Honeywell Series 60, Level 62

MANAGEMENT SUMMARY

Honeywell's Series 60 Level 62 product line has been a popular alternative over the years to such systems as the IBM System/34 and System/38. It has also represented an effective migration path for earlier Honeywell small business system users as well as IBM System/3 customers. The Level 62 uses numerous hardware and software conversion aids to achieve this upward compatibility.

The Level 62 has been effectively replaced by the DPS 7 family of distributed processing systems (Report 70C-480-09). Honeywell has provided migration aids for Level 62 users to easily move to the newer and more powerful systems. Honeywell will continue to support Level 62 systems already in place.

The Level 62 evolved from a series of separate and distinct submodels, introduced in April 1974, to a basic processor with three performance level enhancements. Each firmware package increases processor performance, main memory capacity, and flexibility of peripherals, while minimizing conversion time. The present system configuration and packaging approach was introduced in January 1979.

HARDWARE

The Level 62 consists of a basic system with three performance level enhancements, Modules C, D, and E. The basic system comes with 96K of memory and a 6-channel I/O processor. It also requires two 20-megabyte disk drives, a line printer, a system console, and either a card reader, cassette tape subsystem, diskette subsystem, or communications subsystem.

The Honeywell Series 60 Level 62 Systems have experienced wide acceptance in the user community, with over 3,000 systems installed worldwide. The product line has been superseded by the newer DPS 7 family of systems.

MODELS: Series 60 Level 62, Basic System.
CONFIGURATION: Single CPU, three performance upgrades, 96K to 992K bytes of memory, up to 1,800 megabytes of disk storage, and up to 25 communications lines.
COMPETITION: IBM System/34, System/38; Burroughs B1900; NCR V-8400; Univac System 80.
PRICE: Purchase prices for typical systems can range from $65,700 to about $400,000.

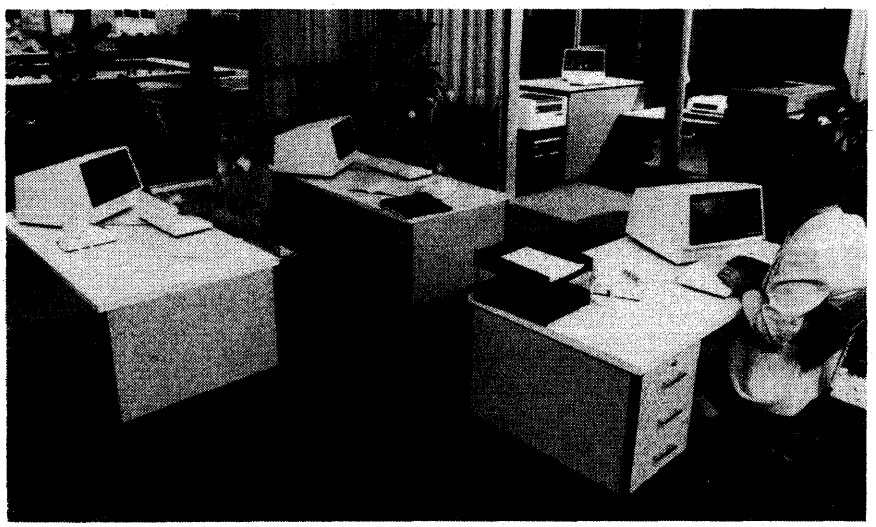
CHARACTERISTICS

MANUFACTURER: Honeywell Information Systems, Inc., 200 Smith Street, Waltham, Massachusetts 02154. Telephone (617) 895-6000.

Honeywell Information Systems is a division of Honeywell Incorporated, an international corporation whose products include industrial and residential control systems, sophisticated test instruments for both medical and industrial applications, aircraft guidance systems and instrumentation, photographic equipment, satellite support subsystems, and electronic data processing products.

MODELS: Series 60, Level 62.

DATE ANNOUNCED: April 1974 (original Model 62/60); January 1977 (Full-Range); July 1978 (Entry Level); January 1979 (Extended Level).



Honeywell's Level 62 system is at the lower end of the company's Series 60 product line. It comes as a basic system with three different performance enhancements, plus a full complement of peripherals. The Interactive Processing System (IPS) offers many enhancements above the well-established GCOS operating system.

REFERENCE EDITION: This is a mature product line, and no significant further developments are anticipated. Because of its importance, coverage is being continued, but no future update is planned.

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SOFTWARE

The field-proven GCOS Level 62 operating system provides facilities for processing up to 13 unrelated activities, including communications, batch, and spooling. Generally, between two and six users can run concurrently on typical configurations. Level 62 GCOS features spooling, dynamic resource allocation, automatic job scheduling, job accounting, and failsoft facilities that allow the system to survive certain main memory and peripheral failures. All Level 62 users can interactively access all system facilities in either transactional or traditional batch modes from distributed, multiuser workstations through the Interactive Processing System (IPS), an information management subsystem of Level 62 GCOS.

User programs can be written in System/3-compatible RPG, in Cobol-74, or in Fortran IV. In addition, Honeywell offers a large selection of financial management programs, an inventory management and production scheduling and control system, plus sales order processing and inventory management programs for distributors.

Honeywell provides a large number of conversion software routines that permit users to convert existing software for operation on the Level 62 systems. These routines permit conversion from both IBM and earlier Honeywell systems.

RELIABILITY/MAINTAINABILITY FEATURES

All Level 62 CPUs have improved diagnostic capabilities that serve to increase system availability by significantly reducing diagnostic and repair times on malfunctioning systems. The advent of CPUs with multiple processing units has offered the computer industry the opportunity to incorporate fixed diagnostic routines into one or more of the internal processing units that make up these CPUs. The diagnostics routines are added to the microcode of the processing unit and invoked only on special command, and can be initiated either remotely or locally.

Honeywell's Level 62 Remote Maintenance System (RMS/62) permits field engineering personnel to diagnose hardware, firmware, software, and operational (human) problems from a remote location. One major benefit that users can derive from RMS/62 is the diagnosis of software problems and implementation of repairs by vendor personnel without the need for site visits or taking the system down for maintenance.

COMPETITIVE POSITION

The Level 62 was originally designed as a migration path for the IBM System/3 Model 10 and other well-known units. With subsequent performance improvements the Level 62 competed with such systems as the Burroughs B 1700 and low-end B 1800 product lines, NCR's low-end Criterion series units, and Univac's 90/25, 90/30, and 90/40 systems. In its present configuration, the Level 62 is

CHECKING: One parity bit is appended to each byte. On all Level 62 systems with more than 224K bytes of memory, single-bit memory errors are automatically corrected by the Error Detection and Correction feature.

STORAGE PROTECTION: Protection is provided by dividing user programs into two sections, designated Segment 0 and Segment 1. Segment 0 contains all data that will be changed during program execution, such as buffers and transient data storage. Segment 1 contains all constants and instructions. Each segment is defined by a base address and length, and these parameters are stored in four hardware registers. This scheme prevents attempts to execute data or to use instruction coding as data. Each pair of user segments cannot be shared or accessed by other user programs. A fifth register, the lower boundary register, contains the address of the first user location beyond the system software.

RESERVED STORAGE: A portion of main storage is reserved for firmware in addition to ROS. A special register, the P-register, prevents access to these memory locations by any software. Also protected is the 13K-byte area where the supervisor resides, including both the transient and resident areas assigned to the supervisor.

