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Hardware

**8407 Diskette Drive
General Description**

Description

UP-8922 Rev. 2

This Library Memo announces the release and availability of "SPERRY 8407 Diskette Drive General Description", UP-8922 Rev. 2.

This manual provides a basic description of the SPERRY 8407 Diskette Drive. The 8407 diskette drive is a freestanding, autoloader-type device designed to handle removable interchangeable diskette storage media.

This revision documents a number of technical changes, including the addition of two commands: seek and continue.

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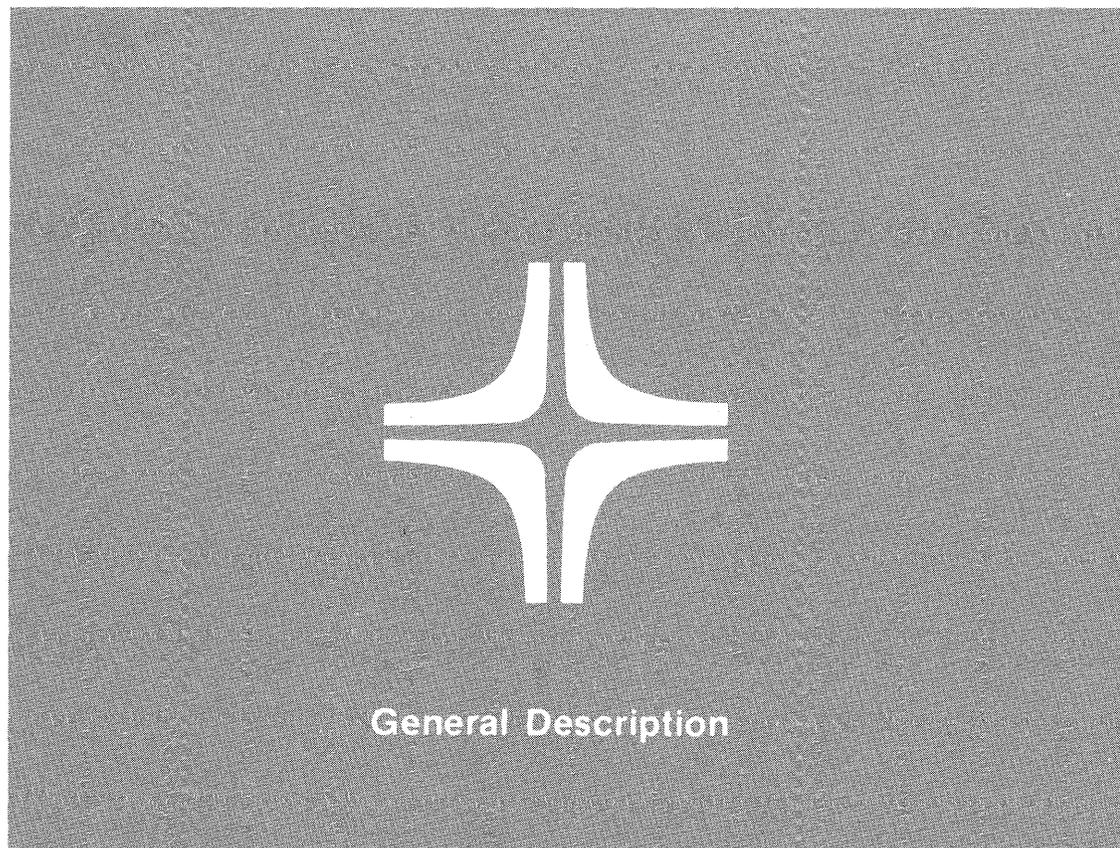
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Library Memo for
UP-8922 Rev. 2

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8407 Diskette Drive



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Compliance is based upon a system configuration that includes SPERRY peripherals/subsystems so labeled, and cables furnished by Sperry or built to Sperry specifications and assembly procedures.

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1. Introduction

The SPERRY 8407 Diskette Drive (Figure 1-1) is a freestanding, autoloader-type diskette storage device that can be attached directly to system interfaces. It is designed to handle up to 20 removable interchangeable diskette storage media having either single-side or double-side recording surfaces. Recording format can be in either single or double density.

The 8407 diskette drive provides modern cardless processing using flexible disk input/output.

