Burroughs L 8000 Series

MANAGEMENT SUMMARY

The L 8000 Series computers, announced in October 1972, are the latest and most powerful members of Burroughs' large and highly successful L Series family of keyboard-oriented small accounting computers.

Since first introduction of the L Series in 1968 as non-communications versions of the keyboard-oriented TC 500 Terminal Computers, Burroughs has installed more than 25,000 of the small business systems in a broad range of industries and applications.

In contrast to the disk memories used in earlier L and TC Series computers, the L 8000 processors utilize MOS memory and logic circuitry to achieve greatly increased internal speed—yet maintain complete upward compatibility of programs, data, and operating procedures with the earlier models. Earlier L and TC Series computers use a machine language called System Language 3 (SL3). The L 8000 maintains upward compatibility with these L and TC programs by incorporating SL3 as one of two machine languages that are available for the L 8000. The other System Language (SL5) is basically an extension of SL3 that allows for increased memory addressing and additional peripheral device handling capability.

The basic L 8000 Series system consists of a single compact console, 20-cps ball printer, and forms handler. Twelve L 8000 models are currently available, and a wide array of forms-handling facilities and input/output equipment can be attached to these systems.   ▷

These keyboard-oriented accounting computers employ MOS memory and substantially extend the performance range of Burroughs' popular L Series family, while maintaining full compatibility with the earlier models. A wide array of forms-handling facilities and input/output equipment is available.

CHARACTERISTICS

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

MODELS: L 8200, L 8300, and L 8400 Accounting Computers and L 8500 Magnetic Record Computer.

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 eight bytes equaling one 64-bit word).

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

FLOATING-POINT OPERANDS: No provisions for floating-point arithmetic are offered.

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 memory. Arithmetic instructions are of the one-address "add-to-accumulator" type. All instructions are decimal in ▶
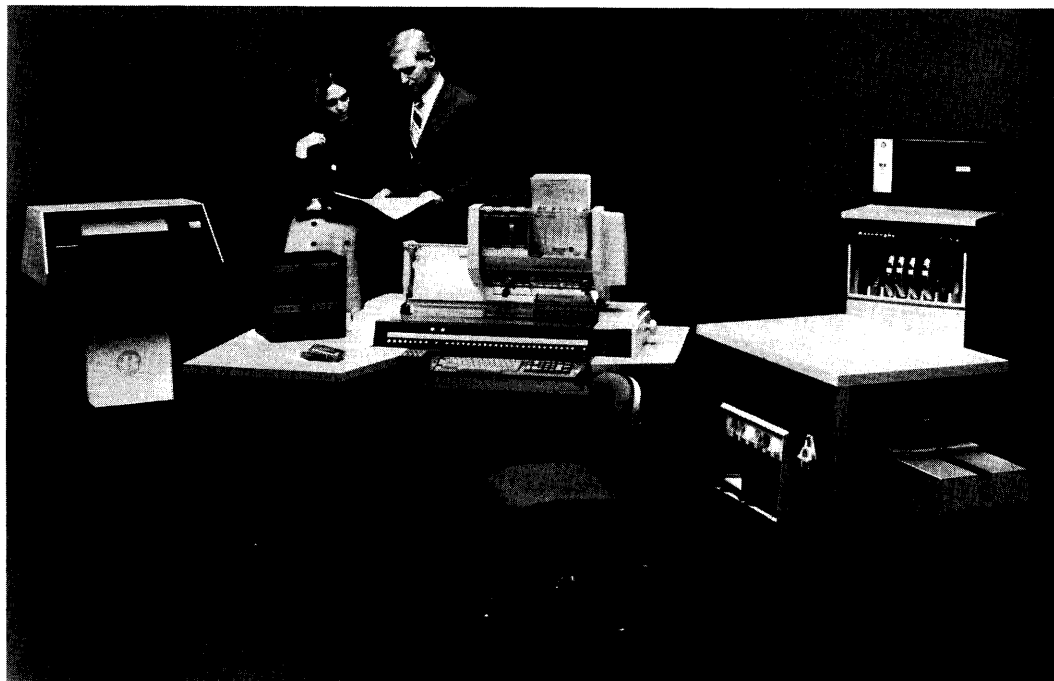
An expanded configuration of the L 8500 Magnetic Record Computer is shown here. From left to right are a line printer, 4-drive Cassette Tape Subsystem (on console shelf), console with optical Magnetic Record Handler, free-standing Magnetic Record Reader, and 9-track magnetic tape unit.

