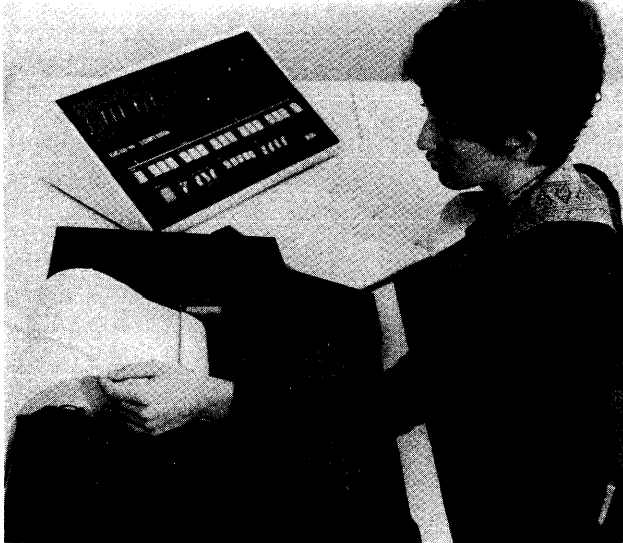


Honeywell Series 15



These two 16-bit systems represent the Honeywell EDP Division's first thrust into two important sectors of the computer market. The Model 1530 Scientific/Commercial System is essentially a "faster 1130," while the Model 1540 Communications System is an effective remote data concentrator or programmable remote terminal.

MANAGEMENT SUMMARY

The Honeywell Series 15, announced in February 1970, is a line of two low-cost computers for small-scale scientific, commercial, and communications applications. They are the first products aimed at this market by Honeywell's EDP Division—and the first non-Series 200 computers introduced by the EDP Division since 1963. Honeywell's strong marketing and support organization represents a powerful new force in this growing segment of the EDP market.

The Model 1530 Scientific/Commercial System and the Model 1540 Communications System share the same processor architecture and offer many of the same peripheral devices, but the two systems are oriented toward significantly different applications, as their names imply. Both are based upon the H-316 minicomputer which is manufactured and sold by Honeywell's Computer Control Division. In order to avoid marketing conflicts that might otherwise arise between Honeywell's EDP and Computer Control Divisions, the Series 15 computers will not be marketed for process control applications or for communications functions other than remote terminal and remote concentrator applications.

The Model 1530 is aimed specifically at the small-scale scientific/commercial market which has been the almost exclusive domain of the IBM 1130 since its introduction in 1965. More than 4000 IBM 1130 systems are currently in use, representing an installed value of more than \$350 million. Though the 1130 was designed for engineering and scientific applications, it has also found widespread use as a low-volume business data processing system. ➤

CHARACTERISTICS

MANUFACTURER: Honeywell Inc., Electronic Data Processing Division, 60 Walnut Street, Wellesley Hills, Mass. 02181.

MODELS: 1530 Scientific/Commercial System and 1540 Communications System.

DATA FORMATS

BASIC UNIT: 16-bit word. Each word can hold two 8-bit bytes, one single-precision operand, or half of a double-precision operand.

FIXED-POINT OPERANDS: One or two 16-bit words, with sign in leftmost bit position. Negative numbers are expressed in two's complement form.

FLOATING-POINT OPERANDS: No hardware facilities; floating-point arithmetic is handled by subroutines.

INSTRUCTIONS: One 16-bit word per instruction. There are four classes of instructions: Memory Reference, Input/Output, Shift, and Generic. Each Memory Reference instruction consists of: a 1-bit "flag" which denotes indirect addressing, a 1-bit "tag" which denotes indexing, a 4-bit operation code, a 1-bit "sector code", and a 9-bit memory address. The sector code indicates whether the specified address is in sector 0 (locations 000 through 511) or in the same 512-word sector as the instruction being executed.

INTERNAL CODE: 6-bit BCD; other codes of up to 8 bits can also be manipulated.

MAIN STORAGE

STORAGE TYPE: Magnetic core.

CYCLE TIME: 1.6 microseconds.

CAPACITY: Model 1530—8,192 to 16,384 words in 4,096-word increments; Model 1540—4,096 to 16,384 words in 4,096-word increments.

CHECKING: Parity checking is standard in Model 1530 and optional in Model 1540.

STORAGE PROTECTION: The first 15 words of core storage are protected against writing and are used to hold the Operating System/15 loader. ➤

Honeywell Series 15

▷ Many of the installed 1130 systems are now operating at their maximum capacity, and IBM currently offers their users no convenient, economical way to upgrade.

