INTERFACE AND INSTALLATION MANUAL

for

SERIES 700 AND 500

FLEXIBLE DISK DRIVES

MFE CORPORATION

INTERFACE AND INSTALLATION

MANUAL

for

SERIES 700 AND 500

FLEXIBLE DISK DRIVES

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1.0 INTRODUCTION

1.1   Purpose

This manual contains the information needed to install and interface the MFE 700 and 500 Series Flexible Disk Drives (Figure 1-1) with host electronic equipment. The descriptions, data, and procedures presented herein have been oriented toward both the original equipment manufacturer (OEM) and the ultimate user. Accordingly, this manual will enable the OEM to effectively integrate these flexible disk drives with the host equipment and to obtain the advantages of the broad range of capabilities that these drives offer. The user should also find this manual useful in understanding the basic functional characteristics and capabilities of the MFE 700 and 500 series of equipment.

It should be emphasized that this manual only addresses the installation and interface requirements associated with the MFE 700 and 500 series disk drives. The scope, content, and detail of this information is not considered adequate to maintain or repair this equipment. For situations which require the maintenance and repair of this equipment, the MFE 700 and 500 Series Flexible Disk Drive Maintenance Manual should be obtained.

Additional documents which the OEM or user should find helpful in understanding the function and operation of disk drives include:

- MFE Model 650 Controller Manual
- MFE 700 and 500 Series Flexible Disk Drive Application Notes

Copies of these documents and the MFE Maintenance Manual can be obtained by contacting the MFE Computer Access Systems marketing department, Keewaydin Drive, Salem, New Hampshire 03079.
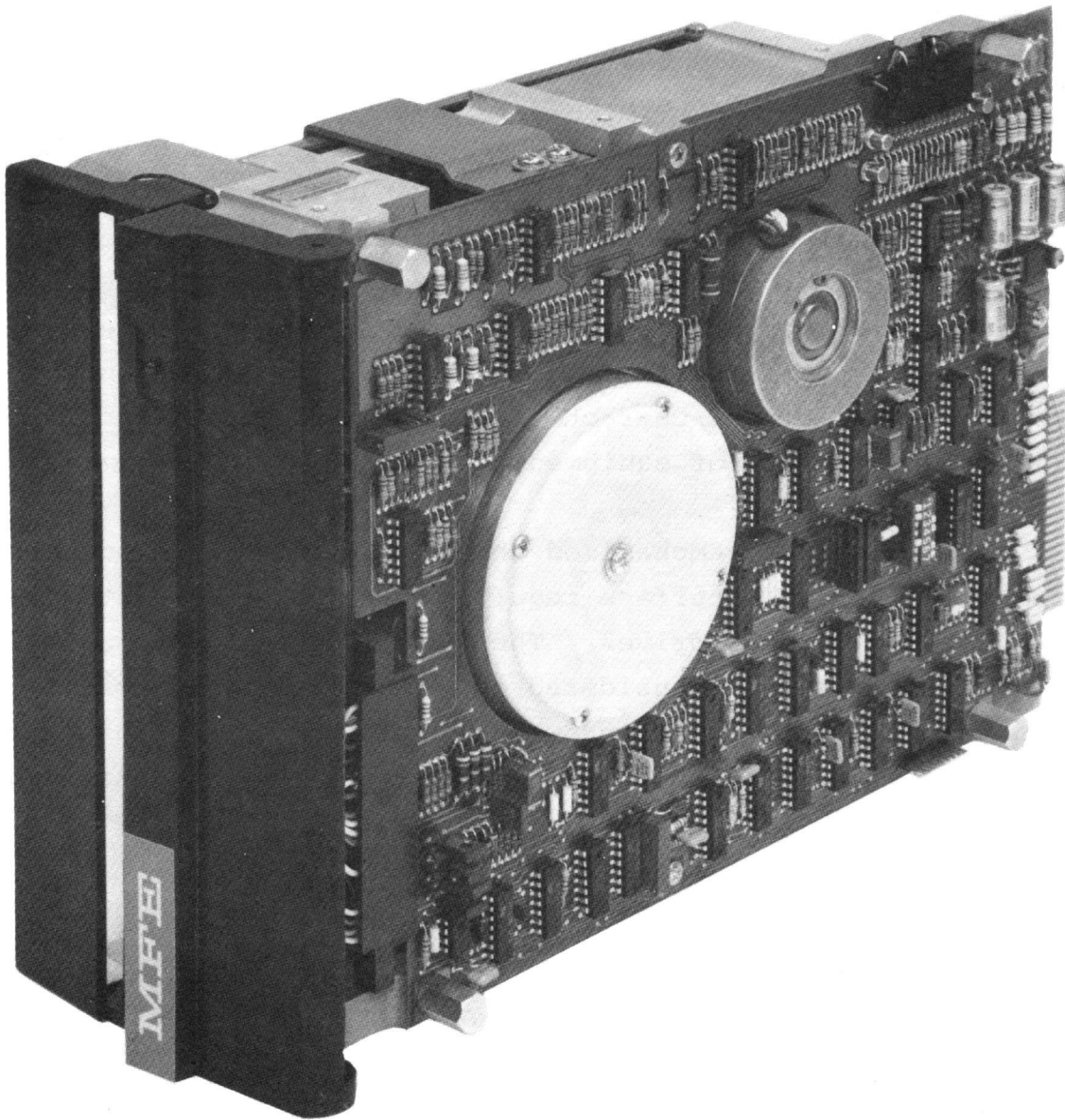
FIGURE 1-1:   MFE SERIES 700 AND 500 FLEXIBLE DISK DRIVES
(DC Spindle Motor Drive Model Shown)

1.2   MFE Series 700 and 500 Flexible Disk Drives

The MFE Series 700 and 500 Flexible Disk Drives (FDD) represent an innovative approach to the economical storage and retrieval of data in electronic data processing (EDP systems). Through the flexible magnetic disk media and the unique design of these drives, the OEM/user is offered all the capabilities of conventional flexible disk drive equipments plus the following unique features:

- Up to 12.8 megabits storage on standard 8" diskette.

- Double or single sided operation

- Double or single density READ/WRITE

- Smallest, most compact IBM-compatible double or single sided FDD

- Lowest power FDD (with DC spindle motor option)

- AC/DC motor option

- Widest variety of factory and/or user installed options

- Proprietary (HELI-BAND^{TM}) precision head positioning mechanism

- IBM-compatible head with tunnel erase and track 43 current switching

- Expansion to double track capability

- Extended head and pressure pad life

- Fastest track-to-track access time available

- Field replacement of head carriage assembly without alignment diskette or test equipment

When combined with the controller from the host EDP system and a qualified flexible disk storage media, the Series 700 and 500 FDDs will provide the OEM/user with unparalleled capabilities for mass data storage with rapid access and low equipment cost. The specific data storage capabilities of the MFE Series 700 and 500 FDDs are outlined in Table 1-1.

TABLE 1-1

DATA STORAGE CAPABILITIES

MODE	TRACKS	BITS/TRACK	UNFORMATTED BYTES/DISK (8 Bits/Byte)	ACCESS TIME TRACK-TO-TRACK
SINGLE SIDED SINGLE DENSITY	77	41,664	400 K	3 msec.
SINGLE SIDED DOUBLE DENSITY	77	83,328	800 K	3 msec.
DOUBLE SIDED SINGLE DENSITY	154	41,664	800 K	3 msec.
DOUBLE SIDED DOUBLE DENSITY	154	83,328	1,600 K	3 msec.
DOUBLE TRACK	See Section 5.3 herein for details of Double Track capabilities.			1.5 msec.

The MFE Series 700 and 500 FDDs are available in several basic models. The 700 series encompasses FDDs with a double-sided capability, while the 500 series FDDs offer single-sided operation for applications where the maximum storage capability is not required and additional equipment economy is desired. Within each series, models are also classified by drive motor (AC/DC), and type of disk (Hard or Soft Sector). Table 1-2 identifies the eight basic models which comprise MFE's line of flexible disk drives.

The basic capabilities of the MFE series 700 and 500 FDDs can be expanded by the selection of up to seven factory-installed options and/or the implementation of a wide variety of user options (see Table 1-3). With the availability of several models and the ability to select a large number of options, the OEM can tailor the MFE FDD to his specific need, thus realizing maximum system data storage effectiveness. The specific options which are available are defined in Section 3.0, and the procedures for implementing the user-installed options are presented in Section 5.0 of this manual.

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TABLE 1-2

BASIC MODEL CHART

700 SERIES - DOUBLE SIDED		500 SERIES - SINGLE SIDED	
MODEL	DESCRIPTION	MODEL	DESCRIPTION
700	AC MOTOR, SOFT SECTOR	500	AC MOTOR, SOFT SECTOR
701	AC MOTOR, HARD SECTOR	501	AC MOTOR, HARD SECTOR
750	DC MOTOR, SOFT SECTOR	550	DC MOTOR, SOFT SECTOR
751	DC MOTOR, HARD SECTOR	551	DC MOTOR, HARD SECTOR

TABLE 1-3

AVAILABLE OPTIONS FOR SERIES 700 AND 500 FLEXIBLE DISK DRIVES

FACTORY INSTALLED OPTIONS	
A. Data Separation - Single Density Mode B. C. Single/Flippy Sensor* D. Track 43 Sensor *Std on 500 series	E. Write Protect Sensor F. Front Panel LED G. Door Unlock H. Door Lock

CUSTOMER INSTALLED OPTIONS	
1. 8, 16, 32 Sectors	13. Power Saver - DC Spindle Motor Only
2. Activity Light Function	14. In Use / Door Lock
3. Daisy Chain Interface	15. Step-In / Step-Out
4. Select Drive without Loading Head	16. Write Protect
5. Select Drive Loading Head	17. Diskette Type (Single or Double Sided)
6. Load Head without Selecting Drive	18. Binary Select
7. Radial Ready	19. Write Fault Output
8. Radial Index/Sector	20. Alternate I/O Pins
9. Radial in Use/Door Lock	21. Minus 5 Volt
10. Radial Head Load	22. Separate Data and Clock
11. Schmitt Trigger Inputs	23. Head Select
12. Disk Change	24. Hard/Soft Sector

The MFE 700 and 500 Series FDDs have been designed and configured to read and write on a diskette and interchange data with a wide variety of host equipments. Soft sectored models (700, 750, 500 and 550) are IBM 3600 and 3740 campatible, allowing interchange of flexible disks with IBM and other compatible drives (Track 43 write current switching and tunnel erase capabilities provided). Additionally, all MFE FDD models offer a direct functional replacement and the opportunity for an easy physical replacement for the corresponding Shugart Associates Model SA-800/801 and 850/851 diskette storage drives. Typical applications of MFE's 700 and 500 Series FDDs include: intermediate storage for large computers, mini-computer or microprocessor systems, key entry systems; batch terminal data storage; diagnostic test storage; word processing systems; point of sales systems; and data files for small business systems.