CENTRAL PROCESSORS

The Level 62 uses a microprogrammed processor. Level 62 systems are based on one central processor that can be enhanced through the addition of hardware packages. These packages, known as performance modules, permit greater main memory capacity, greater peripheral capacity, and performance increases of 33, 78, or 90 percent over that of the basic configuration.

The Level 62 central processor is divided into a CPU and an I/O control unit. The CPU consists of five functional units: the main memory control, the processor logic unit, the command generator, read-only memory (ROM), and microprogram control. The main memory control interfaces with main memory, and contains addressing and data interchange registers. The processor logic unit provides control functions to the CPU. It controls instruction fetching, decoding, and execution as well as main memory and I/O operations. The command generator decodes machine-language microinstructions from either main memory or ROM and generates appropriate control commands and transfer functions to accomplish the operations specified by the instructions.

Read-only storage contains the resident microprograms needed to control the system. The internal hardware facilities of the Level 62 CPU are used chiefly for execution of these microprograms. High-speed control microprograms, such as those used for disk storage, are stored in ROS, while control microprograms for low-speed peripherals are stored in main memory. The microprogram control can address the entire 240-bit ROS or the first 64K words of main memory. It addresses, fetches, and stores data from ROS or main memory and also calculates the succeeding microinstruction address.

A time-of-day clock is also incorporated in the Level 62 CPU.

CONTROL STORAGE: Consists of both bipolar read-only storage (ROS) and firmware routines located in main memory. Routines from both sources are executed by the CPU. Read-only memory access time is 170 nanoseconds for the Level 62 CPU.

REGISTERS: The Level 62 CPU has 29 16-bit registers that include 16 general-purpose registers, 8 base address registers, and 5 special-purpose memory protection registers. Eight of the general-purpose registers can be used for address indexing.

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Datapro telephoned several Level 62 users around the country for additional comments. While all were basically satisfied with their systems, the prevailing feeling was that Honeywell had all but forgotten them, and was concentrating its efforts in newer systems. Some indicated they were investigating systems from other vendors as a result.

One firm, a midwestern food service company, normally experiences 98 percent uptime with the Level 62, and the system functions very well in a batch environment. However, the DP manager told us he wants to bring up interactive activities on his system, but feels there is no way for him to accomplish this. He said he wants to keep his Level 62, but so far hasn't been able to solve the communications issue. The basic system and GCOS are "very good," and about the only trouble he's had is with the system's line printer.

The next user we contacted was a chemical firm in the southeast who runs several applications in the Level 62, as well as the Interactive Processing System for program development. The DP manager told us his Level 62 "handles it all pretty well." The conversion from an older Honeywell 58 was fairly easy, and the present system provides 95 percent uptime. Plans for 1982 include more memory, larger-capacity disk drives, and some new applications. System support has been generally good, although he commented he hasn't seen his technical rep for over a year, and typically handles problems either via Honeywell's remote maintenance facilities or by calling other Level 62 users in the area.

A third user, a manufacturing firm in the northeast, told us the conversion from his previous IBM System/3 was "not too bad", and that the current Level 62 handles a diverse job mix "very well." The system has virtually no downtime, and any problems are typically peripherals. The DP manager is very pleased with the Level 62, and, after comparing its performance with other systems, particularly from IBM, feels the price/performance of the Level 62 is very good. Once again, Honeywell's shift in emphasis for system support has left him very disappointed. Most of his software updating is performed via remote patching over telephone lines. He was very positive about this aspect of his service, although he felt the rest of Honeywell's support was "almost non-existent."□

Total cabinet capacity is 23.2 million bytes for an MSU0112 and MSU0116 combination. A second cabinet can house an additional MSU0112 spindle and can be expanded to include an MSU0113 or MSU0116 unit for a total subsystem capacity of 46.4 million bytes.

MSS0317 MASS STORAGE SUBSYSTEM: Consists of two 20.13-megabyte drives plus the addressing option. The MSS0317 uses the Honeywell Type M4180 (or equivalent) disk pack, an 11-disk unit with 20 recording surfaces. Data is formatted at 7294 bytes per track on 138 tracks per surface. The MSU0317 is field-upgradable to a 58.4-megabyte MSF0317. Four additional spindles and additional capacity for the first two may be added, for a system subtotal of 175.2 megabytes.

MSUU0330/0331 MASS STORAGE UNITS: This subsystem consists of two 80-megabyte disk drives: the MSU0330 primary drive with stand-alone cabinet and the MSU0331 secondary drive that mounts in a drawer in the MSU0330 cabinet. The subsystem also includes the CPA2027/2028 addressing features, each providing addressing capabilities for one two-drive cabinet. Both drives are identical in characteristics and use the Type 4130, or equivalent, 5-disk removable pack. Data is recorded on 5 surfaces, each with 808 tracks.

MSU0390 MASS STORAGE UNIT: A 2-drive, 11-disk system that is similar to the MSU0330 except for its larger 300-megabyte drive capacity. Data is recorded on 19 surfaces of 823 tracks each. The drives can be added to an MSU0330 subsystem.

DDU0001/0002 DISKETTE UNIT: This unit consists of one DDU0001 drive and, optionally, one DDU0002 drive. Subsystem capacity is 256K or 512K bytes, respectively. The unit records IBM 3740-compatible diskettes by formatting data onto 77 tracks, each containing 26 sectors of 128 bytes.

Level 62 systems can operate with from two to six mass storage units through an integrated mass storage controller.

INPUT/OUTPUT UNITS

MTU0120/0121/0111 MAGNETIC TAPE UNITS: These units make up a subsystem that includes an integral controller for up to four drives. The minimum configuration requires one MTU0120 primary drive and one MTU0121 secondary drive. Up to two MTU0111 slave drives can be added to the subsystem. The drives are 18.75-ips units and are available in three configurations: 9-track, 1600 bpi, 30,000 bytes/sec.; 9-track, 800/1600 bpi, 15,000/30,000 bytes/sec.; and 7-track, 200/556/800 bpi, 3750/10,425/15,000 bytes/sec. Drives with different configurations can be intermixed on one subsystem, but all drives must have the same tape speed.

MTU0220/0221/0211 MAGNETIC TAPE UNITS: These units differ from the MTU0120/0121/0111 drives only in tape speed, which is 37.5 ips instead of 18.75, and in data transfer rates, which are twice as high.

CTU0001/0002 CASSETTE TAPE SUBSYSTEM: Includes a single drive unit (CTU0001) and optional second drive unit (CTU0002) integrated into the Level 62 operator panel. Data is recorded serially on two separate tracks at a recording density of 800 bpi. One tape cassette can store up to 520K bytes of data in blocks of up to 256 characters.

PRS0115 LINE PRINTER SUBSYSTEM: This is a self-contained pedestal-mounted, impact printer subsystem. The basic printer has 132 positions with characters spaced at 10 per inch. Print speed in lines per minute depends on the number of characters in each line and the size of the character set used, as shown in the following table. PRS0115 speeds can be field-upgraded by employing the 200-lpm speed feature (PRF0215) and the 300-lpm speed feature (PRF0315).

