

IBM

Executive Guide to the IBM 1440 Data Processing System





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1440

**DATA
PROCESSING
SYSTEM**

EXT I/O READER PUNCH PRINTER

OP B A

STORAGE ADDRESS

INSTRUCTION LENGTH

ALTER RUN I-EX STORAGE EX/INT (P2)
A A
B B
I



A data processing system will be a factor in your future. If electronic data processing isn't solving your data handling problems now, chances are such a system soon will be.

In the past decade, data has assumed new importance in business. The clerical effort required to accumulate and process this data has multiplied. As a result, most large businesses have turned to electronic data processing to help meet these demands.

Smaller businesses, too, have felt the need for electronic data processing systems. But, until now, such systems have been too large and too expensive for the volume of data these businesses handle.

Now, IBM has developed the 1440 Data Processing System—a new, low-cost system specifically designed for smaller businesses. The 1440 meets the basic requirements for an accounting system, and, even more important, it offers the advantages and benefits of a complete business information system—at a size and a price most businesses can afford.

Here is your guide to this new 1440 Data Processing System.

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1440

DATA
PROCESSING



NOV YES
STORAGE
PRINT OUT

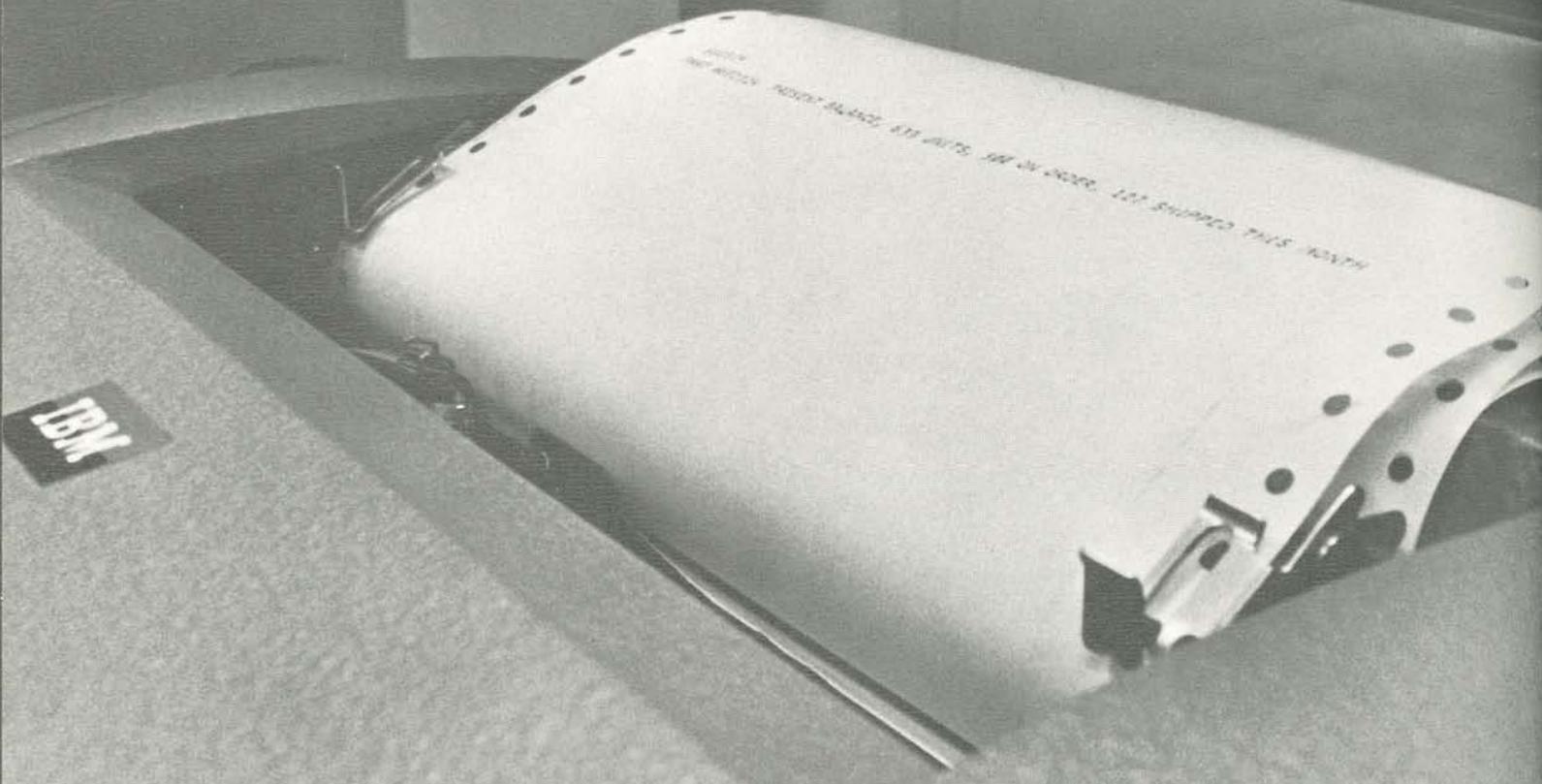
1 2 3 4 5

Control panel with four rotary switches and a 'NOV YES' indicator.

CHECK
RESET

START

Control panel with a 'CHECK RESET' button and a 'START' button.



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This is Data Processing

A data processing system is an impressive sight: blinking lights; cards disappearing into machines; reports being printed in an apparently unending stream. Yet, processing operations are based upon the fundamentals of elementary arithmetic: adding, subtracting, and comparing one number against another number.

