

Honeywell Series 60

MANAGEMENT SUMMARY

On April 23, 1974, Honeywell announced its strategy for consolidating the diverse and unbalanced product line that resulted from the merger of Honeywell and the GE computer operations in 1970. Included in the announcement was a new computer family, the Series 60, a collection of enhanced peripheral devices, and a definition of the growth paths through which Honeywell expects to maintain and upgrade its large and diversified customer base. Honeywell called it The Honeywell Information System, a comprehensive group of products and services that include both current systems and the new Series 60 growth systems, plus the hardware and software "bridges" to enable users to grow into the new system.

Honeywell emphasized that the new Series 60 does not obsolete the systems in its current Series 2000 and Series 6000 product lines. Instead, the company announced the Series 60 product line, running under an enhanced version of the comprehensive GCOS operating system, as the ultimate upgrade series for these systems, as well as for the older Series 100, Series 200, Series 400, and Series 600 systems. What's more, Honeywell introduced an array of conversion aids and compatibility features to assist its users in making the transition.

In the United States, Honeywell announced seven new computer models grouped into four "levels" of computer power. These include the Model 62/60, a small-scale system and the only processor model in the ➤

The Honeywell Series 60 is a family of cost-effective upgrade systems for users of the earlier Honeywell Series 100, 200, 2000, 400, 600, and 6000 computer systems. The new product line features a new complement of peripheral equipment, MOS main memories, an enhanced version of the GCOS operating system, and compatibility aids.

CHARACTERISTICS

MANUFACTURER: Honeywell Information Systems, Inc., 200 Smith Street, Waltham, Massachusetts 02154. Telephone (617) 891-8400.

MODELS: Series 60—Level 62, Model 62/60; Level 64, Model 64/20; Level 66, Models 66/20, 66/40, 66/60, and 66/80; Level 68, Model 68/80.

DATA FORMATS

BASIC UNIT: Level 62 and 64: 8-bit byte (plus parity bit); Level 66 and 68: 9-bit byte (plus parity bit).

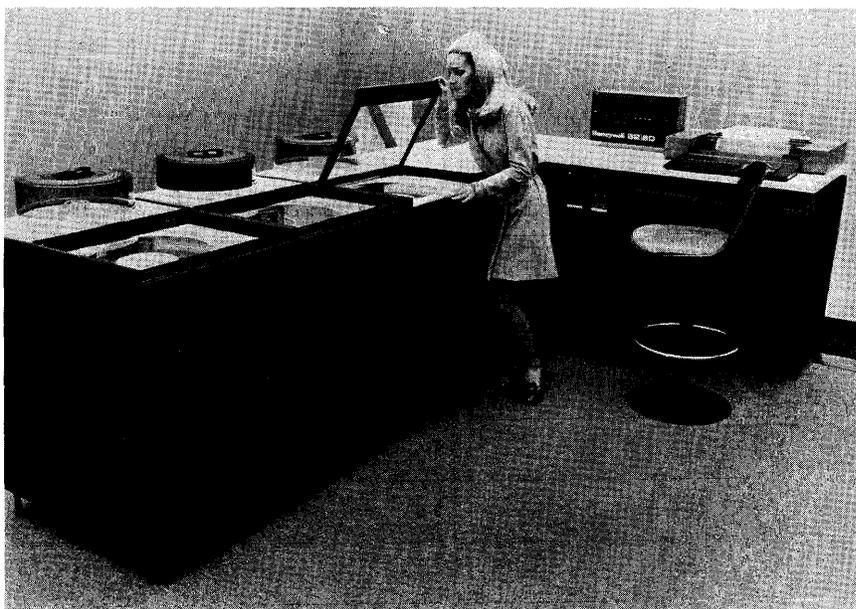
MAIN STORAGE

STORAGE TYPE: Metal oxide semiconductor (MOS).

CAPACITY: See table.

CYCLE TIME: See table.

CHECKING: Parity bit with each word is checked whenever storage is referenced. When the data is retrieved, ➤



The Model 62/60, smallest member of Honeywell's new Series 60 computer family, is a disk-oriented system aimed primarily at new users. It offers from 65K to 131K bytes of 1-microsecond MOS memory. System rental prices range from approximately \$4,000 to \$7,000 per month.

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▷ new product line designed primarily to attract new users, and the Model 64/20, a medium-scale system for upgrading Series 100 and small Series 200 and 2000 computer systems. The Level 66 includes four models, the 66/20, 66/40, 66/60, and 66/80, all aimed at users of large Honeywell 200 and 2000 Series systems, the G-400 systems, and the Series 600 and 6000 systems. Top of the line is the Model 68/80, a 1974 version of the specialized Multics system.

In Europe, Honeywell announced four additional systems that are currently not available to U.S. users. The Level 61 Model 58 and Model 60 are designed as upgrade machines for the Honeywell Bull G-50 Series computers. The Level 62 Model 40 is designed to provide a growth path for Honeywell's large base of Gamma 10 users in Europe. And the Level 64 Model 40 is designed to upgrade the large number of Series 100 users in Europe.

All new processor models in the Series 60 product line are scheduled for volume shipments early in 1975, with some pilot installations at selected sites late in 1974. However, Honeywell indicated that it plans to continue to support and enhance the Series 50, Series 2000, and Series 6000 product lines, which have gained wide acceptance and a substantial number of new users for Honeywell during the past four years.

Recent Honeywell marketing strategies have been aimed at encouraging the outright purchase of systems in the Series 200/2000 and Series 600/6000 product lines. In order to preserve that base of purchased systems, Honeywell announced a trade-in policy for owners of purchased systems who upgrade to Series 60 systems. The discount on the purchase price of the Series 60 system will be determined by the purchase price of the older system, the length of time it has been installed, and the price of the Series 60 upgrade system.

CENTRAL PROCESSOR MODELS

MODEL 62/60. Smallest of the Series 60 models available in the U.S., the Model 62/60 is a small-scale, disk-oriented system aimed primarily at new users. Rental prices for Model 62/60 systems will range from approximately \$4,000 to \$7,000 per month. Main storage capacity ranges from 65,536 to 131,072 8-bit bytes of MOS memory, in 16K-byte increments, with a cycle time of 1.0 microsecond per two bytes.

The Model 62/60 includes integrated controls for a 600 or 1050 card-per-minute card reader, a 400 or 600 line-per-minute printer, and up to four 29-million-byte spindles of disk storage. A limited magnetic tape capability is provided in the form of up to two console tape cassette drives, each of which provides for storage of up to 480K bytes of information and a transfer rate of 700 bytes per second. Six read/write channels are ▷

▶ single-bit errors are detected and retried before software error recovery routines are signalled.

STORAGE PROTECTION: A storage protection feature standard with the Model 62/60 shields data and instruction zones of each program from unauthorized access. In Level 64 and Level 66 systems, individual program segments are protected automatically.

The Model 68/80 Multics system uses a hardware ring mechanism that maintains the integrity of several levels of memory access controls. Each ring is identified with a ring number designating the highest level of privilege allocated to procedure segments executed in that ring. The range of ring numbers is from 0 to 7, with Ring 0 having the highest level of privilege. The structure allows the creation of closed subsystems that are mutually exclusive to each other and thus mutually protective.

CENTRAL PROCESSORS

CONFIGURATION RULES: Models 62/60, 64/20, and 66/20 have a single central processor. Model 66/40 can have one or two central processors, one or two I/O multiplexers, and one or two system controllers. Model 66/60 and Model 66/80 can have from one to four central processors, I/O multiplexers, and system controllers. Model 68/80 systems can have up to four central processors, one or two I/O multiplexers (one of which is a spare for redundancy), and from one to eight system controllers.

REGISTERS: The Model 62/60 central processor includes 8 base registers, 16 general-purpose registers, and 5 memory protection registers. The Model 64/20 central processor includes 8 base registers, 16 general-purpose registers (of which 8 can be used for index registers), and 4 special-purpose registers. In Level 66 processors, the processor registers that are available to the program include: one 72-bit accumulator (A and Q registers), eight index registers, one base register, one indicator register, one instruction counter, one timer register, and one exponent register.

INSTRUCTION REPERTOIRE: Models 62/60 and 64/20 have an instruction set consisting of logic and arithmetic instructions for performing packed and unpacked decimal and binary add, subtract, multiply, divide, and editing operations, and for performing logic operations on data and address computations. In addition, the Model 64/20 Compatibility Mode feature incorporates firmware-based implementation of the Honeywell Series 100 or Series 200/2000 instruction repertoire.

Level 66 and 68 processor models have a comprehensive instruction set for performing data movement, binary arithmetic, shifting, logic, and control operations. The instruction set includes complete arithmetic facilities for performing variable-length fixed and floating point decimal arithmetic, and bit and byte string manipulation for processing bytes, BCD characters, packed decimal data, and bit strings.

CACHE MEMORY: Model 66/60 and Model 66/80 central processors employ a cache memory containing 512 four-word blocks of main memory. The cache contents are controlled by a four-level, set-associative address mapping technique and a first-in/first-out algorithm. ▶

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CHARACTERISTICS OF THE SERIES 60 PROCESSOR MODELS

	Model 62/60	Model 64/20	Model 66/20	Model 66/40	Model 66/60	Model 66/80	Model 68/80
SYSTEM CONFIGURATION	1	1	1	1 to 2	1 to 4	1 to 4	1 to 4
No. of Central Processors	1	1	1	1 to 2	1 to 4	1 to 4	1 to 4
No. of I/O Multiplexors	1	1	1	1 to 2	1 to 4	1 to 4	2 (1 spare)
No. of System Controllers	1	1	1	1 to 2	1 to 4	1 to 4	1 to 8
MAIN STORAGE							
Minimum capacity, bytes	65,536	65,536	327,680	524,288	786,432	1,048,576	1,048,576
Maximum capacity, bytes	131,072	131,072	1,048,576	2,097,152	4,194,304	4,194,304	8,388,608
Cycle time, microseconds	1.0	1.0	1.4	1.4	0.75	0.75	0.75
Bytes fetched per cycle	2	4	8	8	8	8	8
CENTRAL PROCESSOR							
Extended (business) Instruction Set	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cache storage unit	No	No	No	No	Yes	Yes	Yes
INPUT/OUTPUT CONTROL							
Maximum data rate per I/O multiplexer, bytes per second	837,000	1,250,000/ channel (3 max.)	2,700,000	2,700,000	4,000,000	4,000,000	4,000,000
No. of disk drives	4	4	32/control	32/control	32/control	32/control	14/control
No. of magnetic tape units	2 cassette drives	6	16/control	16/control	32/control	32/control	16/control
OPERATING SYSTEM	GCOS-62	GCOS-64	GCOS-66	GCOS-66	GCOS-66	GCOS-66	Multics, GCOS-66
EMULATION	—	Series 200/2000, Series 100	—	—	—	—	—
MONTHLY RENTAL (TYPICAL)	\$4,000 to \$7,000	\$5,000 to \$10,000	\$20,000 to \$25,000	\$35,000 to \$40,000	\$45,000 to \$55,000	\$65,000 to \$102,000	Over \$100,000

➤ standard; an optional port expander permits nonsimultaneous operation of three additional unit record devices connected to one I/O channel. An integrated communications subsystem provides for the connection of up to four asynchronous and/or synchronous communications lines.

The Model 62/60 will run GCOS Level 62, a subset of GCOS that supports concurrent execution of up to two batch jobs plus an output writer, or one batch job, one communications job, and an output writer. Language support will include both ANS COBOL-74 and an IBM System/3-compatible RPG compiler. The multiprogramming capabilities and price/performance of the 62/60 clearly make it a worthy competitor to the IBM System/3 Model 15. In addition, Honeywell is providing software aids for converting System/360 Model 20 RPG programs and data files to Model 62/60 format, thus making the 62/60 a contender for upgrading the more than 3,000 Model 360/20 systems still installed.

Although Honeywell indicates that the Model 62/60 will be the primary vehicle in the Series 60 for attracting new users to its customer base, it will also be of interest to users of very small Honeywell Series 200 equipment ➤

➤ The cache memory in the Model 68/80 central processor is a 2,048-word, high-speed buffer store integrated into the processor. The cache contents are controlled by a four-level, set-associative address mapping technique and a first-in/first-out replacement algorithm.

PROCESSOR MODES: There are two modes of processor operation, master and slave. The master mode, used only by GCOS, allows unrestricted access to all of main memory, permits initiation of I/O operations, and permits setting of control registers. The slave mode is used by user programs and also by GCOS when appropriate. In the slave mode, all storage references are relative to the base address register's contents and are restricted to assigned boundaries, program execution times are limited by the timer registers, and input/output and certain control operations cannot be executed.

INTERRUPTS: Interrupt signals are generated by conditions such as successful completion of I/O operations, I/O errors, arithmetic overflow, timer runout, attempts to reference out-of-bounds storage locations, etc. In Level 62 and Level 64 central processors, interrupts are referred to microprogrammed routines located in the central processor read-only memory for initiation of the appropriate servicing routines. In Level 66 systems, every interrupt results in the setting of a specific interrupt cell in the system controller. This causes the processor to take its next pair of instructions from a predetermined storage location which normally results in ➤

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The Model 64/20 features optional microprogrammed emulation of the Honeywell Series 200/2000 and Series 100 systems and is considered the logical upgrade system for most of the current small-scale installations in Honeywell's large customer base. System rental prices range from approximately \$5,000 to \$10,000 per month.

➤ (such as the Models 105, 110, and 115) and the Series 100 systems. Honeywell is supplying program and file conversion routines to aid users of these systems to convert to the Model 62/60, but no emulation capabilities will be provided for the Series 200/2000 systems on this level of the Series 60.

MODEL 64/20. The Model 64/20 is a medium-scale processor with system rentals ranging from approximately \$5,000 to \$10,000 per month. The 64/20 features from 65,536 to 131,072 8-bit bytes of MOS memory with a cycle time of 1.0 microsecond per four-byte word.

Input/output control in the 64/20 is provided by microprogrammable peripheral processors. The integrated unit record processor contains 6 ports for connection of 600 or 1050 card-per-minute card readers, 100 to 400 card-per-minute card punches, 600, 1200, or 1600 line-per-minute printers, and up to 6 asynchronous and/or synchronous communications lines. The optional console printer and CRT console display also connect via the integrated unit record processor. An integrated mass storage processor permits attachment of up to four ➤

➤ the storage of the processor's status and a transfer to the appropriate servicing routine. In multiprocessor systems, a single "control" processor, determined by a manual switch setting, services all interrupts.

