

Summary Description
of
The DATAmatic 1000
Electronic Data Processing System

DATAmatic Corporation
151 Needham Street
Newton Highlands 61, Massachusetts

MANUFACTURER

* On June 20, 1957, Minneapolis-Honeywell Regulator Company acquired the interest of Raytheon Manufacturing Company in DATAmatic Corporation.

DATAmatic is now wholly owned by Minneapolis-Honeywell Regulator Company.

GENERAL CHARACTERISTICS

DATAmatic Systems are composed of fully integrated business machines employing high speed computer principles designed to expedite all phases of record keeping and accounting. DATAmatic 1000 which is described herein, is a large scale, general purpose, electronic data processing system.

A wide range of clerical operations can be handled with speed, accuracy, and economy. In addition, reports essential to management decision can be produced sooner than with conventional methods and business problems containing many variables can be readily resolved.

A typical DATAmatic 1000 system contains the following elements:

- Input Converter
- Magnetic File(s)
- File Reference Device
- Output Converter
- Central Processor
- Central Console

Each of these elements is described below, in non-technical terms. A summary of technical specifications is also provided.

Input Converter

A transcription device known as the Input Converter (Type 1200) is used to convert source data in the form of punched cards into recorded data on magnetic tape. The Input Converter feeds, translates, edits and arranges format for nine hundred fully punched cards per minute.

In the operation of the converter, the punched cards are loaded into the feeding mechanism in quantities up to 3,000 cards at a time, and are then automatically fed sequentially through three stations. The first two stations are used to read and check data from cards and the information is immediately recorded on magnetic tape. A number, manually set by the converter operator for each batch of cards, is recorded with the converted data on the input magnetic tape and used as a filing index. The batch numbers and comparison reading checks are only two in a series of reliability and accuracy features which are inherent in the DATAmatic system. In addition, there are other safeguards incorporated in the circuitry which detect the recording of erroneous data.

The DATAmatic 1000 converters operate independently of all other system elements, permitting input, output and central processing operations to take place simultaneously.

Magnetic Tape

The DATAmatic 1000 uses a three-inch wide magnetic tape of heavy duty construction. There are thirty-one recording channels on the tape which may be used simultaneously. An extraordinary amount of data can be stored on each tape reel of

2700 feet. Actually, one reel of tape can store 37,200,000 decimal digits of information, which is the equivalent of data that would require 465,000 punched cards. Data on the tape can be erased selectively or totally by controlled programs and the tape can be reused many times for new or changed data.

Since the recording surface of conventional magnetic tape is normally subject to some deterioration from manual handling as well as from contact with the recording head, special techniques have been employed to prevent tape damage. A unique sandwich type construction shields the recording surface between two layers of plastic thus preserving it in handling as well as reducing the amount of friction encountered between the tape and the recording head. This sandwich construction has proved to be so satisfactory that life tests in which the tape has been manually handled freely and passed beneath the recording head over ten million times have failed to show any appreciable signs of corrosion or wear on either the recording head or the tape. Furthermore, no loss of information signals has been encountered.

Magnetic File

The Magnetic File (Type 1100) handles magnetic tape for five principal functions:

Record data on magnetic tape from the input converter

Read data from magnetic tape to the output converter

Read data from magnetic tape to the File Reference Device

Transfer data to the Central Processor

Record data from the Central Processor

Volume of transactions and complexity of operations govern the number of Magnetic Files used in a DATAmatic system. The "building block" plan is followed. For moderate sized installations only a few units are needed - but for very large, multiple application installations, as many as 100 Magnetic Files with a capacity of billions of digits can be actively engaged in a single system. A single Magnetic File is capable of reading or recording as many as 60,000 decimal digits or 40,000 alphanumeric characters per second. This is not a peak reading rate but a rate of continuous information flow which can actually be realized. Magnetic tape moves under the reading - recording head at 100 inches per second and can be scanned while the tape is moving in either direction.