A data processing system performs a series of actions or movements, each depending upon another. The series can be short, or long.

This series of actions can be compared to the flow of information through any accounting department. For example, in a payroll accounting system certain steps may be required:

1. Determination of hours worked, or pieces made.
2. Maintenance of current master rate information.
3. Deduction of state and federal taxes.
4. Preparing payroll registers.
5. Paychecks prepared at specified time.

In a payroll department the work involved in performing these steps would be split into various segments. Each represents specific functions, relating to one or more of these steps.

When time cards, labor distribution information and other input documents are received, they move from one operation to another. Each task must be completed before the documents are moved to the next operation.

The flow of these documents follows a set pattern because the work of one operation is usually based upon the successful completion of the previous operation.

The series of actions taken by a data processing system follows the same logical flow of information. When the 1440 Data Processing System handles a problem it performs a series of operations, one after another, in predetermined sequences, until the job is completed.

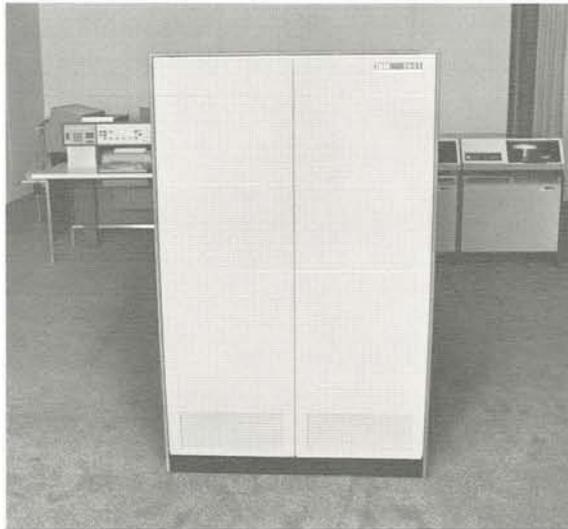
So the 1440 Data Processing System is a very fast, accurate accounting system.

But it is also much more. Because of its ability to store information, the 1440 is also a business information system—an electronic means to provide management with the reports, studies and analyses modern executives need today to run a successful, competitive business. With the 1440, the executive gets up-to-date information, when he needs it, in a form he can use.

This is the real benefit of an electronic data processing system.