1.3   Manual Content and Organization

Section 2.0 of this manual describes the functional and physical characteristics of the MFE Series 700 and 500 FDDs, and presents a summary of the principles of operation. The information and data required to install and interface the FDD with the host equipment is covered in Section 3.0, while Section 4.0 outlines the steps required to operate the FDD once the installation has been completed. Section 5.0 offers a detailed definition of options that are available to the user and describes how these options can be implemented.

2.0 EQUIPMENT DESCRIPTION

2.1 Performance

The flexible disk drive system performs the basic function of transferring data between the host equipment and a flexible disk for storage and subsequent retrieval. With reference to the simplified function diagram (Figure 2-1), the FDD accepts data and control signals from the host system and, on the basis of the information contained in these signals, performs the following functions:

- Positions the read/write head assembly to the appropriate location on the diskette, and rotates the diskette
- Writes data received from the host equipment on the diskette (write function)

or

- Retrieves data previously written on the diskette (read function)
- Provides status signals to the host controller.
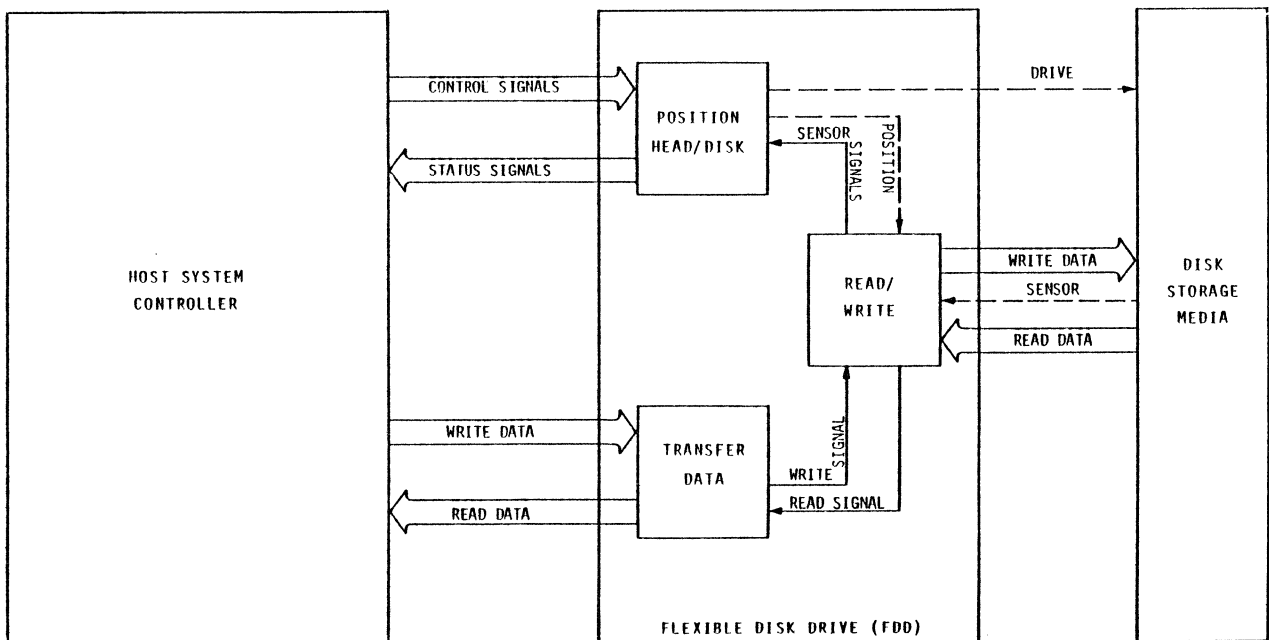
FIGURE 2-1: SIMPLIFIED FUNCTIONAL DIAGRAM

The MFE 700 and 500 Series FDDs have combined the results of advanced electronic and electro-mechanical design to perform these functions with maximum effectiveness while providing the user with unprecedented flexibility in the use of the status and control signals. The functional, physical, and detailed performance characteristics and capabilities of the MFE 700 and 500 Series FDDs are outlined in Table 2-1.

2.2 Physical Characteristics

The MFE 700 and 500 Series FDDs are configured as single compact units measuring 8.55" (21.717 cm) by 4.35" (11.048 cm) by 12.7" (32.258 cm) overall. The cabinet depth required to mount this unit is only 12" (30.48 cm). This configuration allows either two FDDs to be mounted horizontally side-by-side, or four FDDs to be mounted vertically side-by-side in a standard 19" rack (see Section 3.0 for installation information). A simple front door activated mechanism permits easy insertion and removal of diskettes. To prevent media damage, the media will eject from the drive unless the diskette is fully inserted. To facilitate the removal, the diskette ejects forward when the door is opened.

The MFE 700 and 500 Series FDDs consist of four major mechanical subassemblies:

    1)   Main Chassis
    2)   Head Positioner
    3)   Spindle Drive
    4)   Electronics

The general location of each of these subassemblies is shown in Figure 2-2.

2.2.1 Main Chassis

The Main Chassis consists of the die cast baseplate and wiring harness. The baseplate provides the primary structural member to which all of the other subassemblies are mounted.

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TABLE 2-1

CHARACTERISTICS AND CAPABILITIES

DESCRIPTORS	
Function	Flexible Disk Drive
Storage Media	IBM 3600/3740 Diskette or MFE Equivalent
Recording Surfaces	1 (Single Sided) or 2 (Double Sided)
Tracks	77 (Single Track)
Track Density	48 Tracks per inch (0.013"/0.033mm Data Track Width)
Disk Rotational Mechanism	DC or AC Spindle Motor Drive
Head Positioning Mechanism	Helical Band Drive
Track 76 Location	Side "0": 2.029; Side "1": 1.9457
Read/Write Heads	Dual Ceramic Heads with Tunnel Erase
Encoding	Double Frequency - Single Density MFM/M^{2}FM/GCR - Double Density

CAPABILITIES

CAPACITY	PER TRACK	PER DISK
Double Sided/Double Density (Unformatted)	83,328 bits 10,416 bytes	12,832,512 bits 1,604,064 bytes
Double Sided/Single Density (Unformatted)	41,664 bits 5,208 bytes	6,416,256 bits 802,032 bytes
Single Sided/Double Density	83,328 bits 10,416 bytes	6,416,256 bits 802,032 bytes
Single Sided/Single Density (Unformatted)	41,664 bits 5,208 bytes	3,208,128 bits 401,016 bytes
Single Sided/Single Density (3740 Formatted)	26,624 bits 3,328 bytes	2,050,048 bits 256,256 bytes

TRANSFER RATE .... 250,000 bits per second, single density
500,000 bits per second, double density

AVERAGE LATENCY .... 83.3 msec.

DISK ROTATIONAL SPEED .... 360 revolutions per minute

POSITIONING TIME

Access .... 3 msec. track-to-track (Single Track Density)
Setting Time .... 15 msec.
Head Load Time .... 35 msec.

DATA TRANSFER RELIABILITY

Read Error .... < 1 x 10^9 Bits - Soft Errors
< 1 x 10^{12} Bits - Hard Errors

Positioning Error .... < 1 x 10^6 Steps

TABLE 2-1

CHARACTERISTICS AND CAPABILITIES - continued

CAPABILITIES - continued

HARDWARE RELIABILITY

Head Life .... 40×10^6 Wear Revolutions (minimum)

Positioning System Life .. 1×10^{10} steps (minimum)

PHYSICAL CHARACTERISTICS

Configuration	Single rectangular form factor suitable for mounting in 19" rack
Dimensions	Height: 8.55" (21.717 cm) Width : 4.35" (11.048 cm) Depth : 12.70" (32.258 cm)
Weight	10 lbs (4.5 kg)
Power Dissipation	30 Watts (DC Models) 65 Watts (AC Models)
Cooling	Natural Convection
Mounting..................	Any Orientation except PCB facing up or Door facing down

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POWER

AC Motor Models .... 115 VAC, 50/60 Hz, 0.5 amps typical (90-127 V)
220 VAC, 50/60 Hz, 0.3 amps typical (180-253 V)
+5 VDC ± 5%; 1.3 amps
-5 VDC ± 5%; 0.2 amps (-7V to -16V optional)
+24 VDC ± 5%; 0.1 amps at standby
+24 VDC ± 5%; 0.3 amps when not positioning
+24 VDC ± 5%; 2.0 amps when positioning

DC Motor Models .... +5 volts ± 5% at 1.3 amps
-5 volts ± 5% at 0.2 amps (-7V to -16V optional)

+24 V ± 5%; 0.1 amps standby
+24 V ± 5%; 0.6 amps when not positioning
+24 V ± 5%; 2.6 amps when positioning

