categorized as 94 or 128 I/O instructions, 21 or 21 arithmetic, 6 or 6 index, 54 or 84 move and load, and 15 or 18 branch and test instructions for the SL3 or SL5 machine language, respectively. Because the L 8000 and L 9000 processors are microprogrammed, the entire "S" level instruction sets can be altered as desired by Burroughs.

INSTRUCTION TIMINGS: All times are in *milliseconds* for signed 16-digit operands at the user level. The times assume that the machine language instructions being executed at SL5 instructions. However, the shorter SL3 instruction format produces timings about 10 percent faster than the SL5 timings listed below.

|	
Move:	0.745
Add/Subtract:	1.55/1.63
Multiply*/Divide:**	18.25/2.70
Compare & Branch:	1.77

* 1-digit multiplier and signed 16-digit multiplicand.
**5-digit divisor into signed 16-digit dividend.

INTERRUPTS: Four levels, three of which are initiated by peripheral device conditions and can result in programmed action, operator notification (signal light, etc.), or termination of operation. The fourth level permits device status interrogation by the processor.

PHYSICAL SPECIFICATIONS: Processors are 29.875 inches high (at the work surface), 53.25 or 62.5 inches wide (depending on whether the console printer is a 15.5-inch or 26-inch unit), and 41 inches deep. The maximum weight ranges up to about 550 to 600 pounds.

Operational ambient conditions for the processors are 50° to 105°F. with a relative humidity between 5 and 95 percent. Storage conditions (non-operating) are 50° to 160°F. with a relative humidity between 5 and 100 percent. Power requirements for the L 8200, L 8300, L ▶

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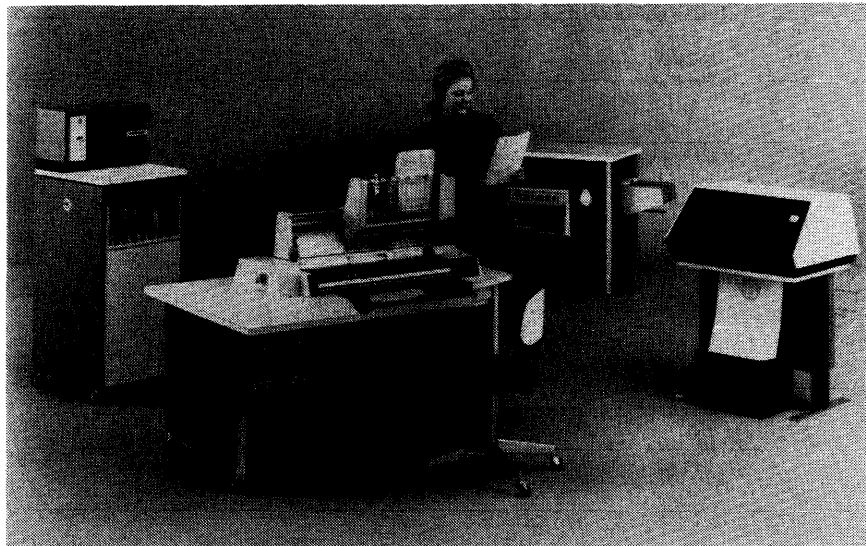
The Burroughs L 8900 Magnetic Record Computer is shown here in an expanded configuration. From left to right are a 9-track magnetic tape unit, the computer with four cassette stations, the free-standing Magnetic Record Handler, and a line printer (85, 160, or 250 lpm). The basic L8941-709, with integral 352-digit magnetic record device, 30-cps console printer, and 6K bytes of user memory, can be purchased for $24,990. The smallest L 8000 configuration begins at $12,990.

▷ In comparison to the earlier L 8500; the user receives improved performance when he selects either the L 8800 or the L 8900, introduced late in 1974. According to Burroughs, the performance of these newer systems has been improved from 17 percent to 40 percent over that of the other L 8000 systems, depending on the application. Throughput has been improved primarily by using 32-character hardware buffers at the keyboard or input side and on the output side. In the other L 8000 computers, the output buffers are soft buffers implemented by Burroughs' micrologic firmware, which resides on disk. Other L 8800 and L 8900 improvements include a faster console printer (30 characters per second vs. 20 characters per second for the other L 8000 systems), a faster program loader (100 characters per second vs. 15.5 characters per second), and an electronic keyboard.

