SUMMARY DESCRIPTION OF THE HONEYWELL 800

fully-transistorized data processing system
for both business and scientific use

INDEX

DSA-20B
5161

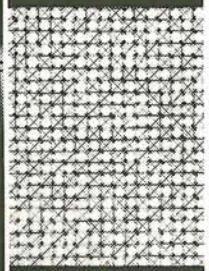
PRINTED IN U.S.A.

HONEYWELL 800

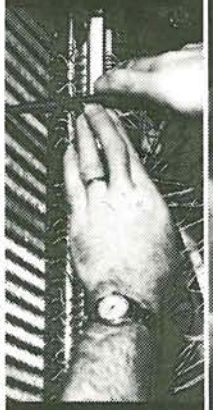
8 ways to identify the leader of the new generation of computers

1
EFFICIENCY
Does up to 8 different, independently programmed jobs at the same time

2
ECONOMY
Processes more data per dollar in a working day, on small-volume applications or large

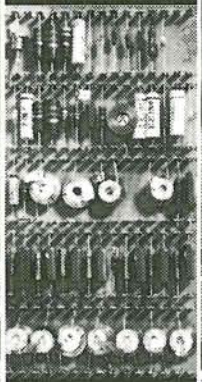


3
EXPANDABILITY
Capacity can be increased indefinitely in small, economical stages



4
RELIABILITY
A new kind of automatic error correction cuts costs of maintaining accuracy

5
VERSATILITY
Can do both business data processing and scientific computation at same time



6
ADAPTABILITY
Honeywell's automatic programming aids and library of routines simplify problem preparation

7
SERVICE
Complete training, programming assistance, maintenance, applications know-how from Honeywell specialists

8
BACKING
Continuing support from a company dedicated to advance of transistorized data processing

INVENTORY CONTROL

PRODUCTION CONTROL

SALES & COST ANALYSIS

REVENUE ACCOUNTING

PAYROLL ACCOUNTING

ORDER-BILLING

MARKET FORECASTING

STOCK TRANSFER ACCOUNTING

GENERAL ACCOUNTING

GENERAL FILE MAINTENANCE

HONEYWELL 800

Processes more business data per dollar in a working day than any other system

---

LINEAR PROGRAMMING

STATISTICAL ANALYSIS

SIMULATION TECHNIQUES

DATA REDUCTION

ACTUARIAL COMPUTATIONS

ENGINEERING COMPUTATIONS

OPERATIONS RESEARCH COMPUTATIONS

DESIGN COMPUTATIONS

DIFFERENTIAL EQUATIONS

HONEYWELL 800

Solves complex scientific problems more efficiently than computers marketed specifically for this purpose

Honeywell 800 is designed especially for growing companies and organizations. Fully transistorized, it is small, powerful and priced competitively with other medium-scale systems. It can be expanded at any time in small, inexpensive increments. Since it can be matched to any application and can grow without limit, you pay only for the capacity you need when you need it, and you never have to face the cost of re-programming for a larger system.

High-speed magnetic tapes and the ability to do more operations simultaneously than any other system give the Honeywell 800 an exceptional advantage in scheduling and handling the high-volume input, output and file maintenance requirements typical of business data processing applications. Up to eight completely independent business programs can be processed simultaneously in considerably less time than the same programs would require if processed one after the other. Furthermore, the ability to start and stop these programs independently eliminates the scheduling problems inherent with systems that must operate sequentially.

To provide the accuracy so fundamental to business operations, all information is verified from the time it enters until the time it leaves the system.

Furthermore, the Honeywell 800 includes Orthotronic record protection, the exclusive Honeywell technique for instantaneous regeneration of lost or damaged information.

High internal operating speeds, expandable memory capacity and the option to work in fixed or floating-point, as well as binary or decimal, arithmetic make the Honeywell 800 better-equipped to handle complex scientific or engineering-type problems than most conventional computers – even those designed specifically for this purpose.

This ability, outstanding in itself, holds particular significance for companies or organizations that require both business data processing and scientific problem-solving. Honeywell 800's ability to process several independent jobs simultaneously is utilized to the maximum when scientific computations are combined with business operations.

If, for example, an engineering computation is placed on the system while an inventory updating program is in process, both programs proceed simultaneously. The engineering computation is achieved at virtually no cost in processing time.