Printer	No. of Char.	80	100	120	132
PRS0115	64	105 lpm	105 lpm	105 lpm	105 lpm
	94	95 "	95 "	95 "	95 "
PRS0115 with PRF0215	64	180 "	180 "	180 "	180 "
	94	160 "	160 "	155 "	150 "
PRS0115 with PRF0215 PRF0315	64	340 "	300 "	250 "	220 "
	94	240 "	240 "	240 "	220 "

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The Level 62 communications subsystem provides a communications throughput of up to 2400 characters per second. The maximum line capacity is 1200 characters per second. In the asynchronous mode, the following line speeds are software-selectable: 110, 150, 300, 1200, or 2400 bits per second. Synchronous line speeds to 9600 bits per second are supported. The optional EDCC subsystem provides throughput of up to 7200 characters per second depending on system configuration. Individual line speeds of up to 9600 bps for asynchronous or 19,200 bps for synchronous transmission are possible. The data communications terminals supported include the Honeywell VP7804/7805/7700/7760/7100/7200, matrix serial printers; the GE TermiNet 300; the Teletype Models 33, 35, 37, and 38; the IBM BSC 2780, 3270, and 3741; and ISO.

SOFTWARE

GCOS: All Series 60 systems run under either a subset or the full implementation of the GCOS operating system.

LEVEL 62 GCOS: The subset of GCOS for the small-scale Level 62 computers features multiprogramming, dynamic memory management, and fail-soft operations. Each activity is a stream of jobs to be processed by the system. Activities are associated with a given input device and are initiated by the system operator. Transition from job to job is automatic within an activity. System resources are allocated at the beginning of a job step and de-allocated at the end of a job step. If resources required for a job step are not available, the job step is placed into a "wait queue." The job is automatically started when resources become available. Jobs within an activity are executed sequentially. Jobs belonging to different activities can be processed concurrently. Any number of jobs can be processed concurrently, limited only by the amount of physical memory present in the system. GCOS also maintains a "run queue," a list of jobs ready for initiation. Whenever an executing job is interrupted, the operating system selects a ready-to-run job from the run queue and processes the job.

The dynamic main memory feature provides automatic memory management. GCOS maintains a map of the locations and sizes of all available memory areas. When a job requires additional memory space, the operating system searches the map for a suitable area and assigns the area to the requesting activity. If no single area is large enough to accommodate the request, GCOS dynamically relocates activities within memory to create one contiguous area large enough to accommodate the request.

GCOS Level 62 uses segment-relative addressing to optimize the use of main memory. All programs on a Level 62 system are executed as fully relocatable segments. Level 62 machine instructions refer to segment-relative addresses, without regard to the physical location of the referenced operand. A segment may reside anywhere in memory, and at different times may reside in different places.

With GCOS, the segments of a program are defined by the compilers and, optionally, under the control of the programmer. Segments are variable in length, permitting segmentation to follow the logic of the program and ensuring that distinct elements, such as iterative loops, are not split between segments.

When a program is ready for execution, the Initiator routine first constructs a portion of the core image on the system disk file and subsequently loads the core image into main memory.

Whenever a new segment is needed, GCOS searches main memory for a large enough space to load the segment. If there is no space large enough, GCOS relocates the segments already in memory to collect all available space into one continuous area. As a last resort, GCOS may remove the least active segment in main memory to make a room for a new segment. The removed segment is only written back to the backing store if it has been changed while in memory. Instruction coding is re-entrant and is never modified.

Job flow through the system is controlled by GCOS job management. The input reader reads the job input while other jobs are executing and translates the job control information into an internal format to speed job processing. A job scheduler schedules the execution of the jobs using a system of job classes and priorities within each class.

Resources are allocated at file, volume, and device levels to each job step, and deallocated when each job step is completed.

Disk files are sharable under Level 62 GCOS. However, if file protection is required, multiple access can occur only in read mode.

The CGOS Level 62 file management facilities support five file organizations: sequential, indexed, relative, queued-partitioned, and queued-linked. The latter two organizations are used only by the GCOS operating system and are invisible to users.

Sequential files are organized solely on the basis of their successive physical locations in the file. The records are also arranged in a logical sequence according to their keys as well as in physical sequence, and are usually read or updated in the same order they appear.

Indexed files are similar to sequential files in that rapid sequential processing is possible. The indexed organization makes it also possible to locate individual records quickly for direct (random) processing. Moreover, new records can be inserted by referring to sequentially ordered indexes associated with the file and physically added at the end of the file.

Relative files are characterized by a predictable relationship between the key of each record and the address of that record on a disk device. This relationship is established by the user. Relative file organization is used when the time required to locate individual records must be kept to an absolute minimum.

The GCOS fail-soft feature allows the operator to reconfigure main memory in the event of a memory failure or to bypass or make a substitution for certain malfunctioning peripheral devices. If a memory module fails, only those jobs directly affected by the failure are aborted. The operator can allow unaffected jobs to run to completion and then reconfigure main memory, or all executing jobs can be suspended, memory reconfigured, and suspended jobs restarted.

The Level 62 GCOS Communications Subsystem supports up to 25 communications lines operating in the synchronous or asynchronous transmission modes. It performs such functions as line discipline, terminal device handling, control character editing, message queuing, error handling and recovery, and synchronization of multiple simultaneous data transmission activities.

GCOS Level 62 supports three standard programming languages: ANSI standard Cobol-74, RPG, and Fortran. A version of the Cincom Systems TOTAL data base management system is also provided.

TOTAL: TOTAL Universal, available for Level 62 systems, is designed for small-scale implementations. It requires 14K bytes of main memory plus an additional amount for I/O buffers. A read-only version that requires only 7K bytes is also offered. The TOTAL Data Base Management System is designed and marketed by Cincom Systems, Inc. For additional details, please see Report 70E-132-01.

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MINIMUM LEVEL 62 SYSTEM: Includes a Level 62 CPU with 96K bytes of memory, a 40.2-megabyte disk subsystem consisting of two 20.1-megabyte MSS0317 disk pack drives, a 100-lpm PRS0115 line printer, and one of the following system input devices: a cassette tape drive or a diskette drive. This minimum configuration is priced at $65,703 or $1,778 per month on a five-year lease. Maintenance charge is $455 per month.

TYPICAL TWO-USER LEVEL 62 SYSTEM: Includes a 160K-byte CPU with the type "C" performance upgrade (33 percent) module, 30-cps console printer/keyboard, and two synchronous direct line adapters; a 160-megabyte disk subsystem consisting of two 80-megabyte MSU0300/0331 drives; a 450-lpm PRS0458 line printer; a 300-cpm CRU0300 card reader; and two VIP7804 1920-character CRT display terminals. This configuration can be purchased for $109,353 or rented for $2,778 per month on a five-year lease. Maintenance charge is $614 per month.

LARGE LEVEL 62 SYSTEM: Includes a 224K-byte CPU with the type "D" performance upgrade (78 percent) module, 120-cps console printer/keyboard, dual cassette tape drives, port expander unit; and two local and six remote synchronous lines; a 480-megabyte disk subsystem consisting of six 80-megabyte MSU0330/0331 disk drives; four 37.5-ips, 9-track MTU0220 magnetic tape units; a 1600-lpm PRU1600 line printer; a 1050-cpm CRU1050 card reader with mark sense capabilities; and a PCU0120 card punch. The system can be purchased for about $376,311 or rented for about $10,681 per month. Monthly maintenance charge is $2,340.