The Model 1530 offers significantly more computing power per dollar to current and prospective users of the IBM 1130. The 1530's computational speed is more than twice as fast as the widely used 1130 Model 2 and at least 50 percent faster than the newer 1130 Model 3. What's more, the 1530 costs less in comparable equipment configurations, and Honeywell's "package" pricing still includes software, training, and systems support.

A typical Model 1530 system, capable of using all of the Operating System/15 software facilities, consists of an 8K central processor with built-in disk drive, console, card reader/punch, and printer. This system can be purchased for \$89,780 or rented for \$2,076 a month (or \$1,841 a month under a 5-year lease). Model 1530 deliveries are scheduled to begin in July 1970.

The Model 1540 Communications System has been developed for two primary uses within the fast-growing data communications field; it can serve effectively as a remote batch terminal or a remote data concentrator. As a programmable remote terminal, the 1540 can perform a wide range of processing functions on locally generated data and then transmit part or all of the data to a larger central computer facility for further processing. As a remote concentrator, the 1540 can accept data from up to 32 low-speed communication lines and concentrate it into a single voice-grade or broad-band line for efficient transmission to a distant computer site. Single-channel and multi-channel communication controls enable the 1540 to interface with a variety of communication facilities and devices.

A minimum Model 1540 system for remote terminal use would include a 4K central processor, console, card reader, line printer, and communications interface. This system can be purchased for \$61,250 or rented for \$1,490 a month (or \$1,323 a month under a 5-year lease). A 1540 system capable of utilizing the Operating System/15 software facilities costs at least \$108,280 to purchase or \$2,713 a month to rent. Customer deliveries of the Model 1540 are due to begin in September 1970.

Both of the Series 15 processors are single-address, binary computers with a 16-bit word length and up to 16,384 words of magnetic core storage with a 1.6-microsecond cycle time. Compared with other computers in their price class, they offer a comparatively large instruction repertoire, flexible addressing, and effective input/output and interrupt capabilities. A High-Speed Arithmetic Package (standard in the 1530 and optional in the 1540) provides hardware multiply and divide instructions as well as double-precision (32-bit) load, store, add, and subtract instructions. ▷

CENTRAL PROCESSORS

▶ **INDEX REGISTERS:** One 16-bit hardware register. All instructions of the Memory Reference type can be indexed. Indexing causes no increase in execution time.

INDIRECT ADDRESSING: Possible through any number of levels; each level adds 1.6 microseconds to the execution time. Indirect addressing and indexing can be combined, with indexing applied to either the original instruction address or any of the indirect address words.

INSTRUCTION REPERTOIRE: A basic set of 72 instructions includes add, subtract, load, and store commands for one-word (16-bit) operands, logical AND and exclusive OR commands, a compare instruction, several byte manipulation instructions, and a variety of skip and conditional transfer commands.

A High-Speed Arithmetic Package, standard in Model 1530 and optional in Model 1540, provides single-length multiply and divide instructions plus add, subtract, load, and store commands for double-length (32-bit) operands.

INSTRUCTION TIMES (in microseconds):

Add/Subtract (16-bit):	3.2
Add/Subtract (32-bit):	4.8*
Multiply (16-bit):	8.8*
Divide (16-bit):	17.6*
Load/Store (16-bit):	3.2
Load/Store (32-bit):	4.8*
Conditional transfer:	1.6
Compare:	4.8

*With High-Speed Arithmetic Package.

INTERRUPT SYSTEM: Two levels of hardware interrupts; the first level is for power failure and the second is for all other interrupts. Under program control, I/O interrupts from up to 16 different sources can be identified. A program interrupt occurs whenever a peripheral device completes an I/O operation. An interrupt causes automatic storage of program status information and branching to an interrupt servicing routine.