To these advances, the L 9000 systems add the improved throughput potential of the 60-cps console printer.

The original L 8000 Series computers, when announced in October 1972, represented the most powerful members of Burroughs' large and highly successful L Series family of keyboard-oriented small accounting computers. The introduction of the L 8800 and L 8900, followed by the L 9000 systems, continues Burroughs' commitment to the small business sector and adds even more power to the product line.

Since the introduction of the first L Series models in 1968 as non-communications versions of the keyboard-oriented TC 500 Terminal Computers, Burroughs has installed more than 110,000 of its small business systems in a broad range of industries and applications.

In contrast to the disk main memories used in earlier L and TC Series computers, the L 8000 and L 9000 processors utilize MOS memory and logic circuitry to achieve greatly increased internal speed—yet maintain complete upward compatibility with programs, data, and operating procedures of the earlier models. ▷

▶ 8400, and L 8700 are a nominal voltage of 120 vac at 8 amperes with a voltage range between 108 and 126 volts at 60 Hertz; heat is dissipated at the rate of 2,389 BTU per hour (maximum). Power requirements for the L 8500 and L 9000 are a nominal 120 vac at 8.2 amperes with a voltage range between 108 and 126 volts at 60 Hertz; heat is dissipated at the rate of 2,457 BTU per hour (maximum). L 8800 and L 8900 power requirements are 120/240 vac.

Special air conditioning and raised flooring are not normally required. The power line should be "clean."

INPUT/OUTPUT CONTROL

I/O CHANNELS: Each type of peripheral device or subsystem except the console can use any available I/O control, and each I/O control, in turn, requires an appropriate "slot" or port in the central processor.

SIMULTANEOUS OPERATIONS: The L 8700, L 8800, L 8900, and L 9000 systems include a 32-character hardware keyboard buffer and a 32-character hardware output buffer, both of which permit simultaneous input/output and processing operations. The keyboard buffer accepts alphanumeric program select and operation control data while processing and printing previously entered data. Thus, indexing, processing, and printing operations can be performed simultaneously.

The L 8200, L 8300, L 8400, and L 8500 systems perform only one I/O data transfer operation at a time, and internal processing is suspended while the processor is transferring data to or from any peripheral device.

All models can be equipped with locally connected TD 700 Data Entry Terminals (keyboards with SELF-SCAN displays) for data entry onto a dedicated magnetic tape cassette station concurrently with execution of a program.

CONFIGURATION RULES: The number of peripheral devices and/or memory modules that can be used in an L 8000 or L 9000 Series system is limited by the capacity of the processor backplane, which can house a maximum of 100 circuit cards. The basic processor logic and first 16K bytes of user memory require 50 card slots, leaving the other 50 slots for additional memory and/or peripheral control logic. ▶

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▷ Earlier L and TC Series computers use a machine language called System Language 3 (SL3). The L 8000/9000 family maintains upward compatibility with these L and TC programs by incorporating SL3 as one of two machine languages available for all L 8000 and L 9000 systems. The other System Language (SL5) is basically an extension of SL3 that allows increased memory and addressing and additional peripheral device handling capability.

The L 8000 and L 9000 Series computers are controlled by "variable micrologic"—an advanced form of micro-programming. Each L 8000/9000 system has from 8K to 16K bytes of microprogram memory, and from 4K to 48K bytes of MOS *user memory* in 2K-byte increments. (Minimum user memory capacity of the L 8500, L 8900, L 9541, and L 9542 Magnetic Record Computers is 6K bytes).

Designed primarily for applications employing visible records and keyboard entry of transaction data, the L 8000 and L 9000 Series computers feature "human-engineered" controls and flexible forms-handling facilities that can accommodate a wide variety of continuous and cut forms, either singly or in various combinations. In addition, the L 8000 and L 9000 Series magnetic record computers can read and write up to 704 digits of data on magnetic-stripe documents, which can be fed, held, and stacked automatically by a unique console device. This feature can "park" a ledger card temporarily following processing for recall, if needed, prior to stacking.

L 8000 or L 9000 Series computers can be equipped with a single or dual data communications interface to become TC 3500 or TC 3800 Series Terminal Computers. Data can be transmitted in either asynchronous or synchronous mode, at speeds ranging from 75 to 9600 bits per second. A TC 3500 can communicate with other Burroughs computers or terminals, as well as with BSC-mode devices from other vendors, enabling it to serve effectively in a wide range of communications functions.