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▷ Purchase prices of the L 8200, 8300, and 8400 models range from $12,990 to $15,690, and their monthly rental prices (for 1-year leases) range from $394 to $476. Purchase prices of the L 8500 Magnetic Record Computers range from $20,990 to $23,990, with monthly rental prices ranging from $637 to $727. These can escalate substantially when expanded memory capacity, auxiliary input/output units, and optional forms-handling facilities are added to the basic systems.

The L 8000 Series computers are controlled by "variable micrologic"—an advanced form of microprogramming. Each L 8000 Series 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 Magnetic Record Computers is 6K bytes).

Designed primarily for applications that involve visible records and keyboard entry of transaction data, the L 8000 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 8500 Magnetic Record Computers can read and write up to 704 digits of data on magnetic-stripe documents, which can be fed and stacked automatically by unique console attachments.

L 8000 Series computers can be equipped with a single or dual data communications interface to become TC 3500 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 ▷

▶ 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: MOS (metal-oxide semiconductor).

CYCLE TIME: 1.5 microseconds. (Memory access times, however, will average 3 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 16,284 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 the L 8500 Magnetic Record Computers and 4K bytes for all other models. The A2011 or A2012 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 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 ▶

SUMMARY DATA FOR THE L 8000 SERIES PROCESSORS

Processor Model	L 8200-100 or L 8200-200*	L 8300-100 or L 8300-200*	L 8400-100 or L 8400-200*	L 8541-100 or L 8541-200*	L 8541-104 or L 8541-204*	L8542-100 or L 8542-200*
Width of forms handler, inches	15.5	15.5	26	26	26	26
Number of print positions	150	150	255	255	255	255
Type of forms feed	Rear	Front	Front	Front	Front	Front
Type of platen	Split	Split	Split	Split	Split	Split
Magnetic Memory Record facilities	None	None	None	Standard	Standard	Standard
Maximum capacity of each magnetic-stripe document, digits	–	–	–	352	352	704
Basic user memory capacity, bytes	4,096	4,096	4,096	6,144	6,144	6,144
Max. user memory capacity, bytes	49,152	49,152	49,152	49,152	49,152	49,152

*Processors with the suffix - 200 or -204 include one Cassette Tape Station as standard equipment.

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	SPEED
MAGNETIC TAPE EQUIPMENT		
A9490-25	Cassette station (includes controller) 10 ips, 800 bpi, 861-256-character records	1 Kc/sec
A1495	Industry-compatible, 12.5 ips, 9-track, 800 bpi	10 KBS
PUNCHED PAPER TAPE EQUIPMENT		
A9122-1	Reader, 5-8 channel	40 cps
A9222-1	Punch, 5-8 channel	40 cps
PUNCHED CARD EQUIPMENT		
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		
A9245-1	132-position, 48/64 character	90 lpm
A9249-2	132-position, 48/64 character	180 lpm

▷ vendors, enabling it to serve effectively in a wide range of communications functions.

The 1.5-microsecond MOS memory used in the L 8000 Series 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 processors fall far below those of the Burroughs B 1700 the IBM System/3 batch-oriented computers. But the slower instruction execution speeds of the L 8000 are well-suited for the operator-oriented applications that the L 8000 is designed to serve.

The L 8000 Series computers represent a direct Burroughs response to the NCR 399 Accounting Computer, an impressive minicomputer-based system that was 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, and currently rank among the "best buys" in the small accounting computer market. However, a number of key features of the L 8000 not found on the NCR 399 include keyboard buffers that allow the operator to type up to 32 alphanumeric characters ahead of the keyboard print mechanism and/or processor, plus the availability of Program Keys for the operator to permit calling in program subroutines. ☐

➤ L and TC series computers. The S-level machine is, in fact, a "soft" processor whose functions are implemented through standard microprograms.

