

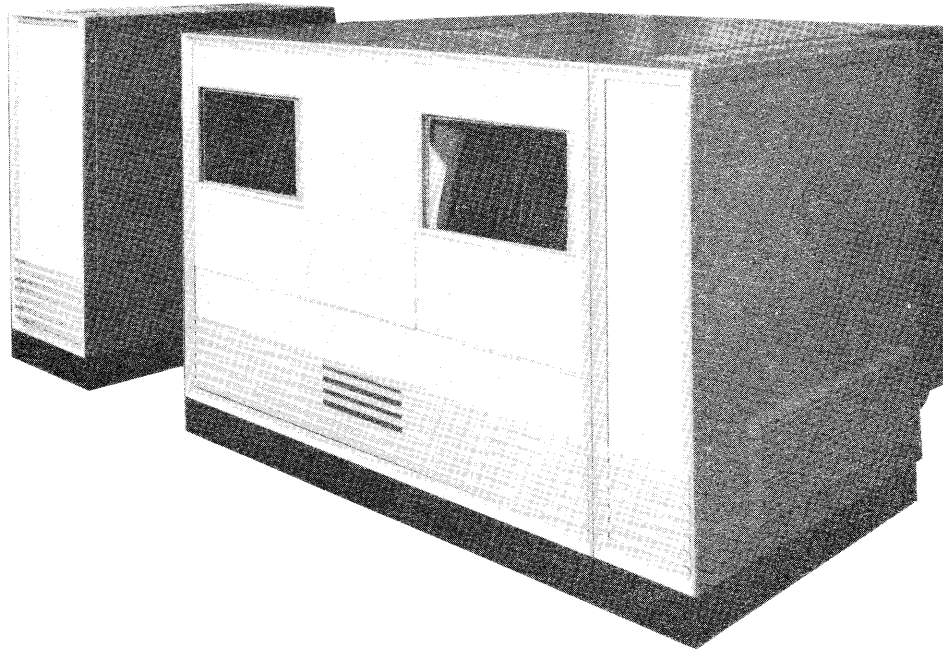
BRYANT COMPUTER PRODUCTS

850 LADD ROAD · WALLED LAKE, MICHIGAN 48088
TELEPHONE 313/624-4571 · TWX 810/232-1550



data

MODEL 2A SERIES 4000 DISC FILE



The Bryant Model 2A Series 4000 Disc Files provide a random access, mass data storage capability. With these devices, storage is in the billions of bits, access time is in milliseconds, and storage cost per bit is in the thousandths of a cent. Available in a two cabinet, 13-disc, A-frame size and a three cabinet, 26-disc, C-frame size — the devices are so constructed that discs may be added separately until the maximum disc complement of the file size is reached. A single disc, which can store up to 150 million bits, forms a convenient increment for building each file size up to its full storage capacity — considering a three-frequency zone format, a capacity of 1.8 billion bits for the A-frame size file and a capacity of 3.8 billion bits for the C-frame size file.

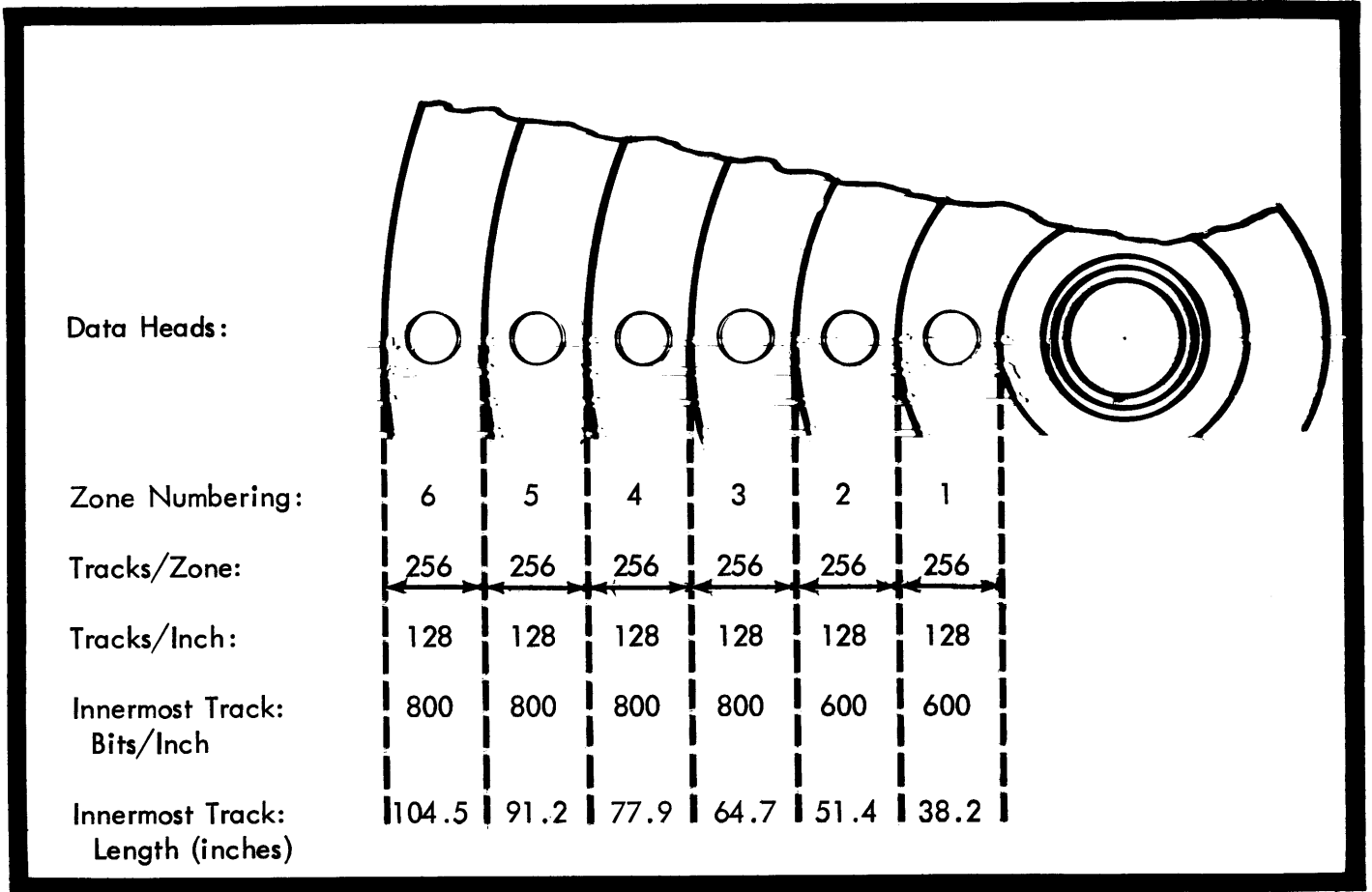
Six write/read magnetic heads are arrayed against zones of each data disc surface. In operating position, the data heads fly within a few microns of the surface, and magnetize or sense the magnetization of discrete areas of the disc.