ENVIRONMENT

Operating Temperature	+40°F (4°C) to +115°F (46°C)
Relative Humidity	20% to 80%, no condensation
Wet Bulb - Maximum	+78°F
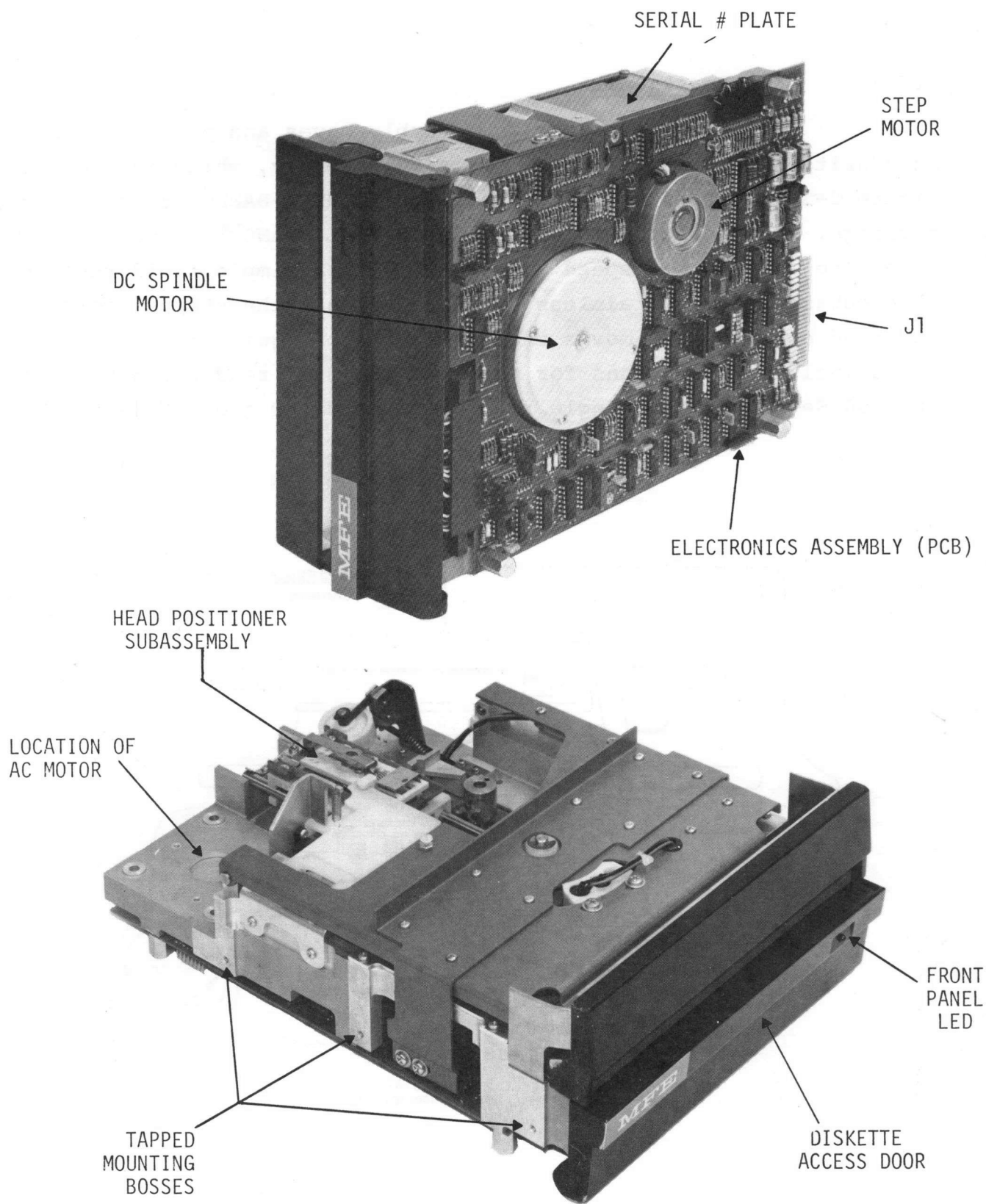
FIGURE 2-2:   MFE SERIES 700 AND 500 FLEXIBLE DISK DRIVES
(Location of Major Components)

2.2.2   Head Positioner

The head positioner subassembly moves and positions the read/write head over the disk. This subassembly, which is shown in Figure 2-3, consists of the stepper motor, HELI-BAND^{TM} drive, and head carriage. The heart of this unit is the HELI-BAND^{TM} drive that combines the features of speed and accuracy in a simple field replaceable subassembly. A stainless steel band links the stepper motor to the head carriage and moves the carriage along guide rails. The carriage includes provisions for mounting the dual read/write heads for the 700 Series or the single read/write head for the 500 Series FDD.
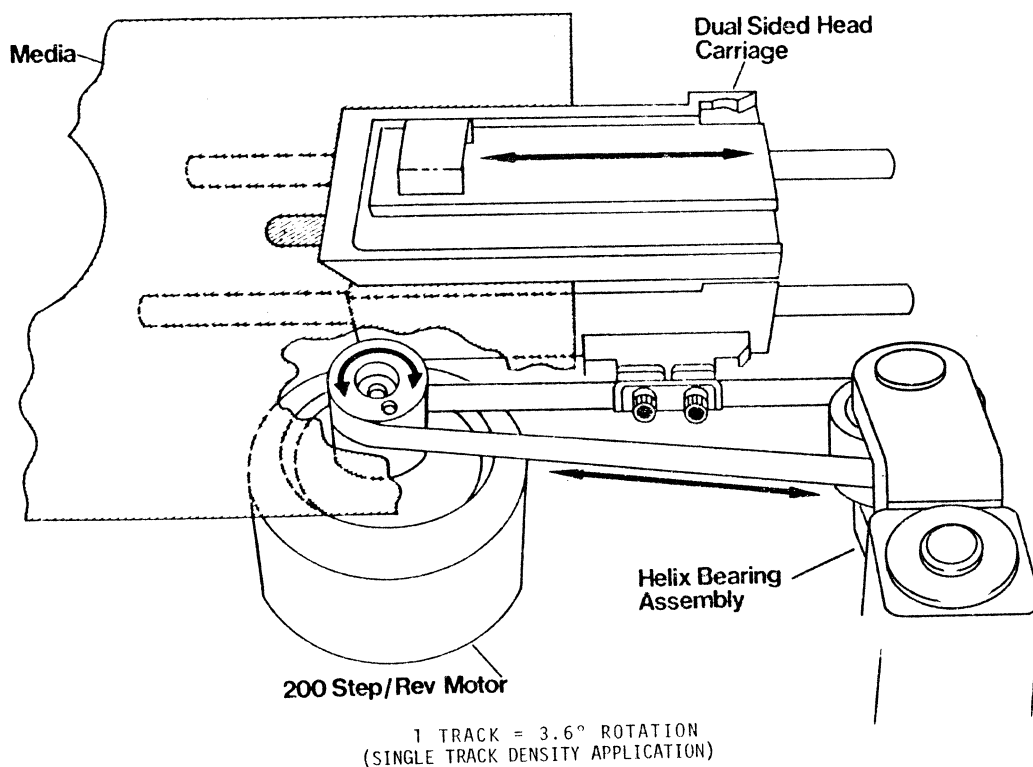
FIGURE 2-3:   HEAD POSITIONER SUBASSEMBLY

2.2.3   Disk Drive

        Diskettes are rotated at a speed of 360 rpm by either an
AC or DC spindle motor. For the AC models (700, 701, 500, 501), the
motor is coupled to the spindle by a flat belt arrangement. The AC
motor is corner-mounted on the chassis for maximum ventilation. For
the DC models (750, 751, 550, 551), a 24 VDC brushless motor with an
MFE proprietary edge-mounted LED encoder for precision speed control
provides direct drive to the spindle. The DC motor is mounted direct-
ly to and concentric with the spindle. An additional electronic speed
control circuit is required with the DC motor models. This circuit
is contained on a separate printed circuit board that is mounted
under the main electronic assembly.

2.2.4   Electronics

        All the electronic circuits (with the exception of the
motor control circuit for the models employing a DC spindle motor)
are packaged on a single 8.25" (20.96 cm) by 10.8" (27.43 cm) printed
circuit board. This subassembly is mounted directly to the chassis
along the bottom surface of the FDD assembly.

2.3   Functional Description

        A complete functional block diagram of the MFE 700 and 500
Series FDD is shown in Figure 2-4. A simplified explanation of the
operation of the FDD can be obtained by following the flow of the
bold lines. FDD operation is initiated by the host controller acti-
vating the DRIVE SELECT control line(s) A ; this results in the
following actions in the FDD:

    a)   the appropriate FDD is selected;
    b)   the head(s) is loaded; and
    c)   the stepper motor is energized.

STEP   [C]
DIRECTION   [B]
DOUBLE TRACK ENABLE

WRITE DATA   [E]
LOW CURRENT
WRITE GATE   [D]

READ DATA   [F]

SEPARATE DATA
SEPARATE CLOCK

[A] DRIVE SELECT

HEAD SELECT
READY
HEAD LOAD
IN USE DOOR/LOCK
POWER REDUCTION
DOOR SOLENOID

WRITE PROTECT
DISK CHANGE
INDEX
SECTOR
DISKETTE SENS
TRACK ØØ

STEPPER ELECT

WRITE CIRCUITS

READ CIRCUITS AND

DATA SEP

CONTROL
AND
SENSOR
CIRCUITS

POWER
CONDITIONING

SIDE 1
SIDE 0

DOOR LED

ACTIVITY
LIGHT

DOOR LOCK
SOLENOID

DOOR
CLOSED
LED/DETECTOR

DOOR LOCK
DOOR CLOSED
DC MOTOR
STEPPER MOTOR

TRACK 43 SENS
TRACK ØØ
HEAD LOAD
WRITE PROTECT
DOUBLE SIDED INDEX/SECTOR
SINGLE SIDED INDEX/SECTOR

INDEX LED
(SINGLE SIDED)
INDEX LED
(DOUBLE SIDED)

INDEX
DETECTOR

WRITE
PROTECT
LED/DETECTOR

HEAD LOAD
SOLENOID

DC MOTOR
AND/OR
SPINDLE ONLY

STEPPER
MOTOR

HELIX BEARING
ASSEMBLY

AC MOTOR

BELT DRIVE TO
SPINDLE ON AC MODELS

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FIGURE 2-4: MFE SERIES 700 AND 500 FDD FUNCTIONAL BLOCK DIAGRAM

Next, the host controller activates the DIRECTION line $\boxed{\text{B}}$ to establish the desired direction of movement of the read/write head. Head movement and positioning is accomplished by pulsing the STEP line $\boxed{\text{C}}$ with one pulse moving the head one track. (Head movement can also be accomplished using the STEP IN / STEP OUT option -- see Section 5.0). To write data the host controller supplies a WRITE GATE $\boxed{\text{D}}$ followed by a sequence of data bits on the WRITE DATA line $\boxed{\text{E}}$. The write circuit in the FDD develops the signals to drive the read/write head, which in turn develops the proper flux patterns to magnetize the disk. In the read mode the host controller disables the WRITE GATE and the read/write head converts the flux pattern on the disk to a train of pulses which are processed in the read circuit and transferred to the host controller on the READ DATA line $\boxed{\text{F}}$.

