

Honeywell Model 58

MANAGEMENT SUMMARY

The Honeywell Model 58 is a compact, low-cost computer system for low-volume business data processing applications. Like its principal competitor, the IBM System/3, the Model 58 is designed primarily to meet the needs of small companies that now use manual methods, tabulating equipment, or service bureaus to process essential business data and are getting into EDP for the first time. Also, like the System/3, the Model 58 has been steadily enhanced by the addition of larger amounts of memory, faster printer and card reader options, increased disk storage capacity, enhanced software, and additional data communications capabilities, including the capability to control up to four terminals simultaneously with batch processing. More than 3000 Series 50 systems have been installed to date, with the great majority of these installations in Europe.

The status of the Model 58 in the U.S. was essentially unaffected by the April 1974 announcement of the new Honeywell Series 60 family of computer systems. Although two entry-level Series 60 systems, the Level 61 Models 58 and 60, were introduced for the European market only, Honeywell stated that it will continue to support and enhance the Model 58 for its U.S. customers.

A basic card-oriented Model 58 system, consisting of the central processor with 5,000 bytes of 1.2-microsecond core storage, 100-lpm printer, 100-cpm card reader, and

Designed for low-volume business data processing, the French-built Model 58 is the smallest member of Honeywell's broad general-purpose computer line. Up to 23 million bytes of disk storage, expanded memory, and single- and multi-line communication controllers expand its scope of practical applications. System rental prices start at less than \$1,000 per month.

CHARACTERISTICS

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

MODEL: Series 50, Model 58.

DATA FORMATS

BASIC UNIT: 8-bit byte. Each byte can represent 1 alphanumeric character, 1 or 2 BCD digits (in unpacked or packed format, respectively), or 8 binary bits.

FIXED-POINT OPERANDS: Arithmetic operations are performed on data held in registers, in packed decimal form. A single-register field is 5 bytes long and can hold up to 9 digits and sign; a double-register field is 10 bytes long and can hold up to 19 digits and sign. Other operations, including move, compare, pack, and unpack, are performed on variable-length fields ranging from 1 to 99 bytes.



The Honeywell Model 58 combines a central processor, alphanumeric and numeric keyboards, card reader, and optional card punch in a single compact unit. The free-standing line printer is shown at the right.

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

Honeywell Model 58

▷ 40-column/second punch, can be rented for just \$967 per month or purchased for \$36,210. A basic disk system, with 3.46 million bytes of storage on two disk pack drives in place of the card punch, can be rented for \$1,370 per month or purchased for \$58,700.

Either the card or disk system can be upgraded to 10,000 bytes of core storage, a 650-lpm printing speed, 300-cpm card reader, an Extended Memory Store that provides up to 64K bytes of MOS memory, and up to 23 million bytes of disk storage. The card reader can be equipped to read hand-written vertical marks as well as punched holes, and the card punch can be equipped with a printing (interpreting) unit. But no magnetic tape, paper tape, MICR, or OCR input/output equipment is currently offered for the Model 58.

A Model 58 system can be linked to another computer by means of a single-line communication controller and either a leased or dialed telephone line. This arrangement turns the Model 58 into a flexible, low-cost terminal computer, capable of processing data locally and communicating with a larger, centrally located computer at a speed of 2000 or 2400 bits per second.

In addition, a Multiworkstation system capability was announced for the Model 58 in March 1973. The Multiworkstation system features the MLC050 Multiline Communication Controller supported by the DOS II operating system, and it permits on-line data gathering from up to four terminals in one partition concurrently with batch processing in a second partition.

The Model 58 is the third and fastest member of the Series 50, a line of small business data processing systems designed and manufactured in France by Compagnie Honeywell Bull, which was called Compagnie Bull-General Electric prior to Honeywell's acquisition of the GE business computer equipment interests in 1970. The Model 53, the first and smallest member of the Series 50 family, was never marketed in the United States. The Model 55 was introduced to the European market in 1966 and to the U.S. in October 1968. A card-only system with a relatively slow 7.9-microsecond core cycle time, the Model 55 was marketed by GE in only four selected U.S. areas: Phoenix, Chicago, Detroit, and Philadelphia.

The Model 58, a program-compatible system that features integrated circuits and over 8 times the internal speed of the Model 55 at a somewhat lower entry cost, was introduced to the European market in the Fall of 1969. In February 1970, GE began test-marketing the Model 58 in the same four U.S. areas as the Model 55. Then, in January 1971, Honeywell announced a nationwide U.S. marketing and support program for the Model 58. The older Model 55 system—which delivers far less performance per dollar—is no longer being marketed in the U.S. ▷

▶ **FLOATING-POINT OPERANDS:** No hardware facilities; floating-point arithmetic is handled by subroutines. Standard format uses 5 bytes per operand, consisting of a 2-digit exponent, sign, and 7-digit fraction.

INSTRUCTIONS: Range from 1 to 8 bytes in length. Arithmetic instructions are 3 bytes long, consisting of a 1-byte operation code and two 1-byte register addresses. Most instructions using variable-length fields (Move Characters, Compare Characters, Pack, Unpack, etc.) are 6 bytes long, consisting of a 1-byte operation code, a 1-byte field specifying the operand length, and two 2-byte operand address fields.