The L 8000 Series computers originally represented a direct Burroughs response to the NCR 399 Accounting Computer (Report M11-656-101), an impressive mini-computer-based system unveiled in March 1972 by Burroughs' perennial arch-rival in the small accounting computer market. Whether by accident or by design, the two competitive product lines are closely comparable in performance and pricing. However, a number of key features of the L 8000 not found on the NCR 399 include simultaneous CPU and I/O operations, keyboard buffers that allow the operator to type up to 32 alphanumeric characters ahead of the keyboard print mechanism and/or processor, and the availability of Program Keys that enable the operator to call in program subroutines.

The 1.5-microsecond MOS memory used in all the L 8000 and L 9000 computers gives them a 30-to-1 internal speed advantage over the earlier L Series computers; but, even so, the instruction execution speeds of the L 8000 and L ▷

▶ MASS STORAGE

No magnetic disk unit nor any other type of random-access mass storage device has been announced for the L Series computers to date.

INPUT/OUTPUT UNITS

(See also Peripherals/Terminals table.)

CONSOLE: This basic unit, available in 13 different models, is the central component of every L 8000 or L 9000 Series computer system. It houses the system's processing logic, memory, keyboard, basic printer and forms handler, control keys and indicators, and basic program loader (a small paper tape reader). In some models, the console also contains Magnetic Memory Record facilities and/or a single cassette tape drive.

The console is 53 or 59 inches wide (for 15.5-inch or 26-inch forms handlers, respectively), 41 inches deep, and 30 inches high.

BASIC PROGRAM LOADER: The basic program loader for the L 8200, L 8300, L 8400, and L 8500 reads 8-channel paper tape from self-threading cartridges at a speed of 15.5 characters per second. It is designed solely for program loading and cannot be used for input of transaction data.

In the L 8700, L 8800, L 8900, and L 9000's, the basic program loader is a photoelectric paper tape reader that reads 8-channel paper tape from self-threading cartridges at a speed of 100 characters per second. The loader on the newer systems is also designed solely for program loading and cannot be used for input of transaction data.

The L 9000 systems' programs can optionally be loaded from a peripheral unit. And, optionally, they can be dynamically overlayed from a cassette.

INTEGRATED PRINTER: The L 8200, L 8300, L 8400, and L 8500 integrated printer uses an interchangeable ball-shaped printing element that prints one character at a ▶

One or two Burroughs TD 700 Series display/keyboard units like this one can be used with an L 8000 or L 9000 for data entry into a dedicated magnetic tape cassette station, concurrently with program execution on the computer. This photograph was taken at a trade show, under very poor lighting conditions, yet the displayed information has high clarity. Burroughs' SELF-SCAN gas technology displays and compact screens and keyboards have proved popular with users.

▷ 9000 processors fall far below those of the Burroughs B 700 and the IBM System/32. Nevertheless, the slower instruction execution speeds of the L 8000 and L 9000 are well suited to the operator-oriented applications they are designed to serve.

USER REACTION

In this report, we will present the reactions of two distinct groups of users. The responses to Datapro's December 1974 user survey on small business computers comprise the first group, which consists of three users with six purchased L 8000 computers. None of these were L 8800's or L 8900's, as these systems were seeing initial delivery at that time. The second group of users was a select group provided by Burroughs; the results of our survey of that group concludes this Management Summary.

The first respondent to Datapro's user survey was most enthusiastic about his 12K L 8541-200 system, reporting it to be "excellent" in all queried categories (overall performance, ease of operation, ease of conversion, hardware reliability, maintenance service, and technical support), except for two (ease of programming and manufacturer's software), which he rated "good." His software was provided entirely by the manufacturer. His sole complaint, after using the system for one year, was that the console printer, at 30 cps, was too slow. He did not have a line printer; the configuration included three cassette tape stations, a stand-alone MMR handler, and an integral 352-digit MMR reader.