This simplified explanation of the operation of the FDD addresses only a portion of the operational features and control options that can be obtained with the MFE Series 700 and 500 equipments. However, the information contained in the following portions of this manual should enable the OEM or user to develop an understanding of the full capabilities of these equipments.

2.4   Functional Circuits

The MFE Series 700 and 500 FDDs consist of the following major functional circuits:

- Stepper Drive Circuit
- Write Circuits
- Read Circuit and Data Separator
- Control and Sensor Circuit
- Disk Drive Assembly
- Head Assembly

2.4.1   Stepper Circuit

The stepper circuit accepts control commands and provides motor drive currents to step and position the head assembly. Two in-

put signals control the stepper electronics. They are configured at the factory as direction and step inputs. The direction of head movement is controlled by the state of the direction line, with a logical one and zero signal corresponding to outward and inward movement respectively. Head motion is initiated by pulsing the STEP line. The head moves one track per pulse.

User-installed options may be used to reconfigure the input lines as step-in and step-out inputs (see Section 5.0). With these options, the stepper electronics will move the head in or out in response to pulses on the STEP IN or STEP OUT lines.

The stepper electronics is normally configured for use with single track density disks. Each pulse applied to the stepper electronics results in two step pulses to the motor.

2.4.2   Write Circuits

The write circuit accepts raw data from the host controller and provides the appropriate write current as well as the required erase current. The write circuit has an input line which must be switched for reduced write current when writing on tracks numbered 43 or higher. The signal may be provided by the host system or automatically by the factory-installed option D (TRACK 43 SENSOR).

This circuit can also contain, as an option, a write protect sensor that will prevent the writing on a diskette when a write protected diskette (see Section 4.3) is used (Option E). Circuit modification is described in Section 5.0.

A write fault circuit is included which monitors internal conditions for improper operation halting the write cycle if necessary and optionally notifying the host through the write fault line.

An automatic erase delay circuit is installed at the factory that can be disabled for external customer control. (See Section 5)

2.4.3   Read Circuit and Data Separator

The read electronics amplifies, filters, and processes the selected head output during the read cycle and provides properly conditioned data at normal logic levels. A factory-installed data separator may be provided for applications where separated data and clock signals are desired. A detailed description of the data separator circuit, which is factory option A, is contained in Section 5.

2.4.4   Control and Sensor Circuits

The control electronics provides a number of control, interlock, and interface functions. Many of these functions are optional and have multiple configurations. Functions included as part of the control electronics are listed below:

- Drive Selection
- Head Loading
- Head Selection
- Daisy chain input/output enabling
- Activity light control (for use with Factory Option F)
- Door lock control (Factory and User options)
- Power reduction (DC Spindle Motor models only)

Section 5.0 describes the methods for implementing these options.

The track 00 sensor circuits output a logical zero to the host system whenever the following three conditions are true:

1)   The track 00 sensor indicates the head is positioned at or adjacent to Track 00.

2)   The stepper drive has the proper phase for Track 00

3)   Internal drive select is true.

The optional Track 43 sensor electronics provides a logical zero whenever the read/write head is positioned between Tracks 43 and 77. This signal is used to reduce the write current (Factory Option D). Additionally, the door close sensor detects the door position (open or close), and provides a signal to the control electronics.

2.4.5   Disk Drive Assembly

A spindle rotation of 360 rpm is provided by a brushless DC motor (models 750, 751, 550, 551) or AC motor (models 700, 701, 500, 501). A user-added power saver option may be installed on DC motor models. This option allows shutdown of the motor when the drive is not selected.

There are also up to two index/sector sensors for reading index and sector information from the disk. Each sensor is positioned to function with either double-sided or flippy/single-sided. Each sensor may also provide an indication of the disk type in use. These sensors are factory installed options. The double-sided diskette sensor is a standard feature on the 700 Series FDD, and the single-sided diskette sensor is standard on the 500 Series FDD. Series 700 FDDs can be equipped with two sensors, while the Series 500 FDDs are limited to one sensor.

The Index/Sector sensor electronics, in addition to providing index signals, may optionally provide 8, 16, or 32 hard sector signals (models 701, 751, 501, 551). An OEM/user installed optional diskette type circuit provides indication that the diskette in use is either a double-sided or a flippy/single-sided diskette.

2.4.6   Head Assembly

The head positioning assembly employs a stepper motor driven stainless steel band (HELI-BAND^{TM}) to drive and position the heads.

The ceramic head(s) function as nearly frictionless load pads while performing the read/write and tunnel erase functions. These heads, which are IBM compatible, can be electronically selected by the host controller via an input control line. Optional methods of selecting the read/write head(s) are described in Section 5.0.

3.0 INSTALLATION AND INTERFACE

3.1 Preparation for Use

After receipt of an MFE Series 700 or 500 FDD, carefully remove the unit from the shipping container. Inspect the unit for visual evidence of shipping damage and proceed to remove all packing material and restraints that have been placed on the unit to protect sensitive parts during shipment. (Refer to Supplement A of this manual for special instructions for unpacking and handling the read/write assemblies.)

Locate the model number and factory option decals on the right side of the chassis and record the model number and option identifier (alpha's) in the appropriate spaces in Table 3-1. This number will identify the basic Series 700 or 500 model and the specific options that have been installed at the factory. A description of these options and their respective model number codes are also listed in Table 3-1. It is important to identify the model number and factory installed option(s) since equipment performance, capability, interface requirements, and many user installed features are directly related to a specific model and/or factory option.

The MFE Series 700 and 500 Flexible Disk Drives are shipped from the factory ready for direct installation in the host equipment. However, before proceeding with the installation, the OEM/user should consider two important areas. These are:

a) The number of FDDs, and the manner in which these units will be connected to the host equipment.

b) The desired user installed options that will be implemented.

FDD installations: The MFE Series 700 and 500 FDDs are configured at the factory for a single drive installation. Accordingly, if only one drive is to be installed, and it is a new installation,

3-1

TABLE 3-1
MODEL AND FACTORY OPTION IDENTIFICATION CHART

□□□	□□□□□□□
700 SERIES - DOUBLE SIDED	A. DATA SEPARATOR
MODEL — **DESCRIPTION**	B.
700 — AC MOTOR, SOFT SECTOR	C. SINGLE SIDED / FLIPPY SENSOR*
701 — AC MOTOR, HARD SECTOR	D. TRACK 43 SENSOR
750 — DC MOTOR, SOFT SECTOR	E. WRITE PROTECT SENSOR
751 — DC MOTOR, HARD SECTOR	F. FRONT PANEL LED
500 SERIES - SINGLE SIDED	G. DOOR UNLOCK**
MODEL — **DESCRIPTION**	H. DOOR LOCK**
500 — AC MOTOR, SOFT SECTOR	* This option is a standard feature on Series 500 models.
501 — AC MOTOR, HARD SECTOR	
550 — DC MOTOR, SOFT SECTOR	** These options are mutually exclusive.
551 — DC MOTOR, HARD SECTOR	

no further action is necessary on the part of the OEM/user. If, however, more than one drive is to be installed, or if this drive is to replace an existing unit, the OEM/user should refer to Sections 3.5 and 3.6 for further instructions.

User options: Since the MFE Series 700 and 500 FDDs have been designed to offer a variety of operational and performance features, the OEM/user can implement a wide range of options of his own. These options, which are listed in Table 3-2, are described in detail in Section 5.0 of this manual. Table 3-2 identifies the available user options and the specific models on which these options can be implemented. After selecting the desired options, the user should refer to Section 5.0 for detailed instructions on the steps that must be taken to implement these options.

Once the FDD has been configured to meet the desired drive selection and options requirements, installation and interface of the FDD can proceed as described in Sections 3.2 and 3.3 respectively.