The zones are divided into 256 concentric tracks, and the heads, through a hydraulically operated digital actuator, are precisely positioned to the selected track.

C-frame disc files are available equipped with either single or optional dual positioning. An auxiliary electronics cabinet is available as an option for either file size.

1. DISCS *

Type: Solid magnesium and dynamically balanced
 Diameter: 39 inches, nominal
 Quantity: Variable 1-26, see model designation
 Coating Type: Bryant magnetic oxide, hard, low-friction finish on both sides
 Surface Organization:



Tracks/surfaces: 1536 per disc surface. The tracks are numbered in each zone from the outermost track (track 0) to the innermost track (track 255).

Zone/Surface: 6 zones per disc surface. A zone is the disc surface area serviced by one general storage data head. Zone radial width is approximately 2 inches.

Track Width: 0.005 inch on 0.0075 inch centers (nominal)

* Of the maximum disc complements, one disc of both standard files is a clock disc. With respect to facing the front of the files, the clock disc is located to the right and left of the pedestal's of the A- and C-frame configurations, respectively.

2. STORAGE CAPACITY

The capability of the magnetic system of a file depends not only upon the individual characteristics of the magnetic surface and the heads, but also upon the recording mode chosen for the file and the signal retrieval characteristics of the playback circuit. Frequency or phase modulation recording with a self-clocked, peak-detection technique is recommended for recording densities of 600/800 bits per inch (BPI) or higher in serial or parallel system operation.

For other frequencies and pulse densities, see graph entitled Storage Capacities vs Disc Zones at various BPI.

Storage capacity in the following table is derived as follows:

$$\text{Track Velocity (in./sec.)} = \text{Innermost Track Length in Inches} \times \frac{\text{RPM}}{60}$$

$$\text{Frequency (Hz)} = \text{Track Velocity} \times \text{BPI}$$

$$\text{Bits/Track} = \text{BPI} \times \text{Innermost Track Length}$$

$$\text{Bits/Zone} = \text{Bits/Track} \times \text{Tracks/Zone}$$

$$\text{Bits/Surface} = \text{Bits/Zone 1} + \text{Bits/Zone 2} + \text{Bits/Zone 3} \dots + \text{Bits/Zone 6}$$

$$\text{Bits/File} = \text{Bits/Surface} \times \text{No. of Data Surfaces/File}$$

