

Rev 8/77

Honeywell Series 60

MANAGEMENT SUMMARY

On April 23, 1974, Honeywell announced its strategy for consolidating the diverse product line that resulted from the merger of the Honeywell and General Electric computer operations in 1970. Called the Honeywell Information System, the announcement encompassed a comprehensive group of products and services that include the Series 60 computer family, a collection of enhanced peripheral devices, and a definition of the growth paths through which the company expects to preserve and upgrade its large and diversified customer base.

At the time of the announcement, Honeywell emphasized that the new Series 60 would not immediately obsolete the systems in its current Series 2000 and Series 6000 product lines. Instead, the new Series 60 product line, operating under either an enhanced version of the comprehensive GCOS operating system or an enhanced version of the Multics operating system, was defined as the ultimate upgrade series for these systems, as well as for the older Series 100, Series 200, Series 400, and Series 600 systems. In addition, to facilitate the transition to the new product line, Honeywell introduced an array of conversion aids, including hardware and software "bridges" and compatibility features, to enable its users to grow into the new systems.

In the United States, the April 1974 Series 60 product announcement included seven new processor models grouped into four "levels" of computer power. These included the Model 62/60, a small-scale system and the only processor model in the original U.S. product line designed primarily to attract new computer users, and ▶

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

CHARACTERISTICS

MANUFACTURER: Honeywell Information Systems, Inc., 200 Smith Street, Waltham, Massachusetts 02154. Telephone (617) 890-8400.

MODELS: Series 60—Level 62, Model 62/40 and Model 62/60; Level 64, Model 64/20 and Model 64/40; Level 66, Models 66/10, 66/20, 66/40, 66/60, and 66/80; Level 88, Model 88/60 and Model 88/80. (For coverage of the smaller Level 61 systems, see Report 70C-480-14.)

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: Error detection and correction bits with each word are checked whenever storage is referenced. When the data is retrieved, single-bit errors are detected and retried before software error recovery routines are signalled. ▶



The Model 66/80 is the most powerful of the five large-scale Level 66 processor models. The Level 66 systems are quite similar to Honeywell's successful Series 6000 computer family and offer Series 6000 users a clear upward growth path. Monthly rentals for Level 66 systems range from about \$16,000 to over \$100,000.

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CHARACTERISTICS OF THE LEVEL 66 AND 68 PROCESSORS

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

➤ Honeywell added two more new processor models to the Series 60 in January 1975: the Level 66 Model 10 and the Level 68 Model 60. Both are designed to lower the price threshold for the company's large-scale multi-dimensional GCOS and Multics operating environments.

CENTRAL PROCESSOR MODELS

MODEL 62/40: One of the newest of the Series 60 processor models, the Level 62 Model 40 is targeted directly at the IBM System/3 Model 10 and signals the beginning of a distinctly more aggressive Honeywell marketing policy for the Series 60 family. To spearhead its second direct attack on the IBM customer base, Honeywell revived the Liberator concept, a strategy that was highly successful in enabling the company to convert large numbers of IBM 1400 accounts to the Honeywell Series 200 in the early 1960's. The new Liberator/3 concept includes the Model 64/40 central processor, an array of new System/3-compatible peripheral units, a compatible RPG compiler, and a set of conversion aids for System/3 user programs and data files.

The minimum Model 62/40 configuration consists of a central processor with 65,536 bytes of main memory, a system console with keyboard printer and one magnetic tape cassette drive, 11.6 million bytes of disk storage, a 400-line-per-minute printer, and a 300-card-per-minute 96-column card reader. This system rents for \$2,322 per ➤

➤ 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 62-bit accumulator (A and Q registers), 8 index registers, 8 address registers, 48 history registers, 1 fault register, 1 mode register, 1 base register, 1 indicator register, 1 instruction counter, 1 timer register, and 1 exponent register in each processor.

INSTRUCTION REPERTOIRE: Models 62/40, 62/60, 64/20, and 64/40 have an instruction set consisting of logic and arithmetic instruction 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 and 64/40 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, Model 66/80, and Model 68/80 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.

PROCESSOR MODES: There are two modes of processor operation, master and slave. The master mode, used only ➤

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The Model 62/60 is a small-scale disk-oriented system aimed primarily at attracting new users to the Series 60 product line. It offers from 65K to 131K bytes of 1-microsecond MOS memory. Typical system rental prices range from about \$3,500 to \$5,500 per month.

▷ Liberator/3 is a conversion concept that includes software for automatically converting System/3 RPG II source programs to Level 62 RPG and for translating System/3 Model 5444 and 5445 disk files to Level 62 format. A Level 62 GCOS simulator is also available for converting System/3 Multi-Function Card Unit functions to disk processing.

First customer deliveries of the Model 62/40 were made in June 1975. The 96-column multifunction card units and the 800-line-per-minute printer were delivered in the fourth quarter of 1975.

MODEL 62/60: The Level 62 Model 60 is a small-scale disk-oriented system with monthly rentals in the \$3,500 to \$5,500 price range. Main memory 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.

When it was originally announced in April 1974, the Model 62/60 included integrated controls for a 600 or 1050 card-per-minute card reader, a 400 or 600 line-per-minute printer, and up to four 29.2-million-byte-spindles of disk storage. The original systems had a limited magnetic tape capability in the form of up to two console tape cassette drives. Concurrently with the introduction of the Model 62/40 Liberator system, Honeywell enhanced the peripheral capabilities of the Model 62/60 to make it, along with the 62/40, a more formidable competitor for the IBM System/3 family. The enhanced version can now support up to six MSU0112/0113/0116 and MSU0310 Mass Storage Units for a maximum capacity of 175.2 million bytes, plus up to four MTU0120/0121/0111 or MTU0220/0221/0211 Magnetic Tape Units. The printing capabilities of the system were also enhanced with the addition of an 800-lpm printer. To smooth the upward growth path for potential System/3 converts, Honeywell also added

▷ 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 ½-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 or MSU0400 Mass Storage Units used with compatibility mode, but the logical file structures of Series 200/2000 files need not be modified.

Series 200/2000 Compatibility Mode operation requires a minimum configuration consisting of a Model 64/20 or Model 64/40 central processor, 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 was released under Level 64 GCOS in August 1975.

The Series 100 Compatibility Mode is also implemented by a combination of microprogramming in the Model 64/20 and 64/40 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 was first installed in July 1975.

INPUT/OUTPUT CONTROL

CONFIGURATION RULES: The Model 62/40 is a single-processor system with integrated input/output and communications controllers. The central processor includes six overlapping I/O channels with integrated controls for up to four mass storage units, unit record equipment, console and a multi-line communications controller for four lines, and magnetic tape cassette handler.

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▷ batch jobs plus an output writer, or one batch job, one communications job, and an output writer. Language support includes 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 many IBM 360/20 systems still installed.

Although Honeywell indicates that the Level 62 systems will be the primary vehicle in the Series 60 for attracting new users to its customer base, these systems could also be of interest to users of very small Honeywell Series 200/2000 equipment (such as the Models 105, 110, and 2020) and the Series 100 systems. Honeywell is supplying program and file conversion routines to aid users of these systems in converting to the Level 62, but no emulation capabilities for the Series 200/2000 systems are provided at this level of the Series 60. Customer shipments of Model 62/60 systems began in August 1974.