INTERNAL CODE: Alphanumeric characters are represented in the ISO (International Standards Organization) internal code. Each character is defined by a 7-bit code; the high-order bit of each byte is 0. Special instructions perform code translations between the ISO internal code and the Hollerith punched card code.

MAIN STORAGE

STORAGE TYPE: Magnetic core.

CAPACITY: 5,000 or 10,000 bytes.

CYCLE TIME: 1.2 microseconds per 1-byte access.

CHECKING: Parity bit with each byte is generated during writing and checked during reading.

STORAGE PROTECTION: None.

MEMORY EXTENSION: The EMS (Extended Memory Store) is a "program" memory unit designed primarily to store segments of large programs for transfer to the Model 58's main memory upon request. Each EMS module contains 8,016 bytes of MOS semiconductor memory, arranged as 28 "words" of 288 bytes each. From one to eight EMS modules can be used in a Model 58 system, providing from 8K to 64K bytes of fast-access auxiliary memory. The EMS connects to a subchannel of the Model 58's high-speed channel and is managed by the microprograms in read-only memory. A single instruction can transfer from one to ten words (288 to 2880 bytes) between EMS and main memory. The channel transfer rate is 312,000 bytes per second, and the time required to transfer one 288-byte word is less than one millisecond. Software support for the EMS requires a Model 58 disk system with 10K bytes of main memory. Honeywell expects typical segmented user programs to show gains of ten to 25 percent in execution speeds when EMS is added to a system. First deliveries were shipped in May 1973.

CONTROL STORAGE

STORAGE TYPE: Prewired read-only memory.

CAPACITY: 1024 40-bit words in card systems; 1536 40-bit words in disk systems.

CYCLE TIME: 350 nanoseconds.

PURPOSE: Holds microprograms which initiate and control the sequence of elementary operations required to execute each machine instruction.

CENTRAL PROCESSOR

INDEX REGISTERS: 100 five-byte numeric registers occupy core storage locations 0096 through 0595. The ▶

Honeywell Model 58

➤ As part of its January 1971 announcement, Honeywell made minor changes in the Model 58 configuration and pricing, and replaced the original DSU162 Disk Storage Unit with the dual-spindle DSU110 Disk Pack Drive. Then, in June 1971, the DSU110 was in turn superseded by the DSS058 Removable Disk Storage Subsystem, which uses industry-compatible 6-disk packs and offers improved price/performance characteristics.

In conventional batch-oriented business data processing applications, the Model 58's relatively slow input/output speeds will naturally limit its performance. The Model 58—like IBM's System/3 Model 6—is better suited for direct-entry or "transaction-oriented" processing, in which the variable data for each transaction is keyed in by an operator seated at the console. This type of operation precludes high-volume processing, but it does enable small business firms to get the fast response and up-to-the-minute control they frequently demand.

The Model 58 equipment is well designed for applications that involve a high degree of operator intervention. In addition to the typewriter-style alphanumeric keyboard, there is a separate numeric keyboard with an associated buffer and 10-digit display panel. The operator can read interpreted data printed on the top edge of each card just before the card is read. Moreover, she can load and unload the card reader and punch while seated at the console.

The Model 58 equipment is quite compact, requires no false floor, and has fairly low power and air conditioning requirements. The central system (including processor, console, card reader, and card punch) is 80 inches wide, 70 inches deep, and 48 inches high and weighs 870 pounds. The line printer is 42 inches wide, 30 inches deep, and 42 inches high and weighs 550 pounds. Heat dissipation is only 5,020 BTU/hour for the basic card system and 8,690 BTU/hour for the basic disk system. A 208-volt, 60-Hertz, 3-phase power line is required.

The Model 58 central processor is controlled by microprograms in read-only storage. These wired-in microprograms initiate and control the series of elementary operations required to execute each machine instruction and supervise I/O operations. Model 58 card systems contain 1024 forty-bit words of 350-nanosecond read-only memory and disk systems contain 1536 words, none of which is accessible to the programmer. The flexibility of this microprogram control helps to keep down the size of both the user's programs and the system control routines in core storage, and this makes it possible for disk or card-oriented Model 58 systems with only 5,000 bytes of core to handle most of the common business data processing applications.

The Model 58 instruction repertoire consists of 69 instructions (78 in disk systems) ranging from 1 to 8 ➤

➤ first ten of these registers can be used as base address registers, permitting base-plus-displacement addressing in many (but not all) instructions which reference core storage. The displacement, ranging from 000 to 999, is specified in the instruction and added to the contents of the specified base address register to form an absolute address.

INDIRECT ADDRESSING: None.

INSTRUCTION REPERTOIRE: 69 instructions, including 7 arithmetic commands, 31 data movement commands, 4 jump commands, 5 comparison and logical commands, 2 shift commands, 3 translate commands, 3 loading and debugging commands, 10 input/output commands, and 4 multiprogramming commands. Disk systems have 9 additional input/output instructions, for a total of 78.

Addition and subtraction are performed on signed decimal operands of 9 or 19 digits (5 or 10 bytes). Multiplication is performed on signed 9-digit operands. Division is handled by a standard subroutine. Also provided are efficient facilities for data movement, comparisons, character insertion, logical AND and OR, packing, unpacking, conditional branching, and ISO/Hollerith code translation.