CONSOLE: The Model 62/60 console incorporates a 30 character-per-second serial printer, an alphanumeric typewriter keyboard, one tape cassette subsystem and an optional second cassette handler, and a system operator panel for monitoring the central processor and all peripheral equipment.

The Model 64/20 console provides a keyboard, a system operator panel, and one tape cassette handler. The tape cassette handler is used for system diagnostics. A 30-cps console printer or a CRT console display is optional.

LEVEL 66 AND 68 SYSTEM CONTROL CENTER (SCC): The CSU6002 SCC is a free-standing operator's console consisting of a keyboard, control panel, interactive visual display, system status display, and serial printer. Two optional remote displays can be connected to the SCC: one can be connected to the interactive display, and the second to the status display. The solid-state console keyboard has a conventional alphanumeric keyboard arrangement consisting of 26 alphabetic, 10 numeric, and 28 special character keys. The operator's interactive display and the system status display are 12-inch CRT displays which have a 1920-character display capacity (24 lines with 80 characters per line). The remote displays are both 23-inch CRT's which can be located anywhere within 1,000 feet of the console.

A 30-cps, 80-column serial printer generates hard-copy output of information displayed on either the interactive display or the system status display. The printer can be switched to either display by the operator, and it can handle forms with up to three carbon copies.

COMPATIBILITY FEATURES: The Model 64/20 processor can be equipped with two extra-cost compatibility features that enable it to execute programs written for Series 200/2000 Mod 1 systems and Series 100 systems.

The capabilities of the Series 200/2000 compatibility Mode are implemented by hardware/firmware housed in the read-only storage of the central processor and by compatibility routines that reside in system memory. The firmware routines execute Series 200/2000 instructions. Machine instructions, such as input/output operations, that cannot be directly executed are passed to the compatibility software routines for interpretation and execution. In simulating Series 200/2000 memory, each Level 64 8-bit byte is formatted as the six data bits and two punctuation bits of a Series 200/2000 character position.

Series 200/2000 punched card files and 1/2-inch magnetic tape files, except those recorded at 1200 bits per inch, can be processed in a Level 64 environment without modification. The contents of Series 200/2000 mass storage volumes must be transferred to mass storage volumes compatible with the MSU0310 Mass Storage Units used with compatibility mode, but the logical file structures of Series 200/2000 files need not be modified. ➤

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▷ 29-million-byte or 100-million-byte disk storage drives for a maximum of 400 million bytes of direct-access storage. An optional magnetic tape subsystem permits attachment of up to six 7- or 9-track magnetic tape drives with transfer rates of up to 120K bytes per second.

The 64/20 features optional microprogrammed emulation of Honeywell Series 100 and Series 200/2000 systems and is considered the logical upgrade for the many small-scale systems in Honeywell's customer base, including the Models 115, 120, 125, 200, and 2020.

The Model 64/20 will run under Level 64 GCOS, a subset of the full-scale GCOS operating system. Programming language support will include an ANS COBOL-74 compiler.

LEVEL 66. Four processor models are available within Level 66, all designed as upgrade machines for Honeywell's extensive Series 600/6000 customer base, for large Series 2000 installations, and for users of the older GE-400 Series processors. In addition, their attractive price/performance makes them strong competitors against the other leading medium- to large-scale computer systems. The Level 66 central processors are derived from the highly successful system design of the Honeywell Series 600/6000 central processors and feature instructions for performing decimal arithmetic, byte processing, BCD character processing, bit string manipulation, and packed decimal arithmetic.

All four Level 66 central processors have available the same complement of input/output devices, although the smaller models incorporate integrated peripheral processors and the larger models are configured with free-standing I/O subsystems. A Level 66 unit record processor provides up to eight ports for connection of 1050 card-per-minute card readers, 100 to 400 card-per-minute punches, and 1100, 1200, or 1600 line-per-minute printers. The mass storage processor can handle up to 32 single-channel spindles of direct-access storage, for a total of over 5 billion bytes of on-line direct-access storage. For dual-channel access, the total number of spindles for one mass storage processor is reduced to 16, or a total of 2.5 billion bytes of on-line mass storage. Multiple mass storage processors can be configured. A maximum of 16 magnetic tape units with transfer rates of up to 320,000 bytes per second can be accommodated by the magnetic tape processor. In addition, an optional document handler processor enables a Level 66 central processor to be configured with up to four MICR/OCR document readers.

Level 66 systems are earmarked by Honeywell for large-scale data base/data communications applications. A Level 66 system can include from one to four Datanet 6600 Front-End Network Processors, with each of the ▷

▶ Series 200/2000 Compatibility Mode operation requires a minimum configuration consisting of a Model 64/20 central processor with 64K bytes of main memory, the Compatibility Mode feature, an integrated mass storage processor equipped with the Series 200/2000 Mode feature and addressing for four mass storage devices, an integrated unit record processor, card reader, printer, and console. The Series 200/2000 Compatibility Mode is scheduled for release in the first quarter of 1975.

The Series 100 Compatibility Mode also will be implemented by a combination of microprogramming in the Model 64/20 read-only storage and emulation routines in system memory, supplemented by mass storage and optional magnetic tape subsystem compatibility features to allow processing of Series 100 data files. The Series 100 Compatibility Mode feature is scheduled for availability in the fourth quarter of 1975.

INPUT/OUTPUT CONTROL

CONFIGURATION RULES: The Model 62/60 is a single-processor system with integrated input/output and communications controllers. The central processor includes six channels, with an optional port expander unit permitting nonsimultaneous operation of up to three additional unit record devices on one I/O channel.

The Model 64/20 is a single central processor system with integrated central processor, integrated mass storage processor, and integrated unit record processor. The peripheral processors access main memory via high-speed input/output channels. The integrated unit record processor has up to six device ports to handle card equipment, printers, paper tape equipment, console devices, and the communications controller. The integrated mass storage processor has ports for up to four mass storage units, and the optional magnetic tape processor can control up to six magnetic tape drives. The magnetic tape processor connects to the integrated magnetic tape channel.

The Model 66/20 is a single central processor system with integrated system controller and I/O multiplexer. The I/O multiplexer can contain from 10 to 18 channel board function slots. Three channel boards are required to constitute a channel connection to a peripheral processor, the Datanet 6600 Front-End Network Processor requires one board, and the console requires one or two boards. The unit record peripheral processor can multiplex up to eight logical channels to separate unit record devices through a single channel of the I/O multiplexer. Two dual-channel mass storage processors can be crossbarred to provide four simultaneous channels from the I/O multiplexer to up to 32 disk storage drives. Each magnetic tape processor can handle up to 16 tape drives. Up to four Datanet 6600 Front-End Network Processors can be connected to any Level 66 system through the I/O multiplexer.

The Model 66/40 system can have one or two central processor units. The peripheral processors, I/O multiplexer, and system controller can be integrated into a single control unit. A free-standing I/O multiplexer is also available. The integrated I/O multiplexer provides up to 18 channel boards, and the free-standing I/O multiplexer can contain up to 54 channel boards for peripheral processor connections. Peripheral device addressing capabilities are the same as for the peripheral processors for the Model 66/20.

▶ The Model 66/60 can be configured as an integrated or ▶

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▷ larger models capable of handling up to 380 communications lines.

All Level 66 central processors can operate under the full multidimensional processing capabilities of the GCOS operating system. Programming languages will include ANS COBOL-68 and COBOL-74, PL/1, FORTRAN, ALGOL, JOVIAL, BASIC, and the GMAP assembly language. Level 66 systems can also utilize an enhanced version of the Integrated Data Store (I-D-S) for design and implementation of network-oriented data base management systems.

MODEL 66/20. Smallest of the Level 66 central processors, the Model 66/20 is estimated to provide approximately the same processing power as the Series 6000 Model 6025, but offers expanded configuration ranges. Monthly rentals range from \$20,000 to \$25,000 for typical configurations. The Model 66/20 can include from 327,680 to 1,048,576 9-bit bytes of MOS main memory with a cycle time of 1.4 microseconds per eight bytes. The Model 66/20 features integrated input/output processors and is configured in single central processor systems only.

MODEL 66/40. The 66/40 provides approximately 1.7 times the processing power of the Model 66/20 at typical system rental of \$30,000 to \$40,000 per month. Main memory sizes can range from 524,288 to 2,097,152 million 9-bit bytes of MOS storage with a 1.4-microsecond cycle time for eight bytes. As in the less powerful Model 66/20, the input/output processors of the Model 66/40 are configured in an integrated unit. However, an optional free-standing I/O multiplexer provides redundancy and increased capacity for interfacing the peripheral processors with the system controller. The Model 66/40 can be configured as a dual-processor system.

MODEL 66/60. The 66/60 provides approximately 1.6 times the processing power of the Model 66/40, with monthly rentals for typical configurations ranging from \$45,000 to \$55,000. The Model 66/60 central processor achieves its superior processing speed partially through the use of a high-speed cache memory incorporated in the central processor. In addition, the main memory cycle time of the Model 66/60 is nearly twice as fast as the two smaller Level 66 central processors—0.75 microsecond to access 8 bytes. A Model 66/60 system can include from 786,432 to 4,194,304 9-bit bytes of MOS memory.

The Model 66/60 central processor system is available in either free-standing or integrated configurations. Systems incorporating an integrated control unit can be configured with up to two central processor units, two system controllers, and up to two input/output multiplexers. Free-standing versions of the Model 66/60 ▷

▷ free-standing system. An integrated system can contain one or two central processors, one or two system controllers, and one or two I/O multiplexers. A free-standing system can include from one to four central processors, system controllers, and I/O multiplexers. An integrated I/O multiplexer can contain up to 27 channel boards, and a free-standing I/O multiplexer can have up to 54 channel boards for connecting peripheral processors. The Model 66/80 is available only in free-standing configurations and can contain from one to four central processors, system controllers, and I/O multiplexers. Each I/O multiplexer contains up to 54 channel boards. The characteristics of the peripheral processors are the same as those of the smaller Level 66 peripheral processors.

The Model 68/80 system can include from one to four central processor units, one or two I/O multiplexers, and from one to eight system controllers. One free-standing system controller is required for each 1,048,576-byte memory module. The I/O multiplexer contains 24 data channels of which 7 are reserved for system functions. A maximum of two Datanet 6600 Front-End Network Processors (of which one is a spare for redundancy) can be connected to an I/O multiplexer. Each mass storage processor can handle up to 14 MSU0400 disk drives. Two crossbarred dual-channel mass storage processors provide four channels to up to 14 disk drives. Series 60 unit record devices and magnetic tape drives are controlled by the unit record processor and the magnetic tape processor.

SIMULTANEOUS OPERATIONS: In the Model 62/60, program execution can proceed concurrently with data transfer operations on six overlapping input/output channels. The maximum total input/output rate of the system is 837,000 bytes per second.

The Model 64/20 peripheral processing subsystems can operate concurrently with the central processor. Each high-speed channel has a maximum data transfer rate of 1,250,000 bytes per second, and all three channels can operate simultaneously at the maximum data transfer rate. All devices and terminals attached to a unit record processor can operate simultaneously. Mechanical operations on a disk or tape subsystem, such as seek and rewind, can proceed simultaneously with a data transfer operation on the same subsystem.

In Level 66 and Level 68 systems, all installed processors and I/O multiplexers can operate simultaneously and independently, with interference occurring only when two or more of these units simultaneously attempt to access the same main storage module.

MAXIMUM I/O DATA RATES: The maximum system input/output data rate of a Model 62/60 system is 837,000 bytes per second. The Model 64/20 incorporates three high-speed channels which form a permanent interface between the peripheral processors and the central processor; all three channels can operate simultaneously at their maximum speed of 1,250,000 bytes per second. In Level 66 systems, each I/O multiplexer can handle an aggregate data rate 2,700,000 bytes per second in Models 66/20 and 66/40 and 4,000,000 bytes per second in Models 66/60, 66/80, and 68/80.

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BULK STORE SUBSYSTEM (BSS): The BSS can be used in Model 68/80 systems and in Series 6000 systems ▷

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➤ can include a maximum of four central processor units, four system controllers, and four input/output multiplexers.

MODEL 66/80. Model 66/80, the top member of the Level 66 series, offers 1.4 times the processing power of the Model 66/60 at monthly rentals ranging from \$65,000 to over \$100,000. Offered only in the free-standing configuration, with separate processors, input/output multiplexers, and system controllers, a fully expanded Model 66/80 system can consist of up to four central processor units, four system controllers, and up to four input/output multiplexers. Like the Model 66/60, the Model 66/80 incorporates a processor cache memory with an access time of approximately 100 nanoseconds. Main memory in a Model 66/80 system can consist of from 1,048,576 to 4,194,304 9-bit bytes of MOS memory with a cycle time of 0.75 microsecond per eight bytes.

MODEL 68/80. The top of the new Honeywell Series 60 family, the Model 68/80 is the latest version of Honeywell's Multics hardware and is aimed at a specialized group of users who need the powerful virtual memory capabilities of the Multics operating system. Among the many advanced features of the Model 68/80 processor are hardware for handling segmentation and paging in a virtual memory environment, a high-speed cache memory for improved performance, and an associative memory for fast hardware access to the virtual memory and for efficient address modification. Model 68/80 provides up to 8 million bytes of MOS main memory plus 134 million bytes of bulk core storage. A system can include up to four central processor units plus multiple free-standing peripheral processors. Typical Model 68/80 configurations will rent for well over \$100,000 per month.

SYSTEM ARCHITECTURE

Of the seven new central processor models introduced with the Series 60 in the U.S., the two smallest models are new designs originating from Honeywell overseas operations, and the Level 66 systems are evolutionary upgrades of the Honeywell Series 600/6000 system architecture. All of the new processor models feature extensive use of MSI/LSI integrated circuits for control logic and metal oxide semiconductor (MOS) main memories. All of the new central processors are byte-oriented and access data on a word basis. Level 62 accesses two bytes at a time, Level 64 accesses four bytes, and Level 66 processors access eight bytes per memory cycle. The larger central processors in the Series 60 product line feature increased modularity, thus permitting more extensive use of distributed processing concepts. Both integrated and free-standing system configurations are available, representing varying levels of concurrent processing capabilities and system redundancy.