TABLE 1-1 STORAGE CAPACITY AT GIVEN FREQUENCY

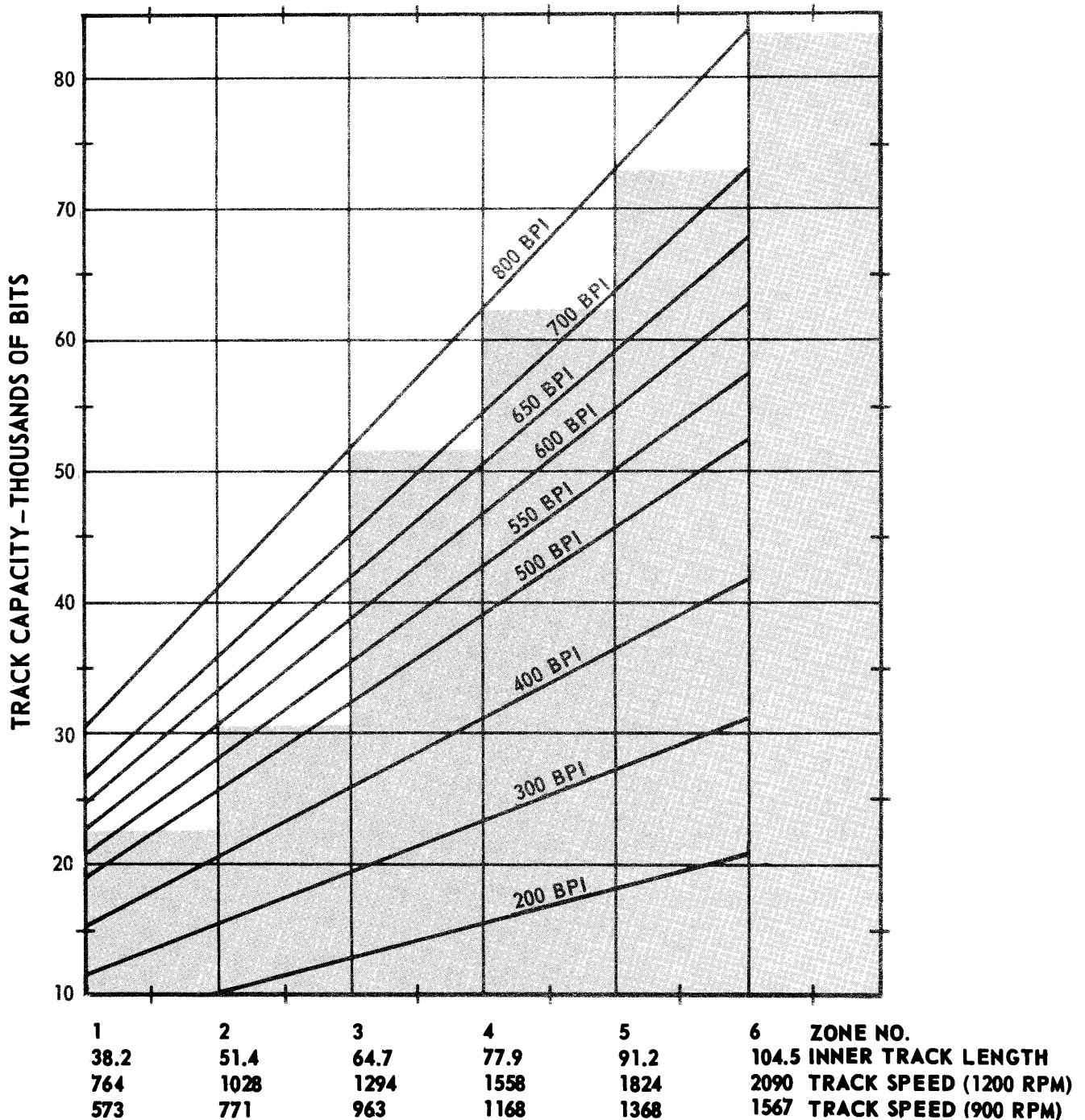
ZONE	THREE-FREQUENCY ORGANIZATION				SIX-FREQUENCY ORGANIZATION			
	Frequency (KHz)		Bits/Track	Bits/Zone	Frequency (KHz)		Bits/Track	Bits/Zone
	900 rpm	1200 rpm			900 rpm	1200 rpm		
1	343.8	458.4	22,920	5,867,520	343.8	458.4	22,920	5,867,520
2	343.8	458.4	22,920	5,867,520	462.6	616.8	30,840	7,895,040
3	776.4	1035.2	51,760	13,250,560	776.4	1035.2	51,760	13,250,560
4	776.4	1035.2	51,760	13,250,560	934.8	1246.4	62,320	15,953,920
5	1094.4	1459.2	72,960	18,677,760	1094.4	1459.2	72,960	18,677,760
6	1094.4	1459.2	72,960	18,677,760	1254.0	1672.0	83,600	21,401,600
			<u>295,280*</u>	<u>75,591,680**</u>			<u>324,400*</u>	<u>83,046,400**</u>
No. of Data Surfaces***			x 50	x 50			x 50	x 50
			14,764,000*	3,779,584,000**			16,220,000*	4,152,320,000**

* Totals shown for Bits/Track column are bits available through head switching at each surface and for the entire file.

** Totals shown for Bits/Zone column are bits per surface and bits per disc file.

*** Surfaces specified are for a C-frame disc file. For an A-frame file, multiply by 24 — the maximum No. of Data Surfaces available for data storage in the smaller, two-cabinet file.

2. STORAGE CAPACITY (Cont.)



NOTES:

1-INNER TRACK LENGTH IS IN INCHES; TRACK SPEED IS IN INCHES/SECOND;
BPI INDICATES BITS PER INCH

2-TRACK CAPACITY-TRACK LENGTH×BPI

3-FREQUENCY-TRACK SPEED × BPI

4-TONED AREA REPRESENTS DATA STORAGE CAPACITY OF THE DISC SURFACE OF A
MODEL 2A DISC FILE

3. SURFACE CHARACTERISTICS

A. Surface Anomalies (Dropouts)

Data discs of the file shall contain no more than $10(N)$ defined dropout tracks; in this factor, N is a variable that is equal to the number of data discs furnished with the file.