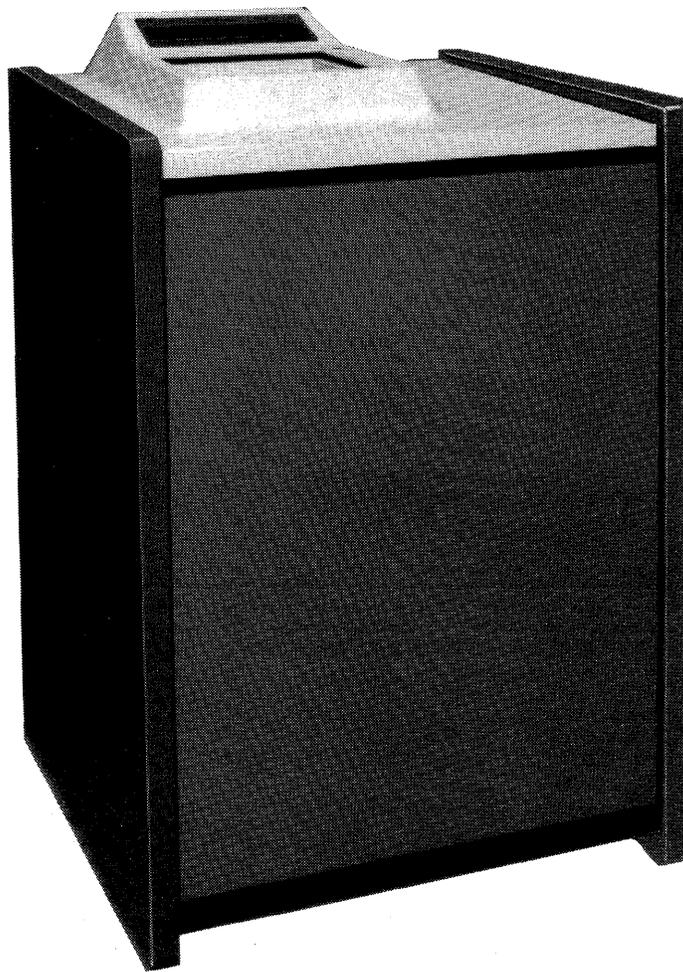


Figure 1-1. 8407 Diskette Drive, Basic Unit

2. Description

2.1. GENERAL DESCRIPTION

The 8407 diskette drive is an external storage device having a self-contained, autoloader-type drive mechanism capable of handling up to 20 removable interchangeable diskettes. The diskettes act as the storage medium for online operation. Each removable diskette is a flexible magnetic disk protected by a plastic envelope, with data recorded on or read from either one-sided or two-sided diskettes. The recording is in either single-density (FM) or double-density (MFM) format. Each drive mechanism sequentially accepts one diskette at a time. The data format is organized into 77 recording tracks per side, with each track divided into 26, 15, or 8 sectors.

2.2. CHARACTERISTICS

The 8407 diskette drive employs a fixed-format approach utilizing electronic sectoring. Information recorded on the tracks consists of:

- Gap bytes
- Sync bytes
- Tractor/sector addresses
- Data
- Cyclic redundancy check (CRC) bytes

Table 2-1 lists the functional characteristics of the 8407 diskette drive.

2.2.1. Compatibility

The 8407 diskette drive is provided with an 8-bit plus parity interface and is capable of processing diskette media that are recorded in the double-density (MFM) method and formatted with:

- 256 bytes/sector, 26 sectors/track
- 512 bytes/sector, 15 sectors/track
- 1024 bytes/sector, 8 sectors/track

The 8407 diskette drive is also compatible with processing diskette media that are recorded in the single-density (FM) method and formatted with:

1. 128 bytes/sector, 26 sectors/track
2. 256 bytes/sector, 15 sectors/track
3. 512 bytes/sector, 8 sectors/track

Table 2-1. 8407 Diskette Drive Characteristics

Item	Characteristic
Drive mechanism per cabinet	1
Data read/write heads per drive mechanism	2
Bytes per sector	128, 256, 512, 1024
Sectors per track	26, 15, 8
Bits per inch density	3400/6800
Physical tracks per diskette	77
Tracks per inch	48
Data bytes per diskette side	
■ Single density	246,272/284,160/303,104
■ Double density	492,544/568,320/606,208
Access time	
■ Track-to-track	3 milliseconds (step time)
■ Head settling	15 milliseconds (step settle time)
■ Head loading	50 milliseconds
Read data rate	Up to 8690 records per minute
Write data rate	Up to 4500 records per minute
Average latency time	83.33 milliseconds
Diskette rotational speed	360 revolutions per minute nominal (166.7 milliseconds per revolution)

2.3. CONFIGURATION

The configuration for the 8407 diskette drive is illustrated in Figure 2-1. The basic 8407 diskette drive unit contains one autoloader mechanism, power supply, power control, microprocessor controller control panel, and frame and casework.

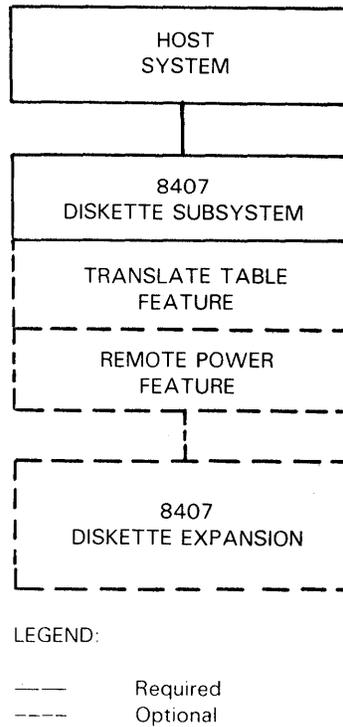


Figure 2-1. 8407 Diskette Drive Configurator

2.3.1. Standard and Special Features

Table 2-2 lists the standard and special features available with the 8407 diskette drive.

Table 2-2. 8407 Diskette Drive Standard and Special Features

Item	Description
8407 Diskette Subsystem	Freestanding drive unit that consists of one 60-Hz diskette drive mechanism, one autoloader mechanism, 60-Hz power supply, power control, microprocessor controller, frame, and casework. The autoloader can process either single- or double-sided diskette media in either single (FM) or double (MFM) density, supporting both SPERRY and IBM formats.
8407 Diskette Expansion	Provides an additional autoloader drive, frame, and casework. The necessary controller logic and power are controlled by the basic 8407 diskette drive.
Translate Table Feature	Provides user-loadable, 512-byte RAM that is used by the 8407 diskette drive to translate inbound and outbound data to the code that is loaded into the RAM
Remote Power Feature	Allows dc power to be controlled from the host processor

2.4. COMPONENTS

The 8407 diskette drive contains a diskette drive mechanism, autoloader mechanism, microprocessor controller, and the diskette media (flexible disks).

2.4.1. Flexible Diskette Drive

The flexible diskette drive (FDC) mechanism used with the autoloader is a direct access storage device. It utilizes the standard 8-inch removable and interchangeable diskette storage media and accepts only one diskette at a time. It has two heads that simultaneously come into contact with the diskette. This permits reading and writing on both sides of the diskette.

2.4.2. Autoloader Mechanism

The autoloader has a feed capacity that can sequentially process up to 20 diskettes without operator intervention. The hopper and stacker both have a maximum capacity of 20 diskettes. They are provided with an empty hopper detector and a stacker full detector. Diskettes are fed one at a time upon command starting with the one nearest the mechanism utilizing the mechanical picker technique. An autoloader mechanism cycle consists of unloading a diskette from the drive to the stacker and then feeding a diskette from the hopper to the drive. The time required to eject one diskette and load the next is 5.5 seconds \pm 0.5 second.