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

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

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 commands can be categorized as 94/128 I/O instructions, 21/21 arithmetic, 6/6 index, 54/84 move and load, and 15/18 branch and test instructions for SL3 and SL5 machine languages, respectively. Because the L 8000 is 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 are SL5 instructions. However, the shorter SL3 instruction format produces timings about 10 percent faster than the SL5 timings listed below.

	L 8000
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: 4 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.

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.

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. ➤

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SIMULTANEOUS OPERATIONS: In general, only one I/O data transfer operation at a time can be performed, and internal processing is suspended while the processor is transferring data to or from any peripheral device.

CONFIGURATION RULES: The number of peripheral devices and/or memory modules that can be used in an L 8000 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. Individual slot requirements are given in the Peripherals/ Terminals table.

MASS STORAGE

No magnetic disc unit nor any other type of random-access mass storage device has been announced for the L 8000 Series computers to date.

INPUT/OUTPUT UNITS

(See also Peripherals/Terminals table.)

CONSOLE: This basic unit, available in 12 different models, is the central component of every L 8000 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.

The basic program loader reads 8-channel paper tape from self-threading cartridges at a speed of 15.5 characters/ second; designed solely for program loading, the unit cannot be used for input of transaction data.

The integrated printer uses an interchangeable ball-shaped printing element that prints data in character-at-a-time fashion at a rated speed of 20 characters/second. The element contains 64 ASCII characters. The print line has a maximum of 150 character positions in the L 8200 and L 8300 models, and 255 positions in all other models. A 32-character print buffer permits printing and printer positioning to be largely overlapped with internal processing.

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 models except the L 8541-104 and L 8541-204, which have a solid platen.

MAGNETIC MEMORY RECORD (MMR) FACILITIES: These facilities, standard in all the L 8500 Series computers, permit data to be read from and recorded upon ledger cards and other documents containing magnetic stripes. The L 8541 models have a single-track MMR facility and can record a maximum of 349 data digits plus a block check digit and two line location digits on each document. The L 8542 models feature an expanded, dual-track MMR facility and can record a maximum of 704 digits on each document, which include 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 9361 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.

A 9362 CONSOLE MAGNETIC RECORD HANDLER: This optional attachment has all the characteristics and capabilities of the A 9361, above plus 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/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 series computer becomes a TC 3500 Series Terminal Computer. Transmission can be in either asynchronous or synchronous mode, at speeds ranging from 75 to 9600 bits/second. In addition to the Burroughs standard line control procedures used for communication with other Burroughs computers and terminals, the TC 3500 can be equipped to use the binary synchronous (BSC) procedures as well as numerous other communications disciplines and communicate with various IBM and IBM-compatible devices. Transmit and receive buffers can be variable in length to a maximum of 4096 characters, as defined by the COBOL program, or greater if written in assembly language.

The TC 3500 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 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. Hence it can serve as a terminal, central processor, or data concentrator.

SOFTWARE

OPERATING SYSTEMS: None.

PROGRAMMING: The principle programming language for the L 8000 Series computer is L 8000 COBOL, a revised, upward-compatible version of Burroughs' present 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 Series for execution by the Interpreter, i.e., by the standard microprograms.

For users who wish to program their L 8000 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 may be assembled on the earlier L and TC Series systems as well as Burroughs' medium-scale computer systems.

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► The SL5 Assembler includes additional instructions for the new L 8000 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 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: The standard equipment lease agreement includes equipment maintenance and permits use of the equipment during one 8-hour period per day. For usage in excess of 8 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. If extra-shift maintenance is desired during after hours usage, the maximum additional charge is 15 percent of the basic monthly rental for full maintenance coverage on a 24-hour/day, 7-days/week basis.

In addition to the 1-year and 5-year leases shown in the equipment price list, Burroughs offers a 3-year lease at intermediate monthly rates.

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 systems include control units. Rental prices are for the basic one-year lease and include equipment maintenance.

MINIMUM SYSTEM: Consists of a Processor with 4K bytes of memory, one Cassette Station, keyboard, and 15.5 inch rear-feed forms handler. Monthly rental and purchase prices are $424 and $13,990, respectively.