Scientific programs are generally characterized by a minimum of input-output action in relation to internal processing. However, for those scientific problems that do require extensive file-storage and input-output, the availability of Honeywell 800 high-speed magnetic tapes becomes an important plus. Furthermore, complete internal checking assures positive accuracy for all types of work.

In addition, the basic unit of information in the Honeywell 800 system, the 48-bit word, is larger than that of most conventional scientific computers. Consequently a greater number of significant figures can be accommodated without need for special multi-precision programming.

Automatically Controlled Parallel Processing increases efficiency, flexibility and economy

The internal operating speed of the Honeywell 800 is 30,000 typical three-address operations per second (equals 70,000 one-address operations per second). This speed coupled with the high transfer rates of Honeywell 800 magnetic tapes (96,000 decimal digits per second per unit) is sufficient to give the Honeywell 800 a basic speed advantage over any other medium-scale data processing system.

AUTOMATIC PARALLEL PROCESSING

Automatic Parallel Processing is an exclusive Honeywell feature that overcomes the economic barriers present in conventional data processing systems. One such barrier resulted from the limitations which relatively low-speed mechanical input and output equipment placed on internal processing. High-speed processing equipment could not be used efficiently when it had to wait for input or output devices to supply or receive information.

Another limitation resulted from the difficulty of completing high-priority jobs on time, while scheduling tightly enough to keep the system occupied as fully as possible.

Automatic Parallel Processing solves both problems by permitting several independent programs, including the necessary input-output devices required for each, to be operating simultaneously.

This unique ability is made possible by two Honeywell engineering achievements, Traffic Control and Multi-Program Control.

Traffic Control is an element of the central processor that monitors up to 16 input and output trunks, and effects the necessary channel connections at the proper time between these trunks and the central processor. Virtually any desired combination of input devices, output devices and magnetic tape units can be connected to these parallel trunks via appropriate control units. Thus, in addition to simultaneous read, write and compute, an unusually wide range of simultaneous operations is possible.

Multi-Program Control is a central processor element that permits up to eight programs to be active simultaneously in the system. Each program proceeds independently of the others without the need of special programming.

All programs running in parallel proceed at maximum speed until their combined central processor requirements reach 30,000 operations per second. At this point, speeds of the individual programs are regulated automatically by Multi-Program Control to maintain this level.

Several peripheral programs (those involving magnetic tapes, readers, printers or punches) will proceed simultaneously at full speed, since their total central processor requirements will rarely approach 30,000 operations per second. At the other extreme, a scientific program tends to utilize all the available computing capacity, and two or more such programs running in parallel will share it equally. Actually, every program includes both peripheral and computational operations in some proportion. Therefore, the necessary shifting back and forth coupled with the varying requirements of programs running simultaneously obviously affect the amount of computing capacity available at any given time. By automatically taking these variations into account, Multi-Program Control is able to achieve a major advance in multiple-program efficiency.

Parallel Processing also provides a unique scheduling freedom. With one program running, others can be added at any time. Pinpoint scheduling of work loads is no longer necessary to achieve maximum efficiency.

TWO MEMORIES

The ability of Honeywell 800 to provide simultaneous control of several independent programs is enhanced by an additional magnetic core memory. This "control" memory provides 256 locations. Both the main memory and the control memory have a six-microsecond read-write cycle, but they overlap each other by three microseconds. Thus, many internal operations are performed at twice the speed that could be attained with only one memory. Also, the wealth of special registers provided by the control memory results in an extremely high degree of automatic program control.

example

How the Honeywell 800 with automatically controlled parallel processing pays off on a typical daily operation

As a brief illustration of the benefits of Honeywell 800 Automatic Parallel Processing, two separate and distinct problems of an engine manufacturer are considered.