➤ upgraded to Level 68. BSS is a high-speed data storage subsystem designed for use as an auxiliary "swapping" memory to improve the throughput of Level 68 systems. Up to four BSS modules can be configured in a system for a maximum storage capacity of 134,217,728 bytes. Each module has a storage capacity from 1,048,576 to 33,554,432 bytes, expandable in 1,048,576-byte increments. Cycle time is 1.5 microseconds. The BSS interfaces directly with the system controllers, and it accommodates eight ports. Data is transferred between the BSS and main memory in blocks of 4,096 bytes, and one block is transferred in about 400 microseconds (excluding software overhead). Data transfer speed for the BSS exceeds 10 million bytes per second.

MSU0310 MASS STORAGE UNIT: This unit is designed to provide medium-capacity random-access storage in Level 62, 64, and 66 systems. Storage capacities for the MSU0310 units vary depending on the formatting conventions of the system in which they are used: capacity is 29.2 million bytes per spindle for Level 62 and 64 systems and 18.4 million bytes per spindle for Level 66. Each storage unit uses one Type M4180 disk pack (or equivalent) whose 11 disks have 20 recording surfaces with 203 tracks per recording surface. Transfer rates, like storage capacity, depend on the system; for Levels 62 and 64 the rate is 312,500 bytes per second, while the transfer rate is 277,000 bytes, (or 416000 characters) per second for Level 66. Average seek time is 38 milliseconds (minimum seek time is 10 milliseconds and maximum is 62 milliseconds), and average rotational delay is 12.5 milliseconds. While data transfer is taking place on one unit, simultaneous seek operations can be performed on all the other drives attached to a mass storage processor. Data protection is ensured by a validity check code in each record/sector, and write protection is standard to prevent inadvertant writing on specified disk packs.

Level 62 systems can operate with two to four MSU0310 storage units through an integrated mass storage controller. The Level 64 systems can include from one to four MSU0310 storage units through an integrated mass storage processor. Level 66 systems can operate with one or two MSP0600/0601 mass storage processors. Two dual-channel MSP0600/0601 mass storage processors can be crossbarred to provide four simultaneously operating channels accessible to as many as 32 MSU0310 disk drives. Each dual channel provides for simultaneous operation of two MSU0310 units. Dual-processor crossbarring provides simultaneous access to any two of up to 32 devices that are shared between two mass storage processors. Alternatively, the MSP0600/0601 can be configured as a single-channel processor operating up to 32 storage units. The MSP0600 is integrated into the system input/output multiplexer, while the MSP0601 is a free-standing mass storage processor.

MSU0400 MASS STORAGE UNIT: Designed for high-capacity data processing environments, this unit can be used with Level 64, 66, and 68 systems. Storage capacities per spindle for the MSU0400 units are 100 million bytes in Level 64 systems and 78 million bytes in Level 66 or 68 systems. Each unit uses one Honeywell Type M4050 disk pack (or equivalent), whose 12 disks have 19 recording surfaces with 411 tracks (7 are spares) per recording surface. Transfer rates are 806,000 bytes per second for Level 64 and 716,000 bytes per second for Levels 66 and 68. Average seek time is 25 milliseconds (minimum seek time is 5 milliseconds and maximum is 45 milliseconds), and average rotational delay is 8.3 milliseconds.

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▷ The Model 62/60 is a product of Honeywell Information Systems Italia. It features a processor subsystem with an integrated input/output controller, an integrated communications subsystem, and a 170-nanosecond read-only store for microprogramming of frequently performed operations such as I/O control, error recovery, and instruction execution.

The Model 64/20, designed by Honeywell Bull in France and Honeywell Boston, consists of a 175-nanosecond read-only memory plus a multiple-function logic unit that performs central processor functions. Processing capability of the 64/20 is distributed between the central processor and the integrated peripheral processor subsystems, which contain microprograms and an arithmetic and logic unit to enable them to translate channel programs into device commands, pack and unpack data, independently retry failed commands, and perform on-line device diagnosis without disturbing normal operations. An address control unit containing an associative memory permits Model 64/20 systems operating under Level 64 GCOS to execute software routines as fully relocatable variable-length segments.

The Level 66 central processors are built on the time-tested architectural principles of the Honeywell 6000 Series and are completely compatible with Series 6000/6000 systems. Like the Series 6000, Level 66 machines employ a memory-oriented structure, with from one to four system controllers controlling communication between system components and servicing all demands on main memory by other system components. A microprogrammed I/O multiplexer (IOM) interfaces the peripheral processors and front-end communications processors with the system controllers and can control data transfers between I/O devices and main memory concurrently with program execution. To control I/O operations, Level 66 systems utilize three peripheral processors, a mass storage processor, a magnetic tape processor, and a unit record processor. Peripheral units are radially connected to these processors, thus permitting a single peripheral unit to be taken off-line without affecting the operation of the remaining units.

In integrated Level 66 systems, the IOM, system controller, mass storage processor, and unit record processor are housed in a single integrated control unit. Free-standing systems offer separate central processors, peripheral processors, I/O multiplexers, and system controllers and provide for greater system redundancy and more peripheral subsystem channels. Level 66 Model 60 and Model 80 systems can include up to four central processors, four system controllers, and four IOM's in a single configuration.

All Level 66 processors incorporate the Extended Instruction Set (EIS) originally introduced for the ▷

▶ While data transfer is taking place on one MSU0400 unit, simultaneous seek operations can be performed on the other drives attached to a mass storage processor. Data protection is ensured by a validity check code in each record/sector, and write protection is a standard feature which prevents inadvertent writing on specified disk packs. Further data integrity is afforded by system-controlled offset track spacing, which permits recovering otherwise unrecoverable data.

Level 64 systems use integrated mass storage processors to connect from one to four MSU0400 storage units to a system. Level 68 systems can operate up to 14 MSU0400 units from one MSP0601 mass storage processor, and two such processors can be configured for a total of 28 MSU0400 units in one Level 68 system. Level 66 systems can operate with one or two MSP0600/0601 mass storage processors. Two dual-channel MSP0600/0601 mass storage processors can be crossbarred to provide four simultaneously operating channels accessible to as many as 32 MSU0400 storage units. Each dual channel provides for simultaneous operation of two MSU0400 units. Dual-processor crossbarbing provides simultaneous access to any two of up to 32 devices that are shared between the two processors. Alternatively, the MSP 0600/0601 can be configured as a single-channel processor operating up to 32 storage units which can be intermixed between MSU0400 and MSU0450 units. The MSP0600 is integrated with the system input/output multiplexer, while the MSP0601 is a free-standing mass storage processor.

MSU0450 MASS STORAGE UNIT: This high-capacity unit is used with Level 66 systems only and has a maximum storage capacity of 176 million bytes. Each unit uses one Honeywell Type 4450 disk pack (or equivalent), whose 12 disks have 19 recording surfaces with 823 tracks (15 are spares) per recording surface. Data is transferred at the rate of 806,000 bytes per second. Average seek time is 25 milliseconds (5 milliseconds minimum seek time and 45 milliseconds maximum), and average rotational delay is 8.3 milliseconds. While data transfer is taking place on one unit, simultaneous seek operations can be performed on the other drives attached to a mass storage processor.

Up to two dual-channel MSP0600/0601 mass storage processors can be crossbarred to provide four simultaneously operating channels accessible to as many as 32 MSU0450 storage units. Each dual channel provides for simultaneous operation of two MSU0450 units; dual-processor crossbarbing provides simultaneous access to any two of up to 32 devices that are shared between the two processors, where 16 devices are controlled by each processor. Alternatively, the MSP0600/0601 can be configured as a single-channel processor controlling up to 32 storage units which can be intermixed between MSU0400 and MSU0450 units. The MSP0600 is integrated with the system's input/output multiplexer, while the MSP0601 is a free-standing mass storage processor.

INPUT/OUTPUT UNITS

MAGNETIC TAPE UNITS: Honeywell offers a wide range of tape drives for the Series 60 systems. Their data formats, tape speeds, recording densities, and data transfer rates are summarized below.

CSF2003 (Cassette Tape Unit): 2 tracks, 7 ips, 800 bpi, phase encoded, 700 bytes/sec. ▶

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The Model 66/80 is the most powerful of the four large-scale Level 66 processor models introduced as part of the Series 60 product line. Each of the Level 66 models has evolved from Honeywell's successful Series 6000 computer family and offers Series 6000 users a clear upward growth path. Monthly rentals for Level 66 systems range from \$20,000 to over \$100,000.

➤ Honeywell Series 6000 systems. The EIS provides business-oriented processing capabilities by performing variable-length fixed and floating point decimal arithmetic, and bit and byte string manipulation. In addition, the two largest Level 66 processors, Models 66/60 and 66/80, employ a high-speed cache memory. The cache memory contains 512 four-word blocks of fast semiconductor storage, each of which mirrors the contents of a four-word block of main memory. If an instruction or data to be referenced by the central processor is available in the cache memory, the information can be retrieved from the cache rather than from main memory, thus reducing access time and increasing the effective processor speed.

Virtual memory capabilities are currently offered only on the Model 68/80, an upgraded version of the Honeywell Model 6180, the central processor announced along with Honeywell's commercial introduction of the Multics system in January 1973. The functions of the Multics system are performed by four modules: a processor unit, main memory, input/output multiplexer, and bulk storage.

The Model 68/80 processor unit includes a 2,048-word cache memory unit, a decimal unit that adds the Extended Instruction Set of business-oriented instructions to the processor's basic instruction repertoire, and special hardware for handling the segmentation and paging of virtual memory. Additional facilities available with the Model 68/80 include hardware for generating 24-bit memory addresses; an associative memory for translation of virtual addresses to real memory addresses; program-addressable registers for preparing virtual memory addresses; instructions for handling segmenta-

➤ MTU0210/0211: 7-track, 37.5 ips, 200/556/800 bpi, 5,625/15,637/22,500 bytes/sec.

MTU0210/0211: 9-track, 37.5 ips, 800/1600 bpi, 30,000/60,000 bytes/sec.

MTU0400: 7-track, 75 ips, 200/556/800 bpi, 11,250/31,275/45,000 bytes/sec.

MTU0400: 9-track, 75 ips, 200/556/800/1600 bpi, 15,000/41,700/60,000/120,000 bytes/sec.

MTU0410: 7-track, 75 ips, 200/556/800 bpi, 11,250/31,275/45,000 bytes/sec.

MTU0410: 9-track; 75 ips, 800/1600 bpi, 60,000/120,000 bytes/sec.

MTU0500: 7-track, 125 ips, 200/556/800 bpi, 18,750/52,125/75,000 bytes/sec.

MTU0500: 9-track, 125 ips, 200/556/800/1600 bpi, 25,000/69,500/100,000/200,000 bytes/sec.

MTU0600: 9-track, 200 ips, 800/1600 bpi, 160,000/320,000 bytes/sec.

Three magnetic tape processor models provide controls for multiple magnetic tape unit operation. The MTP0200 magnetic tape processor controls a maximum of four MTU0210/0211 or six MTU0410 magnetic tape units. The MTP0600 and MTP0601 magnetic tape processors control a maximum of 16 magnetic tape units. Optional cartridge-load capabilities and high-altitude adapters are offered for the MTU0400, MTU0500, and MTU0600 tape units. Optional d-c power-on meters and tape movement meters are available for the MTU0400 and MTU0500. The 9-track models listed above offer phase-encoded recording at 1600 bpi.

UNIT RECORD PROCESSORS: Both a 6-port and an 8-port unit record processor are available, depending on the level of the system. These processors provide control

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▷ tion, paging hardware, and the system clock; hardware for interrupting a process in execution at any point, saving the processor status, and restoring the process at a later time; and hardware for implementing the Multics ring structure. The Model 68/80 system utilizes free-standing mass storage processors, magnetic tape processors, and unit record processors and standard Series 60 peripheral devices, plus a high-speed Bulk Store Subsystem.

All Series 60 systems incorporate features designed to enhance their reliability and availability. Extensive parity checking is performed on data transfers, and most central processors contain duplicate arithmetic and logic addressing circuitry that performs each operation in parallel and compares the results to ensure that the correct result has been obtained. Error diagnosis is performed by microprogramming and software routines in the peripheral processor units used with Level 64 and larger systems. The Model 64/20 and Level 66 main memories incorporate hardware that performs automatic single-bit error correction and detects and retries double-bit errors on all data transfers. In Level 66 systems, built-in hardware test functions permit a single memory module to be exercised off-line without disrupting operation of other components of the system.

The Level 66 GCOS operating system provides additional facilities to minimize system down-time. The Total Online Testing System (TOLTS) performs on-line tests and diagnostics on each system module while normal processing continues. If a module fails a test, the job stream is rescheduled to postpone low-priority operations, the failure is isolated, and the system continues processing without the malfunctioning module. The Honeywell Error Analysis and Logging System (HEALS) analyzes and logs errors associated with the central processor, memory modules, and the microprogrammed peripheral controllers. If an unrecoverable parity error occurs, the memory module is removed from processing and TOLTS can be called to automatically test the module. In addition, GCOS utilizes the extensive hardware modularity of Level 66 systems to support "fail-soft" operations in systems with two or more processors, I/O multiplexers, and system control units.

Level 62 and Level 64 systems also provide such "fail-soft" features as memory reconfiguration and device substitution to minimize the impact of unrecoverable hardware malfunctions.

PERIPHERALS AND COMMUNICATIONS

Announced with the Series 60 was a new set of peripheral devices for the new processor models. The new peripheral line incorporates such state-of-the-art facilities as microprogrammed peripheral processors in ▷

▶ for card equipment, printers, communication, and console equipment. The number of peripheral devices configured is limited by the number of ports available.

CRU0600 CARD READER: Reads 80-column or (optionally) 51-column punched cards serially by column at 600 cards per minute. The input hopper capacity is 3000 cards and the output stacker capacity is 2500 cards.

CRU1050 CARD READER: Reads 80-column or (optionally) 51-column punched cards serially by column at a 1050-cpm rate. The reader has a 3000-card input hopper and a 2500-card output stacker.

PCU0120 CARD PUNCH: Punches 80-column cards in Hollerith or binary code at a speed of 100 to 400 cpm depending upon the number of columns punched in each card. Both the input hopper and the output stacker have a 1600-card capacity.

CCU0400 COMBINATION CARD READER AND PUNCH: Reads 80-column cards serially at 600 cpm and punches 80-column cards at 100 to 400 cpm depending on the number of columns punched per card. The input hopper capacity and the output hopper capacity are both 1600 cards.

