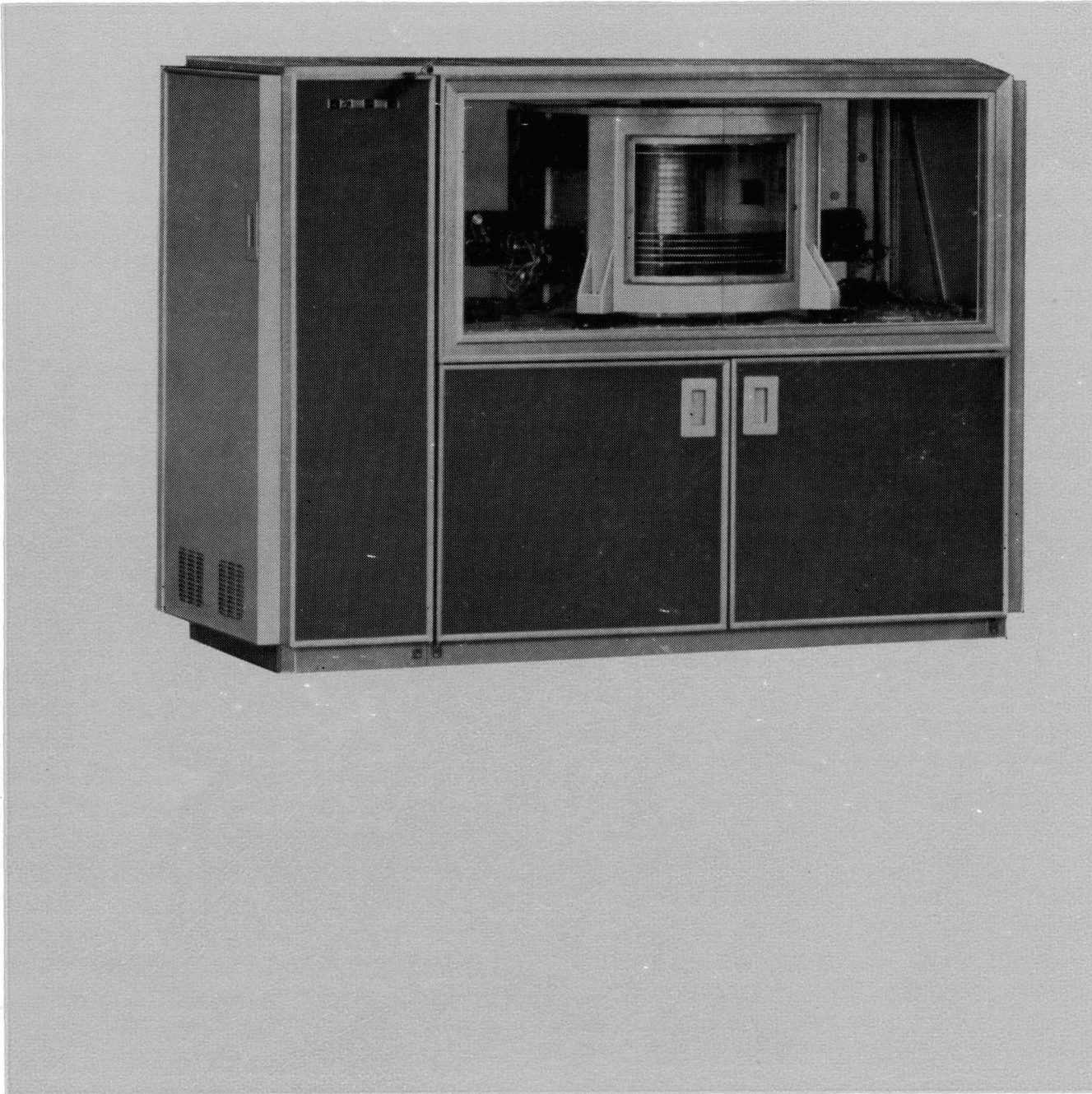




# I.C.T 1900 SERIES

## DATA DISC STORE 1956



### DESCRIPTION

The Disc Store provides bulk storage of data with the facility of direct random access to individual 60-word data sectors. The sizes of disc store available range from 31.5 to 126 million characters. Two configurations of store control units are available, one allowing a single data access and the other allowing two independent data accesses to be in progress at any one time. One dual-access store, or two single access stores, may be connected to a single Central Processor, the latter configuration providing a maximum capacity of 252 million characters.

- Direct access data storage
- 31 to 126 million characters per store
- One or two stores—total 252 million characters
- Average access 220 milli-seconds
- Dual access model doubles access rate

# DATA DISC STORE 1956

## Storage Units

Data are recorded on magnetic discs 31 inches in diameter permanently mounted on a rotating shaft. A storage unit consists of a cabinet containing a multiple-disc assembly with its driving mechanism, and a set of read-write recording heads mounted on moveable arms, one arm being associated with each disc. A storage unit contains 16 discs and has a data capacity of 31.5 million characters. Up to four units may be used together to provide the maximum capacity of 126 million characters per store. If desired, an initial installation can be subsequently expanded up to the maximum size by adding extra storage units.