1. Daily updating of a parts inventory
2. Engineering computation

Inventory Processing

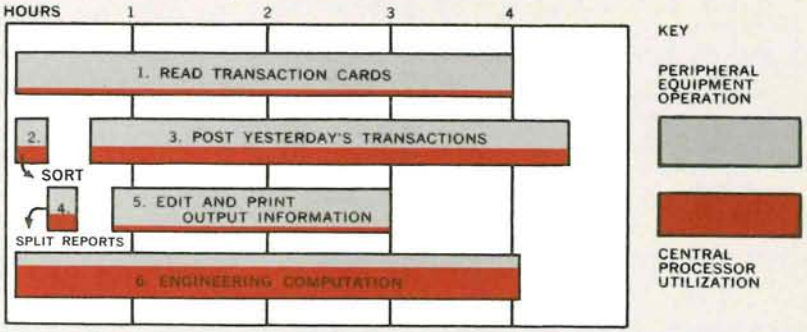
This manufacturer's parts inventory problem consists of maintaining a master inventory file on 500,000 different parts. These records contain such information as part number, number of parts on hand, number reserved for each of the next five weekly production schedules, quantity on each order, number received against each order, and several other items of information. The total amount of information in each record averages 100 alphabetic characters and 1000 decimal digits.

Each day, some 50,000 transactions take place and must be processed against the master record file. Daily transactions, recorded on punched cards, are converted to magnetic tape each day and processed on the following day. The entire daily inventory processing operation consists of five job elements or programs:

1. Read 50,000 transaction cards, edit and check the information for validity and record it on magnetic tape.
   Total time: 3 hours and 55 minutes
   Central processor capacity utilized: 2%
2. Sort 50,000 input transactions to master file sequence.
   Total time: 15 minutes
   Central processor capacity utilized: 33%
3. Post yesterday's transactions to the master record file and, at the same time, extract information from the master file for a series of reports. Record the information on an output magnetic tape for subsequent printing.
   Total time: 3 hours and 50 minutes
   Central processor capacity utilized: 30%
4. Split output from program 3 into different reports and sort items to appropriate order for each report.
   Total time: 15 minutes
   Central processor capacity utilized: 33%
5. Edit output information and print approximately 100,000 lines of various production orders, purchase orders, and reports.
   Total time: 2 hours and 10 minutes
   Central processor capacity utilized: 2%

Note that the time required to carry out these programs would total 10 hours and 25 minutes if they were run individually.

A Honeywell 800 system consisting of six magnetic tape units, a tape control unit, a card reader, a printer, a reader control unit, a printer control unit, a central processor and a console, because of Parallel Processing, *can do the entire job in 4 hours and 30 minutes.* Furthermore, programs 1, 3, and 5 can be started independently of each other, and a delay in any one of them, due to any cause whatsoever, will not affect the starting or operation of the others.



Engineering Computation

This is a scientific computation problem in which engine design parameters are modified and engine performance is computed on a continuing basis. Every day, new parameters are selected as a result of yesterday's run, and a new run is made. Run by itself, it would absorb the full processing capacity of the system.

Total time: 2 hours and 40 minutes
Central processor capacity utilized: 100%

On the Honeywell 800, this engineering computation can be run in parallel with the inventory programs. The inventory programs will continue to take 4 hours and 30 minutes. Since they utilize approximately 34% of the central processor capacity during those 4 hours and 30 minutes, 66% is available for the engineering computation. Instead of being completed in 2 hours and 40 minutes, the engineering computation will require 4 hours. But this is the same 4 hours included within the 4 hours and 30 minutes for the inventory programs. Thus five inventory programs and one engineering computation, representing a total of 13 hours and 5 minutes of computing time, can be overlapped on the Honeywell 800 and completed in 4 hours . . . a 190% gain in efficiency.

It is important to remember, too, that the times stipulated for each inventory program are faster than those achievable by other systems due to the higher magnetic tape and processing speeds of the Honeywell 800. In short, Honeywell 800 could do in 4 hours and 30 minutes a series of jobs which would keep a modern conventional computer busy for two working shifts.

Still another advantage of the Honeywell 800 in connection with this example is its ability to expand economically. A four-fold increase in the size of the parts inventory operation could be handled simply by adding a card reader, a printer, five magnetic tape units and their associated control units. With this added complement, the total job would require 8 hours. In this example, work capacity can be quadrupled, for an increase of less than 60% in monthly cost.

Compact, on-line peripheral devices are reliable, economical and job-tested

INPUT

The Honeywell 800 System operates with all conventional types of input equipment including paper tape readers, magnetic ink character readers, and optical scanners. The major input is, of course, punched cards. Both standard- and high-speed card readers can be used, depending on the requirements of the application. The standard-speed card reader translates 80-column punched cards at a rate of 240 cards per minute; the high-speed card reader, at a rate of 650 cards per minute. Each has two reading stations, and information from each station is automatically compared to verify the accuracy of the readings. In the event of a reading error, switch settings on the card reader determine whether or not the reader should stop and/or eject the card and/or transmit the converted information.