The 1440 Data Processing System has five units: the processing unit, card read-punch, printer, disk storage drive and console.



1441 Processing Unit

The processing unit contains the magnetic core storage unit and the logic and arithmetic units that control the entire system.

The processing unit stores the program instructions and data during processing. It stores 4000 characters of information, with additional capacities of up to 16,000 positions available if needed. The processing unit performs its operations in millionths of a second, (11.1 microseconds basic cycle time), thus providing the 1440's powerful data handling ability.

1442 Card Read-Punch

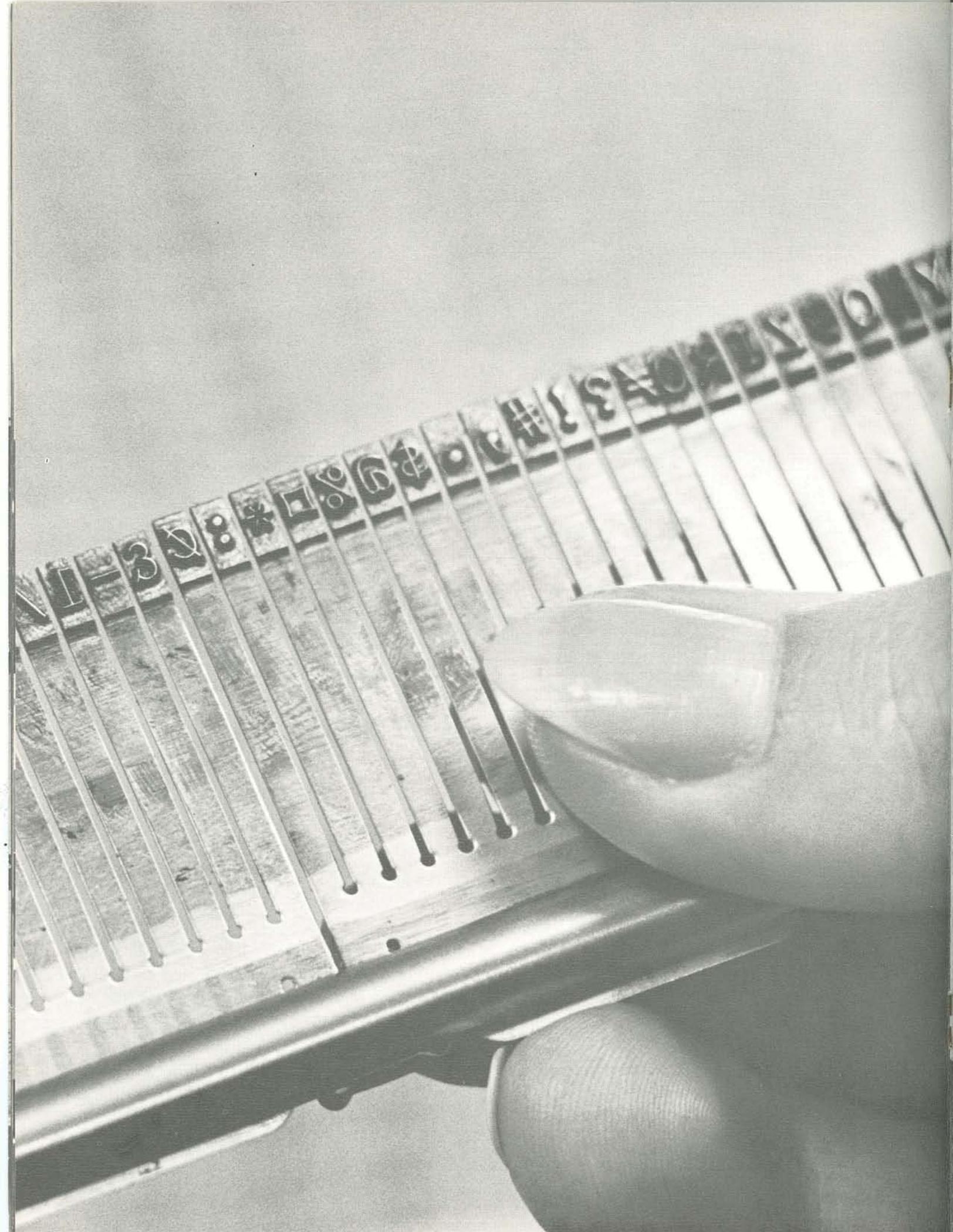
The card read-punch provides the system with card input and output. Here's how a card goes through the machine:

Feeding from the hopper, the card advances to the reading station, where punched information is read into the processor at speeds up to 400 cards per minute. Cards are read by light beams passing through the holes, striking solar cells. The solar cells convert this light energy to electrical impulses. This card-reading method is remarkably accurate.

After data is read from a card, it moves to the punching station. Now the results of the processing unit's calculations may be punched into the card. Cards are punched at speeds up to 270 cards per minute, depending upon the model and the number of columns punched. Finally, the card moves into the stacker.

The 1442 is available in two models. Model 1 reads cards at up to 300 per minute and punches cards at a rate of 80 columns per second. Model 2 reads cards at up to 400 cards per minute and punches cards at a rate of 160 columns per second.

To separate the reading and punching operations, an additional 1442 can be attached to the system. When this is done either one can be used as a reader only, as a punch only, or as a read-punch unit.



1443 Printer

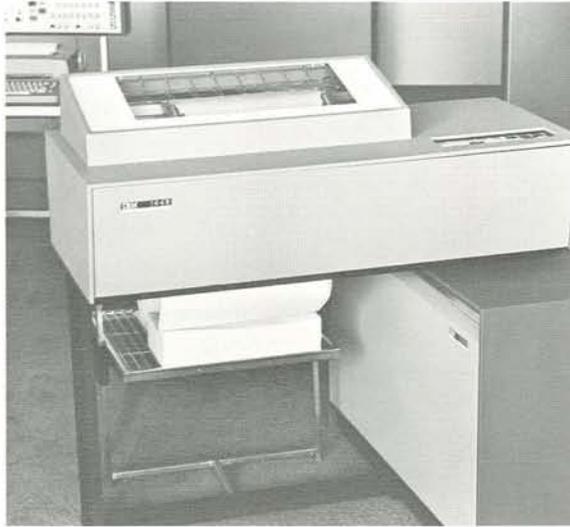
The printer is the principal output medium for the 1440 Systems.

Its outstanding feature is the interchangeable typebar. Various typebars are available with various sets of characters—numbers; numbers and letters; numbers, letters, and special characters, for example. You use the specific typebar required for your particular job. And an operator can change typebars in seconds.

There are two models of the printer. Basic printing speed is 150 lines a minute on Model I, 240 lines a minute on Model II. Using the 13-character numerical typebar, you can print up to 430 lines a minute on Model I and 600 lines a minute on Model II.

The actual printing speed for a particular job or application depends upon the total number of lines to be printed for the job, the amount of processing required for each line that is printed, and the character set that is used. There are 120 print positions. And an additional 24 positions can be added.

The standard 52-character set contains 26 alphabetic; 10 numerical; and 16 special characters. Character sets of 63, 39 and 13 characters are also available.