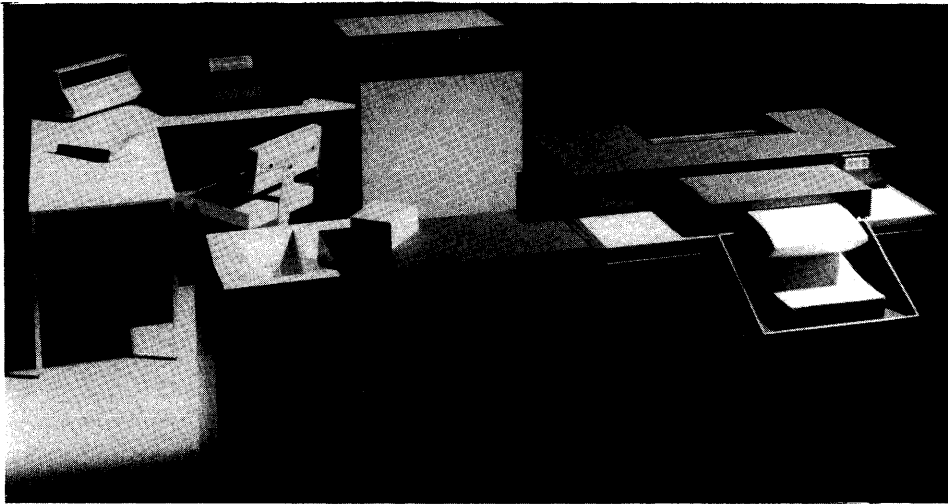
REAL-TIME CLOCK: This optional feature causes the contents of a specific memory location to be incremented by one at adjustable time intervals of 4 to 20 milliseconds. A program interrupt is triggered when overflow occurs.

INPUT/OUTPUT CONTROL

I/O CHANNELS: A Multiplexor Channel, capable of accommodating up to 16 devices, is standard in Model 1530 and optional in Model 1540. Alternatively, a High-Speed Multiplexor Channel can be used in place of the basic Multiplexor Channel in the 1540 only.

CONFIGURATION RULES: The Type 1531 Central Processor, used in Model 1530 systems, contains a built-in single-spindle disk drive and integrated controls for a 1232 Card Reader/Punch and a 1311 Printer. One console ▶

Honeywell Series 15



This typical Model 1530 configuration includes central processor, console, and dual-spindle disk drive (in background), and card reader/punch and line printer (foreground).

▷ Probably as a result of marketing considerations, there are a number of significant configuration differences between the 1530 and the 1540. The following items are standard in the 1530 and extra-cost options for the 1540: Disk Drive, Memory Parity Checking, High-Speed Arithmetic Package, Multiplexor Channel, and control units for the disk drive, card reader/punch, and printer. By contrast, the following items are available for Model 1540 but not for Model 1530: High-Speed Multiplexor Channel, 400-cpm Card Reader, Magnetic Tape Drives (7- or 9-track), Multi-Channel Communication Controls, and Asynchronous Single-Channel Communication Controls.

Software support for the Series 15 computers centers on the Operating System/15 (OS/15), a disk-based operating system designed for sequential batch processing of scientific and/or commercial programs. A Series 15 user has a choice of three programming languages: Assembler, FORTRAN, or RPG. Most non-realtime programs will be written in FORTRAN, and Honeywell has provided a nearly complete implementation of the full USASI FORTRAN language with several worthwhile extensions. The capabilities of the standard FORTRAN language are further enhanced by packages of useful scientific and commercial subroutines, which can also be used in assembly-language programs. No communications software is currently offered for the Model 1540, but Honeywell emphasizes that its Information Services Division is available to develop the specialized software required by individual users.

The Series 15 computers offer no direct object-program compatibility with the IBM 1130, the Honeywell Series 200, or any other widely used computer. Most existing 1130 programs are written in FORTRAN, however, and Honeywell's powerful FORTRAN compiler offers a high degree of upward compatibility with 1130 ▷

▶ teletypewriter (either the standard Type 1001 or the heavy-duty Type 1002) is required in each system, and up to 4 single-channel synchronous communications controls can be attached. Disk storage capacity can be expanded to a maximum of 2.88 million words by adding a Type 3111 Second Spindle and one Type 3112 dual-spindle Disk Pack Drive.

The Type 1541 Central Processor, used in Model 1540 systems, requires either a Type 1001 or 1002 console teletypewriter. Individual control units are required for each of the following types of peripherals: 1222 Card Reader, 1232 Card Reader/Punch, 1311 Printer, one or two 3112 Disk Pack Drives, and one to four magnetic tape drives. A Multiplexor Channel (either standard-speed or high-speed) is required for connection of either disk drives or magnetic tape drives. In addition, up to four single-channel and one multi-channel communication controls can be used in a 1540 system.

SIMULTANEOUS OPERATIONS: A Series 15 processor equipped with a Multiplexor Channel can control up to 16 input/output operations simultaneously with computing. Each word transferred to or from core storage requires 6.4 microseconds of processor time, so gross I/O data transfer rates of up to 156,000 words per second can be accommodated. The High-Speed Multiplexor Channel (optional in Model 1540 only) can handle gross I/O data rates of up to 312,000 words per second.