In on-line operation, information read from punched cards is transferred directly to the magnetic core memory in the central processor in the form of either 10 or 20 words depending on whether normal or transcription mode of conversion is specified. The Honeywell transcription mode offers the user two advantages over normal (Hollerith) mode: punch configurations are not limited to Hollerith characters; and punched cards can contain much more information (for example, three times as many decimal digits). An extra word is appended to each card's worth of information (10 or 20 words) to identify the information as: a correct reading of good data, a correct reading of illegal data, or an incorrect reading.

The card readers can be used off-line for transfer of information from punched cards directly to magnetic tape.

The Honeywell on-line high-speed paper tape reader operates at a speed of 1,000 characters per second and accepts 5-, 6-, 7-, or 8-channel paper tape.

The availability of high-speed and standard-speed punched card equipment for on-line or off-line use, plus the ability to operate many of these devices as well as the other input devices simultaneously, insures the input flexibility necessary to meet any and all requirements.

OUTPUT PRINTING

Both standard-speed and high-speed printers are available with the Honeywell 800. The standard printer operates at 150 lines per minute. Line length is 120 characters (10 to the inch) and line spacing is six to the inch.

The high-speed printer operates at 900 lines per minute. A total of 56 characters: 26 letters, 10 digits and 20 special symbols, are available. Line length is 160 characters (10 to the inch) and line spacing is six to the inch. Any 120 out of the 160 total character positions may be active for a given form. Two-up form printing becomes a reality with the high-speed printer.

Data to be printed is delivered to print storage in a 15-word unit plus ver-

tical format control information. Each unit is printed as one line. Off-line models of both printers are available.

OUTPUT PUNCHING

Punched card output is available in two speeds. The standard card punch operates at 100 80-column cards per minute; the high-speed unit punches 250 cards per minute. Off-line models of both units are available. Paper tape punching takes place at 110 characters per second.

CONTROL UNITS

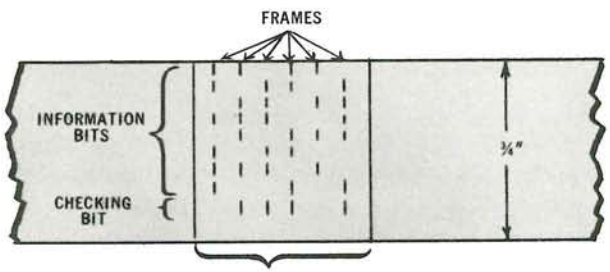
On-line printers and card or paper tape readers and punches are connected to peripheral control units, which are, in turn, connected to input-output trunks of the central processor. Several peripheral control unit models are available, permitting various combinations of one to three input and/or output devices to be connected to one input-output trunk.

Magnetic tape units are connected to tape control units. Each tape control unit can accommodate up to eight magnetic tape units.

The maximum number of tape control units that can be accommodated depends on the number and type of peripheral control units used. A tape control unit requires both an input and an output trunk. A peripheral control unit requires one input and/or output trunk. A maximum of eight input and eight output trunks is available. Any desired combination of control units within the limitation of the 16 trunks is permissible.

MAGNETIC TAPE

Information is recorded on ¾″ Mylar-base magnetic tape in nine longitudinal channels. Eight information bits and one checking or parity bit are recorded across the width of the tape and constitute one frame. Six frames, containing 48 information bits (and 6 parity bits), constitute a Honeywell 800 word.



ORGANIZATION OF INFORMATION ON HONEYWELL 800 MAGNETIC TAPE

The 48 information bits in a word may represent an 11-decimal-digit number with its sign, several smaller decimal numbers each with sign, eight alphabetic characters, or a combination of these. A word may also be interpreted as a 44-bit binary number with its sign, or as an instruction. If the system is equipped with the floating-point option, a word may also be interpreted as a sign bit, a seven-bit exponent, and a 40-bit mantissa.

Maximum capacity of each reel of tape is approximately 20,000,000 decimal digits or 1,666,666 words. The information transfer rate is 96,000 decimal digits per second, per magnetic tape unit.