PRU0400 LINE PRINTER: Prints 400 lpm, using a print drum having either a standard 63-character set or an optional 96-character set featuring both upper and lower case characters. Has 120 print positions, optionally expandable to 132. Prints 6 or 8 lines per inch, on continuous forms with up to 6 parts. Programmed operations include print and space, space only, skip, vertical line space, and error status reporting.

PRU0600 LINE PRINTER: Prints 600 lpm, using a print drum having either a standard 63-character set or an optional 96-character set. Has 120 print positions, optionally expandable to 132. Prints 6 or 8 lines per inch, on continuous forms with up to 6 parts. Programmed operations include print and space, space only, skip, vertical line space, and error status reporting.

PRU1100 LINE PRINTER: Prints 1100 lpm, using a print drum with a standard 63-character set. Has 132 print positions. Prints 6 or 8 lines per inch, on continuous forms with up to 6 parts. Programmed operations include print and space, no space, space only, skip, skip to any of 15 coded positions, vertical line space, and error status reporting.

PRU1200 BELT PRINTER: Prints 1200 lpm, using a print belt/cartridge with a special 48-character set, and has a burst speed of 2300 lpm with a limited character set. Other character sets are optional, including sets with 63, 64, and 96 characters. The standard data format is 136 print positions per line (160 print positions optional), spaced 10 characters per inch, with 6 or 8 lines per inch vertical spacing. The PRU1200 prints on single-part or multipart forms (one original and up to five carbon copies).

The print belt is packaged in a lightweight cartridge designed to facilitate removal, interchange, and storage. Each character on the print belt is mounted on a flexible "finger." During printing, the belt passes continually in front of the print hammers. When the character is struck, the flexibility of the finger causes the character to be immobilized at the moment of impact, reducing ribbon drag and improving print quality. The printer is equipped ▶

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➤ the larger systems, microprocessor-based I/O controllers, and advanced diagnostic facilities. Some of the significant new peripheral units introduced with the Series 60 are as follows:

- The MSU0310 Mass Storage Unit provides medium-capacity direct-access storage for Level 62, Level 64, and Level 66 systems. The storage capacity of each removable disk pack varies with the formatting conventions dictated by the host central processor. Storage capacity is 29.2 million bytes per spindle for Level 62 and 64 systems and 18.4 million bytes per spindle for Level 66 systems. Data transfer rates are 312,500 bytes per second for Levels 62 and 64 and 277,000 bytes per second for Level 66 systems. Average seek time is 38 milliseconds. Up to four MSU0310 Mass Storage Units can be connected to a Level 62 or Level 64 processor; a Level 66 mass storage processor can control up to 32 MSU0310 disk drives.
- The MSU0400 Mass Storage Unit is a fast-access, high-capacity disk storage drive for Level 64, 66, and 68 systems. Storage capacities per spindle are 100 million bytes for Level 64 and 78 million bytes for Level 66 and Level 68. Transfer rates are 806,000 bytes per second for Level 64 and 716,000 bytes per second for Levels 66 and 68. Average seek time is 25 milliseconds. Up to four MSU0400 disk drives can be connected to a Level 64 processor, and a maximum of 32 MSU0400 disk drives can be connected to a Level 66 mass storage processor. Level 68 Multics systems can have up to 28 MSU0400 disk pack drives.
- The MSU0450 Mass Storage Units are available with Level 66 systems only. Each Type 4450 disk pack can store up to 176 million bytes of information. Average seek time is 25 milliseconds, and the data transfer rate is 806,000 bytes per second. A maximum of 32 MSU0450 disk pack drives can be connected to a Level 66 mass storage processor for a total of over 6 billion bytes of on-line direct access storage.
- Magnetic tape devices include cassette drives for use on the Model 62/60 system, conventional tape drives with 7- or 9-track capability for low to medium requirements, plus a new high-speed, 9-track, phase-encoded unit for Level 66 systems with a data transfer rate of 320K bytes per second. A variety of densities (200, 556, 800, and 1600 bits per inch) and both NRZI and phase encoding recording techniques are available. The magnetic tape processor for the Model 64/20 central processor can incorporate options for 7- or 9-track NRZI, 7-track IBM BCD, and Honeywell Series 200/2000 magnetic tape compatibility.
- The PRU1200 and PRU1600 Belt Printers use an interchangeable belt cartridge with a set of 48, 63, ➤

➤ with an Automatic Standby feature that deactivates the operating mechanism of the printer when it is not being used. Programmed printer operations include recognition of belt type (48-, 63-, 64-, or 96-character set) from a code on the cartridge, print and space, space only, skip, vertical line spacing, and error status reporting.

PRU1600 BELT PRINTER: Prints 1600 lpm, using a print belt/cartridge with a 48-character set, and has a burst speed of 2300 lpm with a limited character set. Optional character sets include sets with 63, 64, and 96 characters. The standard data format is 136 print positions per line (160 print positions optional), spaced 10 characters per inch, with 6 or 8 lines per inch vertical spacing. The PRU1600 prints on single-part or multi-part forms (one original and up to five carbon copies). Characters are produced by hammer strokes against flexible belt "fingers," each representing one character. The flexibility of the finger causes the character to be immobilized on impact, reducing ribbon drag and improving print quality. The printer includes an Automatic Standby feature that deactivates the operating mechanism when it is not being used. Programmed printer operations include recognition of belt type (48-, 63-, 64-, or 96-character set) from a code on the cartridge, print and space, space only, skip, vertical line spacing, and error status reporting.

DHU0800 DOCUMENT HANDLER: Reads data from magnetically or optically encoded documents. The DHU0800 is connected to Series 60 systems through a document handler processor that supports up to four DHU0800 units, each with an operational speed of 8300 six-inch documents per minute. The DHU0800 has a minimum of 3 (DHU0803) and a maximum of 14 (DHU0814) pockets and can process documents encoded in the ABA E-13B MICR font, the OCR-A, OCR-B, 407, and 7B numeric fonts, and the OCR-A alphanumeric font. Handwritten marks can also be processed. Documents handled can vary in length from 4.85 to 8.75 inches, in width from 2.5 to 4.25 inches, and in thickness from 0.003 to 0.013 inch. The input hopper capacity is 9 inches deep (approximately 690 to 3000 perfectly flat documents), and the output hopper capacity is 3.5 inches deep (approximately 270 to 1170 perfectly flat documents).

DHU1600 DOCUMENT HANDLER: Reads MICR documents printed in ABA E-13B MICR font at up to 1625 documents per minute. The DHU1600 is connected to a Series 60 system through a document handler processor which accommodates up to four DHU1600 units. The standard 4-pocket unit is expandable in 4-pocket modules to a maximum of 32 pockets. Document dimensions can vary from 5.75 to 9.5 inches in length, 2.5 to 4.25 inches in width, and 0.003 to 0.009 inch in thickness. The input hopper capacity is 17.5 inches (approximately 1940 to 5830 perfectly flat documents), and the output hopper capacity is 3.5 inches (approximately 390 to 1170 perfectly flat documents).

PTS 0650 PAPER TAPE SUBSYSTEM: Consists of a PTU0150 Paper Tape Punch that punches 5-, 6-, 7-, or 8-level paper tape at 150 cps and a PTU0500 Paper Tape Reader that reads 5-, 6-, 7-, or 8-level paper tape at 500 cps. The PTS0650 Paper Tape Subsystem contains an integrated controller.

PSU200 PERIPHERAL SWITCH: Permits manual switching of a peripheral system from one I/O multiplexer to another. Can also be used to select either of two peripheral devices or subsystems connected to a single I/O channel. The basic PSU200 is a free-standing console containing one peripheral switch. ➤

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- ▷ 64, or 96 characters and 132 or 160 print positions. Printing speeds using the 48-character set are 1200 and 1600 lines per minute for the PRU1200 and PRU1600, respectively. Both printers have a burst speed of 2300 lines per minute with a limited character set. Other printers are available with printing speeds of 400, 600, and 1100 lines per minute.
- The DHU0800 Document Handler reads from either magnetically or optically encoded documents at an operational speed of up to 830 documents per minute. Up to four DHU0800 units can be attached to a Level 66 computer system through an optional document handler processor. The high-speed DHU1600 Document Handler reads MICR-encoded documents at a speed of up to 1625 documents per minute. The DHU1600 will be supported by the Honeywell Check Handling Executive Control System (CHECS), which includes document entry and proof and transit subsystems for processing large volumes of MICR- and OCR-encoded documents on Level 66 systems.
 - The Datanet 6600 Front-End Network Processors (FNP) are stored-program front-end communications processors for large-volume communications network environments. The two available models, DCP6624 and DCP6632, differ only in main memory size and communications capacity. Either model can handle synchronous, asynchronous, and binary synchronous transmission modes and a wide variety of terminals with differing communications speeds and code sets.

Level 62 processors will have an integrated communications controller capable of handling up to four synchronous and/or asynchronous communications lines, plus software support for applications such as data collection, data distribution, and inquiry/response. Level 64 systems can be equipped with an integrated communications controller capable of handling up to six synchronous and/or asynchronous communications lines at speeds of from 45 to 19,200 bits per second.

SOFTWARE AND COMPATIBILITY

With the Series 60 announcement, Honeywell joined the ranks of unbundled computer manufacturers by announcing separate pricing for most software supplied with the Series 60 computer systems. Monthly equipment rental for a Series 60 system will include the operating system, including basic job management and file management systems, and programming tools such as link editors, debugging aids, the job control language, and conversion aids. Language processors and utilities, applications packages, and communications software will all be separately priced, as will services such as program development, network design, education, and extra sets of documentation. All existing software for the Series ▷

► COMMUNICATIONS CONTROL

MODEL 62/60: Model 62/60 includes as standard equipment an integrated data communications controller that supports up to four communications lines. The communications subsystem can be configured as synchronous, asynchronous, or synchronous/asynchronous.

Special addressing features to address and access communications equipment are offered in multiples of two lines: DCA2101 addressing for two asynchronous lines and DCA2102 addressing for two synchronous lines. A line termination adapter is required for each line: the DCF2101 for asynchronous lines or the DCF2102 for synchronous lines. Alternatively, the DCF2100 allows for direct connection of asynchronous lines.

The Model 62/60's communications subsystem provides the small computer user with 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, or 300 bits per second. Synchronous line speeds to 9600 bits per second are supported. The data communications terminals initially supported include the Honeywell VIP 7700 and BTT 7340 teller terminal, the GE TermiNet 300, and the Teletype Models 33, 35, 37, and 38.

MODEL 64/20: The DCC4100 Communications Controller can be attached to the Model 64/20 unit record processor. It controls up to six lines, in any mix of synchronous or asynchronous modes of transmission. Line speeds can range from 45 to 19,200 bits per second. The unit record processor performs all routine terminal and line handling functions. Terminal support ranges from the Teletype Model 35 up to synchronous or asynchronous CRT terminals.

DATANET 6600 FRONT-END NETWORK PROCESSOR (FNP): Provides large-volume network communications capabilities for Level 66 Systems. The Datanet 6600 is available in two compatible processor versions, the DCP6624 and DCP6632. Both models have common characteristics and differ only in memory size and communications capacity. Both models incorporate an independently programmable computer with an instruction repertoire of 98 single-address instructions. The instruction set includes arithmetic operations, shifting, comparisons, data movement, and peripheral equipment control.

The FNP processors execute more than 500,000 instructions per second, thereby facilitating real-time, concurrent servicing of external devices. Three index registers and multilevel indirect addressing with indexing at each level permit addressing up to 65,536 9-bit bytes of metal oxide semiconductor (MOS) memory.

Memory capacity is 49,152 9-bit bytes for the DCP6624 and 65,536 9-bit bytes for the DCP6632. Both processor memories have a one-microsecond cycle time with addressable word sizes of 6, 9, 18, or 36 bits. Data word lengths can vary, and different lengths can be mixed and packed in storage.

The 6600 input/output control (IOC) is bus-oriented and controls real-time concurrent servicing of local and remote devices. The IOC handles up to 16 connections with an aggregate data transfer rate of 500,000 words per second. The IOC operates independently of the processor ►

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➤ 2000 and 6000 computer systems will remain bundled, and users currently running applications packages on these systems will be able to transfer them to Series 60 systems at no additional charge.

Software support for all Series 60 processors will be provided by several levels of Honeywell's proven GCOS operating system. For Level 62 and Level 64 processors, a subset of GCOS will provide multiprogramming capabilities, dynamic memory management, and fail-safe operations. Level 66 processors will operate under the full-scale multidimensional facilities of GCOS, which permits concurrent local and remote batch processing, on-line transaction processing, time-sharing, and interactive job entry and execution. For Level 66 systems, the Integrated Data Store/I (I-D-S/I) will be available for creating and managing a multi-function data base. Originally developed by GE, I-D-S will be evolved to conform to the standards of the CODASYL Data Base Task Group without sacrificing compatibility with current versions of I-D-S.

The Multics operating system, introduced for commercial use in January 1973, provides a powerful virtual memory capability only for the Model 68/80, the most powerful of the Series 60 central processors. However, Honeywell's experience with the Multics virtual memory and file handling techniques, and the paging and segmentation features already incorporated in the Level 64 and 66 systems, probably will result in the gradual evolution of GCOS toward a virtual storage processing environment when Honeywell becomes convinced that its customers require such facilities.

Honeywell's portfolio of applications packages is one of the largest offered by any computer manufacturer. Applications programs available with Series 600/6000 systems can be transferred directly to Series 60 Level 66 central processors. Honeywell states that applications programs written for Series 200/2000 systems will be executable on Series 60 Level 64 and Level 66 systems in the compatibility mode. Thus, Series 60 systems will offer packages for general financial applications and for industries such as banking, manufacturing, retail distribution, and hospitals and the medical field.

The use of GCOS standards and conventions throughout the entire Series 60 product line provides the means by which Honeywell will finally unify its disparate product line. Further compatibility within the Series 60 product line will be provided by a common COBOL compiler that runs on all Series 60 processors. The new COBOL compiler introduced with the Series 60 conforms to ANS COBOL-74 specifications and will run on Models 62/60 through Model 66/80. FORTRAN is available for the Level 66 systems.

The Series 60 Level 66 processors provide complete upward compatibility for Honeywell Series 600/6000 ➤

➤ and has 16 maskable priority interrupt levels with 16 maskable sublevels per level. It services a variety of terminals connected to the system's communications interface bases.