TABLE 3-2
FDD OPTION MATRIX

#	AVAILABLE USER OPTIONS	ALL MODELS 500/501/550/551 700/701/750/751	SPECIFIC MODELS 501/551/701/751	SPECIFIC MODELS 550/551/750/751	SPECIFIC MODELS 700/701/750/751	SPECIFIC MODELS 500/501/550/551	FACTORY INSTALLED OPTIONS — SPECIFIC OPTION(S) REQUIRED
1	8/16/32 SECTORS		●				
2	ACTIVITY LIGHT	●					F - FRONT PANEL LED
3	DAISY CHAIN INTERFACE	●					
4	SELECT DRIVE W/O LOADING HEAD	●					
5	SELECT DRIVE LOADING HEAD	●					
6	LOAD HEAD W/O SELECTING DRIVE	●					
7	RADIAL READY	●					
8	RADIAL INDEX/SECTOR	●					
9	SCHMITT TRIGGER INPUTS	●					F - FRONT PANEL LED
10	RADIAL IN/USE DOOR LOCK	●					G - DOOR UNLOCK
11	RADIAL HEAD LOAD	●					H - DOOR LOCK (OR)
12	DISK CHANGE	●					
13	POWER SAVER			●			F - FRONT PANEL LED
14	IN USE/DOOR LOCK	●					G - DOOR UNLOCK
15	STEP IN/STEP OUT	●					H - DOOR LOCK (OR)
16	WRITE PROTECT (INHIBIT)	●					E - WRITE PROTECT SENSOR
17	DISKETTE TYPE				●		C - SINGLE SIDED / FLIPPY DISK SENSOR
18	BINARY SELECT	●					
19	WRITE FAULT OUTPUT	●					
20	ALTERNATE I/O PINS	●					
21	MINUS 5 VOLT	●					
22	SEPARATE DATA	●					A - DATA SEPARATOR
23	ALTERNATE HEAD SELECT				●		
24	HARD SECTOR / SOFT SECTOR		●				

3.2   Installation Requirements

3.2.1   General

The basic physical configuration and key interface dimensions of the MFE Series 700 and 500 equipments are shown in Figure 3-1. This configuration permits either two units to be mounted horizontally side-by-side, or four units to be mounted vertically side-by-side, in a standard 19" width rack. These popular mounting arrangements are illustrated in Figures 3-2(a) and 3-2(b). The principle mounting provisions that have been designed into the MFE Series 700 and 500 FDDs consist of three mounting bosses located along each side of the chassis. These bosses are tapped for #8-32 screws. The precise location and characteristics of these mounting provisions are identified in Figure 3-1.

3.2.2   Vertical Mounting

A possible method for mounting single or multiple FDDs vertically, side-by-side, is shown in Figure 3-2(a). Each unit can be individually secured to a shelf using three 8-32 screws and washers. To provide added rigidity, straps can be used along the top of the drive to join the units together and, when required, to connect the units to a rigid member of the host structure. The straps are attached to each drive using #8-32 screws and washers.

3.2.3   Horizontal Mounting

When the drives are mounted in a horizontal position, the four feet are used to provide the primary means of support and also as an optional mounting feature for the unit. As shown in Figure 3-2(b), the drive can be secured to a user supplied cover by inserting #8-32 screws through 5/32" clearance holes in the cover and into the tapped mounting bosses on the drive unit. Horizontal mounting can also be effected by attaching a vertical member of the host equipment (one on each side) to these tapped mounting bosses.

REF SIDE 01

FRONT

± 0.030
4.350
(11.049 cm)

8.550± 0.030
(21.717 cm)

0.270 ± 0.030
(0.686 cm)

12.700± 0.050
(32.258 cm)

TAPPED FEET #6-32
UNC-2B 0.25
(0.635 cm) DEEP,
FOUR PLACES

11.900± 0.060
(30.225 cm)

+.01

0.270
(0.686 cm)

11.630 ± 0.050
(29.540 cm)

0.800
(2.032 cm)

SIDE

#8-32 UNC - 2B
.40 DEEP

6 PLACES

8.000 ± 0.010
(20.320 cm)

± 0.010
0.800
(2.032 cm)

2.585 ± 0.005
(6.566 cm)

4.000 ± 0.010
(10.160 cm)

8.550± 0.030
(21.717 cm)

7.820± 0.010
(19.863 cm)

+.02
4.540
(11.532 cm)

1.900± 0.030
(4.826 cm)

0.400
(0.926 cm)

9.400 ± 0.010
(23.876 cm)

8.650± 0.020
(21.971 cm)

11.200 ± 0.060
(28.448 cm)

1.150 ± 0.030
(2.921 cm)

0.750 ± 0.020
(1.910 cm)

4.350 ± 0.030
(11.048 cm)

REF SIDE 00

FIGURE 3-1:   MECHANICAL INTERFACE DRAWING
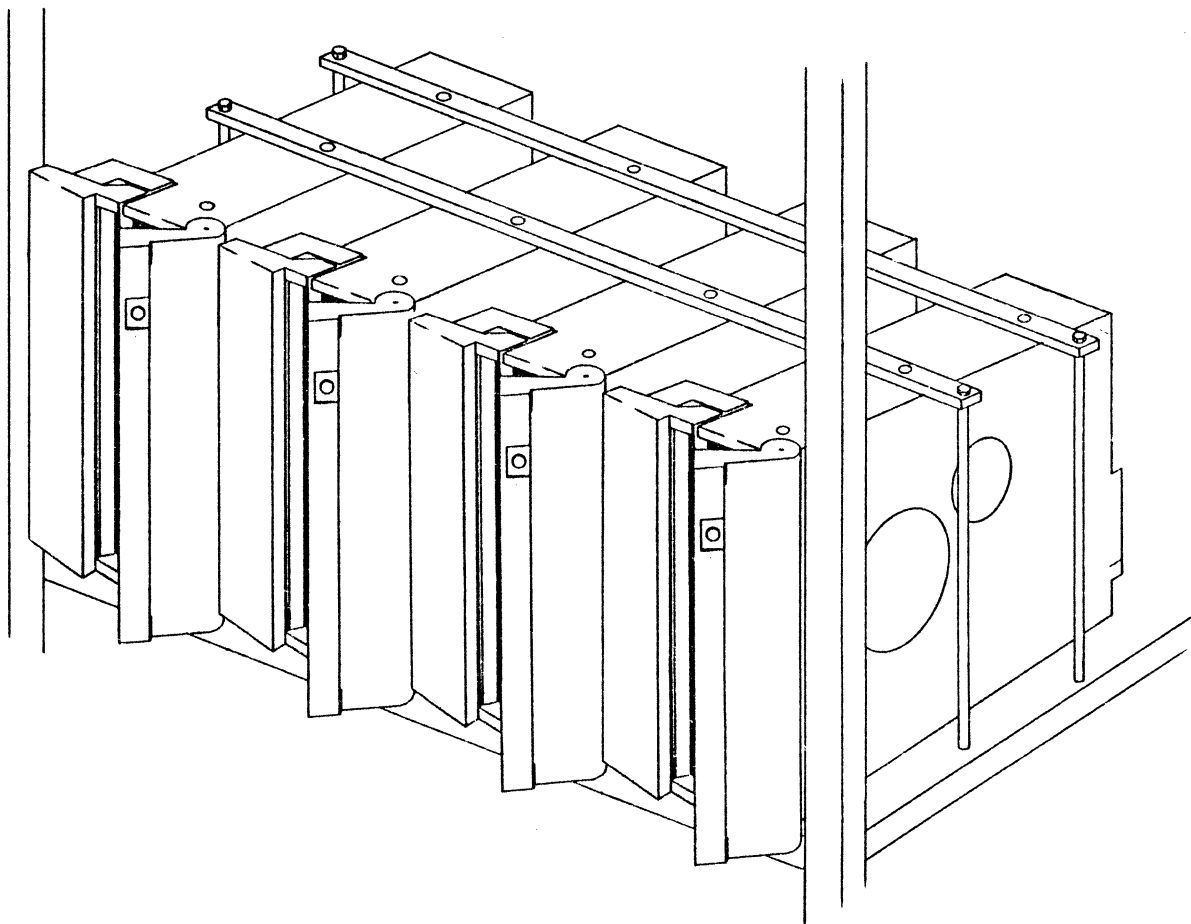
FIGURE 3-2(a): VERTICAL MOUNTING

(FOUR PLACES
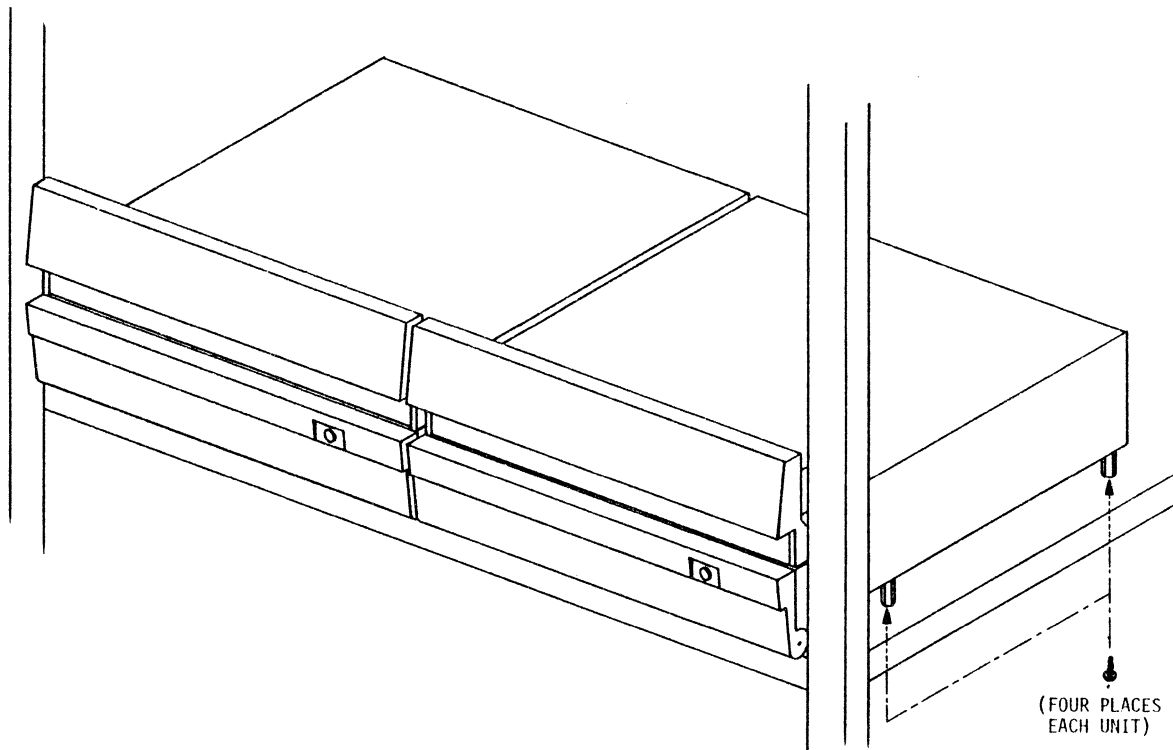EACH UNIT)

FIGURE 3-2(b): HORIZONTAL MOUNTING

3-6

3.3   Interconnections

3.3.1   Connectors

Electrical connections to the MFE Series 700 and 500 FDDs are effected through three connectors (only two required for the DC models). These connectors, which are described in Table 3-3, are located at the rear of the drive. The specific location and configuration of each connector is shown in Figure 3-3. All connectors are compatible with the Shugart SA-800/801 and 850/851 equipments.