Type	Example											
NUMERIC	±	1	2	3	4	5	6	7	8	9	0	1
ALPHANUMERIC	R	O	B	I	N	S	O	N				
ALPHANUMERIC COMPRESSED	C		W	E	B	B	1	7	4			
BINARY	±	(44 BINARY DIGITS)										
INSTRUCTION	OPERATION CODE		ADDRESS A		ADDRESS B		ADDRESS C					
FLOATING POINT	±	EXPONENT (7 BINARY DIGITS)	MANTISSA (40 BINARY DIGITS)									

Each group of words written or read as a result of a single instruction is called a record. These records may vary in length and successive records are separated by inter-record gaps.

Writing occurs with the tape moving in a forward direction. Reading may be done with the tape moving either forward or backward. This read-in-reverse feature eliminates wasteful rewinding time that would otherwise be necessary in operations such as sorting, searching and file maintenance.

In addition, the user has the option of using a fast-rewind feature included in the magnetic tape unit. The rewind instruction transfers a full reel of tape in 1⅓ minutes. Reels may be dismounted from either hub of the unit.

All Honeywell 800 magnetic tape units are compatible with all other Honeywell 800 units and the high degree of switching flexibility available minimizes tape handling and the number of magnetic tape units required by a given application.

ORTHOTRONIC CONTROL

Orthotronic Control, Honeywell's unique automatic error-detection and correction technique, is incorporated in the Honeywell 800. At the end of each record, Orthotronic check numbers are added to each information channel. Words that become lost or damaged are automatically regenerated by Orthotronic procedures, thereby eliminating costly and time-consuming manual correction.

CONSOLE

The operator's console of the Honeywell 800 provides display lights by which the operator can monitor the progress of each and all programs, plus the necessary switching to provide central control. A keyboard and printer provide a means of communicating with the central processor, printing output under control of stored programs, printing the contents of memory locations on demand, and logging all manual console input operations, and starting and stopping any or all programs.

Small, fast central processor outperforms larger, more costly units

Completely transistorized and modularized, the central processor of the Honeywell 800 includes an expandable magnetic core memory, an arithmetic and control section, and the two innovations called Traffic Control and Multi-Program Control.

A built-in marginal checking system permits convenient periodic testing of performance levels, insuring early detection of any deteriorating components.

MAGNETIC CORE MEMORY

A magnetic core memory is the basic storage unit for both data and instructions. It is available in modules of 4,096 words, up to a maximum of four modules. Each word of core storage is individually addressable. Parallel transmission is employed in sending words to and from storage. Memory-access time is six microseconds. High-speed, random-across drum storage is available as optional equipment.

INSTRUCTIONS

Instruction words used in the Honeywell 800 have the same structure as data words. The 48 information bits in each instruction are divided logically into four sections of 12 bits each. For most operations, these sections are interpreted as an operation code followed by three addresses. The operation code designates the type of work to be performed by the machine. For example, an instruction such as DA/600/601/602 signifies that the contents of memory location 600 are to be added decimally (if the instruction read BA, binary addition would result) to the contents of memory location 601 and the result is to be placed in memory location 602. The 12 binary digits of the Honeywell 800 Operation Code are used to designate whether the instruction is peripheral, masked, standard, scientific option etc.

Instruction Word:

Operation Code	Address A	Address B	Address C
12 Bits	12 Bits	12 Bits	12 Bits

INDEXING

To facilitate programming, memory locations may be addressed in either absolute or indexable form. The first of the 12 bits in each address specifies whether the address is to be used as stated (absolute form), or whether it is to be augmented (indexable form). If the address is in absolute form, it means that the remaining 11 bits are used to denote the address of a specific memory location. If the address is in indexable form, the next three bits will be used to select one of eight index registers assigned to the particular program. (A total of eight index registers is included in each special register group.) The contents of the specified index register are then added to the remaining

eight bits of the address group and the sum is used to select the desired memory location.

PROGRAMMING

Up to eight programs may be active at the same time and each is a completely independent entity. Therefore the logic and programming facilities may be explained as if only one program were being processed. All programs proceed in an automatic fashion and the programmer need not be concerned with the number or size of the other programs, nor with the necessity of designating priorities among the several programs.

Each program is controlled by an independent pair of counters and may address any of the magnetic tape and/or other peripheral units.