INSTRUCTION TIMES: Representative execution times, in microseconds, are as follows.

Add/subtract (signed 9-digit fields):	120
Add/subtract (signed 19-digit fields):	165
Multiply (signed 9-digit fields):	2000
Move (5-byte fields):	140
Compare (5-byte fields):	120

INPUT/OUTPUT CONTROL

I/O CHANNELS: 3 "internal" or low-speed channels, used for the keyboard, card reader, and card punch; and one 8-position "external" or high-speed channel, used for the printer, disk drives, and communications controller.

CONFIGURATION RULES: The basic Model 58 Central System includes the 5,000-byte central processor, data entry station, 100-cpm card reader, and 100-lpm printer. The main storage capacity can be increased to 10,000 bytes, the card reader speed to 200 cpm, and the line printer speed to 200 lpm. Optional on-line peripheral equipment is currently limited to a card punch, disk subsystem, and single-line communications controller.

SIMULTANEOUS OPERATIONS: The card punch, numeric keyboard, and alphanumeric keyboard, which operate asynchronously on a character-by-character basis, can operate simultaneously with other peripherals and with internal processing. The card reader can operate simultaneously with other peripherals but not with internal processing. The line printer can be fully overlapped with other low-speed peripheral operations. High-speed I/O operations, such as disk reading or writing, permit no simultaneity. If two or more peripheral devices are connected to a single channel, only one of them can transfer data at a time.

MAXIMUM I/O DATA RATES: 28,000 bytes/second for the "internal" channels and 300,000 bytes/second for the "external" channel. ➤

Honeywell Model 58

▷ bytes in length. Arithmetic operations are performed upon data held in any of 100 five-byte registers, in packed decimal form. Addition and subtraction can be performed on signed 9-digit or 19-digit operands. Multiplication is performed on signed 9-digit operands, and division is handled by a standard subroutine. Data movement and comparison operations can be performed on fields ranging from 1 to 99 bytes in length. Overall, the instruction set is quite flexible—and neither significantly easier nor harder to learn and use than those of most competitive computers.

SOFTWARE AND SUPPORT

In fact, few Model 58 programmers will need to concern themselves with the machine-level instruction set, because nearly all of the current Honeywell software support is built around the MiniCOBOL programming language. Introduced in January 1971 to replace an earlier GECOL compiler that was test-marketed but never officially introduced, MiniCOBOL is a restricted but adequate subset of the COBOL language that is fairly easy to learn, largely self-documenting, and largely upward-compatible with the COBOL compilers for the larger Honeywell computers. A modest operating system facilitates the compilation, storage, and execution of MiniCOBOL-coded programs on disk-oriented Model 58 systems.

Perhaps the most significant feature of the MiniCOBOL programming system is the "indexed random" method of disk file organization it uses. Disk records are stored in random sequence and can be accessed either randomly or sequentially through the use of any one of up to 11 identifying keys. This technique, though relatively inefficient for sequential processing, makes it unnecessary to do any sorting of disk records in most applications.

An ANS Cobol compiler was announced for the Model 58 in November 1972. Disk COBOL operates under the Disk Operating System and provides nine COBOL verbs which are not implemented in MiniCOBOL: ALTER, EXAMINE, SET, SEEK, GET, GET-C, PUT-C, INSERT, and COPY. MiniCOBOL programs can be recompiled in COBOL after minor modifications. The Disk COBOL compiler requires a 10K Model 58 disk system for compilation, but the object programs it produces can be executed on a 5K system.

Communications software was also announced in November 1972 to enable the Model 58 to perform as a satellite processor to a Honeywell Series 200/2000 processor, to another Model 58 central processor, to a Honeywell Series 6000 central processor, or to an IBM System/360 or 370 central processor. The communications modules are assembled with the user's MiniCOBOL or COBOL programs during compilation of the programs.

▶ MASS STORAGE

DSS058 REMOVABLE DISK STORAGE SUBSYSTEM: Provides economical random-access storage on removable Honeywell M-4005 Disk Packs, which are physically compatible with the 6-disk IBM 1316 Disk Pack. The DSS058 Subsystem consists of a control unit flanked by two independent disk pack drives. Each drive holds one pack and has a comb-type access mechanism with one read/write head serving each of the 10 recording surfaces.

Each data track holds 2880 bytes in ten 288-byte sectors. The basic dual-drive DSS058 Subsystem has 60 usable data tracks on each recording surface for a total data capacity of 3,456,000 bytes. Optional features raise the number of usable tracks on each surface to 100 or 200, for a data capacity of 5,760,000 or 11,520,000 bytes, respectively. An additional two disk drives can be added to the DSS058 subsystem giving a total of 23,040,000 bytes. Average head movement time is 60 milliseconds for the basic 60-track drives, 70-milliseconds for the 100-track model, and 85 milliseconds for the 200-track model. Average rotational delay is 12.5 milliseconds, and data transfer rate is 165,000 bytes per second.

INPUT/OUTPUT UNITS

DATA ENTRY STATION: Consists of a numeric keyboard, a 10-digit visual display, and an alphanumeric keyboard.