An alternative "single-word transfer mode" permits I/O data to be transferred via the accumulator, under program control, at a maximum rate of 130,000 words per second.

MASS STORAGE

DISK PACK DRIVES: The Series 15 systems utilize interchangeable single-disk packs with a maximum data storage capacity of 0.72 million 16-bit words per pack. Up to 1,800 data words can be recorded in variable-length records on each of the 200 tracks on each disk surface. Average head movement time is 100 milliseconds, average rotational delay is 17.6 milliseconds, and data transfer rate is 55,312 words per second. ▶

Honeywell Series 15

▷ FORTRAN. Most programs written in 1130 FORTRAN can be compiled on a Series 15 computer with little or no change other than a new set of job control cards.

Though the Series 15's interchangeable single-disk pack is physically the same as the disk pack used in the IBM 1130, the Series 15 uses a different recording format and has a larger storage capacity. IBM-compatible 7- and 9-track magnetic tape drives are available for use with Model 1540, but not for Model 1530.

In comparing the Honeywell 1530 with the IBM 1130, the following items should be seriously considered:

- Model 1530's computational speeds are at least 50 percent higher than those of the fastest 1130. Add times, for example, are 3.2 microseconds for the 1530 versus 8.0 microseconds for the 1130 Model 2 and 4.9 microseconds for the 1130 Model 3.
- Core storage cycle time is 1.6 microseconds for the 1530, versus 3.6 microseconds for the 1130 Model 2 and 2.2 microseconds for the 1130 Model 3.
- The IBM 1130 offers up to 32,768 16-bit words of core storage, versus a maximum of 16,384 words for the 1530.
- Model 1530 has a comparatively powerful instruction repertoire of 82 instructions, versus 29 for the 1130.
- Model 1530's disk packs store up to 720,000 words of data, versus 512,000 words for the 1130.
- Model 1530's disk drives have an average head positioning time of 100 milliseconds (versus 540 milliseconds for the 1130) and a data transfer rate of 55,300 words/second (versus 35,000 words/second for the 1130).
- Model 1530 has a Multiplexor Channel with 16 subchannels, versus 4 for the 1130.
- The IBM 1130 offers card reading speeds of up to 1000 cpm (versus 400 cpm for the 1530) and printing speeds of up to 600 lpm (versus 300 lpm for the 1530).
- The IBM 1130 offers a number of peripheral devices which are not currently available for the 1530: paper tape reader and punch, plotter, optical mark reader, and CRT display units.
- Honeywell's OS/15 and the IBM 1130 Disk Monitor System are quite similar in their overall structure and capabilities.

▶ A Type 3011 Single-Spindle Disk Drive, with an on-line storage capacity of 0.72 million words, is an integral part of the Model 1530 Central Processor; its capacity can be doubled by adding the optional Type 3111 Second Spindle. The integral disk control in the Model 1530 Central Processor also permits connection of one free-standing Type 3112 dual-spindle Disk Pack Drive. Thus, the maximum disk storage capacity of a Model 1530 system is 2.88 million 16-bit words in four on-line disk packs.

The Type 3110 Disk Pack Control Unit permits up to two 3112 dual-spindle Disk Pack Drives to be connected to a Model 1540 Central Processor for a maximum on-line storage capacity of 2.88 million words; either the Multiplexor Channel or High-Speed Multiplexor Channel is a prerequisite.