SOFTWARE: Generally, the basic operating system, basic job management and file systems, programming tools such as linking and debugging aids, the job control language, and conversion aids are provided to Level 62 users at no additional cost. Users also receive communications supervisors at no extra cost. A basic kit of documentation is also provided with the system. Monthly license fees are charged for language processors, utilities, application packages, communications software, and advanced job management and file systems. Extra charges are also levied for customer services, such as education, program development, system design, implementation and conversion, and network design.

CONTRACT TERMS: Level 62 equipment is available for purchase or for rental under a 1-year, 5-year or 6-year lease. Selected peripherals are offered on a 3-year lease. Monthly rental prices include on-call maintenance between the hours of 8 a.m. and 12 midnight.

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
CENTRAL PROCESSOR					
CPS2004	Basic Level 62 Central Processor; includes CPU, 96K bytes of MOS memory, six integrated channels, and a system console consisting of a keyboard, 30-cps printer, console diskette or tape cassette unit, and integrated communications controller for support of 1 to 4 lines	$33,192	$160	$923	$777
MAIN STORAGE					
CMM2354	32K-byte Main Memory Module and addressing	3,315	13	102	86
CAB 2304	Memory Expansion above 224K bytes	11,165	12	270	228
CMM238X	128K-Byte Main Memory Module and addressing	2,750	11	90	76
PROCESSOR OPTIONS					
CPF2300	Scientific Instruction Set	456	1	12	10
CSF2309	120-cps Console Printer, replaces 30-cps printer in basic system	3,591	13	98	83
CPF2304	Performance Module C; provides 33 percent increase in performance	5,956	13	148	124
CPF2305	Performance Module D; provides 78 percent increase in performance	7,496	12	174	146
CPF2307	Performance Module E; provides 90 percent increase in performance	6,614	20	161	135
PEU2300	Port Expander Unit	12,312	27	315	266
MASS STORAGE					
DDU0001/2	Diskette Drive; maximum of two drives	6,441	52	213	180
MSS0317	40.3-Megabyte Mass Storage Subsystem; includes addressing and two spindles	16,580	135	609	508
MSF0317	18.1-Megabyte additional capacity for first two spindles on MSS0317 mass storage subsystem	2,180	NA	58	48
MSF0318	29.2-Megabyte additional capacity for each of the 3rd through 6th spindles	6,420	75	240	201
MSU0330/0331	80-Megabyte Disk Drive and cabinet for drawer mounting (CPS2000)	15,700	81	517	426
CPA2327	Addressing for first two MSU0330 Disk Drives	8,320	10	176	148
CPA2328	Addressing for third and fourth MSU0330 Disk Drives	1,035	4	32	27
CPA2329	Addressing for fifth and sixth MSU0330 Disk Drives	1,035	4	32	27
MSU0390	300-Megabyte Disk Drive	34,500	189	1,238	1,041
CPA2333	Addressing for first two MSU0390 Disk Drives	8,320	10	176	148
CPA2334	Addressing for third and fourth MSU0390 Disk Drives	1,035	4	32	27
CPA2335	Addressing for fifth and sixth MSU0390 Disk Drives	1,035	4	32	27
CPA2336	Addressing for first and second MSU0390 Disk Drives utilizing CPA2127 addressing feature	1,035	4	32	27
CPA2337	Addressing for third and fourth MSU0390 Disk Drives utilizing CPA2127 addressing feature	1,035	4	32	27

*Rental prices include maintenance.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
TERMINALS (Continued)					
7715R	Direct Connect Timing Source	350	3	—	13
7722R	10-cps/30-cps/1200-cps Printer Adapter and Timing Source	750	8	—	29
7725R	Keyboard Keylock	57	2	—	3
7703A/B	Multistation Interface Unit	2,420	23	—	97
7719A/B	Multistation Interface Unit, MIL STD 1886	3,025	20	105	91
RK7719	Dual Channel Expander for 7719; maximum of four	—	—	—	—
RK7703A/B	Dual Channel Expander for 7703A/B	—	—	—	—
7760-60	Master Control Unit; includes diskette drive and interface, terminal controller, communications controller, program loader, and program media	16,800	66	—	457
7761-60	Auxiliary Control Unit; includes data path interface, terminal controller, and program loader; requires 7760-60 and 7767	11,200	36	—	305
7731	Display Adapter for 1920 characters; includes ASCII video generator and storage for 24 lines of 80 characters, required for each display	1,200	5	—	33
7732	Display Adapter for 960 characters; includes ASCII video generator and storage for 12 lines of 80 characters; provides connection for two display stations	1,200	5	—	33
7734	RO Printer Adapter; includes 1920-character print buffer and logic; for 30-cps or 120-cps RO printer	1,360	5	—	36
7767	Datapath Interface; requires 7760-60	960	8	—	27
7768	Direct Timing Source; requires 7760-60	240	1	—	6
7769	Line Repeater Unit; requires 7706-60 or 7707-60	399	2	—	11
7706-60	Display/Keyboard Unit; requires 7731 or 7732	1,750	17	—	50
7707-60	Display/Monitor Unit; requires 7731 or 7732	1,350	9	—	34
7707-64	Keyboard with Numeric Pad; requires 7707-60	400	9	—	16
7716A/B	RO Printer; 30 cps, 120 positions; includes tractor feed	3,600	31	—	151
7717A/B	RO Printer; 120 cps, 120 positions, includes tractor feed	4,360	54	—	180
7741-60	Additional Diskette Device; requires 7760-60	2,166	20	—	61
DATA COMMUNICATIONS EQUIPMENT					
DCC2001	Integrated Data Communications Controller; Second Unit	2,451	5	63	53
DCA2301	Addressing for two Asynchronous Lines	1,653	23	65	55
DCA2302	Addressing for two Synchronous Remote Lines	1,653	23	65	55
DCA2303	Addressing for two Synchronous Direct Lines	342	3	12	10
DCF2300	Terminator for Asynchronous Direct Line	342	3	12	10
DCF2301	Terminator for Asynchronous Remote Line	456	5	16	14
DCF2302	Terminator for Synchronous Remote Line	912	12	36	30
DCF2303	Terminator for Synchronous Direct Line	57	NC	1	1

SOFTWARE PRICES

		Monthly License Fee	Paid-Up License
SYSTEMS SOFTWARE			
SBC0005***	Communications Software—Synchronous Terminals	184	NA
SBC0006***	Communications Software—Asynchronous Terminals	184	NA
SBC0007***	Bisynchronous Communications, IBM 2780 Mode (CP-to-CP)	184	NA
SBC0008***	Bisynchronous Communications, IBM 3741 Terminal Mode	15	NA
SBC0014***	Binary Synchronous 3 Communications Control Supervisor	184	NA
SBC0015***	Binary Synchronous 3 Communications Tributary Supervisor	184	NA
SBC0016***	Binary Synchronous Communications Multileaving Supervisor	184	NA
SBD0001	Universal TOTAL 12; includes maintenance for one year	652	17,932*
SBC0070	Interactive Processing System	62	NA
SBL0002	RPG	16	NA
SBL0005	Cobol-74	122	NA
SBL0007	Fortran	159	NA
SBL0008	Cobol Macroprocessor	67	NA
SBU0002	Sort/Merge	75	NA
SBU0005	Basic Utilities & Test Data Generator	17	NA
SBU0007	IBM 2780 Emulator Utility (CP-to-CP)	15	NA
SBU0008	IBM 3741 Emulator Utility	15	NA
SBJ0001	Transaction Response System	NA	1,594
SBJ0002	Data Collection System for VIP7700	NA	797
SBS0202	Job Accounting	23	NA
SBU0010	Transaction Programming System (TPS)	13	NA
APPLICATION SOFTWARE			
ABD6018	On-Line Sales Order Processing; requires SBJ0001 Transaction Response System	420	13,460

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PROGRAMMING LANGUAGES: Honeywell provides three popular programming languages for Level 62 Systems: COBOL, RPG, and FORTRAN.