MODEL 64/20. The Level 64 Model 20 is a medium-scale processor with system rentals ranging from approximately \$6,000 to \$12,000 per month. The 64/20 features from 65,536 to 163,840 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, a 100 card-per-minute card punch, 600, 800, 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 MSU0310 29-million-byte or MSU0400 100-million-byte disk storage drives for a maximum of 400 million bytes of direct-access storage. The MSU0310 and MSU0400's disk drives can be intermixed on the same CPU. An optional magnetic tape subsystem permits attachment of up to eight 7- or 9-track magnetic tape drives with transfer rates of up to 200K bytes per second.

The 64/20 features microprogrammed emulation of Honeywell Series 100 or 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 runs under Level 64 GCOS, a subset of the full-scale GCOS operating system. Programming language support includes an ANS COBOL-74 compiler.

MODEL 64/40: The Level 64 Model 40 was quietly released in the U.S. in April 1975, one year after its ▷

▶ 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 are integrated into a single control unit. A free-standing I/O multiplexer is also available. The integrated I/O multiplexer provides 18 to 27 channel board slots, and the free-standing I/O multiplexer can contain up to 54 channel board slots 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 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 18 to 27 channel board slots, and a free-standing I/O multiplexer can have up to 54 channel board slots for connecting peripheral processors.

The *Model 66/80* is available only in free-standing configurations and can contain from one to four central processors, one to four system controllers, and one to four I/O multiplexers. Each I/O multiplexer contains up to 54 channel board slots. The characteristics of the peripheral processors are the same as those of the smaller Level 66 peripheral processors.

The *Model 68/60* system can have one or two central processors, one I/O multiplexer with 24 input/output channels, and one system controller for each 262,144 words of main memory. One Datanet 6600 Front-End Network Processor can be connected to the 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 up to 14 disk drives. Series 60 unit record devices and magnetic tape units are controlled by the unit record processor and the magnetic tape processor.

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. 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 62/40 and 62/60, program execution can proceed concurrently with data transfer operations on six overlapping input/output channels. The maximum total input/output rate of each system is 837,000 bytes per second.

The Model 64/20 and Model 64/40 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. All three channels in the Model 64/20 can operate simultaneously at the maximum data transfer rate. All input/output ▶

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➤ magnetic tape units, and four unit record devices. The four larger Level 66 central processors can all be equipped with 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 Datamet 6600 Front-End Network Processors, with each of the 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 include ANS COBOL-68 and COBOL-74, PL/I, FORTRAN, ALGOL, JOVIAL, BASIC, and the GMAP assembly language. Level 66 systems can also utilize an enhanced version of Honeywell's Integrated Data Store (I-D-S) for design and implementation of network-oriented data base management systems.

MODEL 66/10. Announced in January 1975, the Model 66/10 is the smallest and lowest-priced Series 60 processor that can use the full-scale GCOS Level 66 operating system. With typical monthly rentals ranging from approximately \$16,000 to \$20,000, the Model 66/10 computer system fits nicely into a price range that went unfilled in the original April 1974 announcement of the Series 60 product line. In architecture and systems software, the 66/10 represents a downward extension of the four previously announced Level 66 processor models (the 66/20, 66/40, 66/60, and 66/80), and operates under the full-function version of Honeywell's GCOS operating system.

The Model 66/10 achieves its economies through the use of an integrated control unit that contains the I/O multiplexer, system controller, mass storage processor, and unit record processor. Its peripheral performance and expansion capabilities are somewhat restricted in comparison to larger models in the Level 66 family. For example, the Model 66/10 comes only in single-

➤ total subsystem capacity of 46.4 million bytes. The average seek time is 40 milliseconds, average rotational delay is 12.5 milliseconds, and data transfer rate is 312,000 bytes per second. These units use the Honeywell M4020 removable disk cartridge (or equivalent), which contains one disk with two recording surfaces and has 406 tracks per recording surface (including 6 spares). All spindles attached to the same control unit can perform concurrent seek operations simultaneously with a data transfer operation on one spindle. Reliability features include on-line error and status reporting to the central processor and a hardware diagnostic capability for off-line diagnosis.

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 416,000 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 62/40 systems can operate with two to four MSU0310 storage units through an integrated mass storage controller. Level 62/60 systems can have up to six MSU0310 storage units. Model 64/20 systems can include from one to four MSU0310 storage units, and Model 64/40 systems can include up to eight 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 except on the Model 60/10, which can have a maximum of eight 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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➤ 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 that of the 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 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.

LEVEL 68: The top members of the Honeywell Series 60 family, the Model 68/60 and Model 68/80, are the latest versions of Honeywell's Multics hardware and are aimed at a specialized group of users who have requirements for the powerful virtual memory capabilities of the Multics operating system. Among the many advanced features of the Level 68 central processors are hardware for handling segmentation and paging in a virtual memory environment, a high-speed cache memory for improved performance (available in the Model 68/80 processor only), an associative memory for fast hardware access to the virtual memory and efficient address translation, and a ring structure for program and data protection to allow the creation of closed ➤

➤ **MTU0111/0120/0121:** 9-track, 18.75 ips, 200/556/800/1600 bpi, 3,750/10,425/15,000/30,000 bytes/sec.

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.

MTU0220/0221: 9-track, 37.5 ips, 200/556 bpi, 7,500/20,850 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 eight MTU0210/0211, MTU0410, or MTU0500 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 for card equipment, printers, communication, and console equipment. The number of peripheral devices configured is limited by the number of ports available.

CRU0306 CARD READER: Available for Model 62/40 and Model 62/60 systems, this unit reads 96-column cards at a speed of 300 cards per minute. Contains a 600-card input hopper and a 600-card output hopper.

CCU0506/CCU1006 MULTIFUNCTION UNITS: Available for Model 62/40 and Model 62/60 systems, these units perform reading, punching, printing, and stacker selection operations on 96-column cards. Additional functions that can be performed under program control include sorting, merging, collating, interpreting, and reproducing. The Model CCU0506 reads cards at a rate of 500 cards per minute and the Model CCU1006 reads at 1000 cards per minute. Both units have a punching speed of 120 cards per minute. The printing speed for both units is also 120 cards per minute. The printing area on each 96-column card consists of 4 lines, each containing 32 characters.

Each unit includes two 2000-card input stations to provide two simultaneous card paths, one of which is used ➤

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The Model 64/20 features micro-programmed emulation of the Honeywell Series 200/2000 or 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 \$6,000 to \$12,000 per month.

➤ The Model 64/20 and Model 64/40, designed by Honeywell Bull in France and Honeywell Boston, include a 175-nanosecond read-only memory plus a multiple-function logic unit that performs central processor functions. The processing capability of the Level 64 systems is distributed between the central processor and integrated peripheral processor subsystems, which contain microprograms and arithmetic and logic units 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 associate memory permits Level 64 systems operating under native-mode 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 600/6000 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 and system controller are housed in a single integrated control unit ➤

➤ **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 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 ➤

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➤ 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 Level 64 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 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 ➤

➤ 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.

LEVEL 64: 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.

A Datanet 2000 Communications Processor can be attached to the optional fifth input/output channel of the Model 64/40. A minicomputer-based front-end communications processor, the Datanet 2000 was originally designed for use in Honeywell Series 200 and Series 2000 computer systems operating under OS/2000. It consists of a 16-bit minicomputer with 12,288 words (24K bytes) of memory, an interface to the main computer, a network interface for 2 to 120 full-duplex communications lines, a real-time clock, and a control console with I/O typewriter. The storage capacity can be expanded in 4096-word modules to a maximum of 32,768 words (64K bytes). The minicomputer has 75 basic instructions, an effective cycle time of 385 nanoseconds per byte, and an add time of 2.35 microseconds.