TABLE 3-3

CONNECTOR IDENTIFICATION

REF.	TYPE	FUNCTION	MATING CONNECTOR	
J1	50 Pin PCB Edge Card Connector	Data and Control Signals	3M "Scotch Flex" 3415-001 AMP P/N 1-583717-1	P1
J4	AMP P/N 1-480305-0 with Pins P/N 60620-1	AC Power (Used on AC Models only)	AMP P/N 1-480303-0 with Pins P/N 60619-1 or MFE P/N 40337073 with Pins 40337107	P4
J5	AMP P/N 1-380999-0	DC Power	AMP P/N 1-480270-0 with Pins P/N 60619-1 or MFE P/N 40337180 with Pins 40337107	P5

3.3.2   J1 - Data and Control Signal

All data and control signals are transferred between the MFE Series 700 and 500 FDDs and the host controller through a 50-pin PCB connector. A description of the P_{IN}-P_{OUTS} are shown in Figure 3-4. The pins are numbered sequentially 1 through 50 inclusive with the even numbered pins on the component side of the printed circuit board (PCB) and the odd numbered pins on the side without the components. Pin 2 is located on the end of the PCB farthest from connector J5, and a key slot is located between Pins 4 and 6.

Many of the interconnections between the FDD and the host controller are optional, and should be used only when the appropriate factory or user installed option has been implemented.
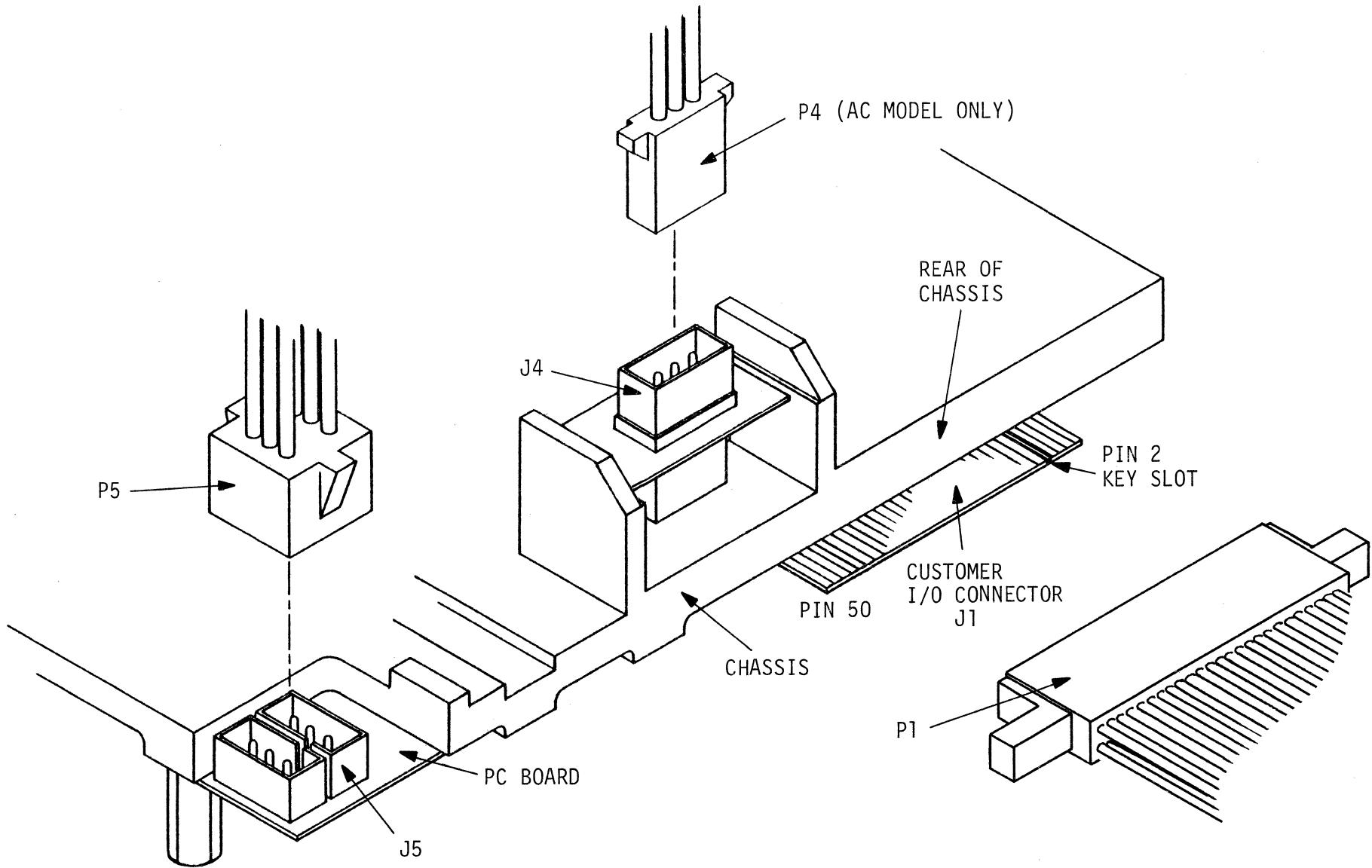
FIGURE 3-3:   LOCATION OF CONNECTORS

HOST CONTROLLER		MFE-FDD

DISKETTE SENSE (OPTIONAL)* 2   1
WRITE FAULT (OPTIONAL) 4   3**
LOW CURRENT (OPTIONAL) 6   5**
DOUBLE TRACK ENABLED (OPTIONAL) 8   7**
POWER REDUCTION (OPTIONAL) 10   9**
DISK CHANGE (OPTIONAL) 12   11**
HEAD SELECT* 14   13**
IN USE (OPT) OR DOOR LOCK (OPT) 16   15
HEAD LOAD (OPTIONAL) 18   17
INDEX 20   19
READY 22   21
SECTOR (OPTIONAL) 24   23
DRIVE SELECT 1 26   25**
DRIVE SELECT 2 28   27**
DRIVE SELECT 3 30   29
DRIVE SELECT 4 32   31
DIRECTION (STEP IN) 34   33
STEP   (STEP OUT) 36   35
WRITE DATA 38   37
WRITE GATE 40   39
TRACK 00 42   41
WRITE PROTECT (OPTIONAL) 44   43
READ DATA 46   45
SEP DATA (OPTIONAL) 48   47
SEP CLOCK (OPTIONAL) 50   49

J1

* 700 SERIES ONLY

** THESE PINS CAN
BE USED AS AL-
TERNATE INPUT/
OUTPUT PINS
(SEE SECTION 5.0)

FIGURE 3-4: DATA AND CONTROL INTERFACE LINES

3-9

3.3.3 J4 - AC Power

The AC power connector, J4, is mounted on a bracket directly behind the head carriage. It is a three-pin connector with the connections defined in Table 3-4. (This connector is supplied only on Models 500, 501, 700, and 701, which have AC drive motor.) AC power at 115 volts, 60 Hz or 220 volts, 50 Hz can be applied to the unit through this connector.

CHECK THE EQUIPMENT IDENTIFICATION PLATE FOR THE CORRECT VOLTAGE AND FREQUENCY BEFORE APPLYING POWER.

TABLE 3-4

J-4 AC POWER CONNECTOR (AC Models only)

PIN	DESCRIPTION
1	AC Input
2	Frame Ground
3	AC Input
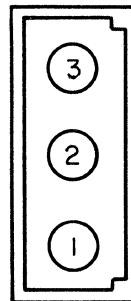
3.3.4 J5 - DC Power

The DC power connector, J5, is mounted on the rear edge of the PCB. This is a six-pin AMP Mate-N-Lok connector with connections as shown in Table 3-5.

TABLE 3-5

J-5 DC POWER CONNECTOR

PIN	DESCRIPTION
1	+24 VDC
2	+24 V Return
3	DC Ground
4	-5 V DC (-7 to -16 V Optional)
5	+5 VDC
6	DC Ground

3.4 Data and Control Interface
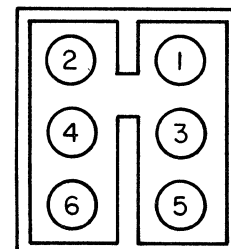
3.4.1 General

Figure 3-4 lists and identifies each of the control and data interface signals which exist between the FDD and the host controller. These interfaces, which fall into two primary groups (standard and optional) can be classified by direction of signal flow with the FDD serving as the reference. All data and control signals are TTL compatible and exhibit the standard TTL signal characteristics.

The output lines from the MFE Series 700 and 500 FDDs are all open collector driven from 7438 integrated circuits capable of sinking 40 milliamperes each. The OEM/user equipment must be capable of sinking 36 milliamperes minimum with an "ON" voltage of 0 to 0.4 volts DC.

Throughout this manual, a logical "one" statement will be used to refer to a signal with a 2.5 volts to 5.25 volts level, and a logical "zero" statement will indicate a signal with a level of 0 volts to 0.4 volts at the input connector, J1.

3.4.2 Standard Interfaces

3.4.2.1 Inputs

The MFE Series 700 and 500 FDD units have nine standard input lines. Each of these lines is terminated on the PCB by a 220 ohm resistor connected to +5 VDC, and a 330 ohm resistor connected to ground. These terminations, which are contained in an integrated circuit mounted on the PCB, may be removed in certain applications (see Section 5.0).