MINIMUM MAGNETIC LEDGER SYSTEM: Consists of a Processor with 6K bytes of memory, one Cassette Station, keyboard, and 26-inch Magnetic Memory Record forms handler. Monthly rental and purchase prices are $667 and $21,990, respectively.

EXPANDED CARD/CASSETTE/PRINTER SYSTEM: Consists of a Model Processor with 16K bytes of user memory, four Cassette Stations, 96-column Multi-Purpose Card Unit, 180-lpm Line Printer, standard keyboard, and 26-inch front-feed forms handler with Dual Pin Feed Device. Monthly rental and purchase prices are $1,507 and $54,800 respectively. ■

EQUIPMENT PRICES

PROCESSORS AND MAIN STORAGE		Purchase Price	Annual Maint.	Rental (1-year lease)*	Rental (5-year lease)*
L 8200-100	Processor with 4K bytes of user memory and 15.5" rear-feed forms handler	12,990	568	394	355
L 8200-200	As above, with 1 Cassette Tape Station	13,990	665	424	382
L 8300-100	Processor with 4K bytes of user memory and 15.5" front-feed forms handler	13,490	568	409	369
L 8300-200	As above, with 1 Cassette Tape Station	14,490	665	440	396
L 8400-100	Processor with 4K bytes of user memory and 26" front-feed forms handler	14,690	598	446	402
L 8400-200	As above, with 1 Cassette Tape Station	15,690	695	476	429
L 8541-100	Processor with 6K bytes of user memory and 26" single-track MMR forms handler with split platen	21,990	894	667	601
L 8541-200	As above, with 1 Cassette Tape Station	22,990	991	697	628
L 8541-104	Processor with 6K bytes of user memory and 26" single-track MMR forms handler with solid platen	20,990	894	637	574
L 8542-204	As above, with 1 Cassette Tape Station	21,990	991	667	601
L 8542-100	Processor with 6K bytes of user memory and 26" dual-track MMR forms handler with split platen	23,990	924	697	628

*Rental prices include equipment maintenance

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EQUIPMENT PRICES

		Purchase Price	Annual Maint.	Rental (1-year lease) *	Rental (5-year lease) *
PROCESSORS AND MAIN STORAGE (Continued)					
L 8542-200	As above, with 1 Cassette Tape Station	23,990	1,021	727	655
A 4011	2 KB Memory Module (up to 16 KB total)	1,100	21	31	28
A 4011-1	2 KB Memory Module (over 16 KB)	810	21	21	19
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
PERIPHERAL EQUIPMENT					
A 2322	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 2331-4	Controller for A9418-2	1,990	23	53	48
A 2331-1	Controller for A 9119-1	990	23	25	23
A 9119-1	96-Column Card Reader; 300 cpm	3,500	300	85	77
A 2331-2	Controller for A 9419-2	1,900	23	53	48
A 9419-2	96-Column Card Reader/Punch/Data Recorder	9,490	852	240	216
A 2331-3	Controller for A 9419-6	2,100	23	59	53
A 9419-6	96-Column Multi-Purpose Card Unit (programmable stacker select)	11,390	1,020	285	257
A 2361-1	Controller for A 9249-1	1,400	23	39	35
A 9249-1	Line Printer; 90 lpm	8,500	720	240	216
A 2361-2	Controller for A 9249-2	1,500	23	42	38
A 9249-2	Line Printer; 180 lpm	11,200	840	280	252
A 9490-25	Cassette Tape Substem:				
—	First Station (includes controller)	1,940	97	55	50
—	Second, Third, or Fourth Station	1,940	74	55	50
A 2392	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	Magnetic Record Reader; single-track	4,790	305	148	112
A 9162	Magnetic Record Reader; dual-track	4,990	305	161	122
A 9361	Console Magnetic Record Handler; stacker/hold; includes PF 26 or 29	1,500	105	42	38
A 9362	Console Magnetic Record Handler; feeder/stacker/hold; includes PF 26 or 29	2,790	168	78	70
	Continuous Forms Pin-Feed Devices:				
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

*Rental prices include equipment maintenance.

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