Programs stored in the Datanet 2000 poll the lines, translate ASCII code to or from the 6-bit Series 200/2000 internal code, queue messages in core or on an optional 512,000-byte fixed-head disk file, transfer data to or from the main processor, provide recovery and error handling, initialize and load the system, and permit operator intervention when necessary. Incoming messages are transferred into the minicomputer's A register, two bytes at a time, in codes of up to eight levels. Transmission can be either full-duplex or half-duplex, over either leased or switched lines, and in either synchronous or asynchronous mode. Line speeds of 45.5 to 10,800 bits per second can be handled. Cyclic redundancy checking is optional.

The basic Datanet 2000 handles up to 8 lines. Its capacity can be increased in 16-line increments to a maximum of 120 lines. Interface modules are available for a wide variety of communications devices and services, including virtually any device that communicates in the ASCII or IBM BSC mode. First deliveries of the Datanet 2000 occurred in the fourth quarter of 1972.

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 in the basic FNP processor. A paging mechanism allows the addressing of up to 262,144 9-bit bytes with larger memory capacity. ➤

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▷ 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 is 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 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. Model 64/20 systems can be equipped with an integrated communications controller capable of handling up to six synchronous and/or asynchronous communications lines at speeds of 45 to 19,200 bits per second. The slightly larger Model 64/40 can also be equipped with an optional Datanet 2000 Communications Processor to support larger communications networks and to provide compatibility with larger Series 2000 systems which are configured with a Datanet 2000-based communications network.

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 includes 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 are all separately priced, as are services such as program development, network design, education, and extra sets of documentation. All existing software for the Series 2000 and 6000 computer systems remains bundled, and users currently running applications packages on these systems can transfer them to Series 60 systems at no additional charge.

Software support for all Series 60 processors is provided by several levels of Honeywell's proven GCOS operating system. For Level 62 and Level 64 processors, a subset ▷

▶ 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 has 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 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.
- High Level Data Link Control Interface (DCF6019)—for one channel utilizing the HDLC 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 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 ▶

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➤ processors and are supplied with the central processors at no additional charge. 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), Mod 1 (TR), and OS 2000 systems software, applications programs, and user-written programs to run on Level 64 systems with little or no modification. Series 200/2000 files also require no modification. Honeywell states that the overwhelming number of small Series 200 users are operating under the Mod 1 operating systems.

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, data base, and communications capabilities of the OS/2000 operating system. For these users who elect a gradual transition, Honeywell has promised three more releases of OS/2000 each of which will add functional extensions to OS/2000's current environment.

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, a Series 200/2000 Compatibility Mode for OS/2000 systems is available for the Level 66 central processors.

There is no direct program compatibility between the Series 60 processors and other competitive product lines. In the original Series 60 announcement, moreover, Honeywell announced few new features that would provide enhanced compatibility with competitive systems. Only the Model 62/60 was provided with a conversion package for translating IBM System/360 Model 20 RPG programs and data files to Model 62/60 formats. For larger competitive systems, the Honeywell offering was limited to the CAPS conversion aids for UNIVAC (ex-RCA) Series 70 and IBM System/360 COBOL programs. In 1974, Honeywell was clearly giving first priority to the consolidation of its own customer base.

The about-face to a more aggressive marketing stance occurred with the April 1975 introduction of the Model 62/40 Liberator/3 package, which provides compatibility with the IBM System/3 through a System/3-compatible RPG II compiler, System/3-compatible peripherals, plus program and file conversion aids.

COMPETITIVE POSITION

With system rentals ranging from approximately \$2,400 per month for an entry-level Model 62/40 system to well ➤

➤ characters. Jobs are entered in the system through the Input Reader, which creates a record of each job's resource requirements for use by the Supervisor in job scheduling.

Jobs are examined for scheduling according to a four-level user-assigned priority structure, with Level 4 designated the urgent priority level. Within each priority level, jobs are scheduled according to the availability of system resources. An alternative scheduling system is available, in which one partition can be assigned to each scheduling priority queue and jobs are scheduled on a first-in/first-out basis within each priority queue.

Peripherals devices can be shared by programs running in any partition, or they can be assigned to a specific processing partition or allocated to the operating system data transcription routines. Peripherals can be identified by absolute symbolic device names (referring to a specific device) or by device-category symbolic names (referring to any device of a particular type). Disk devices can be shared among partitions. Alternately, a disk volume or disk file can be reserved for exclusive use by one partition. Disk files can be assigned file read exclusivity, file write exclusivity, or file read/write exclusivity to determine the type of access allowed for each partition.

Other features of Release 1 of Level 64 GCOS include: 1) a centralized recovery facility that provides partition restart, system restart, and recovery for disk and tape files; 2) a roll-out/roll-in facility that permits jobs in execution to be rolled out to mass storage to allow immediate processing of urgent jobs; and 3) a job accounting facility that logs the utilization of all system components. The second release of Level 64 GCOS, scheduled for availability in May 1976, will add support for communications processing and the console CRT. Release 3 of Level 64 GCOS, scheduled for the second quarter of 1977, will include support for COBOL-74 and native-mode GCOS operation, including the GCOS nucleus and job control language.

Level 64 GCOS requires a Model 64/20 central processor with a minimum of 65,536 bytes of main memory or a Model 64/40 central processor with 98,304 bytes of main memory. The resident monitor resides in the central processor's system memory but also occupies 28,672 bytes of processor main memory.

LEVEL 66 GCOS: This integrated operating system is the basis for all Series 60 Level 66 software. It has facilities for controlling concurrent local batch processing, on-line transaction processing, and time-sharing. Level 66 GCOS is based on GCOS 6000, the operating system support for the earlier Honeywell Series 6000 computers.

GCOS handles local and remote batch jobs in the same manner except for the input and output routines they use. User jobs can enter the system simultaneously from multiple local and remote terminals. Jobs entering the system are routed to a System Scheduler, which permits a large number of jobs (limited by available direct-access storage) to be queued in up to 50 installation-designated jobstreams. These jobs are initiated by assigned job class, by highest priority within the class, and on a first-in, first-out basis among jobs of equal priority. For jobs without preassigned priorities, GCOS calculates priorities on the basis of their resource requirements. Also, an "Express" jobstream is provided for jobs that require a minimum of system resources. Express jobs are allocated peripheral resources before nonexpress jobs. A "Hold" stream permits jobs to be entered but their initiation deferred to a specified date and time or until initiated by the operator.

➤ Jobs are passed from the GCOS System Scheduler to the Allocation Queue according to their relative priorities. ➤

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| | Excellent | Good | Fair | Poor | WA* |
|----------------------------|-----------|------|------|------|-----|
| Ease of operation | 3 | 1 | 0 | 0 | 3.8 |
| Reliability of mainframe | 1 | 2 | 0 | 0 | 3.3 |
| Reliability of peripherals | 1 | 1 | 1 | 0 | 3.0 |
| Maintenance service: | | | | | |
| Responsiveness | 1 | 2 | 0 | 0 | 3.3 |
| Effectiveness | 0 | 2 | 1 | 0 | 2.7 |
| Technical support | 0 | 2 | 1 | 0 | 2.7 |
| Operating system | 4 | 0 | 0 | 0 | 4.0 |
| Compilers and assemblers | 2 | 1 | 1 | 0 | 3.3 |
| Applications programs | 1 | 0 | 2 | 0 | 2.7 |
| Ease of programming | 1 | 3 | 0 | 0 | 3.3 |
| Ease of conversion | 1 | 3 | 0 | 0 | 3.3 |
| Overall satisfaction | 1 | 3 | 0 | 0 | 3.3 |

* Weighted Average on a scale of 4.0 for Excellent.