The numeric keyboard permits rapid entry of the digits 0 through 9 and three special characters; the keyed data is temporarily held in a 10-character buffer and displayed in a digital display. The display permits verification of the keyed data prior to storing it in memory, and can also be used to display stored numeric data. The alphanumeric keyboard resembles a typewriter, with 45 keys and a space bar. It permits entry of 63 characters in ISO internal code. Typed alphanumeric data goes directly into core storage, on a character-by-character basis.

CARD READER: Reads standard, Hollerith-coded cards of 80 or 51 columns. Reading speed is 100 cpm for the basic CRD050 Card Reader; 200 cpm with the CRK051 optional feature, and 300 cpm with optional feature CRK051. Cards are read in column-by-column fashion by 12 photocells. The input hopper and single output stacker hold 500 cards each. Cards can be read singly or continuously. Data printed across the top of each card is visible to the operator before the card is fed to the read station. The reader halts and an indicator is lit when any of the following conditions is detected: feed hopper empty, stacker full, card jam, or defective read. An optional feature permits optical reading of hand-written vertical black marks as well as punched holes.

CARD PUNCH: Punches standard 80-column cards in Hollerith code at a rated speed of 40 columns per second. The time required to move each card to the punch station is 330 milliseconds, and ejection speed (for columns to the right of the last column punched) is 80 columns per second. Overall punching speed ranges from 26 cards per minute (when all 80 columns are punched) to 40 cards per minute (when only the first 10 columns are punched). An optional printing unit permits interpretation of the punched data, with a resulting speed reduction to 20 columns per second. The input hopper and single output stacker hold 500 cards. The punch halts and an indicator is lit when any of the following conditions is detected: feed hopper empty, stacker full, card jam, or punch error.

Honeywell Model 58

➤ At present, Honeywell offers no symbolic assembler, no report program generator, no FORTRAN compiler, and no BASIC or PL/1 compiler for the Model 58. Thus, a Model 58 buyer must be sold on the MiniCOBOL or COBOL system as well as on the equipment itself. Though MiniCOBOL will be entirely adequate to meet the programming needs of most Model 58 users, a report program generator would unquestionably speed up the programming process for the one-time reports that are often required.

The major packaged application programs currently offered for the Model 58 are highly significant ones because they are designed to handle the five most common business data processing applications: payroll, accounts receivable, accounts payable, inventory reporting, and general ledger. Honeywell's Financial Management System consists of these five programs in versions for both 5K card and disk systems. All are coded in MiniCOBOL to facilitate tailoring them to match each user's specific requirements. A version of Honeywell's manufacturing information and control system, MiniFACTOR, is also provided for the Model 58. The system maintains bills of materials and performs materials requirements planning for small manufacturing companies.

Honeywell's support program for the Model 58 marked the firm's first small step into separate pricing of supporting services. Software and educational courses are still "bundled" (i.e., offered at no extra charge), as with all other Honeywell computer systems. But each Model 58 customer receives only a certain predetermined amount of "free" technical support: 32 man-days for a card system and 50 man-days for a disk system. Users who need more technical support must contract and pay for it.

Model 58 support activities are focused upon a network of 40 Field Support Centers. Each center is equipped with a full Model 58 system and facilities for demonstrations, training, programming, and debugging.

Honeywell offers two off-line punched card units, also designed and manufactured in France by Compagnie Honeywell Bull, for use with Model 58 computer systems. The P112 Card Punch is an unbuffered printing keypunch used to transcribe data into standard 80-column cards. It features two program drums, a 500-card feed hopper, two 500-card stackers, automatic right justification, conditional duplication, backspacing, a 20-column/second punching speed, and an 80-column/second skipping speed. The CS100 Card Sorter is a 13-pocket sorter that sorts 80-column cards at the rate of 550 cpm. Its capabilities include digit suppression, zone sorting, sort suppression, batch sorting, and a card counter.

➤ PRT065 PRINTER: Prints at a maximum rate of 200 lines per minute. Character set consists of 64 characters. Printing speed of the basic model is 100 lines per minute for a 48-character subset of frequently used characters or 66 lpm when the full 64-character set is used. An optional feature increases the speed to 200 lpm for the 48-character subset or 100 lpm for the full 64-character set. The basic model has 96 print positions, expandable to 128 positions through an optional feature. The printer is housed in a free-standing cabinet that is normally placed to the left of the central processor and console. Prints on continuous forms ranging from 3 to 16 inches in width and from 4 to 16 inches in depth. Horizontal spacing is 10 characters per inch, and vertical spacing is either 6 or 8 lines per inch. Vertical formatting is controlled by a 3-channel paper tape loop. Printing is performed by hammer-actuated rotating print wheels; each wheel serves 4 adjacent print positions through horizontal movement of the paper between print-wheel revolutions.