Communications lines interface the 6600 FNP through two available bases: the general-purpose communications base (DCU6202) and the Type 1 or Type 2 asynchronous communications base. The DCU6202 communications controller can handle up to 32 concurrently operating transmission lines. It interfaces synchronous and asynchronous channels at speeds from 50 to 50,000 bps. Transmission can be simplex, half-duplex, or full-duplex in either two- or four-wire operation. One DCU6202 is standard for the DCP6624. The DCP6632 can have two, or optionally three, DCU6202 communications controllers.

The Type 1 and Type 2 asynchronous communications bases provide for time-division multiplexing, by character, between the FNP and asynchronous terminals with speeds up to 300 bps. The Type 1 base can be configured with up to six asynchronous channel groups with a maximum of 24 line terminations at 6.67, 10, or 15 cps and 17 line terminations at 20 or 30 cps. The Type 1 asynchronous communications base is standard with the DCP6624 and DCP6632, and each FNP can contain a maximum of one.

The Type 2 asynchronous communications base is available only for the DCP6632 FNP. Each Type 2 base can be configured with up to 13 asynchronous channel groups. Each base can service up to four different transmission speeds. The maximum number of simultaneous line terminations per Type 2 base is 52 lines at speeds of 6.67 and 10 cps, 26 lines at speeds of 15 cps, and 17 lines at speeds of 20 to 30 cps. A maximum of five Type 2 asynchronous communications bases can be attached to a DCP6632 FNP.

The following optional channels are available for use on the DCU6202 General-Purpose Communications Base:

- Channel Interface, Asynchronous (DCF6010)—for two channels, half or full duplex, asynchronous, operating at up to 2400 bps and utilizing 7- or 8-bit codes; EIA RS-232C interface.
- Channel Interface, Asynchronous (DCF6011)—for two channels, half or full duplex, asynchronous, operating at up to 2400 bps and utilizing 7- or 8-bit codes; EIA interface is replaced by 20 milliamp current interface.
- Channel Interface, Synchronous (DCF6012)—for one channel, either half or full duplex, synchronous, ASCII, operating at up to 10,000 bps; MIL-STD 188C interface.
- Channel Interface, Synchronous (DCF6013)—for two channels, either half or full duplex, synchronous, ASCII, operating at up to 10,000 bps; EIA RS-232C interface.
- Channel Interface, Synchronous, with Automatic Call Unit (DCF6014)—same as DCF6013, except that one channel can be used with an Automatic Call Unit (ACU).
- Channel Interface, Binary Synchronous, with Cyclic Redundancy Check (DCF6015)—for one channel, in either binary synchronous or ANSI/ECMA mode; capable of half or full duplex operation, utilizing either ASCII or EBCDIC code, and transparent or ➤

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▷ computer systems, and present Series 600/6000 users can move directly to the Level 66 to achieve an improved level of price/performance. In addition, current users of 6000 Series systems who require the additional functions of Level 66 GCOS can field-upgrade their systems by adding a GS 6000 option for a one-time charge of \$100,000, although the performance of the upgraded system will not match that of a comparable Level 66 upgrade machine.

Upward compatibility for Series 200/2000 and small Series 100 systems is provided by the Compatibility Mode features for the Level 64 Model 20 central processor. Implemented by a combination of microcode in the read-only storage and software routines in system memory, the Series 200/2000 Compatibility Mode is designed to permit Mod 1 (MSR) and Mod 1 (TR) systems software, applications packages, and user-written programs to run on Level 64 with little or no modification. Series 200/2000 files also require no modification. The Series 200/2000 Compatibility Mode will rent for \$400 per month and will be available in the first quarter of 1975. The G-100 Compatibility Mode also will rent for \$400 per month and will be available at the end of 1975. An integrated compatibility capability featuring concurrent Series 200/2000 compatibility-mode and Level 64 native-mode operations is scheduled for delivery late in 1975. Honeywell states that the overwhelming majority of small Series 200 users are operating under the Mod 1 operating system.

Medium and large-scale Series 200/2000 installations, including such systems as the Model 1015, 1200, 2040, and larger systems, have two choices. They can continue to upgrade within the Series 2000 product line, utilizing the extensive multiprogramming capabilities of the OS/2000 operating system. For these users who elect a gradual transition, Honeywell promises three more releases of OS/2000, each of which will provide an additional degree of compatibility with GCOS.

Alternatively, medium- and large-scale Series 200/2000 users with extensive communications, time-sharing, and data base requirements can move directly into the Level 66 family of processors. For these installations, Honeywell is providing the Conversion Aids Programming System (CAPS) routines to aid users of Series 200/2000 and 400 systems to convert COBOL programs and data files to Level 66 formats. In addition, Honeywell states that a Series 200/2000 Compatibility Mode for OS/2000 systems will be made available for Level 66 central processors in the future.

There is no direct program compatibility between the Series 60 processors and other competitive product lines. Moreover, Honeywell announced few new features that would provide additional compatibility with competitive systems. Only the Model 62/60 comes with a conversion package for translating IBM System/360 Model 20 RPG ▷

▶ nontransparent operation at rates up to 10,000 bps; EIA RS-232C interface.

- Channel Interface, Broad Band (DCF6016)—for one channel interfacing to Bell System Type 301 and 303 modems, half or full duplex, operating at up to 10,000 bps, and utilizing 5-, 6-, 7-, or 8-bit codes.
- Channel Interface, General Purpose, (DCF6017)—for one channel, either half or full duplex, synchronous or asynchronous, operating at up to 50,000 bps, using 5-, 6-, 7-, or 8-bit codes.
- Channel Interface, General-Purpose, with Automatic Call Unit (DCF6018)—same as DCF6017, with use of an Automatic Call Unit.
- Data Link Control Interface (DCF6019)—for one channel utilizing the DLC disciplines in either half or full duplex synchronous mode; this option has an EIA RS-232C interface and is bit or character oriented, with transmission rates up to 50,000 bps; it incorporates a 16-bit CRC to ensure data integrity and information control.

The following channels are available for use on the Type 1 and Type 2 Asynchronous Communications Bases:

- Asynchronous Channel Groups, with Automatic Call Unit (DCF6026)—for 3 channels, one of which can be a dial-out, using a Bell System 103A, E, or F, or 113 type data set or equivalent.
- Asynchronous Channel Group (DCF6027)—same as the DCF6026, for 4 channels without an ACU.
- Asynchronous Channel Group (DCF6028)—for 4 channels, using 20 milliamp current interface for direct connection to teleprinters, without modems.
- Asynchronous Channel Group (DCF6029) for 4 channels, with interface conformance to MIL-STD 188C.

SOFTWARE

GCOS: All Series 60 systems will 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 dual-activity multiprogramming, dynamic memory management, and fail-soft operations for Model 62/60 processors. Each activity is a stream of jobs to be processed by the Model 62/60 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. A maximum of two activities and an output writer can be processed concurrently. GCOS also maintains a "run queue," a list of jobs ready for initiation. Whenever an executing job is interrupted, the operating system selects a read-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 ▶

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- ▷ programs and data files to Model 62/60 formats. For larger competitive systems, the Honeywell offering is limited to the CAPS conversion aids for UNIVAC Series 70 and IBM System/360 COBOL programs. Clearly, Honeywell is giving first priority to the consolidation of its own diverse customer base.

COMPETITIVE POSITION

With Series 60 system rentals ranging from less than \$4,000 per month on the low end to well over \$100,000 per month for the large-scale Multics systems, members of the Series 60 product line will be competing with a wide range of competitive equipment.

In performance, the Honeywell 62/60 is comparable to the IBM System/3 Model 15, while the Honeywell 64/20 offers performance roughly equivalent to that of the IBM System/370 Model 115. In the \$10,000 to \$20,000 per month rental range, Honeywell will continue in the near future to offer its medium-scale Series 2000 central processors with extensive multiprogramming capabilities provided by the OS/2000 operating system. On the medium-to-large-scale end of the Series 60 line, the Honeywell 66/20 compares roughly with the IBM System/370 Model 145, the Honeywell 66/40 with a small System/370 Model 155, the 66/60 with the System/370 Model 158, and the 66/80 with the System/370 Model 168.

However, with the exception of the Model 62/60 with its software conversion package aimed at IBM System/360 Model 20 users, Honeywell paid little heed to its mainframe competitors. Although Honeywell did not rule out the prospect of offering compatibility features to users of competitive equipment sometime in the future, the primary current objective of the Series 60 is to provide a cost-effective, state-of-the-art family of growth systems, with easy-to-use hardware and software bridges, to protect the investments of Honeywell's current customers in installed equipment and programming. □

- ▷ 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.

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.

In the event of a peripheral device failure, only the job directly affected is suspended, and normal processing of unaffected jobs continues. GCOS automatically searches

available system resources for a similar device to be used as a substitute, and the suspended job is automatically restarted. Operator intervention is required only when a volume on the failed device must be mounted on the substituted device.

Data management services provided by Level 62 GCOS include file security checks, allocation and deallocation of file space, label checking, and blocking and deblocking of data. Device-independence capabilities are available, permitting specifications such as device type, block length, and buffer size to be deferred until the program is submitted for execution. An automatic volume recognition feature verifies the standard labels on disk files and standard or nonstandard labels on tape cassette files. Three file organizations are available to the programmer—sequential, indexed, and direct—and two additional file organizations are used by the system. The queued partition file organization is used by GCOS to store sequential data, such as linkable and loadable program modules, and the queued linked organization is used by GCOS for libraries of source program modules.

The Level 62 GCOS Communications Subsystem supports up to four 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 an interface between COBOL applications programs and the communications subsystem. These include the ENABLE, SEND, RECEIVE, and DISABLE verbs.

LEVEL 64 GCOS: Model 64/20 systems will operate under a multitasking version of GCOS. A single program can consist of a number of interdependent program sequences identified as tasks, which can be executed concurrently by the processor. Dispatching and synchronization of task execution is controlled by the central processor based on a 16-level priority structure. Level 64 GCOS is scheduled for release in the fourth quarter of 1975.

LEVEL 66 GCOS: Software support for Level 66 systems will be Level 66 GCOS. It controls concurrent local and remote job entry, on-line transaction processing, and time-sharing. Level 66 GCOS is derived from the Series 6000 GCOS operating system, which is described in detail in Report 70C-480-11.

NETWORK PROCESSING SUPERVISOR: The Level 66 NPS is an extension of the Series 6000 NPS. It controls five types of remote processing in any combination: remote job entry, transaction processing, time-sharing, message switching, and direct program access. The information network, controlled by a combination of the Datanet 6600 Front-End Network Processor and the NPS software, can range in size from several terminals to a comprehensive, distributed information network with multiple host processing facilities. NPS interfaces with the following Honeywell computer systems as remote batch systems: Series 100, Series 200/2000, and Datanet 700 Remote Network Processors (for remote job entry or remote concentration). In addition, NPS provides the necessary binary synchronous communications discipline and interface to communicate with IBM 2780 remote batch terminals and System/360 and System/370 computers in remote job entry applications.

INTEGRATED DATA STORE: I-D-S/I is based on the features of Series 6000 I-D-S as described in Report

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► 70C-480-11. However, Level 66 I-D-S/I offers added capabilities for use in developing large, network-oriented data base systems. Among the new enhancements are:

- A larger data base capacity that permits the implementation of data bases containing up to 64 billion characters and more than 1 billion user records.
- A data base restructuring utility that assists the user in making changes to his data base after initial design and implementation. Restructuring includes record-type deletion, field addition and deletion, field size changes, and the establishing or removing of inter-record linkage fields.
- Data description subsetting, a new copy facility that allows the programmer to request a subset of the data description required by his particular application. Only the specified records and interrecord relationships are included in the subset, removing the necessity for recompiling unaffected programs when data base changes occur.

COBOL: Two new COBOL compilers were announced for the Series 60, both of which comply with the ANS COBOL-74 specifications.

LEVEL 62 COBOL-74: This is a compatible subset of the full Level 66 COBOL-74 compiler. It has facilities for handling packed and unpacked decimal data and fixed-point binary data, plus capabilities under the GCOS operating system for overlaying user-specified program segments. New capabilities, previously not available in COBOL 68, include a debugging facility that allows the programmer to specify debugging instructions in the COBOL language, a new capability for communication with terminals, the ability to call other programs written in higher-level languages during execution, and the ability to copy predefined COBOL text into the source program. Level 62 COBOL-74 operates under GCOS-62 and requires 32,768 bytes of main memory, one disk unit, one printer or SYSOUT file, and one sequential input file or source library.

LEVEL 66 COBOL-74: The new COBOL compiler for Series 60 Level 66 systems provides the functional modules specified for ANS COBOL-74, including the Debug, Sort/Merge, and Report Writer facilities. Level 66 COBOL-74 uses ASCII as the standard internal code set and accommodates packed decimal and 16-, 32-, and 36-bit binary standard numeric representations. Additional features include a communications facility that permits development and debugging of programs by remote users, support for the Data Manipulation Language specified by the COSASYL Data Base language Task Group, and a "language mask" for selecting language elements to be recognized and compiled. COBOL-74 will run on a Series 60 Level 66 system with a minimum of 524,288 bytes of main memory.

RPG: The GCOS Level 62 RPG compiler is available for Model 62/60 systems and operates in the multiprogramming mode under GCOS Level 62. Along with the compiler, Honeywell announced an IBM System/360 Model 20 conversion package for translating 360/20 data files and source programs to the Honeywell Model 62/60 environment. The Honeywell RPG compiler includes facilities for support of sequential, indexed, and direct file organizations, device independence, dynamic table handling, instruction look-ahead, program diagnostic traces, and utilization of standard data management access routines by object programs. Input files can be entered from punched cards, magnetic tape cassettes, or disk. The use of standard data management access routines permits the interchange of data files among RPG and COBOL programs. In addition external routines, such

as COBOL routines, can be linked with an RPG object program prior to execution. The RPG compiler requires a minimum of 18,000 bytes of main memory, one disk unit, one printer or SYSOUT file, and one sequential input device or source library.

CONVERSION AIDS: The Conversion Aids programming System (CAPS) is a library of routines designed to facilitate conversions to Series 60 systems from Honeywell, IBM, and UNIVAC Series 70 computers. COBOL program translations, tape file conversion routines, and program flow analyzers are available for Honeywell Series 200, Honeywell Series 400, IBM System/360, and UNIVAC Series 70 programs. These routines should significantly reduce the time required to convert and test COBOL programs and their associated data files. A translation routine is also available for programs written in MAP assembly language for the Series 400.