Another survey respondent, with two 8K L 8300's and two 16K L 8500's rated the L 8300's "excellent" in overall performance and ease of operation, "good" in ease of programming (all programs developed in-house) and hardware reliability, "fair" in ease of conversion and manufacturer's software, and "poor" in maintenance service. The user's L 8500's were rated "excellent" in ease of operation, "good" in overall performance and ease of programming, "fair" in ease of conversion, hardware reliability, and manufacturer's software, and "poor" in maintenance service and technical support. The user had 14 months of experience with the L 8300's and one year's experience with the L 8500's. And he had two strong complaints: he said that the data save device didn't work in a power failure and that the Burroughs service personnel were not fully qualified—that they knew either the system's mechanical aspects or electronics, but not both. He cited COBOL programming capability and ease of operation as major strengths of the system.

The third respondent to Datapro's survey, with an L 8500 and four months' experience, rated the system in only four categories. Called "fair" were hardware reliability and maintenance service, and called "poor" were technical support and manufacturer's software (used exclusively by this customer). The user stated that the system was installed to provide inventory control at a remote location and to send data for the day to an IBM System/370 at a ▷

▶ time at a rated speed of 20 characters per second. The L 8700, L 8800, and L 8900 systems use a similar printer, but one having a speed of 30 characters per second. Both the 20- and 30-cps printers have printing elements with 64 ASCII characters. The print line has a maximum of 150 character positions in the L 8200 and L 8300 models, and 255 print positions in all other models. A 32-character print buffer permits printing and printer positioning to be largely overlapped with internal processing. In the L 8800 and L 8900 systems, the buffer is a hardware item; in all other models, the buffer is incorporated in the micrologic firmware.

In the L 9000 systems, the integrated printer is a matrix printer, pictured on the second page of this report. It operates at 60 characters per second and skips at 330 spaces per second. Printing can be bidirectional and "intelligent," meaning that the head can calculate the optimum print direction for each line and move to the most significant character position at high speed. While this new mechanism cannot employ red/black ribbon as the earlier ones do, there will seldom, if ever, be a problem of program incompatibility with earlier L 8000 systems. This is because when the older machines used red to indicate negative amounts, the program also usually called for a pair of parentheses, CR symbol, or minus sign as well, so that carbon copies, etc., would show the negative amounts. The L 9000 systems simply ignore program commands to use the red ribbon shift.

Forms can be inserted from the front in all models except the L 8200, which has a rear-feed forms handler. A split platen is standard in all current models.

MAGNETIC MEMORY RECORD (MMR) FACILITIES: These facilities, standard in the L 8500, L 8900, and L 9500 computers, permit data to be read from and recorded upon ledger cards and other documents containing magnetic stripes. The L 8541, L 8941, and L 9541 models have a single-track MMR facility and can record a maximum of 352 data digits plus a block-check digit and two line-location digits on each document. The L 8542, L 8942, and L 9542 models feature an expanded, dual-track MMR facility and can record a maximum of 704 digits on each document plus a block-check digit and two line-location digits. An additional facility is available by which the ledger cards can be used as an output medium onto which object programs can be dumped and from which they can be subsequently reloaded.

A 9362 CONSOLE MAGNETIC RECORD HANDLER: This optional attachment receives magnetic-stripe documents ejected from the console and, under program control, either stacks them in sequence or holds them for subsequent reprocessing; the holding step is called "parking." The A 9362 includes automatic feeding and insertion of a file of magnetic-stripe documents into the console. If desired, the A 9362 can be used to permit a semi-unattended mode of operation depending upon user application requirements.

A 9161 MAGNETIC RECORD READER: Reads data stored on magnetic-stripe documents and transmits the data to the central processor for processing at up to 45 documents per minute.

A 9162 MAGNETIC RECORD READER: Has the same characteristics and capabilities as the A 9161 plus dual-track reading capability for up to 704 digits to be read from two tracks on each document.

COMMUNICATIONS CONTROL

When equipped with a data communications interface, an L 8000 or L 9000 Series computer becomes a TC 3500 or TC ▶

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▷ central site in batch mode. He stated that the system was unable to perform this function at the time of our survey, several months after the due date.

The six users whose identities were provided to Datapro by Burroughs all rated their L 8000 Series systems quite highly. To provide these names, Burroughs tapped a reservoir of satisfied users in the Minneapolis and Southern Texas areas, each with about one year's experience. All were first-time computer users, although many had previous experience with earlier Burroughs accounting machines. One installation contained two L 8000's. Few of the configurations had extra peripheral units (e.g., line printers, card I/O units, etc.), and that accounts for our reporting of only four responses to the query about the reliability of peripheral units in the tabulation below.