PRT112 PRINTER: This comparatively new unit employs the same basic drum-type printing mechanism that has long been used with the Honeywell Series 200 computers to greatly increase the Model 58's capacity for printed output. The character set consists of 63 characters, and 132 print positions are standard. The basic model has a rated printing speed of 300 lines per minute when printing a subset of 49 contiguous characters, or 262 lpm when the full 63-character set is used. Optional features increase the nominal print speed to either 450 or 650 lpm for the 49-character subset (or to 360 or 536 lpm, respectively, for the full 63-character set). Skipping speed is a maximum of 25 inches per second. The integral control unit includes a full-line buffer, enabling printing to proceed simultaneously with other peripheral operations. Printing is spaced at 10 characters per inch horizontally and 6 to 8 lines per inch vertically, on continuous forms ranging from 4.75 to 17.75 inches in width. First deliveries were made in September 1973. (The basic Model 58 configuration, which formerly included the 100-lpm PRT065 Printer, has been altered to allow selection of either the low-speed or high-speed printer).

SLC058 SINGLE-LINE COMMUNICATION CONTROLLER: This unit equips a Model 58 Processor to transmit and receive data over a single communications line. It can link a Model 58 to another Model 58, to a Honeywell Series 200, 2000, or 6000 computer, or to an IBM System/360 or 370 computer. Transmission is in half-duplex synchronous mode, at speeds up to 2000 bits per second over switched telephone lines or 4800 bits per second over leased lines. (The hardware capability extends to 9600 bps, but current software support imposes the 4800 bps limit.) The standard code is ISO, consisting of seven data bits plus odd parity; but a transparent mode permits transmission and reception of any eight-bit code, including ASCII or EBCDIC (normal or transparent). An optional Poll/Select Feature for the SLC058 enables several Model 58 computers to communicate with a central computer via the telephone network and a single-line controller at the central site. The SL058 will supersede the earlier and less flexible SLC055 controller, which is now offered on an "as available" basis. SLC058 deliveries began in October, 1972, and supporting software for both card and disk systems were available in January 1973.

➤ MLC050 MULTILINE COMMUNICATION CONTROLLER: Simultaneously handles up to four directly ➤

Honeywell Model 58

▷ MODEL 58 VS. SYSTEM/3

The Model 58 is Honeywell's principal answer to the enormously popular IBM System/3. Thus, it seems appropriate to analyze the similarities and differences between the two systems.

There are a number of noteworthy similarities between the Model 58 and the System/3. Both are compact business data processing systems designed mainly for "entry" users who are installing their first computers. Both can be rented (in minimum configurations) for less than \$1,000 per month. Both can be equipped with disk storage and communications controllers. But there are also a number of noteworthy differences:

- The Model 58 uses standard 80-column cards, whereas the System/3 places primary emphasis on IBM's newer 96-column cards.
- The System/3 has substantially higher instruction execution speeds despite a slower core storage cycle time.
- The Model 58's input/output speeds are intermediate between those of the batch-oriented System/3 Model 10 and the much slower transaction-oriented System/3 Model 6.
- The Model 58 uses separate card reader and punch units, whereas the System/3 Model 10 combines the reading and punching functions in the 5424 Multi-Function Card Unit.
- The System/3 Model 10 offers far greater configuration expansion possibilities in terms of main storage capacity (to 49K bytes), disk storage capacity (to 50 million bytes), card input speed (to 500 cpm), and printing speed (to 1100 lpm). Moreover, the System/3 Model 15, added to the System/3 family in July 1973, provides a compatible growth path for Model 10 users.
- The Model 58 lacks the magnetic tape input/output capabilities which are available with the System/3 Model 10 and Model 15.
- The System/3 Model 10 can be equipped with a magnetic ink character reader.
- Model 58 users will generally do all their programming in MiniCOBOL or COBOL, whereas IBM now offers a choice of RPG II or BASIC for the System/3 Model 6 and RPG II, COBOL, or FORTRAN for the System/3 Model 10.
- The Model 58 offers "bundled" software, education, and a reasonable amount of technical support at no extra charge, whereas System/3 users must pay ▷

- ▶ and/or remotely connected terminals. Transmission is in half-duplex (two wire) asynchronous mode, at speeds up to 300 bits/second in local (direct connection) mode or 2400 bits/second in remote (modem connection) mode. The standard transmission code is eight ASCII (seven data bits plus parity); translation of data codes and control characters is accomplished via standard software. The MLC050 can operate in either manual or automatic answering mode. It accommodates standard modems that meet the EIA RS-232C interface specifications.

SOFTWARE

OPERATING SYSTEMS: Model 58 card systems operate independently of any operating system, which means that operator intervention is always required between programs. The MiniCOBOL Compiler punches out the necessary initialization and loader routines for each object program it produces, and a MiniCOBOL Supervisor deck, which is loaded along with the program, controls its execution and provides a trace function to facilitate debugging.

Model 58 disk systems, on the other hand, operate under the control of the MiniCOBOL or COBOL Disk Operating System (DOS). DOS is an integral part of the COBOL or MiniCOBOL Programming System.

DISK OPERATING SYSTEM: A complete operating environment for programs written in MiniCOBOL and COBOL for disk-oriented Model 58 systems. Programs, data files, and the DOS system itself are stored on disk files and brought into main memory as needed during processing. The flow of programs and other functions is controlled by a series of order cards entered via the card reader.

DOS consists of four major programs: Monitor, Compiler, DAFILE, and PACK.