A defined dropout track for threshold detection technique is one wherein the signal falls below a given high threshold or a noise spike rises above a given low threshold while the operating threshold is set between the two.

A defined dropout track may not be detectable at the operating threshold; however, they must be considered as potentially detectable.

B. Overall Surface Quality

Prior to installation in the disc file, all Bryant discs are examined by an automatic surface checker that digitally tests the entire surface including the guard bands between the recording tracks. Discs are selected to provide no more than one defined dropout track per track position per head row.

C. Methods of Compensating For Surface Anomalies

Dropouts can be minimized by utilizing a self-clocked, peak-detection read amplifier that is capable of accommodating localized signal modulation. Even when this technique is used, however, it is recommended that a sector relocation capability be utilized in the system. Such a capability would: (1) enable the transfer of data to a spare disc surface should the peak-detection read amplifier be incapable of handling marginal dropouts; and (2) provide spare storage backup should accidental damage occur to any normal data storage surfaces.

4. MAGNETIC HEADS

Data Heads

Type:	One magnetic head mounted in an aerodynamic low-friction pad
Quantity:	Six head pads per disc surface. Total quantity of heads is dependent upon number of discs
Mounting:	Movable to 256 discrete locations
Head Pole Width:	0.005 inch (nominal)
Number of Coils:	One bifilar wound, center-tapped coil

Clock/Fast Access Heads

Type:	Two magnetic heads mounted in an aerodynamic low-friction pad
Mounting:	Head pads mounted to a fixed arm
Quantity:	Eight head pads (16 heads) per clock disc surface One clock bar standard with single head positioner

5. HEAD POSITIONERS

Type:	Open loop electro-hydraulic digital actuator with built-in power amplification and acceleration and de-acceleration control
Quantity:	Single Positioner System — Standard; Dual Positioner System — Optional (C-frame only)
Positioner Controls:	An eight bit binary static address controls the 256 discrete locations of each positioner system Dual digital positioner system can be operated and controlled as independent systems or programmed to operate in a simultaneous or alternate mode

6. ACCESS TIME

Access time is defined as the time from specific track selection to the point in time at which the addressed record is located. Access time is composed of switching time — less than 50 us, positioning time, verification time and latency time. The major components are described below.

Positioning Time:

Positioning time is defined as the time required from the moment a specific data track is selected until the selected track is reached and the signal amplitude is at its full value continuously. Positioning time is dependent upon track address desired and the size of the file. Average positioning time is based on:

$$\text{Av. time per move} = \frac{\text{Sum of times of all possible moves}}{\text{Number of possible moves}}$$

Verification Time:

35 ms approximately.

Latency Time:

Average (1/2 disc rotation)
Maximum (1 disc rotation)

1200 RPM = 25 ms, 900 RPM = 34 ms.
1200 RPM = 50 ms, 900 RPM = 67 ms.

NO. of DISCS	POSITIONING TIME (Milliseconds)		
	Minimum	Average	Maximum
Single Positioner File			
1 to 13	40	100	160
14 to 26	50	110	180
Dual Positioner File			
1 to 8*	40	100	160
9 to 13*	50	110	180

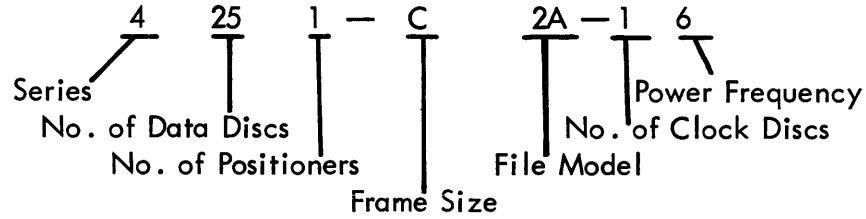
* Number of discs listed for dual positioner file are discs/module (or serviced by one positioner)

7. PHYSICAL DATA

Types:

Two sizes available. See facing diagram.

Type Designation:



CABINET	SIZE	WEIGHT	FLOOR LOADING
A-FRAME (13 DISCS)			
Disc File Unit	70"W x 46"D x 52"H	3440 lbs	25 lb/sq. in.
Environmental Control Unit (2-Ton)	34"W x 33"D x 52"H	600 lbs	Caster Mounted
Electronics Auxiliary Unit (Optional)	12"W x 46"D x 52"H	175 lbs	13 lb/sq. in.
C-FRAME (26 DISCS)			
Disc File Unit	70"W x 46"D x 52"H	3340 lbs	24 lb/sq. in.
Power Control Unit	22"W x 46"D x 52"H	910 lbs	11 lb/sq. in.
Environmental Control Unit (3-Ton)	70"W x 35"D x 52"H	1000 lbs	Caster Mounted
Electronics Auxiliary Unit (Optional)	12"W x 46"D x 52"H	175 lbs	13 lb/sq. in.