The IBM System/360 Model 20 conversion package consists of software aids for converting 360/20 RPG programs to Model 62/60 RPG format, and utility routines for converting tape and disk files to Model 62/60 file formats. A simulator for the System/360 Model 20 Multi-Function Card Machine is also provided, eliminating the need to convert punched card files. The conversion routines are accompanied by a Conversion Guide that provides guidelines for the total conversion process. The conversion routines run as an activity under GCOS Level 62 and require 18,000 bytes of main memory, two disk units, one printer, and a card reader.

APPLICATION PROGRAMS: Application programs available for the Series 60 will include all application programs presently available for Series 6000 computer systems, which will run on Series 60 systems without modification. Series 200/2000 application programs will run on the Model 64/20 in the Series 200/2000 Compatibility Mode. Application packages available for the Model 62/60 include Accounts Payable, Accounts Receivable, General Ledger, Payroll, Inventory Management, and a Production Scheduling and Control System.

For larger Series 60 systems, Honeywell is placing particular emphasis on application packages for manufacturing, banking, distribution, education, health services, financial management, and management sciences. Some of the principal packages are listed below:

Manufacturing:

- FACTOR (manufacturing MIS)
- Inventory Management
- Production Scheduling and Control
- Sales Order Processing

Banking:

- Check Handling Executive Control System (CHECS)
- Bank Information System Network (BISNET)
- Metropolitan Online Savings System
- Bank Management Information System
- MICRCOM (remote MICR processing)
- Proof and Transit
- Demand Deposit Accounting Systems
- Savings Accounting
- Installment Loan Accounting

Distribution:

- MI-DIS (Management Information for Distributors)

Education:

- SCRIBE (Systems for Computerized Reporting of Information for Better Education)
- EDINET (Educational Instruction Network)

Health Services:

- Hospital Accounting System

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► MEDACS (Medical Administrative Control System)
Hospital Computer Sharing System
VITAL (on-line hospital data management system)

Financial Management:
Accounts Receivable
Accounts Payable
Payroll
General Ledger

Management Science:
MPS (Mathematical Programming System)
GPSS (General Purpose Simulator System)
SIMSCRIPT (simulation language)
ASTRA (multiproject planning and scheduling)
NASTRAN (structural design and analysis)
ANC (numerical control)
Computerized Publication System
Biomedical Statistical Programs

PRICING

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

SMALL MODEL 62/60 SYSTEM: Consists of a CPS2600 central processor with 81K bytes of MOS main memory, I/O peripheral controller, six I/O channels, the standard system console (with 30-cps serial printer, keyboard, and one tape cassette handler), two MSU0310 disk drives (58.4 million bytes), a PRU0400 printer (400 lpm), and a CRU0600 card reader (600 cpm). Monthly rental and purchase prices for the system are approximately \$4,000 and \$188,100, respectively.

TYPICAL MODEL 64/20 SYSTEM: Consists of a CPS4200 central processor with 98,304 bytes of MOS main memory, Series 200 Compatibility, a CSU4100 operator's console unit, three integrated I/O channels, three MSU0310 disk drives (105 million characters), MTP0200 magnetic tape processor and 3 MTU0410 magnetic tape units, a PRU0600 printer (600 lpm), a CRU0600 card reader (600 cpm), and a PCU0120 card punch (100-400 cpm). Monthly rental and purchase prices are approximately \$7,650 and \$381,900, respectively.

TYPICAL MODEL 66/20 SYSTEM: Consists of a CPS6202 central processor, 131K words of main memory, a CSU6001 operator's console, integrated input/output multiplexer with 10 channel function slots, integrated system controller, an MSP0600 single-channel mass storage processor, two MSU0450 disk drives (400 million bytes), an MTP0600 magnetic tape processor, four MTU0400 magnetic tape units, a URP0600 unit record processor, a PRU1200 printer (1200 lpm) with a 63-character print belt, a PCU0120 card punch (100-400 cpm), and a CRU1050 card reader (1050 cpm). Monthly

rental and purchase prices are approximately \$21,900 and \$1,038,700, respectively.

TYPICAL MODEL 66/60 SYSTEM: Consists of a CPS6624 central processor with 262,144 words of MOS main memory, system control center, free-standing system controller, free-standing input/output multiplexer with 35 channel function slots, an MSP0601 free-standing mass storage processor, four dual-channel MSU0450 disk drives (800 million bytes), an MTP0601 magnetic tape processor, six MTU0500 magnetic tape drives, a free-standing URP0600 unit record processor, two PRU1600 printers (1600 lpm) with 63-character print belts, a CRU1050 card reader (1050 cpm), and a PCU0120 card punch (100-400 cpm). Monthly rental and purchase prices are approximately \$52,900 and \$2,437,500, respectively.

SINGLE-PROCESSOR MODEL 68/80 SYSTEM: Consists of a CPS8824 central processor with 262K words of main memory, Bulk Store Subsystem with 1,048,576 words of bulk store, free-standing system control, free-standing input/output multiplexer with 35 channel function slots, a CSU6001 operator's console, an MSP0601 mass storage processor, eight MSU0400 disk drives 9600 million bytes), an MTP0601 magnetic tape processor, three MTU0500 magnetic tape units, a URP0600 unit record processor, two PRU1600 printers (1600 lpm) with 96-character print belts, a CRU1050 card reader (1050 cpm), a PCU0120 card punch (100-400 cpm), and a motor generator. Monthly rental and purchase prices are approximately \$86,500 and 7,746,600, respectively.

SOFTWARE: 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 all Series 60 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: Series 60 equipment is available for purchase or for rental under a 1-year, 3-year, or 5-year lease. The 1-year and 3-year basic monthly rentals entitle the user to 176 hours of central processor usage per month with on-call remedial maintenance between the hours of 8 a.m. and 6 p.m. on Mondays through Fridays. For scheduled usage beyond this period, with on-call maintenance service, the user pays an additional charge which is a fixed percentage of the monthly maintenance charge. Alternatively, the user can obtain on-call maintenance service at standard hourly rates of \$45 per man-hour. Unlimited use is permitted for all peripheral devices and for central processors on a 5-year lease. ■

Honeywell Series 60 EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
MODEL 62/60 PROCESSOR, MAIN STORAGE, & PROCESSOR OPTIONS					
CPS2600	Central Processing System; includes CPU, integrated I/O peripheral controller, six I/O channels, operator's console with printer, keyboard, one tape cassette handler, system operator panel, and 65,536 bytes of memory	75,410	225	1,571	1,492
CMA2640	Memory addressing; one required for each 16K-byte memory module added to CPS2600	960	2	20	19
CMM2640	16K-byte memory module for first CPS2600 memory expansion increment; CMA2640 is prerequisite	3,840	4	80	78
CPA2004	Disk addressing capability for the first two mass storage units	24,770	120	516	490
CPA2005	Disk addressing capability for mass storage expansion to the third and fourth units	4,370	20	91	86
CPA2007	Printer addressing capability for PRU0400 or PRU0600	5,090	8	106	101
CPA2012	Card reader addressing capability for CRU0600 or CRU1050	3,170	7	66	63
CPA2014	Card punch addressing capability for PCU0120	3,890	9	81	77
CPA2207	Printer hardware/firmware addressing capability to support a PRU0400 or PRU0600 when attached to a PEU (port expansion unit)	5,090	8	106	101
CPA2212	Card reader hardware/firmware addressing capability to support a CRU0600 or CRU1050 when attached to a PEU	3,170	7	66	63
CPA2214	Card punch hardware/firmware addressing capability to support a PCU0120 when attached to a PEU	3,890	9	81	77
DCA2001	Data communications asynchronous addressing capability	2,880	20	60	57
DCA2002	Data communications synchronous addressing capability	2,880	20	60	57
PEU2001	Port expander unit; 3-port expansion	5,280	16	110	105
PEF2001	Port expander unit cabinet and power supply	1,920	6	40	38
MODEL 64/20 PROCESSOR, MAIN STORAGE, & PROCESSOR OPTIONS					
CPS4200	Central Processing System; includes three integrated I/O channels, integrated main storage processor, integrated unit record processor, and 65,536 bytes of memory	109,285	142	2,112	2,006
CMA4250	Memory addressing capability; one required for each 32K-byte memory module added to CPS4200	1,920	1	40	38
CMM4250	32K-byte memory module; CMA4250 is prerequisite	7,600	4	160	152
CPF4004	Series 100 compatibility mode	19,200	14	400	380
CPF4005	Series 200/2000 compatibility mode	19,200	14	400	380
MSA4000	Mass storage addressing capability for four disks	13,400	31	320	278
MSP4310	Series 200/2000 mass storage compatibility mode option	225	5	5	5
MTP0200	Magnetic tape processor	21,070	70	458	397
MTP1021	Series 200/2000 compatibility mode option	2,295	5	56	48
MTF1023	IBM read/write option for MTP0200	2,295	5	56	48
MTF1024	NRZI option for MTP0200	2,860	3	68	60
MTA0301	Magnetic tape addressing for MTU0210/0211	3,600	13	76	88
MTA0303	Magnetic tape addressing for MTU0410	7,200	26	176	152
URA0015	Unit record addressing for CRU0600/1050	3,170	7	66	63
URA0016	Unit record addressing for PCU120	3,890	9	81	77
URA0017	Unit record addressing for CCU0400	4,130	12	86	82
URA0010	Unit record addressing for PRU0600	7,535	13	157	149
URA0012	Unit record addressing for PRU1200	7,535	13	157	149
URA0013	Unit record addressing for PRU1600	7,535	13	157	149
MODEL 66/20 PROCESSORS & OPTIONS					
CPS6200	Central Processing System; includes CPU, integrated system controller, integrated input/output multiplexer with 10 channel function slots, CPU addressing, IOM addressing, memory addressing, and 81,920 words of memory	591,150	1,119	11,823	11,232
CPS6201	Central Processing System; includes CPU, integrated system controller, integrated input/output multiplexer with 10 channel function slots, CPU addressing, IOM addressing, memory addressing, and 98,304 words of memory	614,600	1,169	12,292	11,677
CPS6202	Central Processing System; includes CPU, integrated system controller, integrated input/output multiplexer with 10 channel function slots, CPU addressing, IOM addressing, memory addressing, and 131,072 words of memory	661,450	1,269	13,229	12,568
CPS6203	Central Processing System; includes CPU, integrated system controller, integrated input/output multiplexer with 10 channel function slots, CPU addressing, IOM addressing, memory addressing, and 196,608 words of memory	755,100	1,469	15,102	14,347
CPS6204	Central Processing System; includes CPU, integrated system controller, integrated input/output multiplexer with 10 channel function slots, CPU addressing, IOM addressing, memory addressing, and 262,144 words of memory	848,800	1,669	16,976	16,127
MXF6002	IOM Data Rate Expansion; maximum of 1 for CPS6200-CPS6204	21,120	30	459	408
MXF6003	IOM Expansion for CPS6200-CPS6204; expands IOM from 10 channel function slots to 18	20,800	32	416	395

* Rental prices include maintenance.

Honeywell Series 60 EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
MODEL 66/40 PROCESSORS & OPTIONS					
CPS6402	Central Processing System; includes CPU, integrated system controller, integrated input/output multiplexer with 18 channel function slots, CPU addressing, IOM addressing, memory addressing, and 131,072 words of memory	1,087,050	1,575	22,185	21,076
CPS6403	Central Processing System; includes CPU, integrated system controller, integrated input/output multiplexer with 18 channel function slots, CPU addressing, IOM addressing, memory addressing, and 196,608 words of memory	1,178,850	1,682	24,058	22,855
CPS6404	Central Processing System; includes CPU, integrated system controller, integrated input/output multiplexer with 18 channel function slots, CPU addressing, IOM addressing, memory addressing, and 262,144 words of memory	1,270,650	1,789	25,932	24,635
CPS6406	Central Processing System; includes CPU, one integrated system controller and one free-standing system controller, integrated input/output multiplexer with 18 channel function slots, CPU addressing, IOM addressing, memory addressing, and 393,216 words of memory	1,510,300	2,077	30,823	29,282
CPS6408	Central Processing System; includes CPU, one integrated system controller and one free-standing system controller, integrated input/output multiplexer with 18 channel function slots, CPU addressing, IOM addressing, memory addressing, and 524,288 words of memory	1,693,950	2,291	34,570	32,842
CPU6400	Additional central processor for CPS6403-CPS6408; maximum of one	595,500	873	12,406	11,786
MODEL 66/60 PROCESSORS & OPTIONS					
CPS6603	Central Processing System; includes CPU, integrated system controller, integrated input/output multiplexer with 18 channel function slots, CPU addressing, IOM addressing, memory addressing, and 196,608 words of memory	1,448,750	1,805	29,871	28,377
CPS6604	Central Processing System; includes CPU, integrated system controller, integrated input/output multiplexer with 18 channel function slots, CPU addressing, IOM addressing, memory addressing, and 262,144 words of memory	1,519,450	1,849	31,329	29,763
CPS6606	Central Processing System; includes CPU, one integrated system controller and one free-standing system controller, integrated input/output multiplexer with 18 channel function slots, CPU addressing, IOM addressing, memory addressing, and 393,216 words of memory	1,716,300	2,011	35,388	33,619
CPS6608	Central Processing System; includes CPU, one integrated system controller and one free-standing system controller, integrated input/output multiplexer with 18 channel function slots, CPU addressing, IOM addressing, memory addressing, and 524,288 words of memory	1,857,650	2,099	38,302	36,387
CPS6623	Central Processing System; includes CPU, free-standing system controller, free-standing input/output multiplexer with 35 channel function slots, CPU addressing, IOM addressing, memory addressing, and 196,608 words of memory	1,508,350	1,879	31,100	29,545
CPS6624	Central Processing System; includes CPU, free-standing system controller, free-standing input/output multiplexer with 35 channel function slots, CPU addressing, IOM addressing, memory addressing, and 262,144 words of memory	1,579,000	1,923	32,557	30,929
CPS6626	Central Processing System; includes CPU, two free-standing system controllers, free-standing input/output multiplexer with 35 channel function slots, CPU addressing, IOM addressing, memory addressing, and 393,216 words of memory	1,775,900	2,085	36,616	34,785
CPS6628	Central Processing System; includes CPU, two free-standing system controllers free-standing input/output multiplexer with 35 channel function slots, CPU addressing, IOM addressing, memory addressing, and 524,288 words of memory	1,917,250	2,173	39,531	37,554
CPS6632	Central Processing System; includes CPU, three free-standing system controllers, free-standing input/output multiplexer with 35 channel function slots, CPU addressing, IOM addressing, memory addressing, and 786,432 words of memory	2,255,450	2,423	46,504	44,179
CPS6636	Central Processing System; includes CPU, four free-standing system controllers, free-standing input/output multiplexer with 35 channel function slots, CPU addressing, IOM addressing, memory addressing, and 1,048,576 words of memory	2,593,700	2,673	53,478	50,804
CPU6600	Additional central processor for CPS6603-CPS6636; maximum of one with integrated CPS, three with free-standing CPS	759,400	956	15,820	15,029
MODEL 66/80 PROCESSORS & OPTIONS					
CPS6824	Central Processing System; includes CPU, free-standing system controller, free-standing input/output multiplexer with 35 channel function slots, CPU addressing, IOM addressing, memory addressing, and 262,144 words of memory	2,050,200	3,097	42,272	40,158

*Rental prices include maintenance.