SEQUENCING

As data is processed within the Honeywell 800 system, instructions are carried out in the order specified by a sequence counter. The sequence counter designates the address of the next instruction to be performed. Normally, it is incremented by unity each time an instruction is performed. Certain instructions, however, can be used to set the sequence counter to a predetermined value permitting a departure from the basic sequence. To provide a means of returning to the proper point in the program, a history register is used to record the setting of the sequence counter at the point of departure.

To provide still greater flexibility, there is a co-sequence counter associated with each sequence counter. The selection of successive instructions to be performed may be controlled by either the sequence counter or the co-sequence counter at the option of the programmer. This is called operation in the bi-sequence mode. A history register is also provided for the co-sequence counter.

INTER-PROGRAM CONTROL

In some applications, notably those which require searching on tape, it may be advantageous to allow one program to control another. An example of this might be a file maintenance program for a low-activity application where a multiple-tape search technique is employed. In such a case, a program operating under control of one sequence counter may insert a starting value into another sequence counter and cause it to become active. Thus, a second program may be started with the same technique a human operator would employ at the console. A program may not only start another, but it may also monitor its progress and stop it, if necessary. Any simultaneous peripheral operation may also be monitored by a program to determine when it has been completed.

DEFINED INSTRUCTIONS

The complement of instructions in the Honeywell 800 has been designed to facilitate all normal data processing operations of both a business and scientific nature. For those exceptional situations where standard orders are not sufficient, the programmer has the unique facility of incorporating special-purpose instructions called *simulator instructions.*

A simulator instruction, though not a built-in instruction, is used by the programmer as if it were. The system responds to it by calling in a subroutine. There is no practical limit to the number of simulator instructions (and their associated subroutine) that may be included in the Honeywell 800, provided sufficient memory space is available. Thus, any set of orders may be incorporated in the system. This feature provides the ability to simulate any special-purpose order structure which the programmer may envision.

MASKING

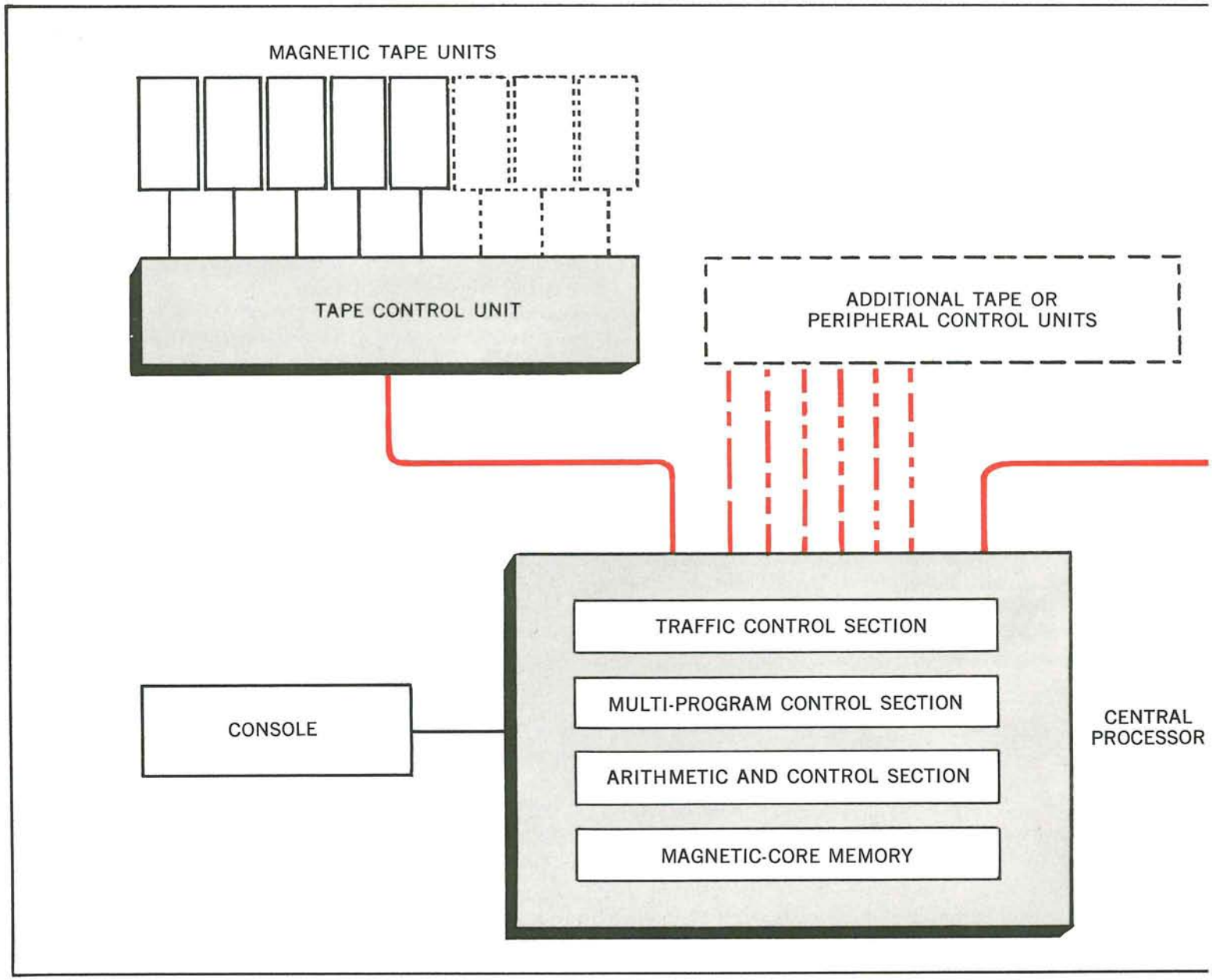
In many instances it may be desirable for the programmer to compare portions of words, to perform arithmetic operations on fields of less than word length, or to select data from within a word for transfer to other processing operations. This is accomplished in the Honeywell 800 by highly versatile masking abilities. The use of mask words permits the internal processing instructions to isolate any portion of an information word and ignore the remainder. By inserting a number into a special register, called a mask index register, the programmer may designate any group of 96 memory locations as storage positions for masks used with his program. In each masked order, the programmer specifies which one of these is to apply for that operation. The mask index register contents may be changed by the programmer at any point in his program. Thus, an essentially unlimited number of locations for storing masks is at his disposal.