The Monitor program is the principal link between DOS and the programmer and operator. It reads order cards and either performs the requested operations or loads and initiates the appropriate systems programs. The DOS Supervisor, an element of the Monitor, oversees the execution of programs. The Supervisor performs all disk addressing and also contains an Alert Recovery Routine that allows the operator to specify changes in normal execution.

The MiniCOBOL or COBOL Compiler reads a source program, checks it for coding errors, prints a source program listing with diagnostic messages, translates the program into machine instructions, and stores the resulting object program on a disk file.

The DAFILE program manages data files by reserving disk areas for files, defining the structures of files, and copying files from one disk area to another.

The PACK program manages the information in disk storage. Data can be transferred from disk to punched cards or printer, restored to the disk from cards, copied from one disk area to another, renamed, or deleted.

Disk files are organized as follows. The basic unit of data transfer is one "page", consisting of two sectors or 576 bytes. Each disk file consists of a variable number of records and occupies a whole number of disk cylinders. Each record, in turn, is composed of a variable number of fixed-length elements, up to a maximum record length of one page (576 bytes). The "principal element" in each ▶

Honeywell Model 58

➤ separately for nearly all of the software, technical support, and educational services they receive.

For transaction-oriented processing in small business firms, the Model 58 shapes up as a well-conceived and thoroughly practical answer. But if your business is the type that necessitates the batch processing of thousands of transactions and the generation of voluminous reports every day, chance are you'll be better advised to consider a system such as the Honeywell Model 2020, NCR Century 50, Burroughs B 1700, or IBM System/3 Model 10, among others.

USER REACTION

In a Datapro survey of 10 Honeywell Model 58 installations, users gave the system high ratings for both ease of use and ease of operation. The ratings assigned by the 10 users interviewed, representing 10 Model 58 computer systems, are summarized below:

	<u>Excellent</u>	<u>Good</u>	<u>Fair</u>	<u>Poor</u>
Overall performance	3	6	1	0
Ease of programming	4	5	1	0
Ease of operation	6	4	0	0
Hardware reliability	2	6	2	0
Maintenance service	4	5	0	1
Technical support	1	7	2	0
Manufacturer's software	1	7	2	0

As the table indicates, all 10 of the individuals interviewed in this survey rated the Model 58 as either excellent or good with respect to its ease of operation. Users cited the automatic indexing facility of the disk file organization for obviating the need for time-consuming data record sorting. The ease of program initiation through simple order cards was also pointed out as a distinct advantage. Users also stated that a minimum of experience is required for programming in the MiniCOBOL environment, although the inevitable complaints appeared about its limitations in comparison to larger ANS COBOL compilers. The Model 58 received its lowest ratings from two early installations; there, replacement parts for malfunctioning hardware were slow to arrive, early versions of the software required some rewriting, and the depth of technical knowledge required for support was still being imported from France.

The relatively slow input/output capabilities of the system were mentioned most often as the Model 58's major shortcoming. On the other hand, users were pleased with the capabilities provided by Honeywell for upgrading the hardware and software capabilities of their systems.

➤ record contains an identifying key from one to 15 bytes in length. Any other elements in the record are called "secondary elements".

The structure of the disk files is "indexed random". Each file consists of the data records, written in random sequence, and an index, which lists the keys of all the data records and their physical addresses, whenever a new record is added to the file, its key and address are added to the index. Each time the file is opened, the index is resorted into the proper sequence if any changes have been made. Thus, the index can be read either sequentially or at random, and the corresponding data records can be accessed directly.

In addition to the primary index described above, it is possible to create up to ten "secondary indexes" for each disk file. Thus, a single data file can have up to 11 indexes, each keyed to a different element in the data records. Each index can be sorted and then accessed either sequentially or randomly. Therefore, in most applications there is no need to sort the data records themselves.

Segmentation—the division of a program into logical parts so that it can fit into the available main memory—is performed automatically by the Disk MiniCOBOL Programming System when necessary. The segmentation process is completely transparent to the programmer. Although segmentation invariably reduces the efficiency of object program execution, it enables a Model 58 to execute programs which would otherwise be too large to process at all.

Additional features provided by COBOL DOS include the capability to store and update COBOL source programs directly on disk by using a DOS software program called SOURCE. COBOL DOS also supports a COPY feature that permits record descriptions to be written once on a Source Library File and applied to multiple programs. Changes made in the Source Library File are reflected in all programs using that entry.

COMMUNICATIONS SOFTWARE: Communications program packages permit Model 58 systems that include the Model SLC058 Single-Line Communications Controller to be used as satellite computers to Honeywell Series 200/2000, IBM System/360 and 370, Honeywell Series 6000, and other Model 58 central processors. Batch processing can be performed when the Model 58 is not operating on-line to the host computer. Both point-to-point and multipoint configurations are supported. In a card system, the data communication module is included in the MiniCOBOL 10K supervisor. In disk systems, the data communications modules are in the form of tasks included as part of the standard DOS library. User interfaces to the data communications modules are provided through the COBOL and MiniCOBOL verbs OPEN, READ, WRITE, and CLOSE. The communications software modules provide facilities for on-line processing of data messages by user-written COBOL programs.