The systems replaced by the Series 60 equipment included an IBM System/370 Model 168 and a Control Data 3300 (each by a Model 66/20), an IBM System/370 Model 145 and a Honeywell Model 8200 (each by a Model 66/60), and a Honeywell Model 2020 (by a Model 62/60). All of the systems were performing business data processing functions, and two systems were also engaged in scientific/engineering computing, five were handling data communications, and three were executing data base management applications.

The average number of terminals per system was 7 remote batch terminals and 37 interactive terminals. One system represented a combination of purchased and rented equipment; two systems, a Model 68/80 and a Model 66/20, were purchased; three were rented from Honeywell; and one, a Model 66/60, was acquired through a third-party leasing arrangement.

On the whole, the Series 60 Level 66 systems fared very well in the ratings supplied by these early users, receiving average ratings of good (3.0) or better in 9 of the 12 performance categories rated in the Datapro survey. The two categories in which these Series 60 systems earned outstanding ratings were Ease of Operation, in which the users gave the systems a nearly perfect rating of 3.8, and Operating System, in which the four Level 66 systems earned a perfect score of 4.0.

In their remarks, the areas singled out by these users where Honeywell's performance could be improved included technical support, maintenance service, and the documentation supplied for the new systems. On the plus side, the users cited operating system flexibility, enhanced throughput capability, ease of data base and data communications implementation, on-line programming, and time-sharing capabilities as the outstanding characteristics of this portion of the new Series 60 product line. Although the user of the Model 68/80 Multics system declined to supply numerical ratings for his newly installed system, he listed the system's interactive processing capabilities, the ease of sharing data among system users, and the facilities for protection and security of on-line data as outstanding features of the Multics system.



generated by all activities are collected within the GCOS file system and then batched on multiple printers and/or card punches. Printing and punching are performed concurrently with the processing of other jobs and the entry of still other jobs into the system.

GCOS is designed for use in both single-processor and multiprocessor configurations. In multiprocessor systems, the Dispatcher collects activities for all processors from a single queue. All processors execute both GCOS and user programs, but only the one designated to be the control processor responds to interrupts.

Remote access is a featured capability of GCOS in each of its processing dimensions: batch, transaction processing, and time-sharing. The communications control functions are performed by the Datnet 6600 Front-End Network Processor. Any Series 60 program that can be entered at the central computer site can also be entered remotely via a batch terminal or a keyboard terminal. Output can be routed to the originating terminal, one or more other terminals in the communications network, central-site card punches and printers, or the GCOS SYSOUT facility. A Communications Mass Store Link permits remote batch terminals to communicate directly with mass storage via the front-end communications processor, bypassing the central processor and main storage. User programs executing in the batch mode can establish communications with remote terminals to accept input or issue a remote inquiry request.

TRANSACTION PROCESSING: The Level 66 GCOS Transaction Processing System (TPS) invokes the loading and execution of the appropriate application programs for processing transactions received from remote terminals. The Transaction Processing System requires a front-end network processor and can accept transactions from Honeywell BTT 7340 Bank Teller Terminals; Teletype Models 33, 35, and 37; and the Datnet 760, VIP Series 765, 775, 785, and 7700 Keyboard-Display Terminals.

The TPS is modular in design and consists of the Transaction Processing Executive, user-written Transaction Processing Applications Programs, the Transaction Input Interface at each remote terminal, and the Interslave Communication (INTERCOM) Facility. The Transaction Processing Executive Program (TPE) receives transactions from remote terminals, checks them for validity, and queues input transactions according to user-established priorities. TPE then initiates the appropriate Transaction Processing Applications Program for processing the transaction, and directs the output to the originating terminal. TPE also maintains a journal of input and output data to facilitate recovery activities. The Transaction Processing Applications Programs (TPAP's) can be written in any language processor supported by GCOS, including COBOL, FORTRAN, or GMAP, and are stored in the GCOS file system for activation as required. TPAP's can also request direct communication with a terminal to process a transaction in the interactive mode.

The Transaction Input Interface provides simplified procedures for entering transactions from either teletype or keyboard-display consoles. The INTERCOM facility permits data to be exchanged between the Transaction Processing Executive and applications programs through direct buffer-to-buffer transfers. The Transaction Processing Executive operates as a privileged slave program under the GCOS operating system and is activated by an operator command.

TRANSACTION DRIVEN SYSTEM: Announced in October 1974, TDS is a licensed Honeywell software product designed for high-volume on-line transaction processing. It is compatible with the Remote Terminal Supervisor (GRTS) and the Network Processing Supervisor (NPS), can process a variety of terminal messages, and supervises concurrent processing of multiple transactions and their associated tasks. The TDS executive program executes under GCOS. User-written transaction



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automatic blocking and deblocking. The system includes capabilities for processing GFRC (File and Record Control) files on magnetic tape and linked mass storage, and for both American National Standard and IBM System/370 magnetic tape files. File organizations supported include sequential, relative, indexed, and integrated files. UFAS also includes facilities for error checking and the initiation of error processing as defined by ANS COBOL-74, and file integrity protection for normal and abort processing.

The access modes supported are Sequential, Random, and Dynamic (which allows files to be accessed first sequentially and then randomly, or vice versa) without closing and reopening the files. Space and buffer management and physical input/output services are also provided for the three access modes. The integrated file organization pertains to variable-length mass storage records that are accessed through a data base key provided by the I-D-S/II data base management system.

INTEGRATED DATA STORE (I-D-S/I AND I-D-S/II): I-D-S/I is an enhanced version of I-D-S, a data base management system originally developed by GE. The software is described in detail in Datapro Report 70E-480-01. A further enhanced version of the data base management system, I-D-S/II, was released in November 1975 and marks the beginning of an evolution of I-D-S toward conformance with the recommendations of the CODASYL Data Base Task Group. I-D-S/II is fully integrated with Honeywell's COBOL-74 compiler, and user interfaces are also planned for FORTRAN and PL/1. I-D-S/II is a separately priced program product and has a monthly license fee of \$400. In addition, the monthly license fee for the COBOL-74 Subschema Translator is \$100, and the Interactive I-D-S/II option costs \$75 per month.

MANAGEMENT DATA QUERY SYSTEM (MDQS): An enhanced version of the Data Query System that permits interrogation of sequential, indexed-sequential, or I-D-S file organizations. MDQS operates as a subsystem to GCOS in both batch and time-sharing environments. In order to implement MDQS, user and system directories are defined to identify the data base and the files associated with the data base. An optional Privacy File can be established for storing user identification and passwords associated with the data base.

MDQS provides a Data Definition Language to permit description of the data base, including relationships and attributes of the data to be processed by MDQS procedures. A Procedural Language provides simple English commands for retrieving data, performing arithmetic computations on retrieved data, and selecting output for printing. A complement of utility programs is provided for updating directories, inserting and deleting file entries, and converting data files to MDQS format.

MDQS is available in two versions: MDQS II, a data base retrieval and report generation system, and MDQS IV, a system that offers all MDQS II capabilities plus data base creation and maintenance features.