2.4.3. Microprocessor Controller

The microprocessor controller uses five 2-bit slice central processing element (CPE) integrated circuits (ICs) with a 4K x 32-bit control store (PROM) and a 9K x 9-bit read/write (RAM) storage. Control store sequencing is accomplished by programmable logic arrays (PLAs).

The microprocessor uses 1024 bytes of the RAM for a working area and the remaining 8192 bytes are used as record buffers. This provides:

- sixty-four 128-byte record buffers when the record-length format is 128 bytes per sector;
- thirty-two 256-byte record buffers when the record-length format is 256 bytes per sector;
- sixteen 512-byte record buffers when the record-length format is 512 bytes per sector; and
- eight 1024-byte record buffers when the record-length format is 1024 bytes per sector.

2.4.4. Diskette Media

The diskette media (shown in Figure 2-2) are removable and interchangeable magnetic storage media that consist of a single flexible disk enclosed in a protective plastic envelope. One version of the media permits recording on only one side of the disk, while the second version permits recording on both sides of the disk.

The disk has 77 recording tracks per side, with each track being divided into 26, 15, or 8 sectors. The tracks are numbered 0 through 76, with track 0 being defined as the outermost track. Typically, track 0 is reserved for labels, and tracks 1 through 74 are used to store data. Tracks 75 and 76 are used as alternate data tracks when there are defective tracks in the data area (tracks 1 through 74).

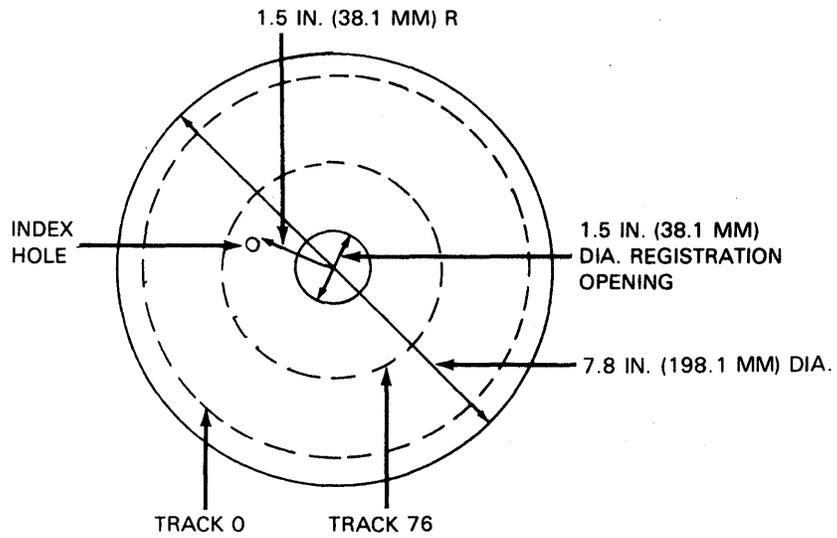
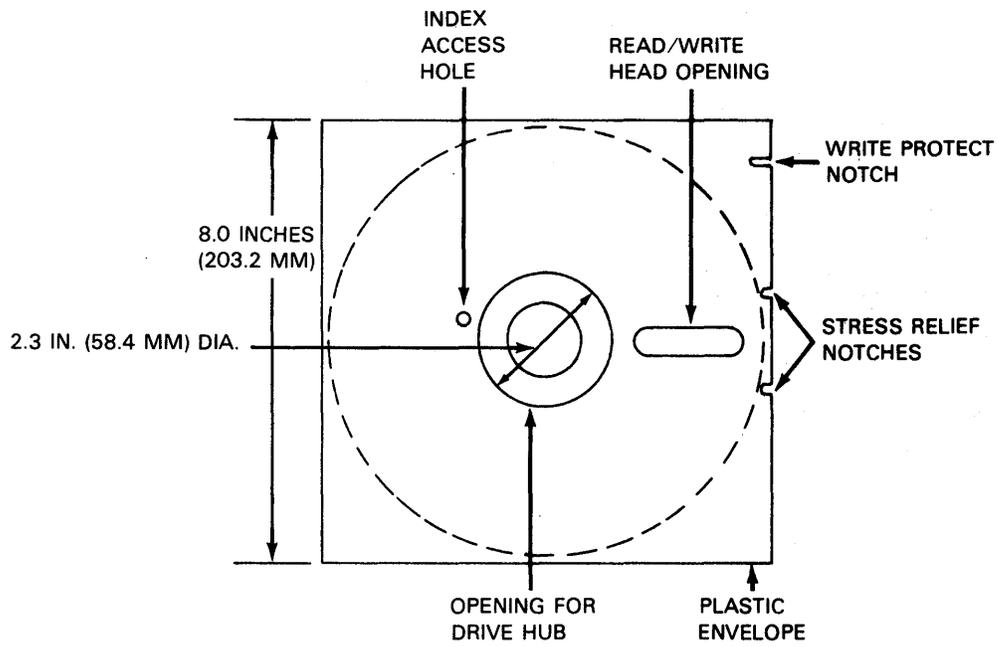
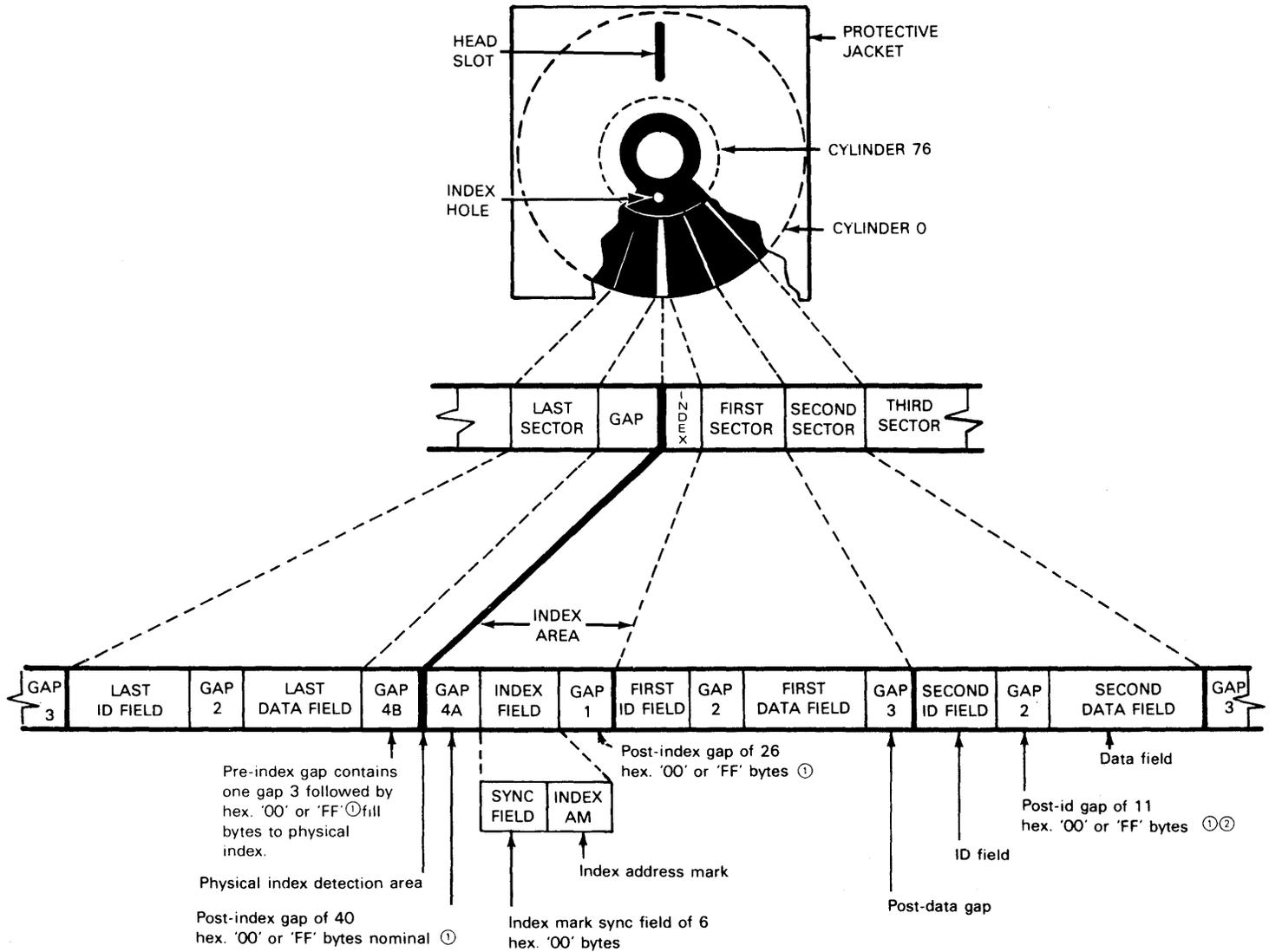