Level 62 COBOL: This compiler conforms to American National Standard specification X3.23-1974. The level of implementation of each of the functional processing modules is as follows:

Module	Level of Implementation
Nucleus	2
Table Handling	1
Sequential I/O	2*
Relative I/O	2*
Indexed I/O	2*
Sort	2
Segmentation	2
Inter-Program Communication	1
Debug	2
Library	1
Communications	2

*Not a complete implementation.

Three modules are incomplete implementations of the indicated levels. The Sequential I/O module omits variable-length and spanned record capabilities, the Relative I/O module omits variable-length record capabilities, and the Indexed I/O module omits ALTERNATE KEY and variable-length record capabilities.

The compiler is disk-resident and accepts inputs from 80- or 96-column cards or from the source unit library disk. It produces object-code modules from disk work files that can be linked into executable load modules.

Comprehensive diagnostic and debugging tools are included with Level 62 COBOL. The diagnostic routines produce listings, data maps, card maps, and cross-reference listings. The debugging routines permit specification of data items and procedures to be monitored during program execution. All debugging statements can be automatically omitted from the compilation once the program is finished.

The Level 62 COBOL compiler requires 34,816 bytes of main memory, one disk unit, a printer or spooling file, and a sequential input device or source library.

The COBOL Data Communications Extension (GTC/MCS) is an optional extension to the basic COBOL ANS 74 language processor that provides language and functions representing Level 1 support of the Communications Module of the 1974 COBOL ANS Standard.

FORTRAN: Level 62 FORTRAN is a version of ANSI FORTRAN IV with some extensions. The language processor consists of two packages, the FORTRAN compiler and the FORTRAN run-time package. Level 62 FORTRAN occupies 28,672 bytes of main memory and requires one disk unit, one printer or spooling file, and one sequential input device, input stream, or source library.

RPG: The RPG language processor used in Level 62 systems permits the interchange of data files among RPG, FORTRAN, and COBOL programs. Object programs can be written in COBOL, FORTRAN, or other languages. The Level 62 RPG compiler occupies 28,672 bytes of main memory and requires one disk unit, one printer or spooling file, and one sequential input device or source library.

APPLICATIONS SOFTWARE: Honeywell offers several vendor-supported user applications as well as its Applications Reference Index (ARI). The ARI program is a service established by Honeywell that lists applications software packages that have been developed by non-Honeywell sources and are offered for sale by the developer. The ARI currently lists and describes over 100 applications packages.

Application packages available for Level 62 systems include Accounts Payable, Accounts Receivable, General Ledger, Payroll, Inventory Management, and Production Scheduling and Control System. A complete list of all Honeywell-supported packages is listed in the Equipment Prices section of this report.

PRICING

EQUIPMENT: The following systems are representative of the wide range of possible Series 60 Level 62 configurations. The quoted rental prices are for the basic one-year lease and include equipment maintenance.

MINIMUM LEVEL 62 SYSTEM: Includes a Level 62 CPU with 96K bytes of memory, a 40.2-megabyte disk subsystem consisting of two 20.1-megabyte MSS0317 disk pack drives, a 100-lpm PRS0115 line printer, and one of the following system input devices: a cassette tape drive or a diskette drive. This minimum configuration is priced at $65,703 or $1,590 per month on a five-year lease. Maintenance charge is $435 per month.

TYPICAL TWO-USER LEVEL 62 SYSTEM: Includes a 160K-byte CPU with the type "C" performance upgrade (33 percent) module, 30-cps console printer/keyboard, and two synchronous direct line adapters; a 160-megabyte disk subsystem consisting of two 80-megabyte MSU0300/0331 drives; a 450-lpm PRS0458 line printer; a 200-cpm CRU0300 card reader; and two VIP7804 1920-character CRT display terminals. This configuration can be purchased for $109,353 or rented for $2,583 per month on a five-year lease. Maintenance charge is $608 per month.

LARGE LEVEL 62 SYSTEM: Includes a 224K-byte CPU with the type "D" performance upgrade (78 percent) module, 120-cps console printer/keyboard, dual cassette tape drives, port expander unit; and two local and six remote synchronous lines; a 480-megabyte disk subsystem consisting of six 80-megabyte MSU0330/0331 disk drives; four 37.5-ips, 9-track MTU0220 magnetic tape units; a 1600-lpm PRU1600 line printer; a 1050-cpm CRU1050 card reader with mark sense capabilities; and a PCU0120 card punch. The system can be purchased for about $376,311 or rented for about $9,528 per month. Monthly maintenance charge is $2,181.

SOFTWARE: Generally, the basic operating system, basic job management and file systems, programming tools such as linking and debugging aids, the job control language, and conversion aids are provided to Level 62 users at no additional cost. Users also receive communications supervisors at no extra cost. A basic kit of documentation is also provided with the system. Monthly license fees are charged for language processors, utilities, application packages, communications software, and advanced job management and file systems. Extra charges are also levied for customer services, such as education, program development, system design, implementation and conversion, and network design.

CONTRACT TERMS: Level 62 equipment is available for purchase or for rental under a 1-year, 5-year or 6-year lease. Selected peripherals are offered on a 3-year lease. Monthly rental prices include on-call maintenance between the hours of 8 a.m. and 12 midnight.■