## Store organization

On each surface of each disc there are two zones for the storage of data, an inner zone and an outer zone, making a total of four zones per disc. The arm associated with each disc has eight read-write heads, two being associated with each zone on the disc. Each arm is capable of moving independently of all other arms. An arm moves radially in relation to a disc and can assume one of 64 adjacent positions. Since the two heads associated with a zone are arranged to record on separate data tracks, a total of 128 tracks can be recorded in each zone. Each data track is sub-divided into data sectors, separated by inter-sector gaps, and consists of sixty 25-bit words recorded bit-serially along the track. As in the Central Processor, each word consists of 24 data bits together with a parity check bit. Data tracks in the inner and outer zones on a disc

contain 12 and 20 data sectors respectively. Every sector in a disc store is assigned a unique binary address by which it may be directly accessed for reading or writing. The address bits are used to select the disc, the arm position, the read-write head and the sector. For convenience of addressing each inner zone track is grouped with the outer zone track on the same disc surface, and is accessible from the same arm position, to form a track-pair containing 32 consecutively addressed sectors. The store arrangements are summarized in the table below.

## Store access time

The time taken to access a data sector consists of the sum of times for (a) moving the head arm belonging to the selected disc to the selected position, if it is not already in that position, and (b) waiting for the disc to revolve to the point where the beginning of the first required data sector is positioned under the read-write heads. (This is known as 'latency' time.) The average arm-positioning time, if the arm is not already correctly positioned, is 190 milli-seconds. The average latency time, which is half of the disc revolution time, is 30 milli-seconds, the disc speed being 1,000 revolutions a minute. A program may request the disc store to read or write up to 32 consecutively addressed data sectors in a single access. Provided that the sectors are all on the same disc and are accessible from a single arm position each sector will be transferred at a rate of one sector per 3 milli-seconds (outer zone) or one per 5 milli-seconds (inner zone), once the

beginning of the first sector arrives under the read-write heads. If the requested sectors are not all accessible from a single arm position on a single disc, Executive will split the transfer into two separate disc store accesses and carry them out consecutively; the time for the whole transfer will then be the sum of the separate times for the two accesses.

## Access control

One Access Control Unit must be included with each disc store, and is capable of controlling up to four 16-disc storage units.

The Access Control is housed in a cabinet that matches a storage unit in size and style, and is normally placed adjacent to a storage unit. A second Access Control Unit may, if desired, be included with a Disc Store, and will permit two simultaneous operations to take place within the same Disc Store. An interlock ensures that both Access Controls do not attempt simultaneously to obtain access to the same disc, but access to any two distinct discs can take place simultaneously and independently. Thus the overall processing rate achievable by the dual access disc store is effectively doubled. Associated with each Access Control is a Channel Control which is housed in the Central Processor and is fitted only when required. The Channel Control includes data buffers to enable data to be transferred between it and the Central Processor in units of one word.

## Disc store reservations

Executive will maintain an index of all data files currently in the Disc

	16-disc units	Discs and arms	Arm positions	Track-pairs	Data sectors	6-bit characters
Maximum store	4	64	4,096	16,384	524,288	125,829,120
16-disc unit		16	1,024	4,096	131,072	31,457,280
Disc			64	256	8,192	1,966,080
Arm position				4	128	30,720
Track-pair					32	7,680
Sector						240
Number of bits used to address		6	6	2	5	

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Store. The index will include the names of the files and their address allocation, together with other details. A portion of the Disc Store will be reserved for the index and for Executive routines associated with the Disc Store. A program wishing to read or over-write a data file that is already in the Disc Store must request it by name, and Executive will allocate that part of the Disc Store to the program. Free areas of Disc Store may also be allocated to a program on request. Executive will check that every read or write operation relating to that data file or area does not call for a sector outside the limits of that file or area. Where desired, Executive will prevent a data file from being over-written except by specific named programs. It will also ensure that no file is deleted, and its store space re-allocated to another file, unless its validity date is passed.

## **Error recovery**

To ensure that data are correctly written on the Disc Store a program may request that newly-written data are examined and subjected to a parity check on a subsequent revolution of the discs. Occurrence of parity error will cause Executive to re-write the data.

If a parity error occurs during a reading operation, Executive automatically attempts to repeat the operation up to a predetermined number of times since this will usually eliminate the error. If the error cannot be eliminated the program can determine the position of the erroneous word, and may utilize any of the rest of the data from the sector.

## SPECIFICATION

*Average access time* 220 milli-seconds includes:  
*Average arm motion time* 190 milli-seconds (including track address confirmation)  
*Average latency* 30 milli-seconds  
*Maximum arm motion time* 275 milli-seconds (including track address confirmation)  
*Disc speed* 1,000 revolutions per minute  
*Data transfer rate* (character rate within sector)  
100 kc/s (outer zone)  
60 kc/s (inner zone)  
*Sector size* 60 words 240 characters  
*Sector transfer time* (includes inter-sector gap)  
3 milli-seconds (outer zone)  
5 milli-seconds (inner zone)  
*Packing density* 600 bits an inch (maximum)

## PHYSICAL CHARACTERISTICS

	<i>16-Disc</i>	<i>Access</i>
	<i>Storage</i>	<i>Control</i>
	<i>Unit</i>	<i>Unit</i>
Height	64 inches	64 inches
Width	68 inches	18 inches
Depth	35 inches	35 inches
Weight	2575 pounds	445 pounds

*This specification is subject to modification*

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