TOTAL: Two versions of the TOTAL Data Base Management System are available for Level 64 systems for execution under GCOS Level 64. TOTAL is designed for small-scale implementations of the system, while TOTAL Central is an enhanced version of the data base management system with "multi-thread" capabilities to support multiple applications programs making simultaneous accesses to the data base. The TOTAL Data Base Management System is designed and marketed by Cincom Systems, Inc., and is described in detail in DATAPRO 70 Report 70E-132-01. TOTAL Central requires 17K bytes of main memory plus input/output buffers; a Series 60

Level 64 central processor with 128K bytes of main memory accommodates TOTAL Central, the GCOS Level 64 operating system, and two typical user programs. The TOTAL Interactive Query Language (IQL) is an interactive English-language query facility that permits retrievals to be made from remote terminals through a Datanet 2000 Communications Processor. TOTAL IQL occupies 27K bytes of main memory plus space required for input/output buffers.

TOTAL ON-LINE TESTING: TOLT is an on-line test and diagnostic system that runs under GCOS. Its objective is to improve the system's reliability and availability through the use of on-line preventative and corrective maintenance techniques. TOLT monitors and saves all error status information, makes periodic surveillance checks of various hardware modules, and calls in specific diagnostic tests and on-line troubleshooting programs. TOLT and GCOS are designed to take full advantage of the various maintenance facilities of the Series 60 hardware: programmable voltage margins, programmable timing strobes, history registers, programmable channel wrap-arounds, parity and sequence checks, snapshot channel hardware, and a fault register.

The Honeywell Error Analysis and Logging System (HEALS II) is a software system that works in conjunction with TOLT, GCOS, and the Series 60 fault recovery hardware. The Instruction Retry feature attempts to recover from transient errors such as incompleting operations, parity errors, and illegal procedures. Errors associated with the Extended Instruction Set are logged by the HEALS Logging program but are not retried. The HEALS Logging program accumulates statistics on the results of instruction retry operations and processor and main memory errors. If an unrecoverable parity error occurs, a storage segment is reconfigured, and TOLTS is activated to test the malfunctioning segment. An Error Summary File contains summaries of processor errors and addresses and data associated with parity errors. Parity errors are analyzed in order to isolate malfunctioning bits. A Microprogrammable Peripheral Controller Statistics Report Program produces listings of errors associated with the controller and associated peripheral devices.

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. NPS also provides powerful customization and parameterization facilities to facilitate implementation of additional terminal types and network protocols into the system.

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

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► programs and data, a tree-structured hierarchy for organization of user and system storage, and the availability of multiple programming environments and user interfaces within a single system.

Information in the Multics system's virtual memory is organized in variable-length segments. Each segment can contain either programs or data or can be a directory, i.e., a catalog of related segments represented in tree structure. Segments are directly addressable by a symbolic name. The Multics hardware uses a segment descriptor to determine the absolute address of the segment and its access attributes. Any word, character, or bit within a segment can be referenced by its location within the segment. Segments can reside anywhere in main memory and can alter their size independently of other segments up to a maximum segment size of 262,144 words. New segments can be created by user programs by supplying the supervisor with a symbolic name and access attributes, such as users permitted to access the segment and their access rights. Read, write, execute, and append access categories are supported by Multics. Multics makes extensive use of pure-procedure segments that are both re-entrant and recursive to permit the sharing of a single copy of a program or data by multiple users.

Multics uses demand paging to determine which portions of a segment are to be present in main memory. Segments are automatically divided into fixed-size pages of 1,024 words, and paging is performed automatically by the Multics hardware, so that only the currently accessed pages of a segment are required in main memory.

All input/output operations are performed automatically by Multics. The programmer is required to supply the symbolic name of the segment and the address of the desired item within the segment, or the relative address stated in the terminology of a higher-level language. A device-independent input/output system is available that permits interchangeable reading and writing on magnetic tapes, communication terminals, cards, printers, and storage system segments through the use of symbolic names. User output can be automatically queued for printer or punched card output. User-written input/output routines can also be accommodated by the system.

Controlled sharing of programs and data is facilitated by the Multics ring structure, a unique security scheme that is implemented as an integral part of the segmentation and paging scheme. The ring structure, in conjunction with the segment access control list, permits programs to access another owner's data base only through an owner-supplied program that specifies what data can be referenced and what operations can be performed. The Multics ring structure provides eight levels of protection ranging from 0, the most privileged, to 7, the least privileged. The Multics operating system operates in rings 0 through 2, while user programs usually execute in rings 3 through 7. The ring mechanism permits segments operating in one ring to access only those segments that are executing in equivalent or lesser privileged rings, provided they are also listed in the access control list of the segment. Access to higher privileged segments is permitted only through programs supplied by the owners of the higher privileged segments. All segments in the Multics systems are assigned three-level ring attributes that can be used for specifying separate ring levels for reading, writing, and executing the segment.

Multics is written in PL/1, a feature that facilitates the interfacing of user modifications with the operating system.

Multics administrative functions permit various users to define configurations, operating procedures, and the secondary storage quotas that are available to specified groups of users. These features, along with the Multics protection facilities, allow multiple operating environments to be established. Accounting procedures are available to measure each user's use of the system in each environment.

Time-sharing and batch users communicate with the system through a command processor, which interprets

user requests and invokes the appropriate software component to perform the function, eliminating the need for users to deal with traditional job and control language. User modifications in the command processor can define restrictions to use of the system for specified users.

Languages available to Multics users include PL/1, FORTRAN, APL, BASIC, and the ALM assembly language. In addition, the system includes a wide variety of utility programs, including text editors, debugging aids, performance measurement tools, interuser communication facilities to permit messages to be transmitted among users, and on-line documentation of system software and user programs.

Honeywell is manufacturing the Multics system in its Phoenix plant, and a Multics support facility has been established in Phoenix. All Multics educational courses are separately priced.

APPLICATION PROGRAMS: Application programs available for the Series 60 include all the application programs developed for the 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
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