Honeywell Series 60, Level 62

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
LINE PRITNERS (Continued)					
CPA2110	Addressing for PRU1200/1600	13,224	45	331	297
PRF0022	160 Print Positions, PRU1200/1600 Line Printers	2,610	15	93	78
PRB0402	Print Belt, 48 characters, IBM	2,567	95	165	151
PRB0513	Print Belt, 63 characters, ASCII	2,460	90	151	134
PRB0600	Print Belt, 94 characters, ASCII	2,567	90	165	151
PRB0703	Print Belt, 64 characters, Series 200/2000	2,460	90	151	134
CARD EQUIPMENT					
CRU0300	80-Column Card Reader, 300 cpm	6,441	55	197	167
CRU0306	96-Column Card Reader, 300 cpm	6,441	55	197	167
CPA2116	Addressing for CRU0306	969	3	25	21
PEA2116	Port Expansion Unit Addressing for CRU0306 Card Reader	969	3	25	21
CRU0500	80-Column Card Reader, 500 cpm	7,560	68	247	219
CPA2111	Addressing for CRU0300/0500	1,995	10	55	46
CRF0001	IBM Mark Sense for CRU0300/0500 Card Reader	4,305	19	141	125
CRF0002	HIS Mark Sense for CRU0300/0500 Card Reader	4,305	19	141	125
CRU0600	80-Column Card Reader, 600 cpm	21,126	125	715	620
CRU1050	80-Column Card Reader, 1050 cpm	25,290	185	891	766
CRF0003	51-Column Card Capability for CRU0600/1050	2,079	5	67	55
CRF0004	Mark Sense for CRU0600, HIS and IBM format	7,787	48	237	205
CRF0005	Mark Sense for CRU1050, HIS and IBM format	7,787	48	237	205
CPA2112	Addressing for CRU0600/1050	3,078	11	80	67
PCU0120	80-Column Card Punch, 100 to 400 cpm	19,078	116	700	589
CPA2114	Addressing for PCU0120	3,762	13	99	83
TERMINALS					
VIP7100	Asynchronous CRT, 12 lines of 80 characters, TTY-compatible	1,500	23	—	64
VIP7105	Asynchronous CRT, 12 lines of 80 characters, upper and lower case, TTY-compatible	1,600	24	—	67
VIP7804	Synchronous CRT, 24 lines of 80 characters, 95 ASCII character set, 12-inch screen	3,060	33	—	114
VIP7805	Synchronous CRT, 24 lines of 80 characters, 95 ASCII character set, 15-inch screen	3,360	39	—	128
7700R	Synchronous CRT, 24 lines of 80 characters, 63 ASCII character set, upper case only; requires 7731 or 7732	3,990	36	—	142
7705R	Same as 7700R but with 95 ASCII character set	3,990	36	—	142
7715R	Direct Connect Timing Source	350	3	—	13
7722R	10-cps/30-cps/1200-cps Printer Adapter and Timing Source	750	8	—	29
7725R	Keyboard Keylock	57	2	—	3
7703A/B	Multistation Interface Unit	2,420	23	—	97
7719A/B	Multistation Interface Unit, MIL STD 1886	3,025	20	105	91
RK7719	Dual Channel Expander for 7719; maximum of four	—	—	—	—
RK7703A/B	Dual Channel Expander for 7703A/B	—	—	—	—
7760-60	Master Control Unit; includes diskette drive and interface, terminal controller, communications controller, program loader, and program media	16,800	66	—	457
7761-60	Auxiliary Control Unit; includes data path interface, terminal controller, and program loader; requires 7760-60 and 7767	11,200	36	—	305
7731	Display Adapter for 1920 characters; includes ASCII video generator and storage for 24 lines of 80 characters, required for each display	1,200	5	—	33
7732	Display Adapter for 960 characters; includes ASCII video generator and storage for 12 lines of 80 characters; provides connection for two display stations	1,200	5	—	33
7734	RO Printer Adapter; includes 1920-character print buffer and logic; for 30-cps or 120-cps RO printer	1,360	5	—	36
7767	Datapath Interface; requires 7760-60	960	8	—	27
7768	Direct Timing Source; requires 7760-60	240	1	—	6
7769	Line Repeater Unit; requires 7706-60 or 7707-60	399	2	—	11
7706-60	Display/Keyboard Unit; requires 7731 or 7732	1,750	17	—	50
7707-60	Display/Monitor Unit; requires 7731 or 7732	1,350	9	—	34
7707-64	Keyboard with Numeric Pad; requires 7707-60	400	9	—	16
7716A/B	RO Printer; 30 cps, 120 positions; includes tractor feed	3,600	31	—	151
7717A/B	RO Printer; 120 cps, 120 positions, includes tractor feed	4,360	54	—	180
7741-60	Additional Diskette Device; requires 7760-60	2,166	20	—	61
DATA COMMUNICATIONS EQUIPMENT					
DCC2001	Integrated Data Communications Controller	2,451	5	58	49
DCA2301	Addressing for two Asynchronous Lines	1,653	23	60	51
DCA2302	Addressing for two Synchronous Remote Lines	1,653	23	60	51
DCA2303	Addressing for two Synchronous Direct Lines	342	3	11	9
DCF2300	Terminator for Asynchronous Direct Line	342	3	11	9
DCF2301	Terminator for Asynchronous Remote Line	456	5	15	13
DCF2302	Terminator for Synchronous Remote Line	912	12	33	28
DCF2303	Terminator for Synchronous Direct Line	57	NC	1	1

*Rental prices include maintenance.

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are logical records that do not have index entries in the main index. Each C-record is associated with a P-record via a pointer in the P-record. A C-record can in turn point to another C-record.

The indexed file organization permits up to eight secondary indexes to be created by a utility program that constructs index entries according to a key, other than the prime key, without distinguishing between P-records and C-records.

Indexed organization is best suited for files that are processed rapidly in sequence but also need to be available for direct inquiry.

Relative files are characterized by a predictable relationship between the key of each record and the address of that record on a disk device. This relationship is established by the user. Relative file organization is used when the time required to locate individual records must be kept to an absolute minimum. This technique is useful for direct inquiry system and transaction processing systems in which file size is relatively stable and the control field (key) can be easily used to develop a relative record number.

The GCOS fail-soft feature allows the operator to reconfigure main memory in the event of a memory failure or to bypass or make a substitution for certain malfunctioning peripheral devices. If a memory module fails, only those jobs directly affected by the failure are aborted. The operator can allow unaffected jobs to run to completion and then reconfigure main memory, or all executing jobs can be suspended, memory reconfigured, and suspended jobs restarted.

The Level 62 GCOS Communications Subsystem supports up to 25 communications lines operating in the synchronous or asynchronous transmission modes. It performs such functions as line discipline, terminal device handling, control character editing, message queuing, error handling and recovery, and synchronization of multiple simultaneous data transmission activities. COBOL communications verbs are supplied to provide and interface between COBOL applications programs and the communications subsystem. These include the ENABLE, SEND, RECEIVE, and DISABLE verbs.

GCOS Level 62 supports three standard programming languages: ANSI standard COBOL-74, RPG, and FORTRAN. A version of the Cincom Systems TOTAL data base management system is also provided. Level 62 GCOS also supports several software investments when changing from certain Honeywell and non-Honeywell systems. Among the source coding that can be converted for use on Level 62 systems is IBM System/3 RPG programs; System/360 Model 20 RGP and System/360 Model 20 files; and Honeywell Series 200/2000 COBOL, Series 200/2000 Easycoder, Series 200/2000 files, and Series 100 programs and files.

TOTAL: TOTAL Universal, available for Level 62 systems, is designed for small-scale implementations. It requires 14K bytes of main memory plus an additional amount for I/O buffers. A read-only version that requires only 7K bytes is also offered. The TOTAL Data Base Management System is designed and marketed by Cincom Systems, Inc., and is fully described in Report M12-132-101.

TRANSACTION PROCESSING SYSTEM (TPS): TPS permits users to execute real-time functions through a network of terminals. These functions are user-defined interactive Transactional Programs (ITP's) and are developed using an RPG/COBOL-like language. TPS manages a set of predefined (active) ITP's each of which may access files that have been declared as belonging to the particular environment of the TPS activity.

Multiple ITP's can be initiated through a user terminal. When this condition occurs, the TPS controls and insures the integrity of each active program and its respective file updating requirements. TPS activities can be run concurrently with other batch or communications activities.

TPS currently supports only two terminals, the VIP 7700 and the DTU7170. Terminals cannot directly establish and maintain dialogues with other terminals.

PROGRAMMING LANGUAGES: Honeywell provides three popular programming languages for Level 62 Systems: COBOL, RPG, and FORTRAN.