Figure 2—2. 8407 Diskette Media

The diskette employs fixed format that utilizes electronic sectoring. Information recorded on the tracks consists of gap bytes, sync bytes, track/sector addresses, data, and cyclic redundancy check bytes. The track formats supported are the IBM-compatible, single-density (FM) and double-density (MFM) type recordings. These formats are shown in Figures 2-3 and 2-4, respectively.



NOTES:

1. Hexadecimal FF is preferred.
2. When updating data field, this gap is maintained at 11 bytes ± 2 bytes.

Figure 2-3. FM Track Format

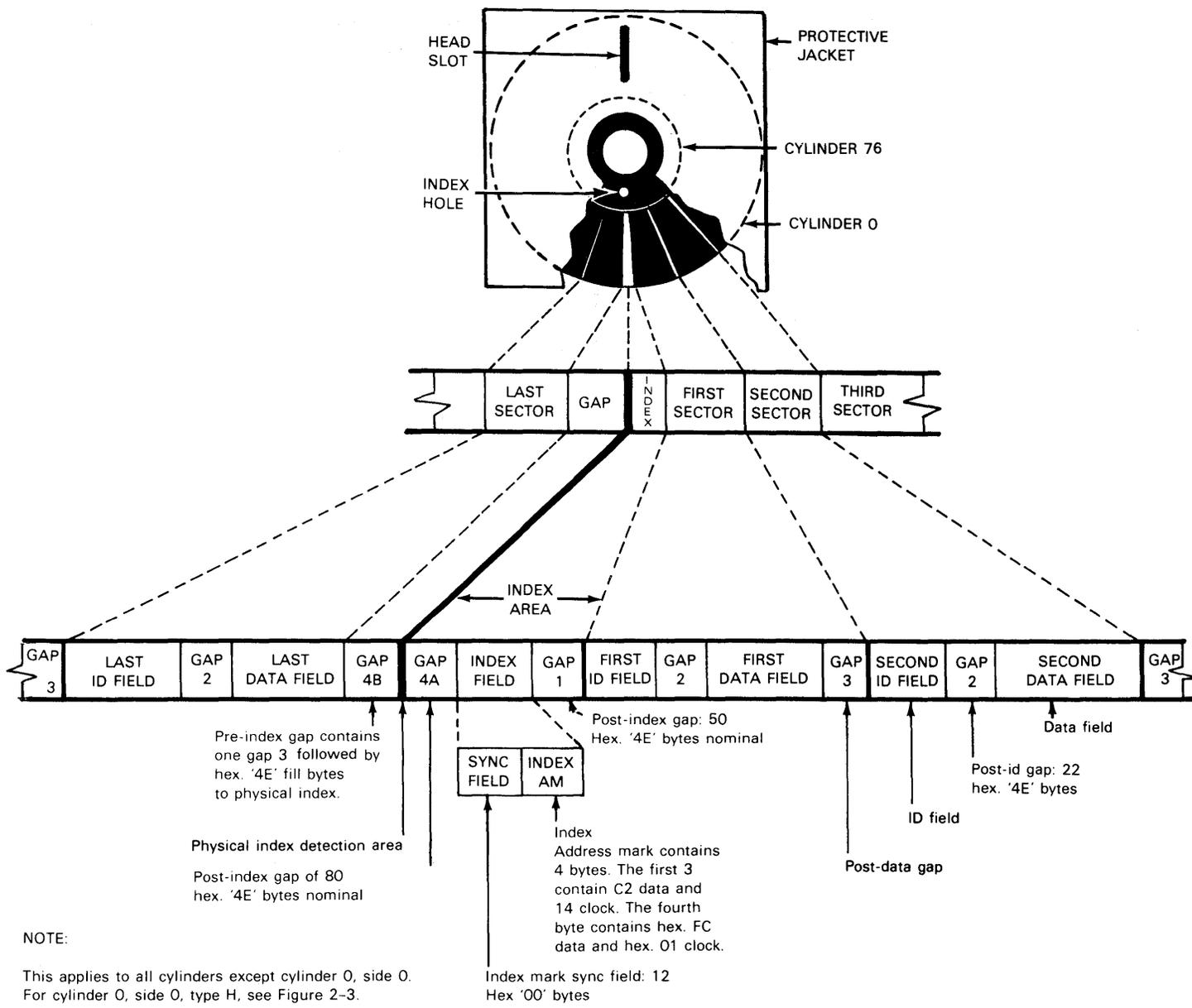


Figure 2-4. MFM Track Format

2.4.5. Direct Access Mode (DAM)

For the user who cannot operate within the file structure and operating constraints of data set mode (DSM), DAM provides essentially unrestricted access and operation with the mounted diskette. Along with this freedom, the user assumes the responsibility for maintaining any existing file structure and integrity while operating in this mode.

2.4.6. Data Set Mode (DSM)

The DSM provides the user the capability of processing diskette data organized in a file structure according to Sperry standards. In this mode, less user support software is necessary to process sequential files because the subsystem processes and checks most of the data set label and maintains certain parameters when processing records.

3. Command Repertoire

3.1. COMMANDS

The hardware capabilities of the 8407 diskette drive are directed and controlled by a comprehensive set of commands. These commands with a brief description of their functions are listed in Table 3-1. Any other commands issued are rejected, resulting in a unit check status being returned to the host processor.

Table 3-1. Command Repertoire (Part 1 of 3)

Command	Mne- monic	Hex. Code	Function
Sense	SNS	04	Transfers data to host specifying the condition of the drive unit
Test I/O	TIO	00/ 03	Removes pending status from the addressed control unit and drive
Set Inhibit Status	SIS	10	Sets state of drive to prevent subsystem from initiating a status sequence
Reset Inhibit Status	RIS	20	Permits drive unit to initiate a status sequence
No Operation	NOP	03	Acknowledges whether addressed controller is installed and state of addressed controller
No Operation	NOPS	73	Acknowledges whether addressed controller is installed
Record Length Mode Set	RLMS	43	Sets the state of the drive to terminate read or write commands at record length boundaries. Record length mode state is set in drive unit.
Record Length Mode Reset	RLMR	53	Resets the state of the drive to terminate read or write commands at record length boundaries. Record length mode state is reset in drive unit.
Cylinder Mode Set	CMS	C3	Sets the state of the drive to terminate read or write commands at cylinder boundaries. Cylinder mode state is set in drive unit.
Cylinder Mode Reset	CMR	D3	Resets the state of the drive to translate read or write commands on cylinder boundaries. Cylinder mode state is reset in drive unit.
Recover	RCVR	13	Positions the device back to the starting track, side, sector of the immediately previous read or write command

Table 3—1. Command Repertoire (Part 2 of 3)

Command	Mne-monic	Hex. Code	Function
Feed	FD	23	Causes autoloader mechanism to initiate the unload/load sequence of one diskette from the drive into the stacker and another diskette from the hopper into the drive
Unload	UNLD	33	Causes autoloader mechanism to initiate the unload sequence of one diskette from the drive into the stacker
Softscope	SS	63	Used for test and diagnostic purposes
Format Write	FW	11	Used to prep or initialize a track
Write	W	01	Places host data onto a diskette in both DSM and DAM
Write Control	WC	41	Places host data onto a diskette with a special code placed into the address mark field preceding the data
Data Set Open	DSO	21	Conditions the diskette drive to process a sequentially organized data set of one extent
Data Set Close	DSC	51	Causes drive to exit from DSM and enter into DAM
Load Track/Side/Sector	LTSS	31	Specifies to the host system the next physical sector to be processed
Write Subsystem Buffers	WSE	71	Loads the diskette drive sector buffer with known data
Load Physical Track	LPT	61	Used for test and adjustment purposes
Initial Load	IL	02	Causes host system to position the addressed device to the load point and begin reading data for IMPL and IPL purposes
Read Volume ID	RVID	56	Obtains the volume ID record from track 0, side 0, and sector 7 to ascertain whether the correct diskette is installed
Format Read	FR	16	Obtains the ID field bytes from a particular track and side to ascertain the sequence on a track
Read	R	06	Transfers diskette data from noncontrol sectors to the host system
Read Control	RC	46	Transfers diskette data from all sectors to the host system
Read Subsystem Area	RSA	66	Used for test and diagnostic purposes. It transfers up to 1024 bytes from the drive RAM control area to the host system.
Read Subsystem Buffers	RSB	76	Used for test and diagnostic purposes. It can transfer up to 8192 bytes from the drive RAM sector buffer area to the host system.
Set Inbound Translate Mode	SITM	83	Sets mode for addressed device, causing data of inbound commands (R, RC, RVID, RSB) to be translated

Table 3-1. Command Repertoire (Part 3 of 3)