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		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
CPS6826	Central Processing System; includes CPU, two free-standing system controllers, free-standing IOM with 35 channel function slots, CPU addressing, IOM addressing, memory addressing, and 393,216 words of memory	2,247,100	3,259	46,332	44,015
CPS6828	Central Processing System; includes CPU, two free-standing system controllers, free-standing IOM with 35 channel function slots, CPU addressing, IOM addressing, memory addressing, and 524,288 words of memory	2,388,400	3,347	49,246	46,784
CPS6832	Central Processing System; includes CPU, three free-standing system controllers, free-standing IOM with 35 channel function slots, CPU addressing, IOM addressing, memory addressing, and 786,432 words of memory	2,726,600	3,597	56,219	53,408
CPS6836	Central Processing System; includes CPU, four free-standing system controllers, free-standing IOM with 35 channel function slots, CPU addressing, IOM addressing, memory addressing, and 1,048,576 words of memory	3,064,850	3,847	63,193	60,033
CPU6800	Additional central processor unit for CPS6824-CPS6836; maximum of three	1,204,000	1,838	25,084	23,830
CENTRAL PROCESSOR OPTIONS FOR MODELS 66/40, 66/60, & 66/80					
CPA6001	Central processor addressing; required when an additional CPU is added to system (one for each system controller in system); at least one is required when adding a free-standing system controller to a system for redundancy	15,150	21	312	296
MXC6001	Free-standing system controller for fail-soft; memory not included; controls up to 262,144 words of memory; at least one CPF6001 and MXF6001 required	25,200	33	520	494
MXU6001	Free-standing input/output multiplexer with 35 channel function slots; for use when redundancy and/or additional channels are required (does not include channels)	155,850	197	3,213	2,893
MXA6001	Input/output multiplexer addressing; required when MXU6001 is used (one for each System Controller in system); also required when MXC6001 is used	15,150	21	312	296
MXF6002	IOM data rate expansion; maximum of 1 on integrated and 2 for free-standing input/output multiplexers	21,120	30	459	408
MXF6004	IOM Expansion; 9 channel function slots (for use with CPS6403-CPS6408 and with CPS6604-CPS6608 only); maximum of one	30,250	40	624	593
MXF6005	IOM Expansion; 19 additional channel function slots (for use with free-standing IOM; maximum of 1)	47,950	63	989	940
MODEL 68/80 PROCESSORS & OPTIONS					
CPS8824	Central Processing System for Multics; includes free-standing system control, free-standing input/output multiplexer with 35 channel function slots, central processor addressing, IOM addressing, Bulk Store Subsystem including control, port, and 524,288 words of bulk store, memory addressing, and 262,144 words of main memory	2,655,350	4,000	57,886	53,833
CPS8826	Central Processing System for Multics; includes two free-standing system controls, free-standing input/output multiplexer with 35 channel function slots, central processor addressing, IOM addressing, Bulk Store Subsystem including control, port, and 524,288 words of bulk store, memory addressing, and 393,216 words of main memory	2,858,350	4,160	61,946	57,690
CPS8828	Central Processing System for Multics; includes free-standing system control, free-standing input/output multiplexer with 35 channel function slots, central processor addressing, IOM addressing, Bulk Store Subsystem including control, port, and 524,288 words of bulk store, memory addressing, and 524,288 words of main memory	3,004,050	4,250	64,860	60,459
CPS8832	Central Processing System for Multics; includes three free-standing system controls, free-standing input/output multiplexer with 35 channel function slots, central processor addressing, IOM addressing, Bulk Store Subsystem including control, port, and 524,288 words of bulk store, memory addressing, and 786,432 words of main memory	3,352,700	4,500	71,833	67,083
CPS8836	Central Processing System for Multics; includes four free-standing system controls, free-standing input/output multiplexer with 35 channel function slots, central processor addressing, IOM addressing, Bulk Store Subsystem including control, port, and 524,288 words of bulk store, memory addressing, and 1,048,576 words of main memory	3,701,400	4,750	78,807	73,708
CPS8844	Central Processing System for Multics; includes six free-standing system controls, free-standing input/output multiplexer with 35 channel function slots, central processor addressing, IOM addressing, Bulk Store Subsystem including control, port, and 524,288 words of bulk store, memory addressing, and 1,572,864 words of main memory	4,398,750	5,250	92,754	86,958

* Rental prices include maintenance.

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Honeywell Series 60 EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
CPS8852	Central Processing System for Multics; includes eight free-standing system controls, free-standing input/output multiplexer with 35 channel function slots, central processor addressing, IOM addressing, Bulk Store Subsystem including control, port, and 524,288 words of bulk store, memory addressing, and 2,097,152 words of main memory	5,096,100	5,750	106,701	100,208
CPU8800	Additional Central Processor Unit for CPS8824-CPS8852; maximum of three	1,289,900	1,890	25,798	24,508
MASS STORAGE					
Bulk Storage Subsystem:					
MBC6001	Bulk Store Controller for Level 68	41,800	95	1,350	1,165
MBF6001	Bulk System Control Port for Level 68	3,600	5	113	97
MBF6002	Additional Channel for Level 68	10,800	15	337	291
MBS6001	Bulk Store Unit for Level 68	188,800	315	5,950	5,140
MBU6001	Bulk Store Memory for Level 68	178,000	300	5,610	4,850
MBU6002	Bulk Store Memory for Level 68	178,000	300	5,610	4,850
MBU6003	Bulk Store Memory for Level 68	178,000	300	5,610	4,850
Disk Processors, Drives, & Features:					
MSP0601	Mass Storage Processor, free-standing; maximum of 32 single-channel or 16 dual-channel disk units; includes IOM channel	68,760	97	1,602	1,393
MSP0600	Mass Storage Processor, integrated; maximum of 32 single-channel or 16 dual-channel disk units; includes IOM channel	42,440	66	989	858
MSU0310	Disk Unit; 29M bytes	15,345	55	341	324
MSU0400	Disk Unit; 100M bytes; requires rotational position sensing (MSF0004) and IOM data rate expansion (MXF6002)	24,330	80	553	481
MSU0450	Disk Unit; 176M bytes; requires MXF6002 (IOM data rate expansion) and includes rotational position sensing	37,600	93	865	752
MSF0005	Dual Access feature for MSU0310; required with MSF1020 or MSF1031; one per MSU0310	2,295	8	56	48
MSF0002	Dual Access feature for MSU0400/0450; required with MSF1021 or MSF1031; one per MSU0400/0450	2,295	8	56	48
MSF0004	Rotational Position Sensing feature; one required per MSU0400	2,250	8	55	48
MSF1031	Dual-Processor Cross-Bar option; requires 2 single-channel MSP's; not required with MSF1020 or MSF1021 features; requires MSF0005 or MSF0002 features and MSA1028 or MSA1030	40,000	100	1,061	921
MSF1032	Drive Expansion feature; required when more than 16 MSU0310 drives are used with a single-channel processor; one per processor	14,100	10	335	291
MSF1033	Same as MSF1032 above, for MSU0400/MSU0450	14,100	10	335	291
MSF1019	Additional Non-Simultaneous Switched Channel (includes IOM channel)	8,800	10	213	191
MSF1020	Dual Simultaneous Channel for MSU0310; includes IOM channel; requires MSA1028 and MSF0005 features	44,000	133	1,061	921
MSF1021	Dual Simultaneous Channel for MSU0400/0450; includes IOM Channel; requires MSA1030 and MSF0002 features	44,000	133	1,061	921
MSF1022	MSU310 Adapter	2,350	5	56	48
MSF1023	MSU0400/0450 Adapter	12,750	20	292	254
MSA102	MSU0310 Device Addressing—4 devices	2,350	5	56	48
MSA1027	MSU0400/0450 Device Addressing—4 devices	7,000	12	163	142
MSA1028	Dual-Channel Device Addressing—1 per MSA1025 (MSU0310)	235	NC	5	5
MSA1030	Dual-Channel Device Addressing—1 per MSA1027 (MSU0400/MSU0450)	235	NC	5	5
INPUT/OUTPUT UNITS					
Magnetic Tape Processors:					
MTP0200	Magnetic Tape Processor; Level 64	21,070	70	458	397
MTP0600	Magnetic Tape Processor; Level 66 (1x8); includes IOM channel; for MTU0400 and MTU0500	28,600	99	690	620
MTP0601	Magnetic Tape Processor; Level 66 (1x8); includes IOM channel; for MTU0400, MTU0500, and MTU0600	28,600	99	690	620
Magnetic Tape Processor Features For MTP0200:					
MTA0301	Addressing for MTU0210/0211	3,600	13	88	76
MTA0303	Addressing for MTU0410	7,200	26	176	152
MTF1021	Series 200/2000 Mode	2,295	5	56	48
MTF1023	IBM BCD Mode	2,295	5	56	48
MTF1024	NRZI Mode	2,860	3	68	60

* Rental prices include maintenance.

Honeywell Series 60 EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
Magnetic Tape Processor Features For MTP0600/0601:					
MTF1040	Switched Tape Channel (includes IOM channel)	8,800	5	213	191
MTF1041	Dual Simultaneous Channel for up to 2x16 operation; includes IOM tape channel and second channel adapter	46,200	119	1,115	995
MTA1041	Device Addressing; for 4 MTU0400/0500; maximum 2 for 1x8, 4 for 2x16	235	NC	5	5
MTA1042	Device Addressing; for 4 MTU0400/0500/0600; maximum 2 for 1x8, 4 for 2x16	235	NC	5	5
MTF1045	Code Translation; ASCII to Level 66 six-bit code	1,000	NC	27	23
MTF1046	Code Translation; EBCDIC to Level 66 six-bit code	1,000	NC	27	23
MTF1047	Code Translation; EBCDIC to ASCII Code	1,000	NC	27	23
Magnetic Tape Drives:					
MTU0210	Magnetic Tape Unit, primary (37.5 ips)	11,090	50	264	229
MTU0211	Magnetic Tape Unit, secondary (37.5 ips)	9,070	41	216	187
MTU0400	Magnetic Tape Unit (75 ips)	13,790	51	299	280
MTU0410	Magnetic Tape Unit (75 ips)	13,790	51	299	280
MTU0500	Magnetic Tape Unit (125 ips)	18,450	56	430	399
MTU0600	Magnetic Tape Unit (200 ips)	22,700	66	548	476
Magnetic Tape Drive Features For MTU0400/0500:					
MTF0012	Dual Density Option; 800-1600 bpi; 9-track	4,270	25	100	89
MTF0017	Full Density Option; 200-556-800-1600 bpi; 9-track	6,670	41	195	176
MTF0013	NRZI; 200-556-800 bpi; 7-track	6,670	41	195	176
MTF0016	NRZI; 556-800 bpi; 7-track	3,310	15	79	68
MTF0018	Cartridge Load (factory-installed only)	780	2	17	15
MTF0019	Cartridge Load (field-installable)	780	2	17	15
MTF0020	High-Altitude Blower (factory-installed only)	243	NC	5	5
MTF0021	High-Altitude Blower Kit (for field installation)	243	NC	5	5
MTF0022	DC Power-On Meter (factory-installable only)	243	NC	5	5
MTF0023	Tape Movement Meter (factory-installable only)	243	NC	5	5
Magnetic Tape Drive Features For MTU0600:					
MTF0612	9-Track, 800/1600-bpi Density	4,270	25	100	89
MTF0618	Cartridge Load (factory-installed)	780	2	17	15
MTF0619	Cartridge Load (field-installable)	780	2	17	15
MTF0620	High-Altitude Blower (factory-installed)	243	NC	5	5
MTF0621	High-Altitude Blower (field-installable)	243	NC	5	5
Unit Record Processors & Features:					
URP0600	Unit Record Processor, free-standing; includes basic 4-port adapter and IOM channel	24,345	27	552	524
URP0601	Unit Record Processor, Integrated; includes basic 4-port adapter and IOM channel; for use with integrated control unit	18,810	20	427	406
URP0602	Integrated Unit Record Processor for use with free-standing IOM; includes basic 4-port adapter and IOM channel; limits IOM capacity to 35 channel function slots	18,810	20	427	406
URF0040	Unit Record Addressing; 4 additional port attachments; expands URP to maximum of 8 ports; also required if printer types are mixed in one subsystem (PRU1200 and PRU1600 are considered one type in this definition)	900	2	19	18
URF0041	Dual Switched Channel; includes IOM channel; maximum of one	8,148	10	171	160
URA0050	PCU0120 Addressing; one required for each PCU0120	4,500	4	100	97
URA0052	CRU1050 Addressing; one required for each CRU1050	8,010	25	178	173
URA0053	PRU1100 Addressing; one required for each PRU1100	1,800	8	41	39
URA0054	PRU1200 Addressing; one required for each PRU1200	7,585	13	173	150
URA0055	PRU1600 Addressing; one required for each PRU1600	7,585	13	173	150
Printers:					
PRU0400	Printer (400 lpm)	26,680	164	580	551
PRU0600	Printer (600 lpm)	33,440	182	832	722
PRU1100	Printer (1100 lpm)	35,400	220	1,010	875
PRU1200	Printer (1200 lpm)	49,350	263	1,175	1,022
PRU1600	Printer (1600 lpm)	72,160	399	1,804	1,569
PRF0010	12 Additional Print Positions for PRU0400 or PRU0600	970	5	22	21
PRF0022	24 Additional Print Positions for PRU1200 or PRU1600	2,900	10	67	58
Print Belts for PRU1200/1600:					
PRB0402	48 Characters (IBM "AN")	3,960	48	99	86
PRB0500	63 Characters (Series 50/100/400/600/6000)	2,460	40	82	71
PRB0703	64 Characters (Series 200/2000)	2,460	40	82	71
PRB0600	94 Characters (ASCII U/L)	3,960	48	99	86

*Rental prices include maintenance.