DOS II: An enhancement of DOS, DOS II provides all its capabilities plus a second partition for on-line data gathering. Up to four terminals can be supported (either directly or remotely) simultaneously with batch processing. Minimum system requirements are 10K bytes of main memory and 5.76 million bytes of disc storage. Some of the terminals supported by DOS II are the

Honeywell Model 58

➤ Nine of the 10 installations surveyed indicated their satisfaction with the Honeywell Model 58 by rating its overall performance as either good or excellent; reasons given included its low cost for the capability it provides, its ease of use, and its capacity for upward growth. In the words of one Model 58 customer, "For its size, it does an excellent job for the small user." □

➤ Teletype 33, 35, 37, the GE Terminet 300, the Datapoint 3300, and the Hazeltine 1000 and 2000.

MINICOBOL: Honeywell's MiniCOBOL language is an "abridged" version of American National Standard COBOL. MiniCOBOL compilers are provided for both card and disk configurations. In addition to the basic Model 58 system with 5,000-byte central processor, card reader, and printer, the only additional equipment required is a card punch for the card compiler or two disk drives for the disk version.

The card and disk versions of the MiniCOBOL language are identical except for the addition of disk I/O facilities in the latter version. Both are severely restricted (and not fully compatible) subsets of ANS COBOL. As compared with the standard language, MiniCOBOL provides the Nucleus, Table Handling, Sequential Access, and Random Access modules, but all at substantially more restricted levels than the ANS Level I specifications. The Sort, Report Writer, and Library modules are not implemented at all in MiniCOBOL, and the Segmentation modules is implemented in a non-standard manner that takes control of the segmentation process out of the programmer's hands. The 22 procedural verbs available to MiniCOBOL programmers are as follows: ACCEPT, ADD, CLOSE, DELETE (disk version only), DISPLAY, DIVIDE, EXIT, GO TO, IF, MOVE, MULTIPLY, OPEN, PERFORM, READ, REWRITE (disk only), STOP, SUBTRACT, WRITE, and four data communications control verbs.

Whereas the full COBOL language offers numerous alternative techniques for handling most coding problems, MiniCOBOL has been "stripped down" to the essential elements. And for small computers such as the Model 58, this is not necessarily a disadvantage; the MiniCOBOL language is relative easy to learn and use.

The Card MiniCOBOL Programming System consists of three programs: Acceptability, Compiler, and Supervisor. The Compiler and Supervisor are each furnished in different versions for 5K or 10K systems. The Acceptability program reads the source-program deck, checks it for coding errors, and prints a source-program listing with error messages. The Compiler then translates the MiniCOBOL source program into a machine-language object program which is punched into cards. The Supervisor is loaded along with the object program and controls its execution; it permits operation in either the standard (production) mode or in a debug mode that provides a printed listing of each paragraph name as it is encountered during execution.

The Disk MiniCOBOL Programming System, which controls the compilation, loading, and execution of MiniCOBOL programs in disk-oriented Model 58 systems is described under "OPERATING SYSTEMS", above.

MODEL 58 DISK COBOL: This new compiler augments Honeywell's earlier MiniCOBOL for the Model 58 by providing enhanced language facilities that conform with the American National Standard COBOL language. Disk COBOL provides nine COBOL verbs which are not

implemented in MiniCOBOL: ALTER, EXAMINE, SET, SEEK, GET, GET-C, PUT-C, INSERT, and COPY. MiniCOBOL programs can be recompiled in COBOL after minor modifications. Segmentation of programs can be performed under control of the user through use of COBOL control statements. The Disk COBOL compiler requires a 10K Model 58 disk system for compilation, but the object programs it produces can be executed on a 5K system.

UTILITY ROUTINES: None are currently available for the Model 58 except for the DAFILE and PACK routines of DOS, described above. Honeywell maintains that the DOS disk file structure, with its automatic indexing facility, makes a disk sort routine unnecessary, and that any required card utilities (e.g., 80-80 list, reproduce/interpret, etc.) are easy for each user to develop individually.

APPLICATION PROGRAMS: Honeywell's Financial Management System, available in both card and disk versions, consists of packaged programs to handle five of the most common business applications: payroll, accounts receivable, accounts payable, inventory reporting, and general ledger. All coding is in MiniCOBOL. The card version requires a minimum Model 58 configuration consisting of 5K central processor, card reader, printer, and card punch. The disk version requires a 5K central processor, card reader, printer, card punch, and two disk drives.

MiniFactor is a modular system that provides for comprehensive inventory reporting, bill of material processing, and materials requirements planning for small manufacturers. With the Inventory Reporting/Bill of Material modules, both an inventory file and a product structure file can be used to produce both multi-level and single-level parts lists and where-used parts lists. The Materials Requirements Planning modules generate time-phased gross requirements and balance these requirements with projected inventory on-hand and supply orders to determine net requirements. All coding is in MiniCOBOL. The minimum configuration required is a Model 58 central processor with 5K bytes of memory, data entry system, card reader, printer, and at least one disk drive.

PRICING

POLICY: The Honeywell Model 58 system is available for lease or purchase. Honeywell Model 58 users receive all of the software, described in this report, together with reasonable amounts of documentation, at no additional cost.

The standard Honeywell rental agreement permits unlimited usage of the equipment; there are no extra-usage charges. For both leased and purchased systems, on-call maintenance service is provided during any nine consecutive hours between 7 a.m. and 6 p.m., Monday through Friday. On-call service at other times is billed at the current hourly rates.