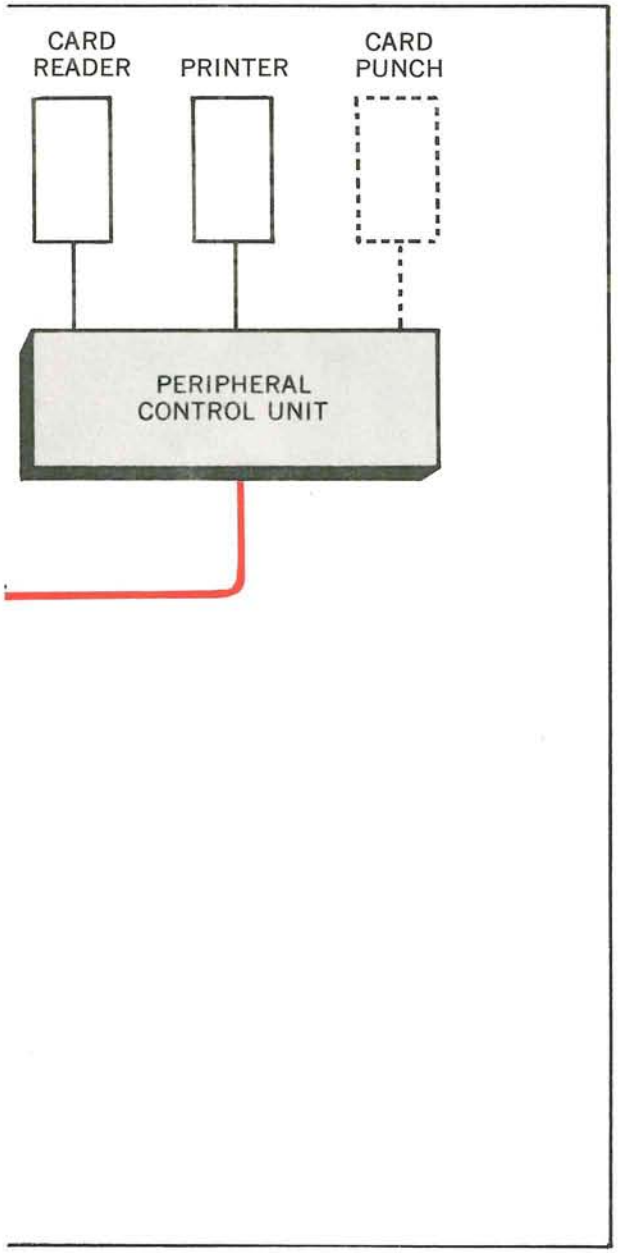
FLOATING-POINT ARITHMETIC

The floating-point arithmetic logic which may be added to the system greatly enhances the computing capabilities of the Honeywell 800. Although this type of arithmetic is not normally required in business data processing applications, it is extremely useful in scientific areas. Furthermore, the 40-bit mantissa provides about 50% more precision than that available in most computers designed specifically for scientific purposes. Inefficient and costly multi-precision programming may, therefore, be avoided in many cases.

AUTOMATIC PROGRAMMING AND LIBRARY ROUTINES

Automatic programming aids, including business and algebraic compilers, assembly programs and a library of utility programs, are supplied with each system. Library routines for fundamental scientific problem solving, and for automatic generation of sorting and merging routines according to parameters supplied by the programmer, are also available.


MAGNETIC TAPE UNITS
TAPE CONTROL UNIT
ADDITIONAL TAPE OR
PERIPHERAL CONTROL UNITS
TRAFFIC CONTROL SECTION
MULTI-PROGRAM CONTROL SECTION
ARITHMETIC AND CONTROL SECTION
MAGNETIC-CORE MEMORY
CONSOLE
CENTRAL
PROCESSOR



High-speed sorting and file maintenance insure economical business data processing

Because of its magnetic tape speeds, Honeywell's DATAmatic 1000 was one of the first electronic data processing systems to make electronic sorting economical.

The Honeywell 800 is capable of sorting even faster. In minimal form and using the most common method of sorting, Honeywell 800 sorts more economically than any other system.

When full advantage is taken of Parallel Processing in the Honeywell 800, special exclusive techniques are available which magnify its speed advantages several times. For example: On a system with 12 magnetic tape units and two tape control units, it is possible to do a three-way merge sort with each string arranged in zig-zag fashion on two tapes. This method is over three times faster than a conventional two-way merge sort and is possible only on a Honeywell 800 system.

FILE MAINTENANCE