Level 62 COBOL: This compiler succeeds Honeywell's COBOL-68 and conforms to American National Standard specification X3.23-1974, which includes several enhancements over the older version. The level of implementation of each of the functional processing modules is as follows:

Module	Level of Implementation
Nucleus	2
Table Handling	1
Sequential I/O	2*
Relative I/O	2*
Indexed I/O	2*
Sort	2
Segmentation	2
Inter-Program Communication	1
Debug	2
Library	1
Communications	2

*Not a complete implementation.

Three modules are incomplete implementations of the indicated levels. The Sequential I/O module omits variable-length and spanned record capabilities, the Relative I/O module omits variable-length record capabilities, and the Indexed I/O module omits ALTERNATE KEY and variable-length record capabilities.

Honeywell, however, has implemented enhancements of its own design in certain modules. The Indexed I/O module has provisions for complementary records, and the Communications module has extensions that improve message processing. In addition, the Nucleus module contains enhancements to some basic functions.

Features not in COBOL-68 and added to the COBOL-74 compiler include: augmented debugging facilities that permit users to specify the debugging techniques in the program and later eliminate them from the final compilation; improved capabilities for terminal communications; the ability to call other programs, including those written in other languages; device independence for sequential files; enhanced text copying capabilities, expanded sequential file functions, and improved indexed I/O techniques that effectively enlarge mass storage capacity.

The compiler is disk-resident and accepts inputs from 80- or 96-column cards or from the source unit library disk. It produces object-code modules from disk work files that can be linked into executable load modules. Users can specify different equipment environments at compile time and at execution time. Compilation can be performed from mixed peripheral inputs or the source library, since all input is integrated into common disk work files.

Comprehensive diagnostic and debugging tools are included with Level 62 COBOL. The diagnostic routines produce listings, data maps, card maps, and cross-reference listings. The debugging routines permit specification of data items

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SOFTWARE: Generally, the basic operating system, basic job management and file systems, programming tools such as linking and debugging aids, the job control language, and conversion aids are provided to Level 62 users at no additional cost. A basic kit of documentation is also provided with the system. Monthly license fees are charged for language processors, utilities, application packages, communications software, and advanced job management and file systems. Extra charges are also levied for customer services, such as education, program development, system design, implementation and conversion, and network design.

CONTRACT TERMS: Level 62 equipment is available for purchase or for rental under a 1-year, 5-year or 6-year lease. Selected peripherals are offered on a 3-year lease. Monthly rental prices include on-call maintenance between the hours of 8 a.m. and 12 midnight.■

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
CENTRAL PROCESSOR					
CPS2004	Basic Level 62 Central Processor; includes CPU, 96K bytes of MOS memory, six integrated channels, and a system console consisting of a keyboard, 30-cps printer, console diskette or tape cassette unit, and single-line communications controller	$33,192	$160	$855	$719
MAIN STORAGE					
CMM2354	32K-Byte Main Memory Module and addressing	3,315	13	94	80
CAB 2304	Memory Expansion above 224K bytes	11,165	12	250	122
CMM238X	128K-Byte Main Memory Module and addressing	2,750	11	83	70
PROCESSOR OPTIONS					
CPF2300	Scientific Instruction Set	456	1	11	9
CSF2309	120-cps Console Printer, replaces 30-cps printer in basic system	3,591	13	91	77
CPF2304	Performance Module C; provides 33 percent increase in performance	5,956	13	137	115
CPF2305	Performance Module D; provides 78 percent increase in performance	7,496	12	161	135
CPF2307	Performance Module E; provides 90 percent increase in performance	6,614	20	149	125
PEU2300	Port Expander Unit	12,312	27	292	246
MASS STORAGE					
DDU0001/2	Diskette Drive; maximum of two drives	6,441	47	188	159
MSS0317	40.3-Megabyte Mass Storage Subsystem; includes addressing and two spindles	16,580	135	564	470
MSF0317	18.1-Megabyte additional capacity for first two spindles on MSS0317 mass storage subsystem	2,180	NA	54	44
MSF0318	29.2-Megabyte additional capacity for each of the 3rd through 6th spindles	6,420	68	211	177
MSU0330/0331	80-Megabyte Disk Drive and cabinet for drawer mounting (CPS 2000)	15,700	77	479	394
CPA2327	Addressing for first two MSU0330 Disk Drives	8,320	10	163	137
CPA2328	Addressing for third and fourth MSU0330 Disk Drives	1,035	4	30	25
CPA2329	Addressing for fifth and sixth MSU0330 Disk Drives	1,035	4	30	25
MSU0390	300-Megabyte Disk Drive	34,500	180	1,146	964
CPA2333	Addressing for first two MSU0390 Disk Drives	8,320	10	163	137
CPA2334	Addressing for third and fourth MSU0390 Disk Drives	1,035	4	30	25
CPA2335	Addressing for fifth and sixth MSU0390 Disk Drives	1,035	4	30	25
CPA2336	Addressing for first and second MSU0390 Disk Drives utilizing CPA2127 addressing feature	1,035	4	30	25
CPA2337	Addressing for third and fourth MSU0390 Disk Drives utilizing CPA2127 addressing feature	1,035	4	30	25
MAGNETIC TAPE EQUIPMENT					
CTU0002/2	Cassette Tape Drive; maximum of two drives	6,441	47	188	159
MTU0111	18.75-ips Slave Drive	6,389	41	189	153
MTU0120	18.75-ips Primary Drive	7,644	52	228	186
MTU0121	18.75-ips Secondary Drive	6,389	41	189	153
MTU0211	37.5-ips Slave Drive	8,568	60	291	253
MTU0220	37.5-ips Primary Drive	9,980	70	317	257
MTU0221	37.5-ips Secondary Drive	8,160	57	260	211
MTF0101	1600-bpi, 9-track Read/Write Head for MTU0211/0220/0221 magnetic tape drives	2,274	13	67	60
MTF0102	800/1600-bpi, 9-track Read/Write Head for MTU0211/0220/0221 magnetic tape drives	2,630	33	99	87
MTF0103	200/556-800-bpi, 7-track Read/Write Head for MTU0211/0220/0221 magnetic tape drives	2,630	33	99	87
MTF1002	NRZ Option	240	—	5	5

*Rental prices include maintenance.

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		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
TERMINALS (Continued)					
7707-64	Keyboard with Numeric Pad; requires 7707-60	400	8	—	15
7716A/B	RO Printer; 30 cps, 120 positions; includes tractor feed	3,600	31	—	141
7717A/B	RO Printer; 120 cps, 120 positions, includes tractor feed	4,360	54	—	168
7741-60	Additional Diskette Device; requires 7760-60	2,166	17	—	57
DATA COMMUNICATIONS EQUIPMENT					
DCC2001	Integrated Data Communications Controller	2,451	5	58	49
DCA2301	Addressing for two Asynchronous Lines	1,653	23	60	51
DCA2302	Addressing for two Synchronous Remote Lines	1,653	23	60	51
DCA2303	Addressing for two Synchronous Direct Lines	342	3	11	9
DCF2300	Terminator for Asynchronous Direct Line	342	3	11	9
DCF2301	Terminator for Asynchronous Remote Line	456	5	15	13
DCF2302	Terminator for Synchronous Remote Line	912	12	33	28
DCF2303	Terminator for Synchronous Direct Line	57	NC	1	1

*Rental prices include maintenance.