INPUT/OUTPUT UNITS

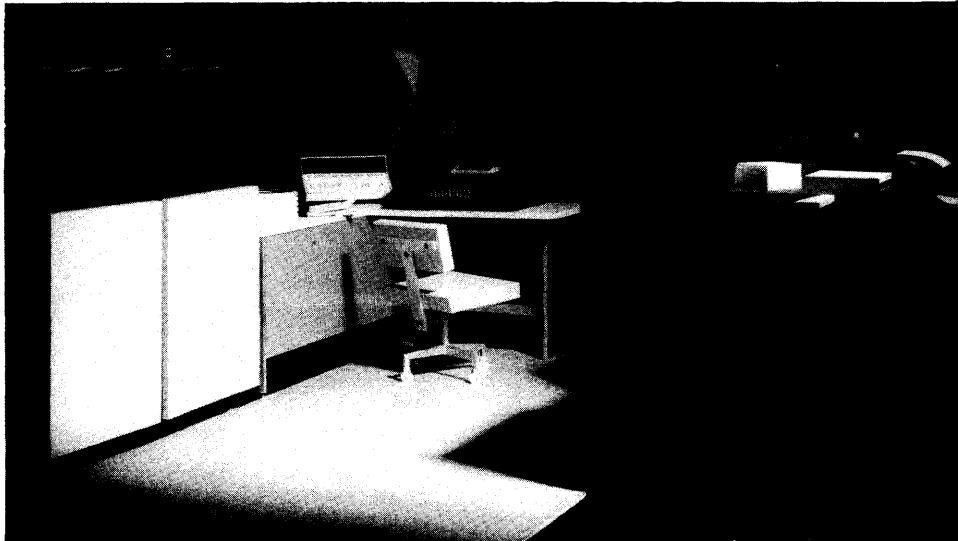
2721/2722 MAGNETIC TAPE DRIVES: Read and record data on 1/2-inch tape in 7-track IBM-compatible format. Usable only with Model 1540 systems equipped with the Multiplexor Channel or High-Speed Multiplexor Channel. The 2700 Magnetic Tape Control Unit includes one 2721 Magnetic Tape Drive and can control up to three additional 2722 Drives. Tape speed is 24 inches per second. Recording densities are 200, 556, and 800 bits per inch, with associated data transfer rates of 4,800, 13,300, and 19,200 characters per second. Vacuum control is used to mount, drive, and stop the tape. Read-after-write checking is performed, and both vertical and longitudinal parity are generated during recording and checked during reading.

2932/2933 MAGNETIC TAPE DRIVES: Read and record data on 1/2-inch tape in 9-track IBM-compatible format. Usable only with Model 1540 systems equipped with the Multiplexor Channel or High-Speed Multiplexor Channel. The 2900 Magnetic Tape Control Unit handles up to four 2932 or 2933 Magnetic Tape Drives. Both 2932 and 2933 Drives have a tape speed of 36 inches per second and a data transfer rate of 28,800 characters per second at 800 bits per inch. They differ only in their alternate recording densities: 200 bpi in the 2932 and 556 bpi in the 2933. Vacuum control is used to mount, drive, and stop the tape.

1222 CARD READER: Reads standard 80-column cards photoelectrically, in column-by-column fashion, at a speed of 400 cpm. Usable only with Model 1540 systems; the 1220 Card Control Unit is a prerequisite. Has a 2000-card feed hopper and one 2500-card stacker. Translates input data automatically from Hollerith card code to 6-bit central processor code. Selected cards can be offset-stacked under program control.

1232 CARD READER/PUNCH: Can read, punch, or read cards and punch additional data into them during the same pass. Reading speed is 400 cpm. Punching speed is 100 to 400 cpm, depending on the position of the last column punched. Has a 1200-card feed hopper and one 1300-card stacker. Translates data automatically between Hollerith card code and 6-bit central processor code. Selected cards can be offset-stacked under program control. Connects to a Model 1530 Processor via the integrated card control or to a 1540 Processor via the 1230 Card Control Unit.

Honeywell Series 15



This expanded remote terminal configuration of the Model 1540 Communications System includes two magnetic tape units.

- ▷ ● Honeywell's OS/15 FORTRAN offers many language features which are missing from IBM 1130 FORTRAN, including complex, double precision, logical, and Hollerith data types, relational expressions, logical IF, assigned GO TO, named COMMON areas, and additional FORMAT options.
- A large and varied library of application programs is available to IBM 1130 users. Although Honeywell plans to develop such a library for the 1530, it obviously won't happen overnight.
- The Model 1530 equipment prices, which are generally lower than the IBM 1130 prices for corresponding configurations, include all software and normal training and systems support. IBM now prices these items separately.

Thus, there are a number of compelling reasons why users and prospective users of the IBM 1130 should take a hard look at the Honeywell Model 1530—but the 1130 has some strengths of its own that should be carefully considered before making a change.

In summary, the impressive Series 15 hardware and software, coupled with the Honeywell EDP Division's proven marketing and support capabilities, should pave the way for a significant Honeywell penetration of the growing market for low-cost scientific and communications computers. □

- ▶ **1311 PRINTER:** Prints up to 300 lines per minute when printing is restricted to a set of 56 contiguous characters on the print drum, or 262 lpm when the entire 63-character set is used. Has 120 print positions, with 12 more positions available as an optional feature. Vertical spacing is 6 or 8 lines per inch, with vertical format controlled by a 2-channel paper tape loop. Skipping speed

is 20 inches per second. Connects to a Model 1530 Processor via the integrated printer control or to a 1540 Processor via the 1310 Printer Control Unit, which includes a one-line buffer.