File Reference Device

Any Magnetic File can be referred to or interrogated without disturbing the rest of the system by means of an auxiliary unit known as the File Reference Device (Type 1150). This unit is used to control a particular Magnetic File from which it is desired to extract specific information such as, account number, work order or item cost. The record or any desired portion of it is printed out by means of the File Reference Device's self-contained printer.

Output Converter

The Output Converter (Type 1300) has two principal functions, both of which are associated with the transfer of data from the Magnetic Files. These are:

Conversion of magnetic recordings to printed records and reports

Conversion of magnetic recordings to standard punched cards

In both functions the output is edited and format is governed automatically by the converter, this feature eliminates many conventional central processor operations usually needed to condition data for output.

Punched card output will be achieved at the rate of 6,000 cards per hour. Two speeds of electro-mechanical printed output will be available, which are:

150 lines of 120 characters
maximum per minute

600 to 900 lines of 120 characters
maximum per minute

Central Processor

The Central Processor performs two principal functions, which are:

Automatic Sequential Control of
Processing Operations

Data Manipulation, (Sorting,
Merging, Automatic Operations)

Physically, it contains the electronic elements and circuitry for carrying out, at high speeds, the stored programs. The fast and reliable internal memory system is composed of magnetic cores with a capacity of 24,000 decimal digits. Four 62 - word buffers are provided for efficient input and output. Access to memory is in parallel and time for reading a word is approximately 10 microseconds.

Searching for items on tape may be accomplished automatically under Central Processor control with the scan being performed on as many as ten magnetic tapes

simultaneously. This scanning is performed under the control of standard machine instructions and at the rate of as much as 600,000 decimal digits per second. The availability of buffer storage makes possible the performance of searching while other central machine operations are in progress.

The Processor is especially designed for high-speed sorting, merging and file maintenance. Some examples of sorting speeds are:

Sort - 60,000 decimal digits per
second (equivalent of 750 fully
punched cards per second)

Merge - 60,000 decimal digits
per second

File Search - 600,000 decimal
digits per second

Central Console

The supervision and master control of the System is exercised through the Central Console (Type 1090). This unit also enables the operator to communicate directly with any element of the system under control of the Processor when required for diagnostic purposes, and receive printed answers to any interrogation of the machine. Under normal operation the Central Console permits monitoring of the machine. It monitors the condition of key components in the system and permits the location of potential trouble before it actually occurs.

Building Blocks

Each unit in the DATAmatic 1000 System is an individual "building block". Enough building blocks are integrated into a sys-

tem to handle the requirements of the records being processed. However, if the work load increases or new applications are developed, additional units can be added. Conversely, if the work load should diminish, units may be removed from the system.

This building block principle is followed within system units which are constructed of small individual packages which contain a limited number of components. These packages may be plugged into the system or removed as required. Consequently, when there is an indication on the Central Console of some component weakening, the package containing the declining component can simply be removed and replaced with a spare package.

Flexibility

The DATAmatic 1000 incorporates a set of orders which guarantees a balance between the rate of reading data from and recording data onto tape, and the processing of the Central Processor. Several of these orders are specifically designed for sorting, merging and file maintenance operations.

In accordance with the building block principle, any number of magnetic files ranging from a minimum of four to a maximum of one hundred may be used with any one DATAmatic 1000 installation. The more units used, the greater the active file capacity available, providing the system with complete flexibility, both in program planning and custom fitting of a system installation. Further flexibility is achieved through the independence of input converter, output converter and Central Processor. Added converter capa-

city can be achieved through the use of additional units.

Reliability

The DATAmatic 1000's reliable operation depends upon:

1. A unique magnetic tape recording system
2. A complete built-in, self-checking system
3. Conservative design of unitized circuit components

Data is recorded on tape in a pattern of magnetic spots for each decimal digit or alphabetic characters, as shown in Table I.

This unique system depends upon the length rather than upon the strength of magnetic spots representing the dot-dash codes for digits or letters. As a result, it can even distinguish between weak signals, thus eliminating a prominent cause of errors in conventional systems.