Command	Mnemonic	Hex. Code	Function
Reset Inbound Translate Mode	RITM	93	Resets mode of addressed drive, causing inbound data commands not to be translated
Set Outbound Translate Mode	SOTM	A3	Sets mode of addressed drive, causing outbound data commands (W, WC, WSB) to be translated
Reset Outbound Translate Mode	ROT M	B3	Resets mode of addressed drive, causing outbound data commands not to be translated
Read Translate Table	RTT	86	Used for test and diagnostic purposes. It transfers up to 512 bytes from the drive unit translate table RAM to the host system.
Write Translate Table	WTT	81	Loads drive unit translator RAM
Read Control Unit ID	RCID	F4	Provides informative data that permits the host system software to determine the drive hardware configuration
Read Device ID	RDID	74	Provides informative data that permits the host system software to determine the drive hardware configuration
Read Display	RDSP	D2	Used for test and diagnostic purposes. It can transfer up to 16 bytes of data that contain information about the operating state of the drive unit.
Set 1100 Byte Count Mode	SBCM	E3	Used to set the state in the addressed device, which causes read and read control commands to be terminated at the loaded byte count value
Reset 1100 Byte Count Mode	RBCM	F3	Used to reset the state in the addressed device, which causes read and read control commands to be terminated at the loaded byte count value
Load 1100 Byte Count Mode	LBC	91	Loads the addressed device with a byte count value, which can be used to terminate subsequent read and read control commands at this specified value
Set Diagnose	SD	4B	Used to place a subsystem in a diagnostic mode and execute a specific subcommand operation via a command-chained read operation
Diagnostic Sense	DSNS	44	Used to recover diagnostic related sense information. It transfers up to 12 sense bytes to the host.
Seek	SK	B1	Used to position the addressed device's read/write head to the next sector to be processed. Buffers up to 8192 bytes of data for a subsequent read command
Continue	CONT	B7	Buffers data after a device has been deselected by an operation at the other device

4. Operator Controls and Indicators

4.1. OPERATOR CONTROLS

The 8407 diskette drive is designed for ease of use, all but eliminating operator attention to a control panel. The flexible diskette controller (FDC) and the control program provide the control for all operations other than turn on, turn off, and manual feed when using the autoloader.

The only operator requirement pertains to the proper installation and removal of the diskette. The procedures for handling the diskette require the operator to load and unload the autoloader with up to 20 diskettes.

4.2. CONTROLS AND INDICATORS

The basic operating controls are grouped on two panels: power and operator.

4.2.1. Power Panel

The power panel is located in the basic diskette drive unit and includes power circuit breakers, an AC ON indicator, a POWER ON/OFF switch, power RESET, LOCAL/REMOTE switch, and six red light-emitting diode indicators that aid in troubleshooting the system if a malfunction occurs. The expansion autoloader has only the AC ON indicator (Figure 4-1).

The basic drive unit is provided with remote power sequencing capability.