Also, in the following tabulation of user reactions, the usual questions about operating systems and application programs have been eliminated because 1) the L 8000's have no operating system, and 2) the application programs were provided by an amalgam of users, Burroughs and three software houses that specialize in Burroughs L Series software.

Four of the six users had purchased their systems, including the user with two L 8000's. The other two users had obtained third-party leases.

With regard to the high degree satisfaction expressed with the compiler, it should be noted that this is actually the user ratings of a Burroughs *service,* namely, the compiling of user programs on a separate Burroughs mainframe (such as a B 3500 or B 3700) and presentation back to the L 8000 user of a program on MMR cards or cassette ready for loading and execution on the L 8000.

Applications for the L 8000's tended to encompass the usual range of accounting functions: general ledger, accounts payable and receivable, and payroll, plus reports, invoicing, customer statements, and check writing.

The three highly regarded software houses that cropped up in the survey were: 1) Computer Concepts & Services, 2625 Clearwater Road, St. Cloud, Minnesota 56301; telephone (612) 253-2170; 2) Lan Systems, 1595 Shelby Avenue, St. Paul, Minnesota 55104; telephone (612) 644-5000; and 3) Software Consultants, Inc., 8700 West 36th Street, Suite 200, Minneapolis, Minnesota 55426; telephone (612) 933-3944. These companies received universal ratings of "excellent" for their L 8000 Series software. Only one "fair" rating for applications software was reported, and that was for one Burroughs effort; but the vendor also received many "excellents" in this category.

Here are the tabulated ratings received from this second group of users, whose names were supplied by Burroughs: ▷

▶ 3800 Terminal Computer. Transmission can be in either asynchronous or synchronous mode, at speeds ranging from 75 to 9600 bits per second. In addition to the Burroughs standard line control procedures used for communication with other Burroughs computers and terminals, the TC models can be equipped to use the binary synchronous communications (BSC) procedures as well as numerous other disciplines and communicate with various IBM and IBM-compatible devices. Transmit and receive buffers can vary in length to a maximum of 4096 characters, as defined by the COBOL program, or greater if written in assembly language.

The TC Series units can be equipped to handle dual data communications operations, with each operation occurring independently of the other. In addition, the two operations can use different transmission speeds, different modes, and different line control procedures. Thus, a TC 3500 or TC 3800 can control a "mini-network" of smaller terminals while simultaneously communicating with a larger central computer, or it can act as a data concentrator for other Burroughs terminal systems.

SOFTWARE

OPERATING SYSTEMS: None

PROGRAMMING: The principal programming language for the L 8000 and L 9000 Series computers is L 8000 COBOL, a revised, upward-compatible version of Burroughs' earlier L/TC COBOL. Compilation of programs written in L 8000 COBOL must be performed on a Burroughs B 3500, B 3700, or B 4700 computer with at least 90K bytes of main storage. The compiler produces object programs in an S-level language that can be loaded into the L 8000 or L 9000 Series for execution by the Interpreter, i.e., by the standard microprograms.

For users who wish to program their L 8000 or L 9000 Series computers in symbolic machine-oriented language, the SL3 Assembler language is fully upward-compatible with that of the earlier Burroughs L and TC Series computers. SL3 programs can be assembled on the earlier L and TC Series systems as well as Burroughs' medium-scale computer systems.

The SL5 Assembler includes additional instructions for the L 8000 and L 9000 Series peripheral devices, and expanded addressing facilities for user memories larger than 6K bytes. SL5 assembly—unlike COBOL compilation—can be performed on the L 8000 or L 9000 Series computer itself.

APPLICATIONS: Burroughs offers a wide assortment of ready-made programs for specific applications from its "Hall of Programs" and its library of Business Management Systems.

The Business Management Systems include programs designed to provide operational control of specific types of businesses through the production of comprehensive management reports. Business Management Systems are currently offered for the wholesale, retail, manufacturing, governmental, hospital, and banking industries. Each system maintains a general ledger using a standard chart of accounts, and produces profit-and-loss statements, balance sheets, and various other reports. Each system is available either with or without formal training at a Burroughs training site.