An arithmetic system of error detection is applied to all numerical and alphabetic information processed in the system through the use of a satellite check number for each unit of coded information. Each transfer of a word during processing is then checked by recreating the satellite of the transferred word and comparing it with the satellite of the original word. Each arithmetic computation is checked in the same manner. This system of checking insures against errors going undetected, since the failure of the satellites to compare properly would immediately indicate an error and stop the machine.

TABLE I

<u>Digit</u>	<u>Recorded Pattern on Tape</u>	<u>Character</u>	<u>Recorded Pattern on Tape</u>
1	. . . ———	A	. ——— . . . ———
2	. . ——— .	B	. ——— . . ——— .
3	. . ——— ———	C	. ——— . . ——— ———

The electronic and mechanical design of the system insures reliable operation and efficient service through the use of packaged circuitry, printed wire techniques and easily accessible components.

Services

The DATAmatic Corporation provides the following services to prospective customers and users at no charge:

- Assistance in feasibility surveys and application analysis
- Training schools for programmers and coders
- Instruction manuals for equipment
- Programming manuals including routines for automatic programming
- Field service on leased equipment

If the user elects to purchase equipment outright, his maintenance personnel will be trained at the DATAmatic factory, or service contracts will be arranged. Fully tested magnetic tape is stocked at the factory and sold to users as needed.

OPERATING CHARACTERISTICS

Circuitry - parallel reading and writing of 31 channels on magnetic tape with serial handling of bits comprising each character and word. Access to high-speed memory is parallel. Arithmetic operations are serial.

Internal operating code-decimal digits-in binary coded decimal, alphanumeric characters in 6-bit code. Every word (alphanumeric or numeric) contains checking digits.

Word length - numeric words comprise 11 decimal digits and sign. Alphanumeric words comprise 8 alphanumeric characters. For compactness in information storage, combination in one word of alphanumeric as well as numeric characters is permissible.

Program code - three address, either programmed or automatic sequencing.

Conditions governing transfer of control - equality and magnitude comparisons and other special conditions such as overflow, end of tape, etc.

MAGNETIC TAPE

Description - plastic, 3 inches in width; reel length, 2,700 feet. Magnetizable material is sandwiched between layers of plastic to protect recorded information and increase tape life. Information on tape is recorded across 31 channels.

Storage capacity per reel - 37,200,000 decimal digits or 24,800,000 alphanumeric characters (equivalent of 465,000 and 310,000 punched cards) respectively.

Read-write speed - effective or net information rate of 60,000 decimal digits a second or 40,000 alphanumeric characters a second.

Tape speed - 100 inches a second both forward and reverse.

Maximum number of tape units - 100

Card-to-Tape Converter

Function - conversion of data in 80-column punched cards to magnetic tape. A plugboard is used to rearrange fields as well as to control various modes of conversion.

Speed - 900 cards per minute.

Magnetic Core Memory

Capacity - 2,000 words (24,000 decimal digits)

Access time - approximately 10 microseconds. Since access to memory is parallel, access time for reading a word from any memory address or delivering any word to any memory address is also approximately 10 microseconds.

Buffer Storage

Input buffer storage comprises two 62-word sections operating in parallel. Output buffer storage comprises two 62-word sections operating in serial.

Internal Storage Registers

Contains seven one-word registers including arithmetic registers and various special control registers.

Output Converter

Function - conversion and editing of data from DATAmatic 1000 tape for automatic line printing at speeds of 150 or 600 - 900 lines per minute, as well as for automatic card punching on standard equipment.

Installation Data

Recommended floor space 40 by 100 feet (for minimum installation).

Voltage requirements - 208 volts, 3 phase, 60 cycle.

Cooling - air cooling with a total of 75 gpm of cooling water required.

Air conditioning - no requirements of user; proper conditioning requirements integral with machine.

Floor loading - less than 125 pounds per square foot.