1001/1002 CONSOLES: One of these teletypewriters is required for console I/O use in every Model 1530 and 1540 system. Their functional characteristics are similar, but Type 1001 is an economical unit for moderate usage whereas Type 1002 is a heavy-duty unit. Both units permit input from a typewriter-style keyboard or hard-copy output at a speed of 10 characters per second. Type 1002 also provides paper tape I/O at 10 char/sec.

COMMUNICATION CONTROLS

SINGLE-CHANNEL COMMUNICATION CONTROLS (SYNCHRONOUS): Direct the transmission and reception of messages in 6- to 8-level codes. Can be operated either in character-by-character mode under direct program control or in message mode via the Multiplexor Channel. Received characters are checked for proper parity. A maximum of four single-channel controls can be connected to a Model 1530 or 1540 Processor. Three types of synchronous controls are available:

Type 4310 (for the 1530) or 4110 (for the 1540): Operates in half-duplex mode over switched voice-grade lines at 2000 bits/second, using Bell System Data Set 201A or equivalent; automatic calling capability is available as an option.

Type 4330 (for the 1530) or 4130 (for the 1540): Operates in full-duplex mode over leased voice-grade lines at 2400 bits/second, using Bell System Data Set 201B or equivalent.

Type 4380 (for the 1530) or 4180 (for the 1540): Operates in full- or half-duplex mode over broadband facilities at 40,800 bits/second, using Bell System Data Set 301B or equivalent.

SINGLE-CHANNEL COMMUNICATION CONTROLS (ASYNCHRONOUS): Direct the transmission and reception of messages in 5- to 8-level codes. Usable only with ▶

Honeywell Series 15

► the Model 1540 Processor; a maximum of four single-channel controls (asynchronous and/or synchronous) can be connected. Each transmitted code normally consists of 11 bits (1 start, 7 data, 1 parity, and 2 stop bits); options permit transmission of other codes. Can be operated either in character-by-character mode under direct program control or in message mode via the Multiplexor Channel. Six basic models and numerous speed modification features permit operation over a wide range of switched and leased communication facilities, in full- or half-duplex mode, at speeds ranging from 45 to 4800 bits/second.

MULTI-CHANNEL COMMUNICATION CONTROLS: Enable a Model 1540 system to handle the asynchronous transmission and reception of message characters over as many as 32 full-duplex low-speed lines. Only one multi-channel control can be connected to a 1540 Processor. The Basic Multi-Channel Communication Control (BMCC) handles up to 32 full-duplex lines and is available with 1, 2, 3, or 4 clocks, enabling it to handle up to 4 different transmission speeds. Clock options are available to handle speeds ranging from 45.5 to 150 bits/second. Maximum system throughput is approximately 4800 bits/second. Interface options with capacities of 4, 8, 12, or 16 lines provide interfaces between the BMCC and either Bell System 103F Data Sets (or equivalent) on leased lines or 103A Data Sets (or equivalent) on switched networks. All data transmission, reception, distribution, and code conversion is under direct program control on a bit-by-bit basis.

SOFTWARE

OPERATING SYSTEM/15: OS/15 is a batch-oriented, disk-resident operating system designed for both scientific and commercial applications. It permits assembly, compilation, updating, and/or execution of programs in continuous sequential fashion. No multiprogramming is possible.

Hardware requirements for OS/15 are a Series 15 Central Processor with 8K words of core storage and the High-Speed Arithmetic and Multiplexor Channel features (which are standard in Model 1530), one disk drive, card reader/punch, printer, and console. OS/15 supports up to 16K words of core storage and up to 4 spindles of disk storage.

The software components of OS/15 are designed to perform four basic functions: operation control, job control, program preparation, and system support.

Operation Control is handled primarily by the OS/15 resident monitor, which coordinates the operation of all OS/15 modules and user programs.

The job control interpreter, which is called from the system disk upon exit from each OS/15 module, includes a card input routine and logic to interpret the system commands. These commands, which can be entered via either the card reader or console, define the jobs to be processed and the operations to be performed (assembly, compilation, execution, file updating, etc.). Programs can be loaded from mass storage in either relocatable object coding or absolute binary format. When an error is detected, a message is printed on the console teletypewriter and the system halts to await operator intervention.

Program preparation facilities consist of the OS/15 Assembler, FORTRAN Compiler, and Report Program Generator, as described below.

OS/15 system support facilities include scientific and commercial subroutines, I/O routines, file updating programs, and disk utility routines. All I/O operations are controlled by relocatable subroutines from the OS/15 system library.