Files with less than maximum number of discs:

Weight is:	33 lb/disc less
Floor loading is:	0.2 lb/sq. in. per disc less

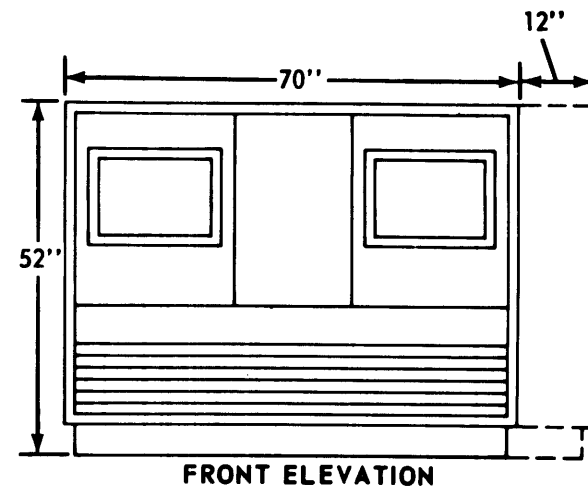
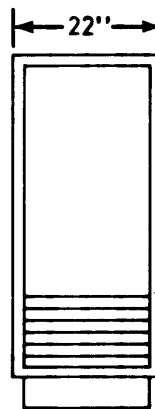
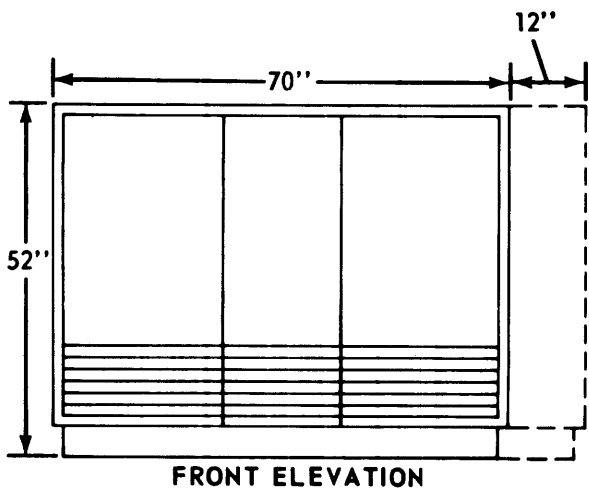
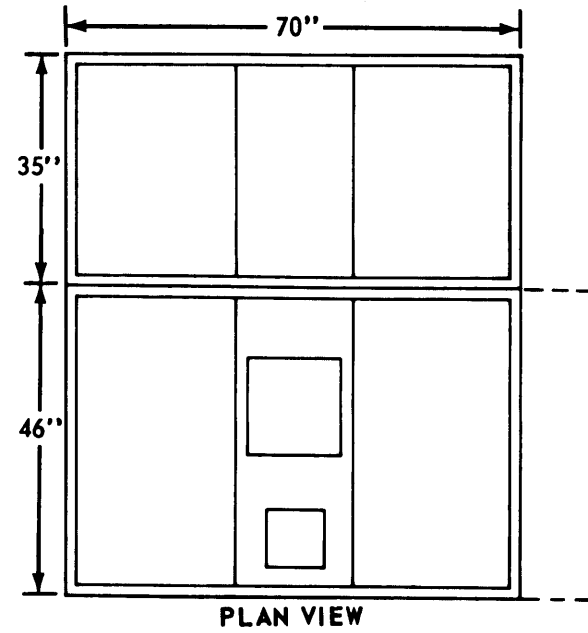
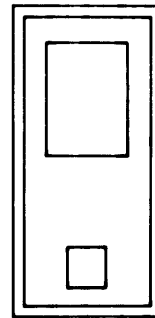
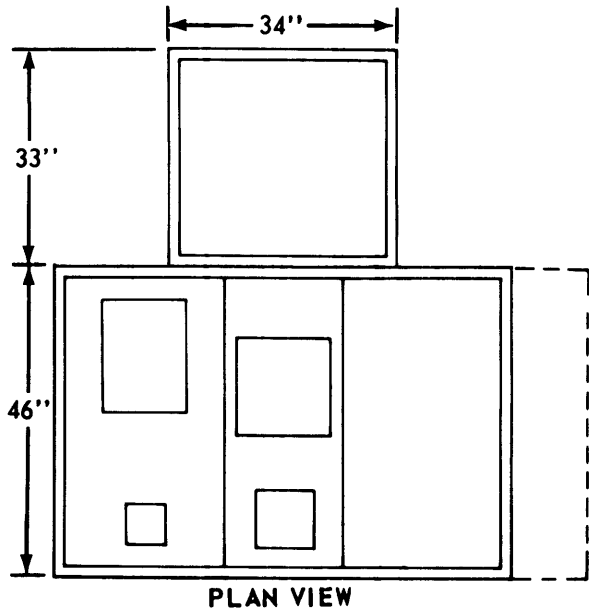
Total plan view area required for installation (without Electronics Auxiliary Unit):

A-Frame	115" deep by 118" wide
C-Frame	117" deep by 200" wide

The area figures allow for maintenance. That is: three feet in rear of Environmental Control Unit; two feet on each side of cabinet(s); and — in the case of the C-frame file — a maximum of five feet between disc file and power control unit cabinets.