A)   Drive Select (Lines 26, 28, 30, 32)

These lines are used to select one of four drives. The desired drive is selected by applying a logical zero on the appropriate line. Each FDD is initially configured as drive one (1) as shipped. An option allows up to eight drives to be selected using a one-of-eight decoder chip and with pins 28 (binary 1), 30 (binary 2), and 32 (binary 4) as the inputs. Pin 26 is the drive enable line.

b)   Head Select (Line 14)

   This line is used only for double sided models (700, 701, 750, 751). A logical zero selects side "1" and a logical one selects side "0". Optionally, for use with older controllers, the drive select lines can be configured to perform head selection.

c)   Direction (Step Out) (Line 34)

   The logic state of this line selects the desired direction of head movement. A logical one will cause the read/write head to move away from the center of the disk when the step line is pulsed; and a logical zero level will cause the read/write head to move toward the center when the step line is pulsed. For use with older controllers the function of this line can be changed by implementing a user installed option (see Section 5.0).

d)   Step (Step In) (Line 36)

   This line is used to cause motion of the read/write head. The trailing edge of a pulse applied to this line will result in the movement of the head one track. A train of pulses will cause the head to move at a rate of one track per pulse. For optional use of this line with older controllers, refer to Section 5.0.

e)   Write Gate (Line 40)

   A logical zero will enable write data to be transferred to the diskette. Stepper logic, data and clock signals are disabled when this signal is held to a logical zero.

f)   Write Data (Line 38)

   Each negative transition on this line which occurs while the write gate is held to a logical zero will create a flux reversal on the diskette.

3.4.2.2   Outputs

   The MFE Series 700 and 500 FDDs provide four standard output lines for the transfer of data and status signals to the host controller. These lines are enabled when the drive is selected.

a) Track 00 (Line 42)

This output is a logical zero when the read/write head is positioned at track zero.

b) Read Data (Line 46)

This line provides buffered raw data as detected by the drive electronics. A negative transition represents a flux reversal on the diskette.

c) Ready (Line 22)

This line will be a logical zero when the diskette is: (1) being driven at the required speed; (2) the door is closed; (3) a write fault has not been detected; and (4) index pulses are being generated.

d) Index (Line 20)

This line will be at logical zero whenever the index mark on the disk is detected. A typical timing waveform of index signals is shown

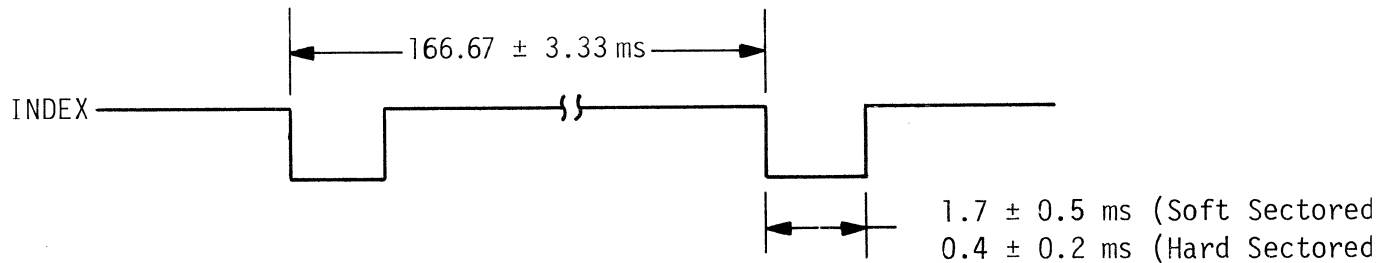
FIGURE 3-5: INDEX TIMING

3.4.3   Optional Interfaces

The interfaces in this group are applicable only when the appropriate factory or user installed option has been implemented. These options are referenced for each interface and described in detail in Section 5.0 of this manual.

3.4.3.1   Inputs

The MFE Series 700 and 500 FDDs are configured to accept four optional control input lines.

a) Head Load (Line 18)

This line, when activated with a logical zero, will allow the head to be loaded independent of the drive select command provided the drive is in the internal ready state. This line will be used when any of the HEAD LOAD user options have been implemented.

b) In Use / Door Lock (Line 16)

This line, when at a logical zero, will be "OR"ed with the drive select line and enable the activity light. This line will be used only when factory option E (FRONT PANEL LED) and user option ACTIVITY LIGHT have been implemented.

c) Power Reduction (Line 10)

This option, which is applicable only to DC motor models (500, 551, 750, 751), can be used to disable the DC spindle drive when the drive is not selected. This is accomplished by applying a logical zero on the line. Two seconds must be allowed after re-enabling this line before normal operation can start. This line will be used only when user option POWER SAVER has been implemented.

d) Low Current / Erase (Line 6)

This line must be activated with a logical zero signal by the controller whenever a track between 43 and 77 has been selected. This line will be disabled when factory option D (TRACK 43 SENSOR) is installed. When Option D is installed, this line may be used to control the tunnel erase head(s) for more precise control.

3.4.3.2 Optional Outputs

Up to eight optional output signals are available from the MFE Series 700 and 500 FDDs.

a) Separated Data (Line 48) and Separated Clock (Line 50)

For single density applications, the electronics can provide a data separator which processes the "raw data" and provides data and clock outputs as logical zeros on lines 48 and 50 respectively. These lines will be available only when the factory option A (DATA SEPARATOR) has been installed. A user-installed option will enable the separator to perform like a Shugart 800/801, 850/851 separator.

b)   Sector (Line 24)

This option is only applicable to the hard sectored models (501, 551, 701, 751). A logical zero is provided by the FDD whenever a sector hole is detected on the diskette (32 sector holes on the hard sectored disk). The timing relationship for the sector and index signals are shown in Figure 3-6. All hard sectored drives are shipped from the factory wired for 32 sectors. (See Section 5.0 for instructions for conversion to eight or sixteen sectors.)
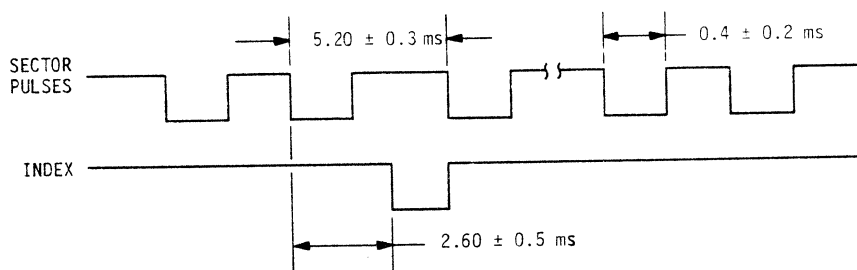

FIGURE 3-6:   SECTOR TIMING

c)   Write Protect (Line 44)

This line can be used to transfer a status signal to the host controller when a write protect disk has been inserted into the FDD. This line will be used only when factory option E (WRITE PROTECT SENSOR) is installed. Upon detecting a write protected diskette, the write circuit of the drive will be disabled. This feature can be removed by the OEM/user if desired (see Section 5.0).

d)   Write Fault (Line 4)

This line is activated to alert the host controller of an unsafe write condition resulting from any one or a combination of the following conditions:

1)   multiple read/write heads have been selected;
2)   no write data has been transferred;
3)   the head has not been loaded; and/or
4)   no erase current was detected;
5)   an attempt was made to step while writing or erasing.

e)   Diskette Sense (Line 2) -- 700 SERIES ONLY

This line will be activated by the FDD (logical one) when a double-sided diskette is installed in the drive. A logical zero indicates that a single-sided or 'flippy' disk is installed in the drive. This line will be used only with factory options B (FLIPPY DISK SENSOR) or C (SINGLE SIDED SENSOR), and user option DISKETTE TYPE have been implemented.

f)   Diskette Change (Line 12)

The FDDs will provide a logical zero on this line when the drive is selected and the drive changed from a READY to NOT READY state since the last time the drive was selected. The condition is reset if the drive is de-selected then re-selected. The timing sequence for the disk change signal is given in Figure 3-7.
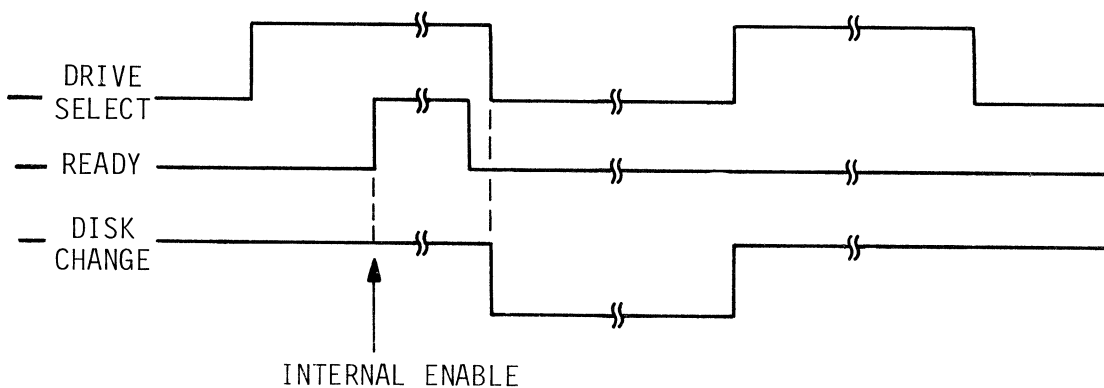

FIGURE 3-7: DISK CHANGE TIMING

This line will be used only when user-installed option DISK CHANGE has been implemented.