Honeywell Series 60

EQUIPMENT PRICES

| | | Purchase Price | Monthly Maint. | Rental (1-year lease)* | Rental (5-year lease)* |
|---|---|----------------|----------------|------------------------|------------------------|
| MODEL 62/40 PROCESSOR, MAIN STORAGE, & PROCESSOR OPTIONS | | | | | |
| CPS2402 | Model 62/40 Central Processing System | 51,950 | 162 | 1,107 | 999 |
| CMA2430 | Memory Addressing | 490 | 1 | 11 | 10 |
| CMM2430 | 8K Memory (1st, 3rd-5th) | 1,960 | 2 | 44 | 42 |
| CMM2431 | 8K Memory (2nd) | 1,960 | 2 | 44 | 42 |
| CPA2002 | Disk Addressing (MSU011X) | 950 | 2 | 21 | 20 |
| CPA2003 | Disk Addressing (MSU011X, 2nd Cabinet) | 1,875 | 4 | 42 | 40 |
| CPA2004 | Disk Addressing (MSU0310) | 13,995 | 90 | 311 | 295 |
| CPA2007 | Printer Addressing | 5,090 | 9 | 114 | 109 |
| CPA2012 | Card Reader Addressing (80-col.) | 3,170 | 8 | 70 | 67 |
| CPA2014 | Punch Addressing | 3,890 | 10 | 86 | 82 |
| CPA2016 | Card Reader Addressing (96-col.) | 950 | 3 | 21 | 20 |
| CPA2018 | Multifunction Addressing | 4,140 | 15 | 92 | 87 |
| DCA2001 | Addressing—Asynchronous | 2,640 | 19 | 55 | 52 |
| DCA2002 | Addressing—Synchronous | 2,640 | 19 | 55 | 52 |
| DCA2003 | Addressing—Synchronous Direct | 480 | 3 | 10 | 10 |
| DCF2100 | Line Terminator Direct (Asynchronous) | 480 | 3 | 10 | 10 |
| DCF2101 | Line Terminator Remote (Asynchronous) | 720 | 5 | 15 | 14 |
| DCF2102 | Line Terminator Remote (Synchronous) | 1,440 | 10 | 30 | 29 |
| DCF2103 | Line Terminator Direct (Synchronous) | 48 | NC | 1 | 1 |
| MTA0100 | Addressing for Magnetic Tape Units | 21,050 | 113 | 556 | 497 |
| CSF2003 | Second Cassette Unit | 1,510 | 5 | 39 | 37 |
| 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 | 243 | 1,697 | 1,530 |
| CMA2640 | Memory addressing; one required for each 16K-byte memory module added to CPS2600 | 960 | 2 | 22 | 20 |
| CMM2641 | 16K-byte memory module for first CPS2600 memory expansion increment; CMA2640 is prerequisite | 3,840 | 4 | 86 | 78 |
| CMM2640 | 16K-byte memory module for expansion beyond 80K bytes; CMM2641 is prerequisite | 3,840 | 4 | 86 | 78 |
| CPA2004 | Disk addressing capability for the first two mass storage units | 27,990 | 180 | 622 | 560 |
| CPA2005 | Disk addressing capability for mass storage expansion to the third and fourth units | 4,370 | 22 | 98 | 88 |
| CPA2007 | Printer addressing capability for PRU0400 or PRU0600 | 5,090 | 9 | 114 | 103 |
| CPA2012 | Card reader addressing capability for CRU0600 or CRU1050 | 3,170 | 8 | 70 | 67 |
| CPA2014 | Card punch addressing capability for PCU0120 | 3,890 | 10 | 86 | 82 |
| CPA2207 | Printer hardware/firmware addressing capability to support a PRU0400 or PRU0600 when attached to a PEU (port expansion unit) | 5,090 | 9 | 114 | 108 |
| CPA2212 | Card reader hardware/firmware addressing capability to support a CRU0600 or CRU1050 when attached to a PEU | 3,170 | 8 | 70 | 67 |
| CPA2214 | Card punch hardware/firmware addressing capability to support a PCU0120 when attached to a PEU | 3,890 | 10 | 86 | 82 |
| DCA2001 | Data communications asynchronous addressing capability | 2,640 | 19 | 55 | 49 |
| DCA2002 | Data communications synchronous addressing capability | 2,640 | 19 | 55 | 49 |
| DCF2100 | Line termination adapter for direct connection of asynchronous terminal | 480 | 3 | 10 | 10 |
| DCF2101 | Line termination adapter for asynchronous line connection | 720 | 5 | 15 | 15 |
| DCF2102 | Line termination adapter for synchronous line connection | 1,440 | 10 | 30 | 27 |
| DCF2103 | Line termination adapter for direct connection of synchronous terminal | 48 | NC | 1 | 1 |
| PEU2001 | Port expander unit; 3-port expansion | 5,280 | 17 | 119 | 107 |
| PEF2001 | Port expander unit cabinet and power supply | 1,920 | 6 | 43 | 39 |
| MODEL 64/20 & MODEL 64/40 PROCESSORS AND MAIN STORAGE | | | | | |
| CPS4205 | Model 64/20 Central Processing System; includes three integrated I/O channels, integrated main storage processor, integrated unit record processor, integrated unit record processor, integrated mass storage processor, and 65,536 bytes of memory | 128,485 | 168 | 2,514 | 2,381 |
| CMM4250 | 32K memory module for Model 64/20 (maximum of three) | 7,680 | 4 | 170 | 161 |
| CMA4250 | Addressing for CMM4250 | 1,920 | 1 | 42 | 40 |
| CPS4405 | Model 64/40 Central Processing System; includes three integrated I/O channels, integrated main storage processor, integrated unit record processor, integrated mass storage processor, and 98,304 bytes of memory | 218,595 | 242 | 4,554 | 4,319 |
| CMM4450 | 32K memory module for Model 64/40 (maximum of five) | 7,680 | 4 | 170 | 161 |
| CMA4450 | Addressing for CMM4450 | 1,920 | 1 | 42 | 40 |
| CPF4008 | Optional I/O channel for Model 64/40 (maximum of two) | 8,545 | 19 | 178 | 174 |
| CPF4100 | Channel addressing for CPF4008 | 1,680 | 1 | 35 | 33 |
| LEVEL 64 PROCESSOR OPTIONS AND I/O DEVICES | | | | | |
| CPF4014 | Series 100 compatibility | NC | NC | NC | NC |
| CPF4015 | Series 200/2000 compatibility | NC | NC | NC | NC |
| MSP4310 | Series 200/2000 disk mode | 225 | NC | 5 | 5 |
| MSP4320 | Series 100 disk mode | 225 | NC | 5 | 5 |
| MSF4002 | MSU0400 capability | 45 | NC | 1 | 1 |
| MSA4000 | Addressing for four mass storage units | 12,100 | 33 | 351 | 306 |

* Rental prices include maintenance.

Honeywell Series 60

EQUIPMENT PRICES

| | | Purchase Price | Monthly Maint. | Rental (1-year lease)* | Rental (5-year lease)* |
|---|--|----------------|----------------|------------------------|------------------------|
| MODEL 66/60 PROCESSORS & OPTIONS (Continued) | | | | | |
| 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 | 2,086,615 | 2,453 | 43,020 | 40,869 |
| 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 | 1,694,180 | 2,212 | 34,932 | 33,185 |
| 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 | 1,773,590 | 2,260 | 36,569 | 34,740 |
| 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 | 1,994,740 | 2,440 | 41,127 | 39,071 |
| CPS6628 | Central Processing System; includes CPU, two free-standing system controllers, free-standing input/output multiplexer with 35 channel function slots, CPU addressing, memory addressing, and 524,288 words of memory | 2,153,560 | 2,541 | 44,401 | 42,181 |
| 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 | 2,533,530 | 2,822 | 52,233 | 49,622 |
| 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 | 2,913,500 | 3,103 | 60,065 | 57,063 |
| CPU6600 | Additional central processor for CPS6603-CPS6636; maximum of one with integrated CPS, three with free-standing CPS | 852,950 | 1,125 | 17,769 | 16,880 |
| 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 | 2,302,785 | 3,646 | 47,480 | 45,106 |
| 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 | 2,523,935 | 3,831 | 52,038 | 49,437 |
| 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 | 2,682,755 | 3,937 | 55,312 | 52,547 |
| 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 | 3,062,725 | 4,278 | 63,144 | 59,988 |
| 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 | 3,442,695 | 4,499 | 70,976 | 67,429 |
| CPU6800 | Additional central processor unit for CPS6824-CPS6836; maximum of three | 1,352,333 | 2,164 | 28,123 | 26,765 |
| 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 | 17,015 | 25 | 350 | 333 |
| 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 | 28,300 | 39 | 584 | 555 |
| 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) | 175,055 | 232 | 3,609 | 3,249 |
| MXA6001 | Input/output multiplexer addressing; required when MXU6001 is used (one for each System Controller in system); also required when MXC6001 is used | 17,015 | 25 | 350 | 333 |
| MXF6002 | IOM data rate expansion; maximum of 1 on integrated and 2 for free-standing input/output multiplexers | 23,720 | 35 | 516 | 459 |
| MXF6004 | IOM Expansion; 9 channel function slots (for use with CPS6403-CPS6408 and with CPS6604-CPS6608 only); maximum of one | 33,975 | 47 | 701 | 666 |
| MXF6005 | IOM Expansion; 19 additional channel function slots (for use with free-standing IOM; maximum of 1) | 53,855 | 74 | 1,111 | 1,089 |
| MODEL 68/60 PROCESSORS | | | | | |
| CPS8623 | Model 68/60 Central System with 192K words | 1,814,695 | 2,346 | 36,536 | 34,709 |
| CPS8624 | Model 68/60 Central System with 256K words | 1,894,105 | 2,394 | 38,173 | 36,264 |
| CPS8626 | Model 68/60 Central System with 384K words | 2,115,255 | 2,579 | 42,731 | 40,595 |
| CPS8628 | Model 68/60 Central System with 512K words | 2,274,075 | 2,675 | 46,150 | 43,705 |
| CPS8632 | Model 68/60 Central System with 768K words | 2,654,045 | 2,956 | 53,837 | 51,146 |
| CPS8636 | Model 68/60 Central System with 1,024K words | 3,034,015 | 3,237 | 61,669 | 58,587 |
| CPU8600 | Additional Central Processor for Model 68/60 system | 1,072,699 | 1,379 | 21,454 | 20,381 |
| 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 | 2,455,580 | 3,867 | 49,494 | 47,019 |
| 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 | 2,676,730 | 4,052 | 54,052 | 51,350 |