Cabinet Finish: Specifications negotiable:

7. PHYSICAL DATA (Cont.)



A-FRAME

C-FRAME

8. ENVIRONMENTAL REQUIREMENTS

All disc files are equipped with an environmental control unit (ECU) that includes a filtration system which maintains the air internal to the disc file cabinet at a fairly low contamination level. Also, a cooling unit included in the ECU serves to remove the heat load from the interior air of the disc file cabinet thereby maintaining the temperature of the air inside the cabinet relatively constant over relatively large room ambient temperature variations. Though an ECU is furnished with the disc file, the following room environmental conditions are also required.

Room Ambient:

Operating Conditions:

Within a $\pm 10^{\circ}\text{F}$ range between 60°F and 90°F with the ECU operating in a closed, recirculating loop configuration

Storage:

-35°F to 130°F

Humidity:

Operating:

40% to 85% (dependent on room ambient range selected — with no condensation)

Storage:

0% to 85% (with no condensation)

Barometric Pressure:

Operating:

32-24 inches of Mercury (Sea level to 6000 feet)

Storage:

32-11 inches of Mercury (Sea level to 25,000 feet)

Dust:

Operating:

Air-conditioned controlled environment and/or computer factory-type installation within an American Society of Testing and Materials (ASTM) Class "C" contamination level. Required preventive maintenance in this environment is described in the service handbook.

Storage:

Warehouse-type environment. Maintenance during storage is described in the service handbook.

Supporting Surface:

Operating:

Flat and horizontal within 3 degrees

Storage:

Flat and horizontal within 15 degrees

9. ELECTRICAL CHARACTERISTICS

Voltage (Standard):

The standard Disc File system is designed to operate with power rated at 208 VAC or 440 VAC \pm 10% 3-phase, 50/60 Hz.

Current:

Variable, with spindle frame and motor size, number of discs, and speed. For typical running current values, see power curves which follow.

Disc Rotation Speeds:

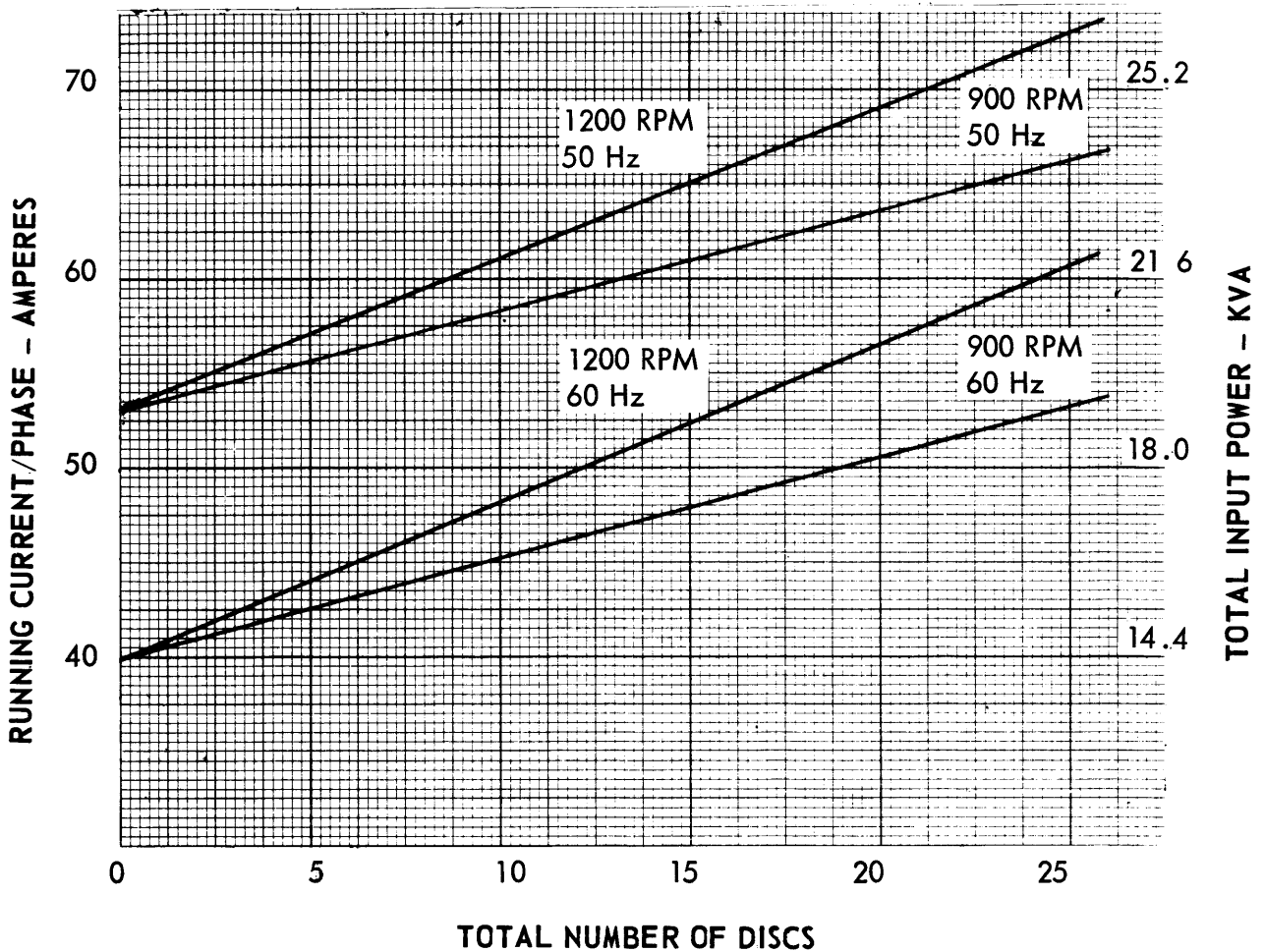
900 RPM or 1200 RPM \pm 5%; (nominal)

Frequency Tolerance:

Refer to graph entitled Disc Speed Variations with Frequency Variation.