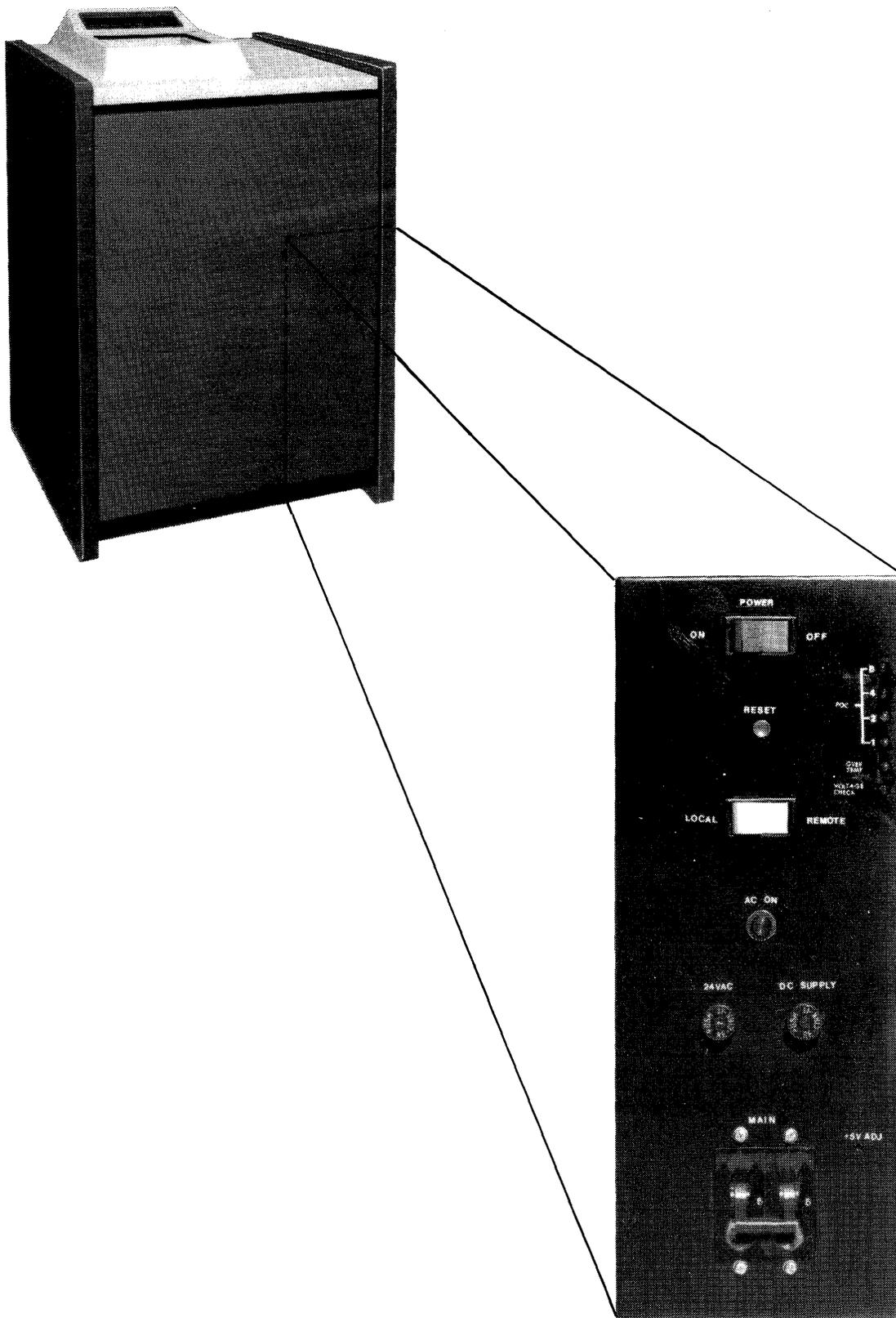


Figure 4—1. Power Panel Controls and Indicators

4.2.2. Operator Panel

The operator panel is mounted on the top of the 8407 diskette drive unit (Figure 4-2).

The panel contains two momentary pushbutton switches and eight backlighted indicators that control drive unit operation and indicate jams, doors open, empty hopper, full stacker, mode of operation (online/offline), controller condition, and stop-run condition.

An additional control, the FEED pushbutton switch and indicator, is provided on the top cover to the right of the hopper and stacker. The switch permits the operator to initiate an unload/load feed cycle. The amber indicator is lit during a homing or manual feed operation. It is also lit during execution of the feed or unload command, indicating an autoloader operation is in progress.

A drive read/write indicator, also mounted on the FEED switch/indicator panel, indicates (when lit red) that a read or write operation is in progress.

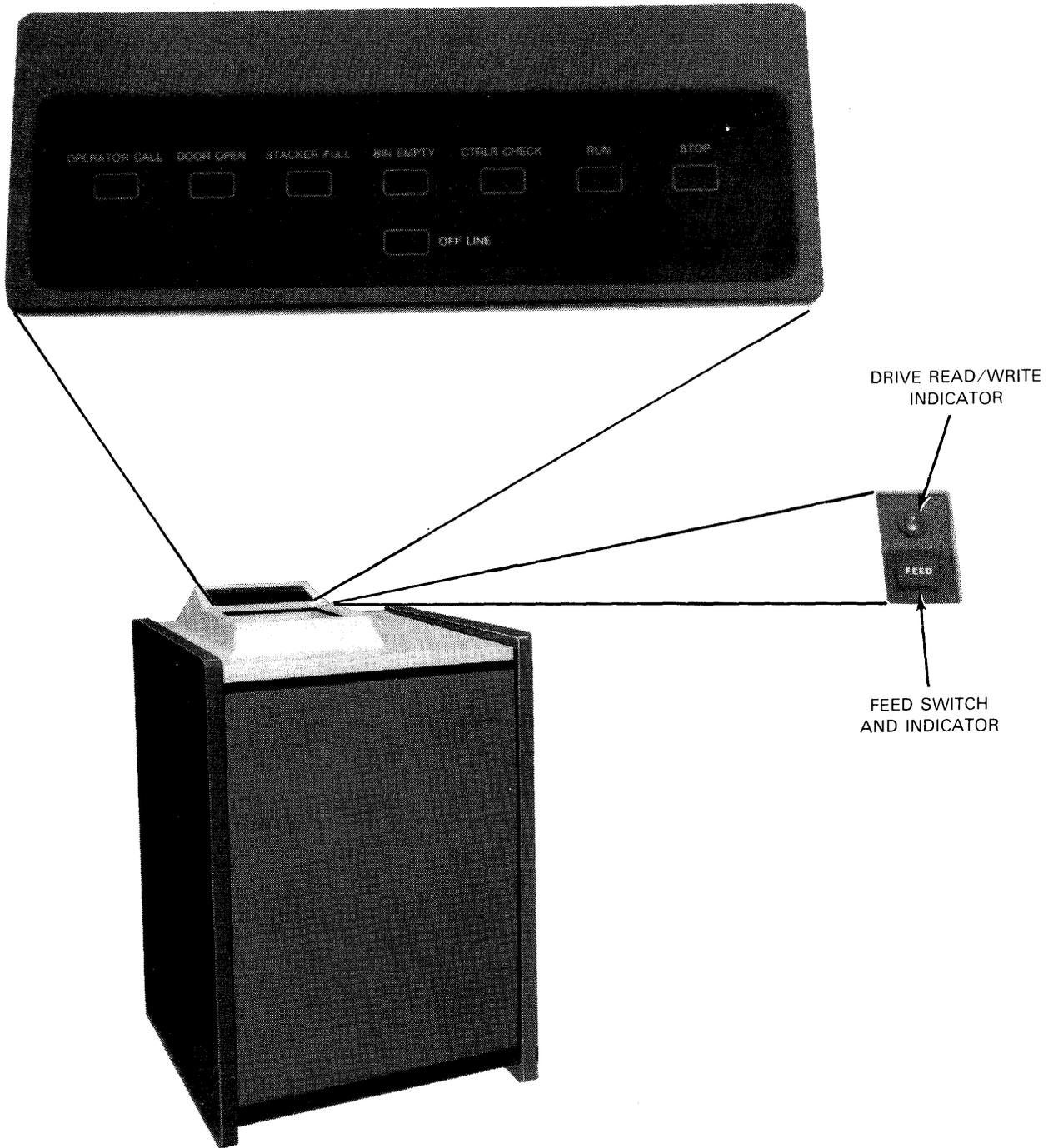


Figure 4-2. Operator Panel Controls and Indicators

5. Physical Characteristics

5.1. DIMENSIONS AND WEIGHT

The general packaging and approximate overall weight and dimensions of the 8407 diskette drive are given in Table 5-1. The basic version is shown in Figure 5-1, while the expanded version is shown in Figure 5-2.