PRICING

POLICY: Burroughs is now offering the L 8000 and L 9000 systems for purchase or on a 1-year or 3-to-5 year lease. The standard maintenance agreement includes equipment ▶

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	Excellent	Good	Fair	Poor	WA*
Ease of operation	5	1	0	0	3.8
Reliability of mainframe	6	0	0	0	4.0
Reliability of peripherals**	3	1	0	0	3.8
Responsiveness of maintenance service	4	2	0	0	3.7
Effectiveness of maintenance service	5	1	0	0	3.8
Quality of technical support	4	2	0	0	3.7
Vendor's compiler service**	3	2	0	0	3.6
Overall satisfaction	6	0	0	0	4.0

* Weighted Average on a scale of 4.0 for excellent.

**Not all of the 6 users responded.

▷ The rating of overall satisfaction, which is a perfect 4.0, speaks for itself. The only negative comments from this group of users were in regard to responsiveness of maintenance service, which two were moved to categorize merely as "good" because the L 8000's were so popular in their areas that the users felt that the support was spread a bit thin. Our survey shows that these users seem to have made wise decisions in choosing their first business data processing systems. ☐

▶ servicing and permits use of the equipment during one eight-hour period per day. For usage in excess of eight hours per day, Burroughs may negotiate for extra-shift charges; however, this is not normally done unless the user wants extended maintenance coverage during these extra use periods.

SUPPORT: One-time charges for individual application programs range from approximately $200 to $2,500. Prices of the Business Management Systems range from $1,500 to $4,000, depending upon the industry and whether or not user training is included. Burroughs technical assistance is available at $120 per day, in half-day increments. Burroughs also offers fixed-price turnkey contracts, under which it assumes total responsibility for the programming and installation of a system.

EQUIPMENT: The following "packaged" systems are complete. The purchase price of the second sample configuration saves $660 over the separately priced components. Purchase price savings on packaged Burroughs L 8000 and L 9000 Series systems range from $660 to $2,000.

L 8300-411: Includes basic L 8300-700 processor plus 10K bytes of user memory, dual pin-feed forms handler, four cassette stations, and a TD 700 for data entry to a dedicated cassette concurrently with program execution. Purchase price is $32,400.

L 8300-310: Same as L 8300-411 except that fourth cassette station and TD 700 are replaced by an 85-lpm line printer. Purchase price is $28,000. ■

EQUIPMENT PRICES

		Purchase Price	Annual Maint.*	Rental (1-year lease)**	Rental (5-year lease)**
PROCESSORS AND MAIN STORAGE					
L 8200-700	Processor with 4K bytes of user memory, 15.5" rear-feed forms handler, 20-cps printer, cassette station	$12,990	$ 771	$446	$424
L 8300-700	Processor with 4K bytes of user memory, 15.5" front-feed forms handler, 20-cps printer, cassette station	13,990	771	482	458
L 8400-700	Processor with 4K bytes of user memory, 26" front-feed forms handler, 20-cps printer, cassette station	14,990	805	518	492
L 8700-700	Processor with 4K bytes of user memory, 15.5" front-feed forms handler, 30-cps printer, cassette station	15,490	862	535	508
L 8800-700	Processor with 6K bytes of user memory, 26" front-feed forms handler, 30-cps printer, electronic keyboard, cassette station	16,490	895	571	542
L 8541-709	Processor with 6K bytes of user memory, 26" single-track MMR forms handler with split platen, 20-cps printer, cassette, forms feeder/stacker	23,490	1,342	718	682
L 8542-709	Processor with 6K bytes of user memory, 26" dual-track MMR forms handler with split platen, 704-digit data track, 20-cps printer, cassette, forms feeder/stacker	24,490	1,377	750	713
L 8941-709	Processor with 6K bytes of user memory, 26" MMR forms handler, split platen, 352-digit date track, 30-cps printer, electronic keyboard, cassette, forms feeder/stacker	24,990	1,442	767	721
L 8942-709	Processor with 6K bytes of user memory, 26" MMR forms handler, split platen, 704-digit data track, 30-cps printer, electronic keyboard, cassette, forms feeder/stacker	25,990	1,478	800	760
L 9300	Processor with 4K bytes of user memory, 15.5" forms handler, 60-cps printer, cassette	16,990	1,007	607	577
L 9400	Processor with 4K bytes of user memory, 26" forms handler, 60-cps printer, cassette	17,990	1,037	643	611

* Annual maintenance prices are for Burroughs Metro schedule.
**Rental prices include maintenance.