The same specifications that give the Honeywell 800 its sorting abilities provide advantages in file maintenance operations.

A typical file maintenance process involves matching a number of transactions against corresponding main file records, processing them, and writing both the updated records and the inactive records on a new magnetic tape. The updated record, or some part of it, is normally written on an output tape for subsequent printing. The number of transactions in a given run is nearly always small in relation to the total number of records. Consequently most time is spent bypassing inactive records, and high tape speeds provide an obvious advantage.

With large files the tape-speed advantage can be multiplied by a factor from two to eight. This is done by adding tape controls and magnetic tape units so that searching is speeded up. A second tape control unit, for example, will generally cut file maintenance time in half.

HONEYWELL SERVICE

matches a system to your needs — helps you use it most efficiently — keeps it working most effectively

Honeywell Service, backed by years of experience in designing, installing and maintaining complex electronic systems, is part of every Honeywell 800 package. Honeywell Service provides you with information, indoctrination, planning and training. It insures competent guidance and assistance in programming. It includes experienced maintenance staffs. Above all, it means continuous, personalized guidance and counsel, a full team of specialists for every customer.

HONEYWELL

For information regarding the application of Honeywell 800 to a specific data processing or scientific problem, contact:

Minneapolis-Honeywell Regulator Co.
Electronic Data Processing Division
Wellesley Hills 81, Massachusetts

Honeywell Controls, Ltd.
Toronto 17, Ontario, Canada
Montreal 28, Quebec, Canada

Honeywell Electronic Data Processing Division Sales Offices in:

ALBANY	CHICAGO	HARTFORD	LOS ANGELES	PITTSBURGH
ATLANTA	CINCINNATI	HOUSTON	MINNEAPOLIS	PORTLAND
BOSTON	CLEVELAND	INDIANAPOLIS	NEW YORK	RICHMOND
CHARLOTTE	DETROIT	KANSAS CITY	PHILADELPHIA	SAN FRANCISCO
		WASHINGTON, D.C.		

Honeywell

Electronic Data Processing