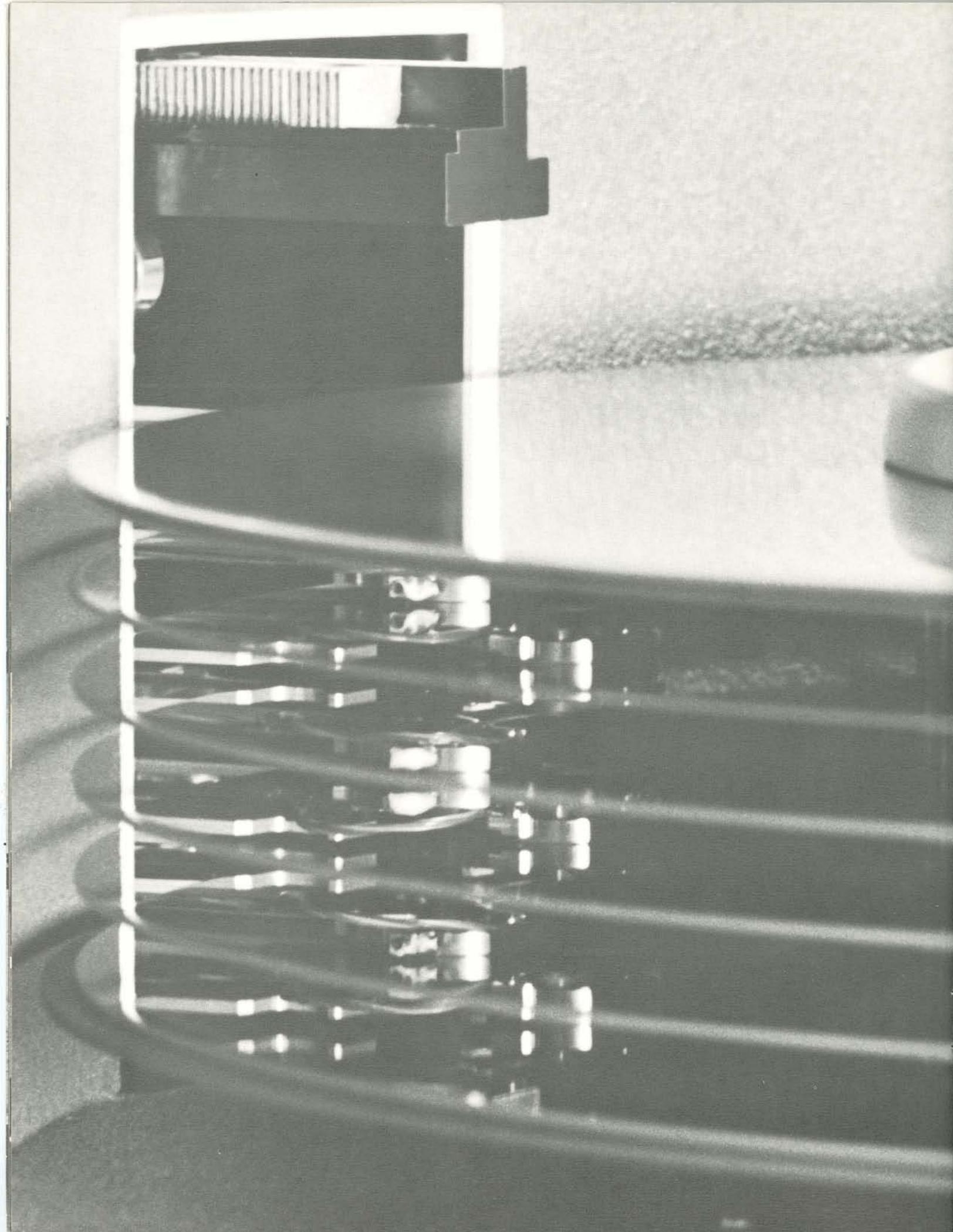


1443 PRINTER

| character sets | lines per minute | |
|----------------|------------------|----------|
| | MODEL I | MODEL II |
| 13 | 430 | 600 |
| 39 | 190 | 300 |
| 52 | 150 | 240 |
| 63 | 120 | 200 |

The 1443 uses an easily changeable paper tape loop to control the automatic spacing of forms in the printer.





1311 Disk Storage Drive & Disk Pack

Real key to the 1440's versatile operation is the removable, interchangeable disk packs.

Because disk packs are interchangeable, you can use as many packs as you need to store all your business records. For a specific job, you use the disk packs containing the business records relating to that specific job.