* Rental prices include maintenance.

Honeywell Series 60

EQUIPMENT PRICES

| | | Purchase Price | Monthly Maint. | Rental (1-year lease)* | Rental (5-year lease)* |
|--|--|----------------|----------------|------------------------|------------------------|
| INPUT/OUTPUT UNITS (Continued) | | | | | |
| MTP0600 | Magnetic Tape Processor; Level 66 (1x8); includes IOM channel; for MTU0400 and MTU0500 | 25,740 | 117 | 760 | 683 |
| MTP0601 | Magnetic Tape Processor; Level 66 (1x8); includes IOM channel; for MTU0400, MTU0500, and MTU0600 | 25,740 | 117 | 760 | 683 |
| Magnetic Tape Processor Features for MTP0200: | | | | | |
| MTA0301 | Addressing for MTU0210/0211 | 3,600 | 14 | 93 | 81 |
| MTA0303 | Addressing for MTU0410 | 7,200 | 28 | 186 | 162 |
| MTF1021 | Series 200/2000 Mode | 2,295 | 5 | 59 | 51 |
| MTF1023 | IBM BCD Mode | 2,295 | 5 | 59 | 51 |
| MTF1024 | NRZI Mode | 2,860 | 3 | 72 | 64 |
| Magnetic Tape Processor Features for MTP0600/0601: | | | | | |
| MTF1040 | Switched Tape Channel (includes IOM channel) | 7,920 | 5 | 235 | 210 |
| MTF1041 | Dual Simultaneous Channel for up to 2x16 operation; includes IOM tape channel and second channel adapter | 41,580 | 141 | 1,229 | 1,097 |
| MTA1041 | Device Addressing; for 4 MTU0400/0500; maximum 2 or 1x8, 4 for 2x16 | 210 | NC | 5 | 5 |
| MTA1042 | Device Addressing; for 4 MTU0400/0500/0600; maximum 2 for 1x8, 4 for 2x16 | 210 | NC | 5 | 5 |
| MTF1045 | Code Translation; ASCII to Level 66 six-bit code | 900 | NC | 30 | 26 |
| MTF1046 | Code Translation; EBCDIC to Level 66 six-bit code | 900 | NC | 30 | 26 |
| MTF1047 | Code Translation; EBCDIC to ASCII Code | 900 | NC | 30 | 26 |
| Magnetic Tape Drives: | | | | | |
| MTU0111 | Magnetic Tape Unit, secondary (18.75 ips) | 6,500 | 35 | 174 | 150 |
| MTU0120 | Magnetic Tape Unit, primary (18.75 ips) | 7,870 | 44 | 209 | 182 |
| MTU0121 | Magnetic Tape Unit, secondary (18.75 ips) | 6,500 | 35 | 174 | 150 |
| MTU0210 | Magnetic Tape Unit, primary (37.5 ips) | 9,980 | 59 | 290 | 252 |
| MTU0211 | Magnetic Tape Unit, secondary (37.5 ips) | 8,160 | 48 | 238 | 207 |
| MTU0220 | Magnetic Tape Unit, primary (37.5 ips) | 9,980 | 59 | 290 | 252 |
| MTU0221 | Magnetic Tape Unit, secondary (37.5 ips) | 8,160 | 48 | 238 | 207 |
| CSF2003 | Additional Tape Cassette Unit | 1,510 | 5 | 39 | 37 |
| MTU0400 | Magnetic Tape Unit (75 ips) | 12,410 | 60 | 330 | 309 |
| MTU0410 | Magnetic Tape Unit (75 ips) | 12,410 | 60 | 330 | 309 |
| MTU0500 | Magnetic Tape Unit (125 ips) | 16,610 | 65 | 474 | 440 |
| MTU0600 | Magnetic Tape Unit (200 ips) | 20,430 | 77 | 603 | 525 |
| Magnetic Tape Drive Features for MTU0120/0220: | | | | | |
| MTF0101 | Nine-Track 1600 bpi Option | 2,250 | 10 | 55 | 49 |
| MTF0102 | Nine-Track 800/1600 bpi Option | 3,290 | 33 | 81 | 72 |
| MTF0103 | Seven-Track 200/1800 bpi Option | 3,290 | 33 | 81 | 72 |
| MTF1001 | Seven-Track 200/1800 bpi Option | 240 | NC | 5 | 5 |
| MTF1002 | Nine-Track 800 bpi or 1600 bpi Option | 240 | NC | 5 | 5 |
| Magnetic Tape Drive Features For MTU0400/0500: | | | | | |
| MTF0012 | Dual Density Option; 800-1600 bpi; 9-track | 3,940 | 29 | 119 | 104 |
| MTF0017 | Full Density Option; 200-556-800-1600 bpi; 9-track | 6,000 | 48 | 215 | 178 |
| MTF0013 | NRZI; 200-556-800 bpi; 7-track | 6,000 | 48 | 215 | 178 |
| MTF0016 | NRZI; 556-800 bpi; 7-track | 3,060 | 17 | 94 | 81 |
| MTF0018 | Cartridge Load (factory-installed only) | 700 | 2 | 19 | 17 |
| MTF0019 | Cartridge Load (field-installable) | 700 | 2 | 19 | 17 |
| MTF0020 | High-Altitude Blower (factory-installed only) | 220 | NC | 5 | 5 |
| MTF0021 | High-Altitude Blower Kit (for field installation) | 220 | NC | 5 | 5 |
| MTF0022 | DC Power-On Meter (factory-installable only) | 220 | NC | 5 | 5 |
| MTF0023 | Tape Movement Meter (factory-installable only) | 220 | NC | 5 | 5 |
| Magnetic Tape Drive Features For MTU0600: | | | | | |
| MTF0612 | 9-Track, 800/1600-bpi Density | 3,940 | 29 | 119 | 104 |
| MTF0618 | Cartridge Load (factory-installed) | 700 | 2 | 19 | 17 |
| Unit Record Processors & Features: | | | | | |
| URP0600 | Unit Record Processor, free-standing; includes basic 4-port adapter and IOM channel | 25,319 | 32 | 620 | 589 |
| URP0601 | Unit Record Processor, integrated; includes basic 4-port adapter and IOM channel; for use with integrated control unit | 19,562 | 24 | 479 | 456 |
| 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 | 19,562 | 24 | 479 | 456 |
| 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) | 936 | 2 | 22 | 20 |
| URF0041 | Dual Switched Channel; includes IOM channel; maximum of one | 8,474 | 12 | 204 | 177 |
| URA0050 | PCU0120 Addressing; one required for each PCU0120 | 4,050 | 4 | 112 | 107 |
| URA0052 | CRU1050 Addressing; one required for each CUR1050 | 7,209 | 29 | 201 | 190 |
| URA0053 | PRU1100 Addressing; one required for each PRU1100 | 1,620 | 10 | 45 | 43 |
| URA0054 | PRU1200 Addressing; one required for each PRU1200 | 6,826 | 15 | 190 | 165 |
| URA0055 | PRU1600 Addressing; one required for each PRU1600 | 6,826 | 15 | 190 | 165 |