OS/15 includes facilities to create and maintain disk files. User files may be of any of the following types: source programs, relocatable object programs, absolute (memory image) object programs, binary data files, or BCD data files. All user files use a common allocation method called "next-record-available dynamic chaining." This technique maintains a push-down stack of available record locations and allocates space to each record as it is written.

COBOL: No COBOL compiler is available.

OS/15 FORTRAN: This compiler operates under OS/15 and converts FORTRAN IV source programs into relocatable object programs in a single pass. The OS/15 FORTRAN language is a nearly complete implementation of USASI FORTRAN, lacking only the extended DO loop and the BACKSPACE statement. Moreover, the OS/15 version includes three useful language extensions: mixed-mode arithmetic, T-format specifications, and ENCODE/DECODE statements. Large programs can be broken into chained overlay segments. Hardware requirements are the same as for the Operating System/15.

OS/15 REPORT PROGRAM GENERATOR: Creates programs that produce reports in a variety of formats. The user supplies a source deck specifying the input and output formats and the required processing, expressed in a straightforward, problem-oriented language. The RPG compiles this deck and produces a relocatable object program which generates the desired report. Multiple input and output files can be accommodated. Hardware requirements are the same as for the Operating System/15.

OS/15 ASSEMBLER: Translates programs written in a machine-oriented symbolic language into either relocatable or absolute object programs. Assembly is a two-pass process. The first pass reads the source program, generates a symbol table, and writes the data on disk. The second pass assigns machine addresses to all symbolic labels and generates the object program. A listing with error messages is produced upon request. Hardware requirements are the same as for the Operating System/15.

Each executable symbolic statement is translated into one machine instruction. Provisions for compound expressions and decimal, octal, and alphanumeric literals facilitate programming. Pseudo-operations generate constants, provide linkages to external subroutines, and control the assembly and loading process. No macro-instruction facilities are provided.

The OS/15 Assembler operates in one of three basic modes: load, absolute desectorized, or relocatable desectorized. In the load mode, absolute programs are produced and all operand addresses must be either in the

Honeywell Series 15

▶ same sector as the instruction or in sector 0. In the desectorized modes, the programmer can write as if all of core storage were directly addressable, and the required indirect-address links are generated by the assembler and loader.

SERIES 15 ASSEMBLER/UTILITY PACKAGE: Provides an assembler, loaders, and memory dumps for 4K or 8K Series 15 systems that do not use the OS/15 software.

UTILITY ROUTINES: System support facilities in the OS/15 library are summarized in the following paragraphs.

OS/15 Scientific Subroutines are written in FORTRAN and can be called by either FORTRAN or assembly-language programs. They handle a broad range of common mathematical and statistical functions, including matrix manipulation, polynomial operations, simultaneous equations, interpolation, integration, differential equations, probability distributions, regression analysis, analysis of variance, time-series analysis, etc.

OS/15 Commercial Subroutines enhance the business data processing capabilities of the OS/15 FORTRAN Compiler by handling rounding, variable-length comparisons, text editing, table lookups, table sorts, etc. The routines can also be used in assembly-language programs.

Object I/O Routines, in relocatable form, are used to handle all normal input and output operations.

An Update routine facilitates updating of source-language programs on disk files by permitting insertion and/or deletion of any line or group of lines.

A Disk Utilities package provides routines which handle the creation, maintenance, and copying of disk files.

APPLICATION PROGRAMS: Though no application packages have been announced to date, Honeywell states that it is gathering together an extensive library of programs already developed by its Information Services Division.

PRICING

EQUIPMENT: The following systems represent the minimum Model 1530 and 1540 configurations which are capable of using the OS/15 software facilities. (Note that Model 1540 systems for specialized communications functions are available at much lower prices.) The quoted rental prices are for short-term leases and include equipment maintenance. Honeywell also offers three-year, four-year, and five-year leases at progressively lower monthly rates.

MODEL 1530 SYSTEM: Consists of 8K Type 1531 Central Processor with Single-Spindle Disk Drive, High-Speed Arithmetic, Multiplexor Channel, and integrated peripheral controls (all standard equipment); Type 1001 Console; Type 1232 Card Reader/Punch; and Type 1311 Printer. Monthly rental and purchase prices are \$2,076 and \$89,780, respectively.

MODEL 1540 SYSTEM: Consists of 4K Type 1541 Central Processor with additional 4K Memory Module, Multiplexor Channel, and High-Speed Arithmetic Package; Type 1001 Console; Type 1232 Card Reader/Punch and control; Type 1311 Printer and control; and one Type 3112 Disk Pack Drive (2 spindles) and control. Monthly rental and purchase prices are \$2,713 and \$108,280, respectively.