Voltage Tolerance:

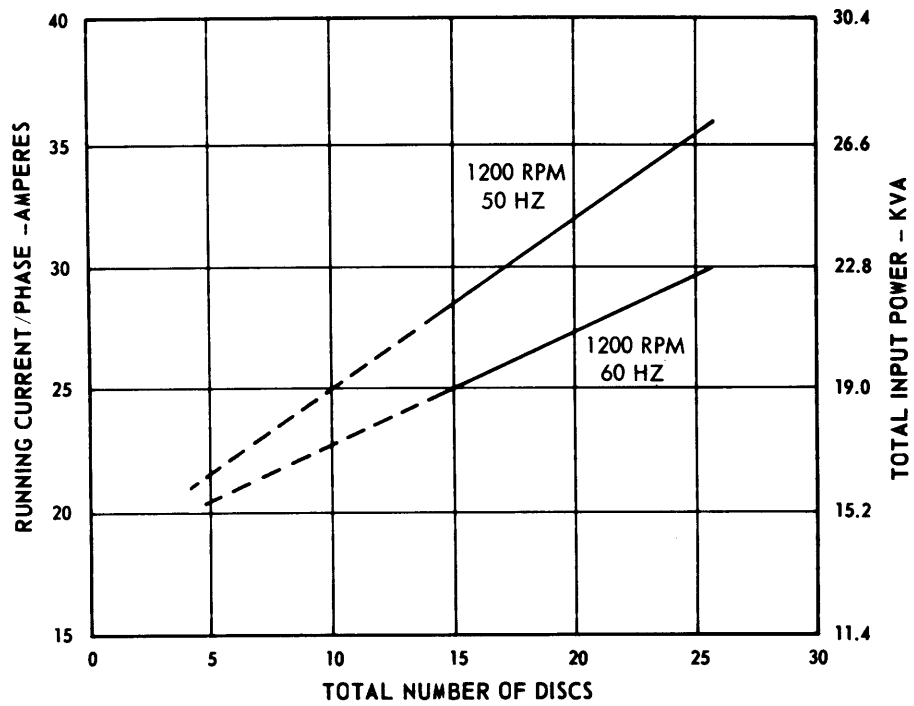
Refer to graph entitled Speed Variation with Line Voltage Variation.



NOTE:

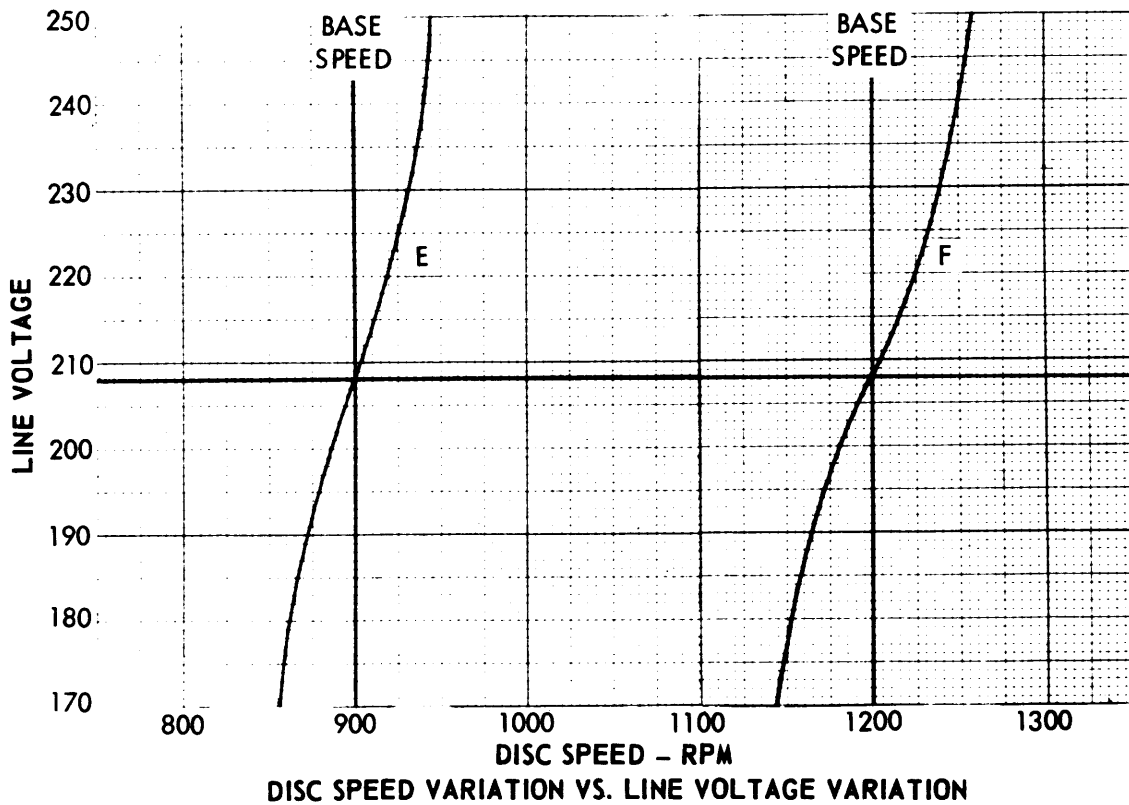
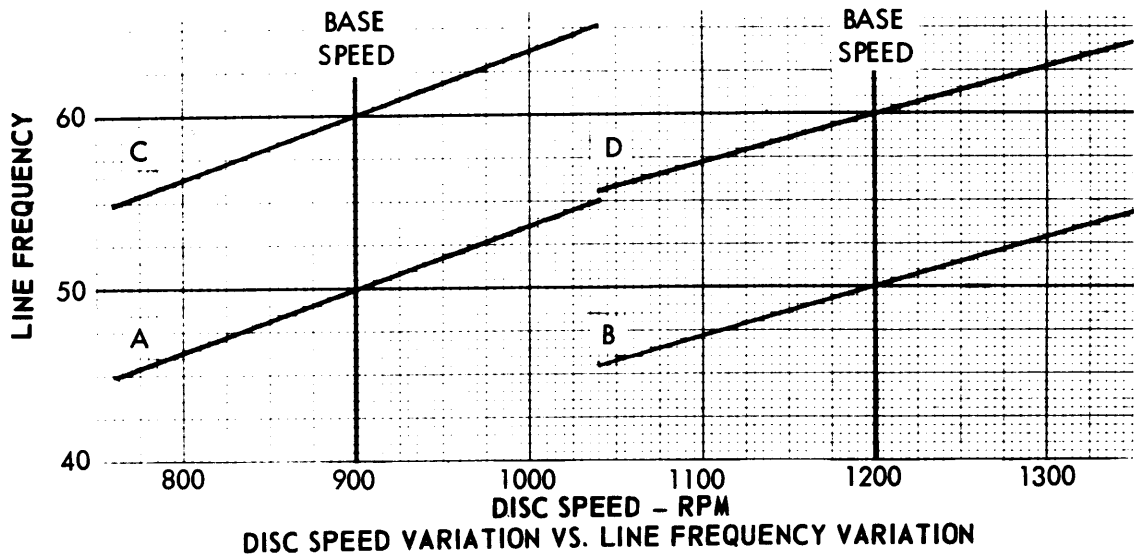
CURVES ARE BASED ON 208 VAC, 3 PHASE, 50/60 HZ, POWER SOURCE; MAXIMUM SURGE CURRENT IS 125 AMPS; $KVA = EI\sqrt{3}$.

9. ELECTRICAL CHARACTERISTICS (Cont.)



NOTE:
 CURVES ARE BASED ON 440 VAC, 3 PHASE, 50/60 HZ, POWER SOURCE; MAXIMUM SURGE CURRENT EQUALS 100 AMPERES AT 50 HZ OR 85 AMPERES AT 60 HZ; $KVA = EI\sqrt{3}$.

9. ELECTRICAL CHARACTERISTICS (Cont.)



LEGEND:

- A — A-FRAME @ 5 HP, C-FRAME @ 5 HP — 900 RPM, 50 Hz
- B — A-FRAME @ 5 HP, C-FRAME @ 10 HP — 1200 RPM, 50 Hz
- C — A-FRAME @ 5 HP, C-FRAME @ 5 HP — 900 RPM, 60 Hz
- D — A-FRAME @ 5 HP, C-FRAME @ 10 HP — 1200 RPM, 60 Hz
- E — A-FRAME @ 5 HP, C-FRAME @ 5 HP — 900 RPM, 50/60 Hz
- F — A-FRAME @ 5 HP, C-FRAME @ 10 HP — 1200 RPM, 50/60 Hz

10. ELECTRONIC RECORDING INTERFACE

A system requires disc, head, zone, and track addressing, read/write mode selection, data, and a write clock for each positioner employed. Read/write electronics shall be mounted in close proximity to the magnetic heads and include linear read preamplifiers, write amplifiers, and head selection circuits. Other electronics are located in the electronics bay of the main cabinet or in a separate auxiliary electronics cabinet. Dimensions of electronics bays are shown in the illustration which follows.

The interface shall perform the following functions:

Select the head zone addressed

Select the disc surface addressed

Select the logic level of the positioner address

Supply clock pulses required

Enable read or write circuits, depending on the condition of mode selection lines

Modulate write data with write clock

Derive a read clock from pulse-form read data

Demodulate pulse from read data

Supply track verification clocks and data

Buffer input and output signals when necessary

Supply lines to ready relay contacts which close when disc file is operating.

10. ELECTRONIC RECORDING INTERFACE (Cont.)