*Rental prices include maintenance.

Honeywell Series 60

EQUIPMENT PRICES

| | | Purchase Price | Monthly Maint. | Rental (1-year lease)* | Rental (5-year lease)* |
|--|--|----------------|----------------|------------------------|------------------------|
| INPUT/OUTPUT UNITS (Continued) | | | | | |
| DHF1611 | Basic off-line fine sort | 1,610 | 6 | 42 | 28 |
| DHF1612 | Expanded off-line fine sort | 460 | 2 | 12 | 5 |
| DHF1613 | Digit override | 690 | 2 | 19 | 10 |
| DHF1614 | Digit edit | 690 | 2 | 19 | 10 |
| DHF1615 | Zero kill | 690 | 2 | 19 | 10 |
| DHF1616 | Field override | 690 | 2 | 19 | 10 |
| DHF1617 | Field edit | 690 | 2 | 19 | 10 |
| DHF1618 | No field/no digit autostart | 690 | 2 | 19 | 10 |
| DHF1619 | Stacker overflow | 690 | 2 | 19 | 10 |
| DHF1620 | Valid character check | 460 | 2 | 12 | 5 |
| DHF1621 | Extended sort control | 2,760 | 24 | 74 | 56 |
| DHF1622 | 8 pocket off-line sort | 1,488 | 10 | 53 | 43 |
| DHF1630 | Multilevel E-13B recognition | 19,320 | 85 | 482 | 424 |
| DATANET 2000 COMMUNICATIONS PROCESSOR | | | | | |
| 2600N | Data Communications Processor; includes control console, 40,960 bytes of memory, coupler, and power supply | 32,050 | 180 | 910 | 816 |
| 2604 | Memory Expansion Module (8,192 bytes) | 4,000 | 29 | 133 | 120 |
| 2605N | Basic Multiline Controller (BMLC); for eight lines | 4,200 | 16 | 110 | 99 |
| 2606 | Asynchronous Interface Module (AIM) for BMLC; two lines per AIM | 9,500 | 37 | 248 | 223 |
| 2607 | Synchronous Interface Module (SIM) for BMLC; two lines per SIM | 9,500 | 37 | 248 | 223 |
| 2608 | Expansion Base for BMLC; expands BMLC by 16 lines | 840 | 3 | 23 | 19 |
| 2609 | Asynchronous Line Module (AIM) for 2608; provides two line interfaces | 420 | 2 | 11 | 9 |
| 2610 | Synchronous Line Module (SLM) for 2608; provides two additional line interfaces | 420 | 2 | 11 | 9 |
| 2611N | Expansion Drawer | 2,520 | 10 | 67 | 59 |
| 2613 | Cyclic Redundancy Check | 840 | 3 | 23 | 19 |
| 2615N | 512K-Byte Fixed-Head Disk File and Control | 18,000 | 93 | 551 | 494 |
| 2617N | Auxiliary Cabinet | 1,690 | NC | 57 | 50 |
| 2621N | Teleprinter Direct Connect Feature | 55 | NC | NC | NC |
| 2622 | Autodial Feature | 2,100 | 9 | 56 | 49 |
| 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 | 179 | 1,843 | 1,603 |
| DCP6632 | Processor; 64K-byte memory, IOM channel and peripheral subsystem adapter; two general-purpose communications bases, asynchronous communications base—type 1, console | 124,874 | 273 | 2,813 | 2,446 |
| 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 | 113 | 572 | 512 |
| DCU6202 | General-Purpose Communications Base; maximum capacity 32 lines | 30,000 | 139 | 705 | 625 |
| 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 | 11 | 74 | 63 |
| DCF6011 | Communications Channel Interface; Asynchronous (two channels); current interface | 2,650 | 10 | 66 | 54 |
| DCF6012 | Communications Channel Interface; General-Purpose (one channel); MIL STD 188C | 3,190 | 11 | 76 | 66 |
| DCF6013 | Communications Channel Interface; Synchronous (two channels); ASCII | 3,600 | 13 | 85 | 74 |
| DCF6014 | Communications Channel Interface; Synchronous (two channels) with Auto. Call Unit | 3,800 | 13 | 90 | 80 |
| DCF6015 | Communications Channel Interface; Binary Synchronous with CRC (one channel) | 3,920 | 21 | 92 | 82 |
| DCF6016 | Communications Channel Interface; Broad-Band (19,200 to 50,000 bps); (one channel) | 4,020 | 15 | 102 | 90 |
| DCF6017 | Communications Channel Interface; General-Purpose (one channel) | 3,120 | 16 | 74 | 63 |
| DCF6018 | Communications Channel Interface; General-Purpose with Auto. Call Unit (one channel) | 3,360 | 17 | 80 | 68 |
| DCF6019 | High-Level Data Link Control Channel (one channel) | 1,446 | 6 | 36 | 32 |
| DCF6020 | Direct Connect Capability—Asynchronous | 440 | 5 | 11 | 11 |
| DCF6021 | Direct Connect Capability—Synchronous | 968 | 5 | 24 | 21 |
| 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 | 21 | 92 | 82 |
| DCF6027 | Asynchronous Channel Group, EIA Interface (four channels) | 3,600 | 13 | 85 | 74 |

*Rental prices include maintenance.

Honeywell Series 60

SOFTWARE PRICES

| | | Monthly Lease | Paid-Up Lease | Annual Maint. |
|---------|----------------------------------|---------------|---------------|---------------|
| SPD0002 | TOTAL | 788 | 27,825 | 1,050 |
| SPD0001 | TOTAL Central | 1,103 | 35,175 | 1,575 |
| SPC0003 | TOTAL Interactive Query Language | 315 | 10,500 | 315 |

LEVELS 66 & 68

System Software

Monthly License Fee

| | | | | |
|---------|--|--|-------|--|
| 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 | |

Program Products

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

| | | Monthly Lease | Paid-Up Lease | Annual Maint. |
|---------|--|---------------|---------------|---------------|
| 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