SOFTWARE AND SUPPORT: Honeywell has not "unbundled" to date, so the Series 15 equipment prices include all of the Honeywell software described in this report plus normal training courses and agreed-upon amounts of systems support. Additional contract programming services are available from Honeywell's Information Services Division.

CONTRACT TERMS: The standard Series 15 rental agreement allows unlimited use of the equipment and provides on-call maintenance service from 8 a.m. to 5 p.m. on Monday through Friday, excluding holidays. Maintenance at other times is billed at the current hourly rates. ■

Honeywell Series 15

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
PROCESSORS AND MAIN STORAGE					
1531	Central Processor (for 1530 system)	50,450	240	1,120	987
1541	Central Processor (for 1540 system)	13,720	115	360	318
0502	4K Memory Module (for 1531/1541)	7,320	28	193	170
0507	Memory Parity (for 1541)	7,320	30	193	170
0511	High-Speed Arithmetic (for 1541)	2,800	10	70	62
0512	Real-Time Clock (for 1531/1541)	800	3	17	17
0520	Multiplexor Channel (for 1541)	2,800	10	70	62
0521	High-Speed Multiplexor Channel (for 1541)	4,800	18	123	108
MASS STORAGE					
3111	Second Spindle for 1530 Disk Pack Drive	9,350	40	230	209
3112	Disk Pack Drive (2 spindles)	14,910	59	374	334
3110	Disk Pack Control Unit (for 1540)	13,600	37	357	315
INPUT/OUTPUT UNITS					
1001	Console	2,280	35	60	53
1002	Heavy-Duty Console	5,880	45	155	136
1222	Card Reader; 400 cpm (for 1540)	9,000	54	214	189
1220	Card Control Unit (for 1540)	5,000	23	100	88
1232	Card Reader/Punch; 400 cpm	16,800	107	422	377
1230	Card Control Unit (for 1540)	7,000	24	158	139
1311	Printer; 300 lpm	20,250	129	474	424
1310	Printer Control Unit (for 1540)	6,800	25	175	151
0131	Printer Line Extension (for 1311)	2,250	13	61	51
2722	Magnetic Tape Drive; 7-track (for 1540)	11,000	44	280	247
2700	Magnetic Tape Control Unit; 7-track; includes one 2721 Tape Drive (for 1540)	17,000	69	438	386
2932	Magnetic Tape Drive; 9-track; 200/800 bpi (for 1540)	20,250	102	487	432
2933	Magnetic Tape Drive; 9-track; 556/800 bpi (for 1540)	20,250	102	487	432
2900	Magnetic Tape Control Unit; 9-track (for 1540)	16,000	55	420	370
COMMUNICATION CONTROLS					
Synchronous Single-Channel Controls:					
4310/4110	2000 bps on switched lines	4,800	18	123	108
4330/4130	2400 bps on leased lines	4,200	16	107	100
4380/4180	40,800 bps	9,075	33	231	215
4311/4011	Auto-Call Option (for 4310 or 4110)	1,000	3	21	21
Asynchronous Single-Channel Controls (for 1540):					
4610	110 bps on 2-point leased lines	4,200	16	107	95
4620	110 bps on multi-point leased lines	4,800	18	123	108
4630	110 bps on switched network	4,800	18	123	108
4640	110 bps on TWX network	4,800	18	123	108
4660	1800 bps on leased lines	4,200	16	107	95
4670	1200 bps on switched network	4,800	18	123	108
4061	Auto-Call Option (for 4630, 4640, 4670)	1,000	3	21	21
Basic Multi-Channel Communication Controls (for 1540):					
7001	BMCC with 1 clock	4,000	16	105	93
7002	BMCC with 2 clocks	5,000	23	130	116
7003	BMCC with 3 clocks	5,400	25	142	125
7004	BMCC with 4 clocks	5,800	27	153	135
Private Line Interfaces (for BMCC):					
7101	For 4 lines	3,200	15	84	74
7102	For 8 lines	3,600	17	95	84
7103	For 12 lines	4,000	19	105	93
7104	For 16 lines	4,400	21	116	102
Switched Network Interfaces (for BMCC):					
7301	For 4 lines	4,000	19	105	93
7302	For 8 lines	4,600	21	121	107
7303	For 12 lines	5,200	23	137	121
7304	For 16 lines	5,800	25	153	135

* Rental prices include equipment maintenance.