An operator changes disk packs easily on a disk storage drive. A pack weighs less than 10 pounds. All disk packs are interchangeable between disk drives. Data written on a disk pack by one 1311 can be read by another 1311. And more data can be added to a disk pack by any other 1311 Disk Storage Drive.

Nearly 3,000,000 characters of information can be stored on just one disk pack. And a 1440 system may have as many as five disk storage drives in operation at one time.

There are ten magnetic surfaces on six disks of a disk pack. Each disk has 100 circular tracks on which business records are stored. Each track is divided into sectors of 100 characters each. Each business record may consist of one or more of these sectors. Thus one disk pack can contain as many as 20,000 records of 100 characters each, or 2,000,000 characters. This can be increased to 2,980,000 characters.

Comb-like arms pass between the rotating disks reading information out of the files, or updating them with new data. These comb-like arms scan the records in sequence or seek out a particular record at random—and do either at great speed.

Data moves at the rate of 77,000 characters per second. All the information stored on a disk pack can be read and re-written in a little more than two minutes. Average access time to a single record is 250 milliseconds. If records are arranged in sequence, in the pack, access time can be as little as two milliseconds per record processed.



IBM 1440 DATA PROCESSING SYSTEM

Control panel for the IBM 1440 Data Processing System. It features a series of indicator lights and buttons on the left, a central section with a rotary switch and several push buttons, and a right section with a grid of 16 indicator lights and a vertical control column.

Labels on the left include: CONTROL, CPU BUS, ADDRESS, MEMORY, and PRINTER. Below these are three vertical bars and a section labeled STORAGE ADDRESS and INSTRUCTION ADDRESS.

Central section labels include: A, B, I, and a rotary switch labeled MODE.

Right section labels include: PRIMARY PULL, and a vertical column with labels: OFF, POWER ON, and a power button.



1447 Console

The IBM 1447 Console gives the operator external control of the system.

Special lights indicate operating conditions of the processing unit, disk storage drives, the card read-punch and the printer.

The operator can display the contents of any storage location during processing and can also control the course of program execution.

The 1447 Console Model 1 provides the basic system control. The 1447 Model 2 includes a console input/output printer. This printer provides written communication between the operator and the system. This is especially useful in obtaining information such as customers' accounts, stock status data, and payroll details that are stored in disk storage. Through the console printer, the operator can request specific data from any disk record, and have that information typed immediately, at about fifteen characters per second. This typed copy also serves as a log of information entered into or received from the 1440 System.

Because the console I/O printer also writes into the system's storage, the operator can examine or alter the status of any particular account, record, or instruction in the system.

Finally, the console printer can be used as an auxiliary output for exception reporting—calling immediate attention to any unusual activities noted during processing.



When application coverage or processing conditions require more program flexibility and faster program execution, special features can be added to a 1440 Data Processing System.

Each special feature contributes to the efficiency of the total system by providing one or more of these advantages:

1. Increased speed
2. Simplified programming
3. Additional system capacity
4. Simplified system organization

Here are some of the more important special features:

Multiply-Divide

Multiplication and division can be accomplished through program subroutines in the 1440. Where applications require a significant amount of calculating, the Multiply-Divide Feature increases processing speed and conserves storage space.

Sense Switches

Sense switches are used for external control over the course of the stored program. The manual toggle switches that control them are located on the 1447 Console.

Setting one or more of these sense switches selects different programs or portions of programs already stored in the processor.

Indexing and Store Address Registers

INDEXING: Many jobs require the same operations to be performed repetitively, changing only the storage locations affected. Changing these addresses each time a repetitive operation is performed requires several program

steps, and additional storage locations which must be set aside for this use. This special feature permits automatic modification (changing) of addresses. This means that fewer instructions are needed, which in turn means that additional storage space is made available for additional program steps.

STORE ADDRESS REGISTERS: This feature is useful when fields or records of variable length are being processed. This feature also provides a convenient method of linking various parts of the program together.