Table 5-1. Weight, Floor Loading, and Dimensions

Parameter	Basic	Basic plus Expansion Autoloader*
Weight	200 lb (90.7 kg)	350 lb (158 kg)
Floor loading	36.7 lb/ft ² (178 kg/m ²)	33.5 lb/ft ² (162 kg/m ²)
Height (overall)	38.0 inches (965.2 mm)	38.0 inches (965.2 mm)
Width	26.5 inches (673.1 mm)	50.5 inches (1282.7 mm)
Depth	31.0 inches (787.4 mm)	31.0 inches (787.4 mm)

*Expanded version

5.2. HEAT DISSIPATION

The maximum heat dissipation is 2200 Btu per hour for the basic diskette and 3100 Btu per hour for the basic unit with a second autoloader attached. No external cooling is required. The intake for cooling is beneath the diskette cabinet and open to room air. A fan draws air in from the floor through the printed-circuit module into and through the diskette mechanism and exhausts the air out the rear louvered panel.

5.3. POWER REQUIREMENTS

The ac power source option is a single phase, 200/208/220/240 volts, 50- or 60-Hz connected as a 3-wire system (two hot lines plus safely ground). Power requirements are listed in Table 5-2. Power distribution for the second autoloader is provided by the basic autoloader power system.

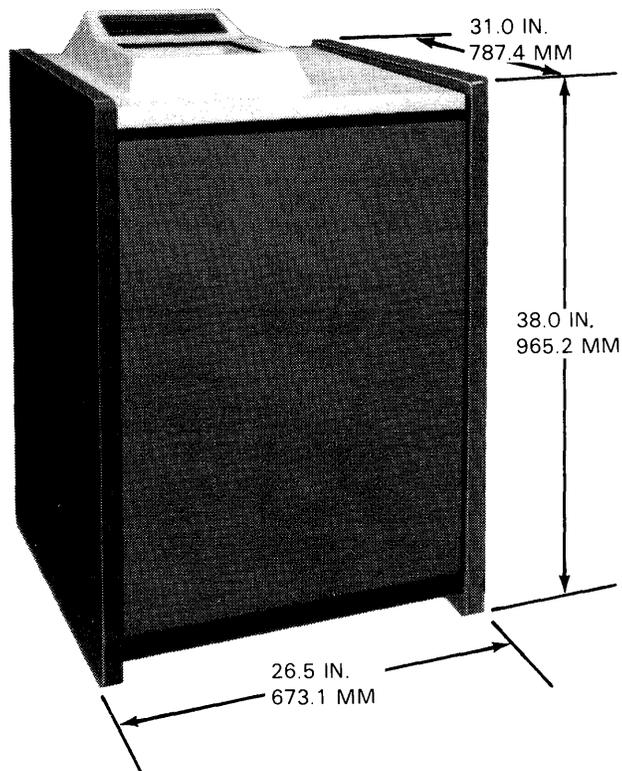


Figure 5—1. Dimensions, Basic Version

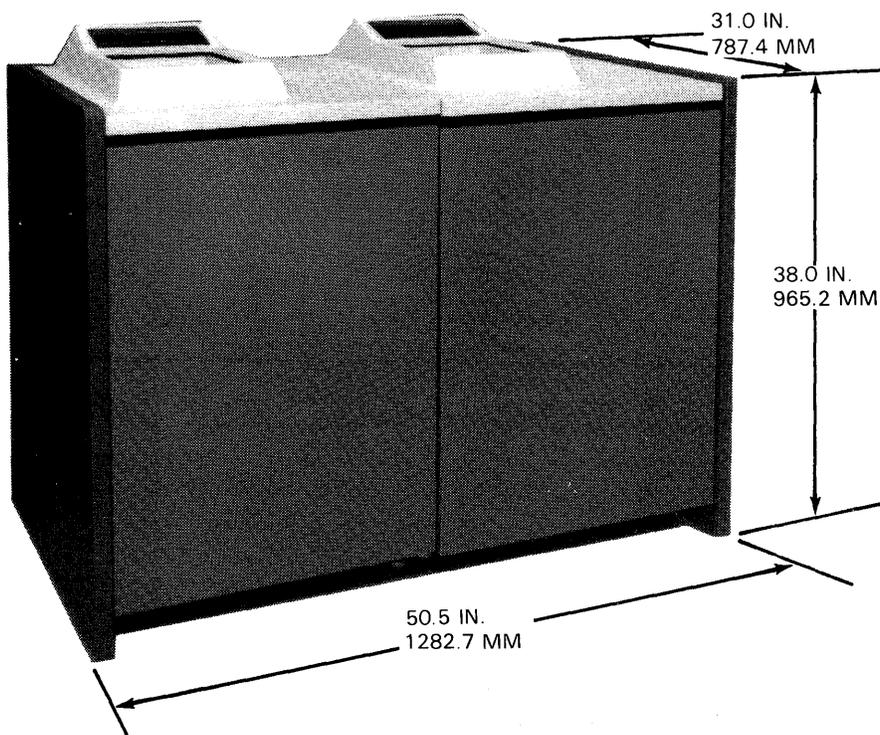


Figure 5—2. Dimensions, Expanded Version

Table 5—2. Power Requirements

Parameter	Basic	Basic plus Expansion Autoloader
Power	0.8 kVA	1.2 kVA
Voltage	200/208/220/240 + 6%–12%	200/208/220/240 + 6%, -12%
Phase	Single	Single
Hz	50 ± 1.0 or 60 ± 1.2	50 ± 1.0 or 60 ± 1.2

5.4. NOISE SUPPRESSION

The 8407 diskette drive casework incorporates the latest acoustical design to provide maximum noise suppression in compliance with American National Standard NC55.

5.5. OPERATING TEMPERATURE AND HUMIDITY

The 8407 diskette drive operates in a temperature range of 54 °F (12 °C) to 90 °F (32 °C) and within relative humidity limits of 25 to 80 percent.



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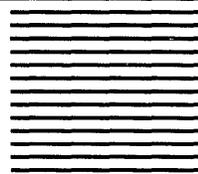
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