A purchase credit option credits the Model 58 user with 70% of the total rent paid if he elects to purchase the equipment within 12 months after it is installed, and with 60% of the total rent paid if the purchase is made between 13 and 24 months after installation.

TECHNICAL SUPPORT: Honeywell will provide up to 32 man-days of technical support for a Model 58 card system ➤

Honeywell Model 58

► and 50 man-days for a disk system at no additional cost. Of this time, a maximum of four days for a card system and six days for a disk system will be spent at the customer's site; the balance of the support will be provided at Honeywell's nearest Field Support Center. This support includes systems analysis and design, compilation and debugging, installation planning, and systems testing—but not programming. Customers who need additional technical support can contract for it at a cost of \$60 per half-day (three to four hours) at the customer's site or \$18 per half-day at Honeywell Field Support Centers.

Model 58 buyers will also receive up to 20 hours of computer time for a card system or 32 hours for a disk system. The time will be furnished on suitable equipment at a Field Support Center, and should be sufficient to meet most users' needs for pre-installation program testing. Additional computer time is available at \$22 per hour for both card and disk systems.

EDUCATION: Honeywell will train a reasonable number of programming and operating personnel for each Model 58 installation at no additional charge. All courses are provided at a Honeywell location.

EQUIPMENT: The following systems illustrate the range of practical configurations for the Model 58. Rental prices include maintenance and are for Honeywell's standard one-year lease. Discounts, of three percent and ten percent from these monthly rates are available under three-year and five-year lease contracts, respectively.

MINIMUM CARD SYSTEM: Consists of 5K Central Processor, Keyboard, 100-lpm Printer with 96 print positions, 100-cpm Card Reader, and 40-cps Card Punch. Monthly (1-year lease) rental, \$967. Purchase price, \$36,210.

MINIMUM DISK SYSTEM: Consists of 5K Central Processor, Keyboard, 100-lpm Printer with 96 print positions, 100-cpm Card Reader, and basic DSS058 Disk Storage Subsystem (3.46 million bytes). Monthly (1-year lease) rental, \$1,370. Purchase price, \$58,700.

EXPANDED DISK SYSTEM: Consists of 10K Central Processor, Keyboard, 650-lpm Printer with 128 print positions, 300-cpm Card Reader, 40-column-per-second punch, and maximum DSS058 Disk Storage Subsystem (23 million bytes). Monthly (1-year lease) rental, \$4,409. Purchase price, \$172,565. ■

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
58 MOD 2	Basic Model 58 Central System; includes 5K-byte central processor, keyboards, 100-cpm card reader, and 10-position visual display	\$23,210	\$135	\$610	\$550
AMK050	Additional Main Memory; 5K bytes	7,900	45	213	190
EMS050	Extended Memory Store; initial 8K bytes (AMK050 is prerequisite)	8,980	40	241	213
EMS051	Additional 8K module of EMS	5,720	30	153	135
CRS050	200-cpm option for Card Reader	6,530	36	176	156
CRK051	300-cpm option for Card Reader (CRS050 is prerequisite)	3,265	18	88	78
OMR050	Optical Mark Reading option for Card Reader	2,370	14	64	58
CPA050	Card Punch; 40 cols/sec.	3,950	26	107	96
PCP050	Print option for CPA050	1,185	6	32	29
PRT065	100-lpm Printer; 96 print positions	9,050	46	250	221
PMK051	128 Print Position option for PRT065	1,585	10	43	38
PMK053	200-lpm option for PRT065	4,350	26	117	106
PRT112	300-lpm Printer; 128 print positions	25,710	200	690	610
PMK054	450-lpm option for PRT112	6,120	38	164	143
PMK055	650-lpm option for PRT112 (PMK054 is prerequisite)	8,370	48	225	199
DSS058	Removable Disk Storage Subsystem (3.46 million bytes; includes 2 disk pack drives and control)	26,440	188	510	456
ADS158	Additional Disk Storage (for DSS058; total of 5.76 million bytes)	3,430	22	138	123
ADS258	Additional Disk Storage (for DSS058; ADS 158 is prerequisite; total of 11.52 million bytes)	6,120	32	244	223
ADS358	Additional Disk Pack Drive for DSS058 (5.76 million bytes; ADS158 and ADS258 are prerequisites)	17,510	94	425	382
ADS458	Additional Disk Storage (for DSS058; 5.76 million bytes)	17,510	94	425	382
SLC058	Single-Line Communications Controller with transparency mode option; 2000/2400/4800 bps	8,980	40	241	213
PLF058	Poll/Select option for SLC058	2,450	10	67	60
MLC050	Multi-Line Communication Controller	12,240	60	328	291
SCU050	Supplemental Channel Unit for 2nd, 3rd, and 4th terminals	1,310	6	33	33
RCA050	Direct Connect Adapter for Loopback Current Interface (1 required per terminal)	320	7	20	20
RCA052	Direct or Remote Adapter for EIA RS-232C Interface (1 required per modem and/or terminal)	1,635	13	41	41
CS100	Offline Card Sorter	3,960	26	85	77

* Rental prices include equipment maintenance.