Honeywell Series 60
EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
Card Equipment:					
CRU0600	Card Reader (600 cpm)	17,500	63	398	345
CRU1050	Card Reader (1050 cpm)	18,500	92	495	429
PCU0120	Card Punch (100-400 cpm)	16,800	65	449	388
CCU0400	Card Reader/Punch (100-400 cpm)	24,815	102	564	536
CRF0003	51-Column Read for CRU0600 and CRU1050	1,900	5	49	43
Paper Tape Equipment:					
PTU0150	Paper Tape Punch (150 cps)	23,100	125	655	585
PTU0500	Paper Tape Reader (500 cps)	20,600	113	585	525
PTS065	Paper Tape System; reader/punch (500/150 cps)	39,200	215	1,105	1,075
Console I/O:					
CSU4100	Console Unit	10,800	33	227	216
CSF4001	Console Printer; 30 cps	7,940	44	189	180
CSF4013	Status Display (CRT)	4,660	18	111	105
CSF4014	Console Display (CRT)	4,660	18	111	105
CSF4006	Printer; 30 cps	7,940	44	189	180
CSF4027	Keyboard Switch	2,140	7	51	48
CSF4028	Keyboard Switch	2,140	7	51	48
CSU6001	System Console, includes IOM channel and keyboard/printer	30,552	50	651	619
CSF6001	Remote Display (23-inch) for CSU6001	2,000	10	113	97
CSF6003	Interactive Local Display (12-inch) for CSU6001	3,710	10	79	74
CSU6002	System Control Center; includes IOM channel	50,870	190	1,365	1,170
Data Entry Subsystem:					
DHF6001	Document handler channel for DHU 1600	4,800	5	107	96
DHF6003	Document handler for DHU 0800	4,800	5	107	96
DHF6004	Document handler control console & adapter	6,160	45	153	133
DHF0700	Data handler procurement for DHU 0800/DHU 1600	116,000	250	2,550	2,285
DHU0803	Document reader/sorter; 3 pockets; 830 dpm	23,520	119	510	485
DHU0814	Document reader/sorter; 14 pockets; 830 dpm	47,040	238	1,020	969
DHU1604	Document reader/sorter; 4 pockets; 1625 dpm	55,225	322	1,300	1,167
DHU1608	Document reader/sorter; 8 pockets; 1625 dpm	68,870	403	1,620	1,455
DHU1612	Document reader/sorter; 12 pockets; 1625 dpm	82,730	483	1,950	1,748
DHU1616	Document reader/sorter; 16 pockets; 1625 dpm	96,600	564	2,275	2,040
DHF0801	E-13B recognition	9,408	30	204	194
DHF0802	CMC-7 recognition	9,408	30	204	194
DHF0803	OCR recognition; numeric	28,224	91	612	581
DHF0804	OCR recognition; alphanumeric	37,632	121	816	775
DHF0805	Optical mark reader	4,704	15	102	97
DHF0810	Second line OCR	7,056	23	153	145
DHF0811	Second OCR numeric font	2,352	8	51	48
DHF0812	Third OCR numeric font	2,352	8	51	48
DHF0820	Off-line fine sort	3,552	8	77	73
DHF0830	Multiple-digit special outsort	2,352	8	51	48
DHF0840	Autoload data format control—MICR	2,352	8	51	48
DHF0841	Autoload data format control—OCR	2,352	8	51	48
DHF1603	Endorser	10,120	65	239	214
DHF1604	Expansion unit (16 additional pockets)	5,060	13	119	107
DHF1605	Expansion module (4 additional pockets)	15,180	47	357	321
DHF1606	Mobile carrier	175	NC	5	5
DHF1607	Short document read capability	690	2	17	10
DHF1608	Short document module expansion	460	2	11	5
DHF1609	Batch ticket detector	690	2	17	10
DHF1610	Resettable item counter	460	2	11	5
DHF1611	Basic off-line fine sort	1,610	6	40	27
DHF1612	Expanded off-line fine sort	460	2	11	5
DHF1613	Digit override	690	2	18	10
DHF1614	Digit edit	690	2	18	10
DHF1615	Zero kill	690	2	18	10
DHF1616	Field override	690	2	18	10
DHF1617	Field edit	690	2	18	10
DHF1618	No field/no digit autosort	690	2	18	10
DHF1619	Stacker overflow	690	2	18	10
DHF1620	Valid character check	460	2	11	5
DHF1621	Extended sort control	2,760	20	70	54
DHF1622	8 pocket off-line sort	1,488	14	50	41
DHF1630	Multilevel E-13B recognition	19,320	72	455	408

* Rental prices include maintenance.

Honeywell Series 60 EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
DATANET 6600 FRONT-END NETWORK PROCESSORS					
DCP6624	Processor; 48K-byte memory, IOM channel and peripheral subsystem adapter; general-purpose communications base, asynchronous communications base—type 1, console	81,780	166	1,739	1,512
DCP6632	Processor; 64K-byte memory; IOM channel and peripheral subsystem adapter, two general-purpose communications bases, asynchronous communications base—type 1, console	124,874	253	2,654	2,308
DCU6201	Asynchronous Communications Base—Type 2; maximum of 52 lines up to 110 bps; for speeds over 110 bps the number of lines is reduced	24,800	105	540	483
DCU6202	General-Purpose Communications Base; maximum capacity 32 lines	30,000	129	665	590
DCF6001	Asynchronous Speed Adapter for general-purpose communications base (110, 134.5, 150, 300, 1,050, 1,200, 1,800 bps)	240	NC	5	5
DCF6002	Asynchronous Speed Adapter for general-purpose communications base (50, 110, 150, 200, 300, 600, 1,200 bps)	240	NC	5	5
DCF6003	Additional Bit Rate Option for Asynchronous Speed Adapter—50 bps	240	NC	5	5
DCF6004	Additional Bit Rate Option for Asynchronous Speed Adapter—75 bps	240	NC	5	5
DCF6005	Additional Bit Rate Option for Asynchronous Speed Adapter—134.5 bps	240	NC	5	5
DCF6006	Additional Bit Rate Option for Asynchronous Speed Adapter—200 bps	240	NC	5	5
DCF6007	Additional Bit Rate Option for Asynchronous Speed Adapter—600 bps	240	NC	5	5
DCF6008	Additional Bit Rate Option for Asynchronous Speed Adapter—1,050 bps	240	NC	5	5
DCF6009	Additional Bit Rate Option for Asynchronous Speed Adapter—1,800 bps	240	NC	5	5
DCF6038	Additional Bit Rate Option for Asynchronous Speed Adapter—2,400 bps	240	NC	5	5
DCF6010	Communications Channel Interface; Asynchronous (two channels); EIA RS-232C	3,120	15	70	59
DCF6011	Communications Channel Interface; Asynchronous (two channels); current interface	2,650	9	62	51
DCF6012	Communications Channel Interface; General-Purpose (one channel); MIL STD 188C	3,190	10	72	62
DCF6013	Communications Channel Interface; Synchronous (two channels); ASCII	3,600	12	80	70
DCF6014	Communications Channel Interface; Synchronous (two channels) with Auto. Call Unit	3,800	12	85	75
DCF6015	Communications Channel Interface; Binary Synchronous with CRC (one channel)	3,920	19	87	77
DCF6016	Communications Channel Interface; Broad-Band (19,200 to 50,000 bps); (one channel)	4,020	14	96	85
DCF6017	Communications Channel Interface; General-Purpose (one channel)	3,120	15	70	59
DCF6018	Communications Channel Interface; General-Purpose with Auto. Call Unit (one channel)	3,360	16	75	64
DCF6019	High-Level Data Link Control Channel (one channel)	1,446	6	34	30
DCF6020	Direct Connect Capability—Asynchronous	440	5	10	10
DCF6021	Direct Connect Capability—Synchronous	968	5	23	20
DCF6022	Speed Adapter for Asynchronous Communications Base—Type 1 and Type 2 (50/75/100/200 bps)	240	NC	5	5
DCF6023	Speed Adapter for Asynchronous Communications Base—Type 1 and Type 2 (50/75/110/200 bps)	240	NC	5	5
DCF6024	Speed Adapter for Asynchronous Communications Base—Type 1 and Type 2 (75/110/150/300 bps)	240	NC	5	5
DCF6025	Speed Adapter for Asynchronous Communications Base—Type 1 and Type 2 (110/134.5/150/300 bps)	240	NC	5	5
DCF6026	Asynchronous Channel Group, EIA and Auto Call (3 channels and one Auto Call)	3,920	19	87	77
DCF6027	Asynchronous Channel Group, EIA Interface (four channels)	3,600	12	80	70
DCF6028	Asynchronous Channel Group, Current Interface (four channels)	2,450	12	57	46
DCF6029	Asynchronous Channel Group, MIL STD 188C (four channels)	3,920	19	87	77
DCF6030	Computer Monitor Adapter	11,000	30	266	240
DCF6031	Line Transfer Device	24,341	62	556	490
DCF6032	Line Expansion Function, Asynchronous; six lines between data set & 2 Communications Bases	2,169	5	50	44
DCF6033	Line Expansion Function, Asynchronous; six comm. channel interface between Communications Base and 2 data sets	2,169	5	50	44
DCF6034	Line Expansion Function, Asynchronous or Synchronous; four lines between Communications Bases	2,169	5	50	44
DCF6035	Line Expansion Function, Asynchronous or Synchronous—four lines between groups of data sets	2,169	5	50	44
DCF6036	Line Expansion Function, Current Interface—24 lines	2,169	5	50	44

* Rental prices include maintenance.

Honeywell Series 60 EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (1-year lease)*</u>	<u>Rental (5-year lease)*</u>
Model 62/60 Line Terminators:					
DCF21 00	Line terminator; asynchronous; direct connect	720	5	15	14
DCF2101	Line terminator; asynchronous lines	2,880	20	60	57
DCF2102	Line terminator; synchronous lines	3,360	23	70	67
MOTOR/GENERATORS – LEVEL 68					
MGS6001	Motor Generator and Control Unit; 31.3 KVA, 60 Hz, 208/440 V, AC input	13,738	32	324	289
MGS6002	Motor Generator and Control Unit; 62.6 KVA, 60 Hz, 440/480 V, AC input	16,238	39	389	347
MGS6003	Motor Generator and Control Unit; 62.6 KVA, 50 Hz, 380 V, AC input	17,238	41	409	363
MGS6004	Motor Generator and Control Unit; 62.6 KVA, 60 Hz, 208 V, AC input	16,238	39	389	347

SOFTWARE PRICES

<u>System Software</u>		<u>Monthly License Fee</u>
SBC0005	Communications Software—Synchronous Terminals	175
SBC0006	Communications Software—Asynchronous Terminals	120
SBL0002	RPG Compiler	46
SBL0005	ANS COBOL-74 Compiler	77
SBS0200	GCOS Level 62 Basic Supervisor	NC
SBU0002	Sort/Merge	46
SBU0003	Test Data Generator	15
SBU0005	Basic Utilities	10
SBV0004	Series 100 File Conversion Package	NC
SBV0006	360/20 Card Conversion Package	NC
SBV0007	360/20 Disk Conversion Package	NC
SBV0009	Series 200 Easycode to Level 62 COBOL Translator	NC
SBV0010	Series 200 COBOL to Level 62 COBOL Translator	NC
SFL6001	ANS COBOL-74 Compiler, with Supporting Libraries	178
SFL6002	PL/1 Compiler with Supporting Library	255
SFL6101	Multics—PL/1 Compiler and Library	NC
SFL6102	Multics—FORTRAN Compiler	350
SFL6103	Multics—BASIC Compiler	350
SFL6104	Multics—COBOL-74	350
SFL6105	Multics—APL	350
SFP6001	Data Management System	800
SFS6001	Transaction Driven System	1,000
SFS6100	Multics Operating System	NC
SFS6106	Multics—GCOS Environment	500
SFS6108	Multics—Remote Batch	150
<u>Program Products</u>		<u>Monthly License Fee</u>
Level 62		
ABF0001	Accounts Receivable	65
ABF0002	Accounts Payable	65
ABF0003	General Ledger	65
ABF0004	Payroll	65
ABM0002	Production Scheduling and Control	179
ABM0011	IMS/62—Requirements Management and Material Requirements Planning	102
ABM0031	IMS/62—Resource Inventory Planning	41
ABM0041	IMS/62—Standard Cost Control	40
Level 64		
ADD0001	Inventory Management System/I	NC
ADD0002	Inventory Management System/II	NC
ADD0003	Vehicle Scheduling	NC
ADD0004	Sales Order Processing	NC
ADE0001	Student Scheduling	NC
ADE0002	Attendance and Grade Reporting	NC
ADF0001	Accounts Receivable	NC
ADF0002	Accounts Payable	NC
ADF0003	General Ledger	NC
ADF0004	Payroll	NC
ADH0001	MEDACS	NC
ADM0002	Inventory Management System/2000	NC
ADM0003	Production Scheduling and Control/2000	179

* Rental prices include maintenance.

Honeywell Series 60 SOFTWARE PRICES

Program Products

Monthly License Fee

Level 66

AEB0002 AEB0003	BISNET Metropolitan Online Savings System CHECS:	NC 250
AEB0004 AEB0005	Document Entry Proof and Transit	NC NC
AEM0001 AEM0003	Inventory Management System/66 Production Scheduling and Control	NC 300

		<u>Monthly Lease</u>	<u>Paid-Up Lease</u>	<u>Annual Maint.</u>
AES0001	ANC; Full APT with Independent Post Processor	100	NA	NA
AES0003	MPS; Linear Programming with Extended Features including Direct Access	200	NA	NA
AES0004	MPS; File Management and Report Writer Features	400	NA	NA
AES0005	GPSS; General Purpose Simulation System for Discrete Modeling	125	NA	NA
AES0006	BMD Statistics	NA	500	300
AES0008	ASTRA PERT/CPM Network Project Control with Resource Allocation	NA	1,000	300
AES0009	NASTRAN; NASA-Developed Structural Analysis	NA	3,000	300
AES0010	Computerized Publication (Error Checking Features)	200	NA	NA
AES0011	Computerized Publication; Text Processor	NC	NC	NC

NA—Not Available
NC—No Charge

* Rental prices include maintenance.