Card Image Feature

This feature makes it possible to read or punch cards in other than the standard code combinations.

Selective Character Set Feature

This feature allows the 1443 Printer to use three additional character sets (interchangeable typebars). A four-position switch enables the operator to designate which of the character sets is being used on the printer. A character set can be removed and another put in its place in less than one minute.

Additional Printing Positions

This feature enables the 1443 Printer to print 144 positions per line, instead of the standard 120 positions per line.

Print Storage

This feature provides extra positions of core storage that are used as temporary storage for data to be printed. From here this data is sent to the printer, while the processor goes on to

other operations. Thus other systems operations can be accomplished simultaneously with printing.

Disk Scan

This feature provides the system with the ability to make a rapid search of a disk pack for a specific code or condition (such as date or account number) contained within the record. The program can search (scan) all records in a file, or all records in a portion of a file.

Direct Access

The standard operation of the disk storage drive is to have the access arms return to the outside edge of the disk pack before each access movement to a new record. The direct access feature reduces access time by allowing the access arms to be moved directly to a new setting without first returning to the outside edge.

Track Record Feature

Normally 20 records of 100-characters each are written in each track. The Track Record Feature provides the ability to write *one* record consisting of 2980 positions of data on one track.

When this feature is installed, the number of data characters that can be stored in a disk pack is increased from 2,000,000 to 2,980,000, assuming that all tracks are written as track records.

Serial Input/Output Adapter

This device is used to attach special purpose machines (such as the 1412 Magnetic Character Reader) to the 1440 Data Processing System.

IBM programming systems are designed to aid the programmer in the preparation and operation of computer programs. By reducing the detailed work of writing programs, these systems enable the programmer to more effectively utilize his time with the 1440 System.

Programming systems for the 1440 are:

1. Autocoder
2. Input/Output Control System
3. Disk Storage Organization program
4. Disk Storage Utility program
5. Report Program Generator
6. Sort

Autocoder

The IBM 1440 Autocoder simplifies the preparation of programs for 1440 Systems. Autocoder enables the user to write programs in business terms rather than actual machine language.

Instructions written in Autocoder language are punched into cards and read into the 1440. An assembly program in the 1440 then produces a complete machine-language program.

With the machine-language program stored in the processing unit, the transaction cards are fed into the 1440 and the desired computations are carried out.

Input/Output Control System

The Input/Output Control System (IOCS) is an extension of the Autocoder program. It eliminates much of the detailed programming required for input/output operations.

The Autocoder processor inserts the appropriate instructions for input/output operations as it recognizes the IOCS instructions.

Disk Storage Organization Program

Disk storage organization programs are provided to assist users in establishing and maintaining data files in disk storage.

Disk Storage Utility Program

Utility programs for disk storage speed the clearing and loading of the disk storage and the transfer of data between disk storage and punched cards, between disk storage and the printer, and between two disk storage drives.

Report Program Generator

Report Program Generator (RPG) facilitates the preparation of programs that write reports. These reports are prepared from data stored in punched cards or disks.

Instead of writing a specific program for each required report, the user need only specify a description of the data from which the report is to be made and a description of the format for the desired report. These specifications are written in terms that require little knowledge of machine-language coding. The RPG then processes the specifications and produces a program that creates the desired report.

Sort

The Sort Program re-arranges the records stored in the disk packs into any desired sequence. It also seeks out records in any desired sequence for printing or punching. If so required, this program can also re-write these records into the disk storage in the new sequence.

The IBM 1440 Data Processing System is much more than machines. A complete program of IBM services support every installation, providing such important assistance as customer education, customer engineering, program libraries, and systems engineering.

Systems Reference Library

The 1440 Systems Reference Library furnished to each customer consists of all IBM technical publications written expressly for the 1440. The Systems Reference Library bibliography contains a list and an abstract of the contents of each publication and other IBM technical publications prepared for the general assistance of 1440 Data Processing System users.



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