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EQUIPMENT PRICES

PROCESSORS AND MAIN STORAGE (Continued)		Purchase Price	Annual Maint.*	Rental (1-year lease)**	Rental (5-year lease)**
L 9541	Processor with 4K bytes of user memory, 26" MMR forms handler, 352-digit data track, 60-cps printer, cassette, forms feeder/stacker, dual pin-feed	$ 25,990	$ 1,585	$ 830	$ 790
L 9542	Processor with 4K bytes of user memory, 26" MMR forms handler, 704-digit data track, 60-cps printer, cassette, forms feeder/stacker, dual pin-feed	26,990	1,585	862	820
A 4011	2 KB Memory Module	800	21	31	28
A 2011	24 KB Extended Memory Potential (required for total user memory capacity of 18 KB through 40 KB)	750	—	21	19
A 2012	32 KB Extended Memory Potential (required for total user memory capacity of 42 KB through 48 KB)	800	—	22	20

NOTE: Processor models coded "-709" are available as "-609" models without the cassette station. Generally, omitting the cassette reduces the purchase price by $1,000. On MMR models with the automatic feeder/stacker forms handler, $2,000 off the purchase price can be saved by deleting the standard automatic forms handling facility. All models can accommodate one or two TD 700 display/keyboards for data entry to a dedicated cassette concurrently with program execution. An additional TD 700 currently has a purchase price of $4,130.

PERIPHERAL EQUIPMENT

		Purchase Price	Annual Maint.*	Rental (1-year lease)**	Rental (5-year lease)**
A 2322-1	Card/Tape Controller (for A 9122-1, A 9222-1, and/or A 9114-1)	1,000	23	28	25
A 9122-1	Paper Tape Reader; 40 char/sec.	1,590	114	42	38
A 9222-1	Paper Tape Punch; 40 char/sec.	1,990	144	53	48
A 9114-1	80-Column Card Reader; 200 cpm	2,790	244	78	71
A 9418-2	80-Column Card Reader/Punch/Data Recorder	10,990	1,020	280	252
A 2331-1	96/80-column Card Controller	2,000	23	56	50
A 9119-1	96-Column Card Reader; 300 cpm	3,500	300	85	77
A 9419-2	96-Column Card Reader/Punch/Data Recorder	9,490	852	240	216
A 9419-6	96-Column Multi-Purpose Card Unit (programmable stacker select)	11,390	1,020	285	257
A 2362-1	Line Printer, Controller	490	—	21	20
A 9249-1	Line Printer; 85 lpm	8,500	720	240	216
A 9249-2	Line Printer; 160 lpm	11,200	840	280	252
A 9490-25	Cassette Tape Subsystem:				
—	First station (includes A 2391-1 controller	1,640	97	59	56
—	Second, third, or fourth station	1,640	74	59	56
A 2392-1	Data Collection MTU Controller	1,000	23	28	25
A 1495-1	Magnetic Tape Unit; 2 ports	11,500	444	365	280
A 1495-2	Magnetic Tape Unit; 4 ports	11,750	444	373	286
A 1495-3	Magnetic Tape Unit; 6 ports	12,000	444	381	292
A 1495-4	Magnetic Tape Unit; 8 ports	12,250	444	389	298
A 9161-1	Magnetic Record Reader: 352-digit data track	4,790	305	148	112
A 9162-1	Magnetic Record Reader; 704-digit data track	4,990	305	161	122
A 7262	Bidirectional Print Option for L 9000's	1,000	25	38	24
A 9362-2	Console Magnetic Record Handler; feader/stacker/hold; includes PF29	2,990	—	84	75
Continuous Forms Pin-Feed Devices (for L 6000 to L 8000 upgrade):					
PF 21	15.5" rear feed; single synchronous	250	—	7	6
PF 22	15.5" rear feed; single asynchronous	250	—	7	6
PF 23	15.5" rear feed; dual	500	—	14	13
PF 24	15.5" front feed; single synchronous	250	—	7	6
PF 25	15.5" front feed; single asynchronous	250	—	7	6
PF 26	15.5" front feed; dual	500	—	14	13
PF 27	26" front feed; single synchronous	250	—	7	6
PF 28	26" front feed; single asynchronous	250	—	7	6
PF 29	26" front feed; dual	500	—	14	13

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**Rental prices include maintenance.