SOFTWARE PRICES

		Monthly License Fee	Paid-Up License
SYSTEMS SOFTWARE			
SBC0005	Communications Software—Synchronous Terminals	160	NA
SBC0006	Communications Software—Asynchronous Terminals	160	NA
SBC0007	Bisynchronous Communications, IBM 2780 Mode (CP-to-CP)	160	NA
SBC0008	Bisynchronous Communications, IBM 3741 Terminal Mode	13	NA
SBC0014	Binary Synchronous 3 Communications Control Supervisor	160	NA
SBC0015	Binary Synchronous 3 Communications Tributary Supervisor	160	NA
SBC0016	Binary Synchronous Communications Multileaving Supervisor	160	NA
SBD0001	Universal TOTAL 12; includes maintenance for one year	515	15,593*
SBL1002	RPG	14	NA
SBL0005	COBOL-74	106	NA
SBL0007	FORTRAN	138	NA
SBL0008	COBOL Macroprocessor	58	NA
SBU0002	SORT/MERGE	65	NA
SBU0005	Basic Utilities & Test Data Generator	15	NA
SBU0007	IBM 2780 Emulator Utility (CP-to-CP)	13	NA
SBU0008	IBM 3741 Emulator Utility	13	NA
SBJ0001	Transaction Response System	NA	1,386
SBJ0002	Data Collection System for VIP7700	NA	693
APPLICATION SOFTWARE			
0010	Sales Order Processing—Order Entry Module	81	2,500
0012	Sales Order Processing—Inventory Accounting Module	54	1,675
0016	Sales Order Processing—Billing and Shipment Module	81	2,500
0017	Sales Order Processing	216	6,675
6011	Sales Order Processing—On-Line Order Entry	130	4,400
6013	Sales Order Processing—On-Line Inventory Accounting; requires SBJ0001 Transaction Response System	90	2,750
ABD6018	On-Line Sales Order Processing; requires SBJ0001 Transaction Response System	365	11,704
ABD0020	PROFIT—Inventory Forecasting Module	197	6,912
ABD0023	PROFIT—Level I	295	10,370
ABD0024	PROFIT—Level II	361	12,674
ABF0001	Accounts Receivable	95	2,387
ABF0002	Accounts Payable	95	2,387
ABF0003	General Ledger	95	2,387
ABF0004	Payroll	95	2,387
ABF0011	Accounts Receivable On-Line	120	3,025
ABF6004**	Payroll Tax Update (for ABF0004)	NA	NA**
ABH0001	Hospital Accounting System (HAS/62)	319	9,550
ABM0002	Production Scheduling and Control (Infinite)	178	6,239
ABM0012	Production Data Management	76	2,674
ABM0022	Capacity Requirements Planning/Production Control Reporting	101	3,565
ABM0011	Inventory Reporting/Bill of Material Processor	106	3,725
ABM0041	Material Requirements Planning	96	3,375
ABM0021	Material Requirements Planning/Resource Inventory	197	6,877
ABM0031	Standard Cost Control	54	1,918
ABM0051	IMS On-Line Inquiry Data Entry	92	3,234

*Software maintenance is required at $1,040 per year.
**The Payroll Update is available for an annual fee of $353 to all customers.

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		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
TERMINALS (Continued)					
7707-64	Keyboard with Numeric Pad; requires 7707-60	400	7	17	14
7716A/B	RO Printer; 30 cps, 120 positions; includes tractor feed	4,500	28	152	132
7717A/B	RO Printer; 120 cps, 120 positions, includes tractor feed	5,450	49	182	157
1741-60	Additional Diskette Device; requires 7760-60	2,166	15	62	53
DATA COMMUNICATIONS EQUIPMENT					
DCC2000	Integrated Data Communications Controller	2,451	5	54	49
DCA2301	Addressing for two Asynchronous Lines	1,653	23	56	51
DCA2302	Addressing for two Synchronous Remote Lines	1,653	23	56	51
DCA2303	Addressing for two Synchronous Direct Lines	342	3	10	9
DCF2300	Terminator for Asynchronous Direct Line	342	3	10	9
DCF2301	Terminator for Asynchronous Remote Line	456	5	14	13
DCF2302	Terminator for Synchronous Remote Line	912	11	31	28
DCF2303	Terminator for Synchronous Direct Line	57	NC	1	1

*Rental prices include maintenance.

SOFTWARE PRICES

		Monthly License Fee	Paid-Up License
SYSTEMS SOFTWARE			
SBC0005	Communications Software—Synchronous Terminals	145	NA
SBC0006	Communications Software—Asynchronous Terminals	145	NA
SBC0007	Bisynchronous Communications, IBM 2780 Mode (CP-to-CP)	145	NA
SBC0008	Bisynchronous Communications, IBM 3741 Terminal Mode	12	NA
SBC0014	Binary Synchronous 3 Communications Control Supervisor	145	NA
SBC0015	Binary Synchronous 3 Communications Tributary Supervisor	145	NA
SBC0016	Binary Synchronous Communications Multileaving Supervisor	145	NA
SBD0001	Universal TOTAL 12; includes maintenance for one year	515	14,175*
SBL1002	RPG	13	NA
SBL0005	COBOL-74	96	NA
SBL0007	FORTRAN	125	NA
SBL0008	COBOL Macroprocessor	53	NA
SBU0002	SORT/MERGE	59	NA
SBU0005	Basic Utilities & Test Data Generator	14	NA
SBU0007	IBM 2780 Emulator Utility (CP-to-CP)	12	NA
SBU0008	IBM 3741 Emulator Utility	12	NA
SBJ0001	Transaction Response System	NA	1,260
SBJ0002	Data Collection System for VIP7700	NA	630
APPLICATION SOFTWARE			
0010	Sales Order Processing—Order Entry Module	81	2,500
0012	Sales Order Processing—Inventory Accounting Module	54	1,675
0016	Sales Order Processing—Billing and Shipment Module	81	2,500
0017	Sales Order Processing	216	6,675
6011	Sales Order Processing—On-Line Order Entry	130	4,400
6013	Sales Order Processing—On-Line Inventory Accounting; requires SBJ0001 Transaction Response System	90	2,750
ABD6018	On-Line Sales Order Processing; requires SBJ0001 Transaction Response System	332	10,640
ABD0020	PROFIT—Inventory Forecasting Module	179	6,284
ABD0023	PROFIT—Level I	268	9,427
ABD0024	PROFIT—Level II	328	11,522
ABF0001	Accounts Receivable	86	2,170
ABF0002	Accounts Payable	86	2,170
ABF0003	General Ledger	86	2,170
ABF0004	Payroll	86	2,170
ABF0011	Accounts Receivable On-Line	109	2,750
ABF6004**	Payroll Tax Update (for ABF0004)	NA	NA**
ABH0001	Hospital Accounting System (HAS/62)	290	8,682
ABM0002	Production Scheduling and Control (Infinite)	162	5,672
ABM0012	Production Data Management	69	2,431
ABM0022	Capacity Requirements Planning/Production Control Reporting	92	3,241
ABM0011	Inventory Reporting/Bill of Material Processor	96	3,386
ABM0041	Material Requirements Planning	87	3,068
ABM0021	Material Requirements Planning/Resource Inventory	179	6,252
ABM0031	Standard Cost Control	49	2,744
ABM0051	IMS On-Line Inquiry Data Entry	84	2,940

*Software maintenance is required at $900 per year.
**The Payroll Update is available for an annual fee of $321 to all customers.