3.5   Multiple Drive Installations

Up to four MFE Series 700 and 500 FDDs can be connected to and controlled by a single host controller using the arrangement shown in Figure 3-8. To implement a multiple drive configuration, the OEM/user is required to perform a simple adjustment on each FDD. This adjustment consists of placing switch S1 (located at the rear of the PCB) in the appropriate position. Table 3-6 indicates the proper setting of the switch for a partuclar drive position. Before an FDD is installed in a multiple drive configuration, its position (1 through 4) should be determined, and S1 should be set in accordance with Table 3-6. With these adjustments made, the FDD is ready for installation in the host equipment as described in Sections 3.2 and 3.3.

IN ALL MULTIPLE DRIVE INSTALLATIONS, ALL DRIVES EXCEPT THE ONE FARTHEST FROM THE HOST SHOULD HAVE Z22 (TERMINATING RE-SISTOR PACK) REMOVED.
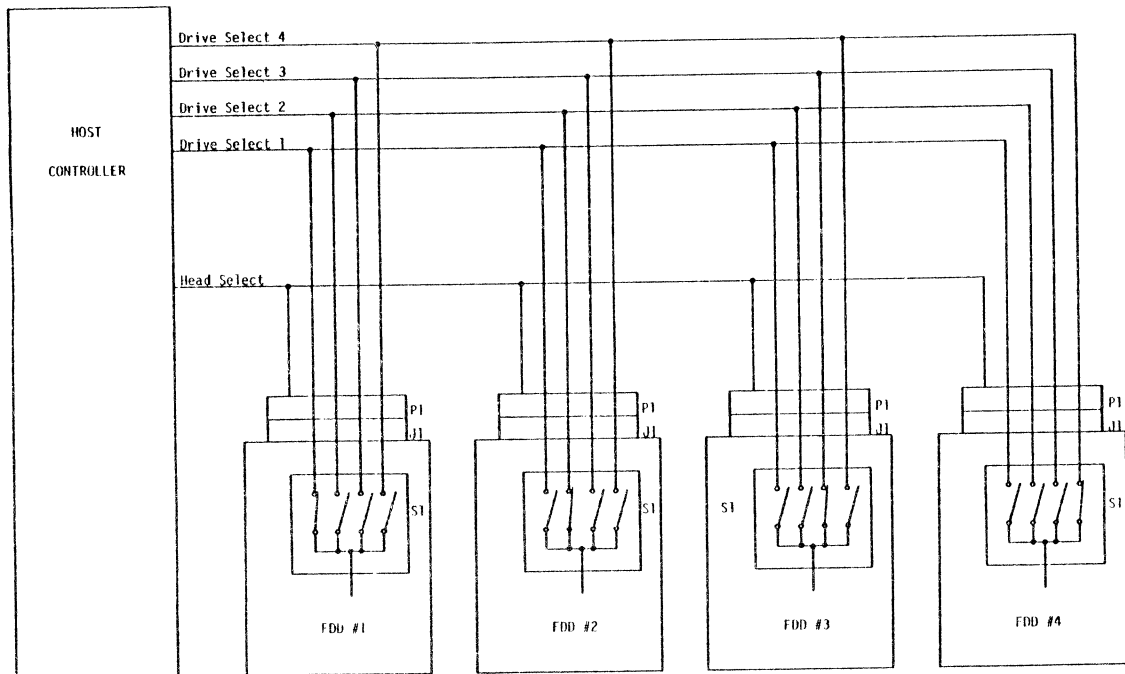
FIGURE 3-8:   MULTIPLE FDD INSTALLATION

TABLE 3-6

SWITCH S-1 POSITIONS SETTINGS FOR
MULTIPLE DRIVE INSTALLATIONS

DRIVE NUMBER	SWITCH S-1 TURN-ON POSITION
1	1 (Note 1)
2	2
3	3
4	4
NOTE 1:	All MFE Series 700 and 500 FDDs are shipped from the factory with these settings

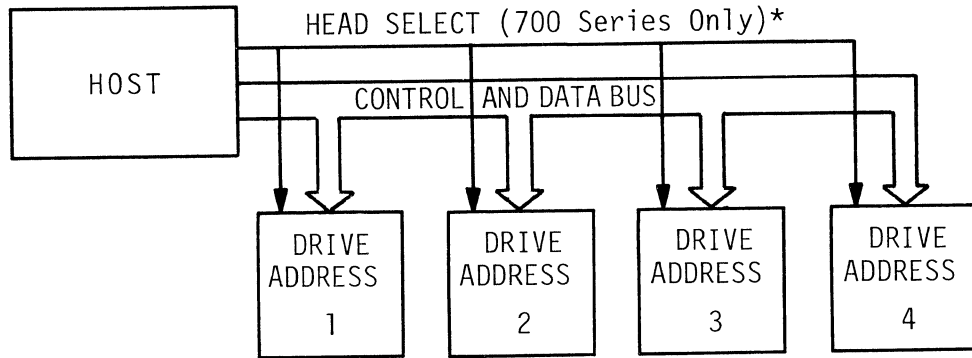ONLY ONE SWITCH PER DRIVE MAY BE ON AT ONE TIME.

The host controller selects (addresses) a particular drive by connecting the appropriate drive select line to ground (logical zero). In this standard address mode four single-sided drives (500 Series) can be controlled by using only the four drive select lines. If the Head Select control line is also used, up to four double-sided models (700 Series) can be handled such that an eight-side capacity can be realized. This alternate arrangement for the 700 and 500 Series models is shown in Figures 3-9(a) and 3-9(b).

The connection and selection capability of the MFE 700 and 500 Series of FDDs can be expanded to eight FDDs by use of the BINARY SELECT user option. Refer to Section 5.0 for details on the operation and implementation of this option.

3.6   Installations Where Double-Sided FDDs Replace Single-Side Drives

Because the MFE series 700 FDD units are double-sided drives, one MFD FDD can replace two conventional single-sided drives. When the MFE Series 700 FDD units are installed as replacements for a conventional single-sided drive, it may be desirable for the user to retain the drive control interface configuration that was used with the single-sided drive(s). To effect such an installation, two simple adjustments are required on the MFE FDD. These consist of setting switch S1 and adding/removing jumpers HS and DS. (Refer to Figure 5-1, Printed Circuit Board Layout, for locations of the jumpers.) By making these adjustments, selection of an MFE drive and side can be accomplished by using only the Drive Select Lines. In this configuration up to two MFE FDD units can be connected to a single host controller as a direct replacement for up to four conventional single-sided drives [see Figure 3-9(b)].

When the four address lines are used to control two double-sided drives, two lines must be allocated to each drive. Each of these lines provides for selection of one disk side. There are four

```
                HEAD SELECT (700 Series Only)*
┌─────────────┐   │  │       │  │       │  │       │  │
│             │   │  │       │  │       │  │       │  │
│    HOST     │   CONTROL│AND DATA BUS│  │       │  │
│             │   │  │       │  │       │  │       │  │
└─────────────┘   ▼  ▽       ▼  ▽       ▼  ▽       ▼  ▽
              ┌────────┐  ┌────────┐  ┌────────┐  ┌────────┐
              │ DRIVE  │  │ DRIVE  │  │ DRIVE  │  │ DRIVE  │
              │ADDRESS │  │ADDRESS │  │ADDRESS │  │ADDRESS │
              │   1    │  │   2    │  │   3    │  │   4    │
              └────────┘  └────────┘  └────────┘  └────────┘
```

In this configuration either the HEAD SELECT input, J1-14, or the alternate HEAD SELECT through the DIRECTION line must be used (700 Series only).

FIGURE 3-9(a):   ALTERNATE DRIVE CONFIGURATIONS FOR
                 SERIES 700 AND 500 FDDs.


```
┌─────────────┐
│             │ CONTROL  AND  DATA
│    HOST     │    │         │
│             │    │         │
└─────────────┘    ▽         ▽
              ┌────────┐  ┌────────┐
              │ DRIVE  │  │ DRIVE  │
              │ADDRESS │  │ADDRESS │
              │  1 & 2 │  │  3 & 4 │
              └────────┘  └────────┘
```
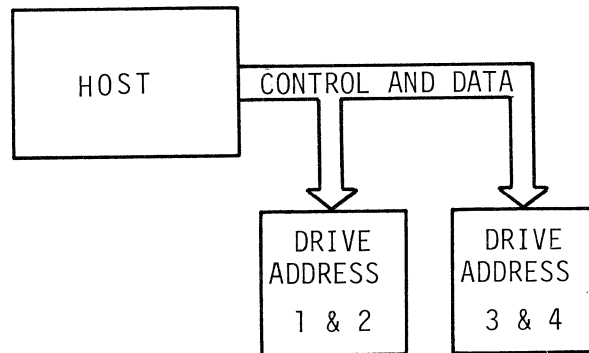
In this configuration, HEAD SELECT J1-14 and alternate HEAD SELECT through the DIRECTION option are not used. Switch S1 and the DS jumpers (alternate DRIVE SELECT) are used in this configuration.

FIGURE 3-9(b):   ALTERNATE DRIVE CONFIGURATIONS FOR
                 SERIES 700 FDD.

sections of swtich S1 (1 - 4) which provide for assignment of one of
four drive select lines to side "0" selection. Generally, there are
four possible user-installed jumpers (DS # 1 - 4) which provide for as-
signment of one of four drive select lines to side "1" selection.
Only one switch and one DS jumper are used in a given drive unit.

Other requirements for this type of drive selection are
that jumper HS-1 be removed and jumper HS-2 be added. A typical
switch and jumper configuration for two double-sided drives is pre-
sented in Table 3-7.

TABLE 3-7

DRIVE SELECT WITH HEAD SELECT

REPLACED DRIVE	DRIVE SELECT		DRIVE/ SIDE	SWITCH S1	JUMPERS		
POSITION	LINE	PIN			DS-4	HS-1	HS-2
1	1	J1-26	1 / 0	S1-1 Closed (ON)	---	Delete	Add
2	2	J1-28	1 / 1	S1-2 Open / S1-7 ON (DS-2)	---	Delete	Add
3	3	J1-30	2 / 0	S1-3 Closed (ON)	---	Delete	Add
4	4	J1-32	2 / 1	S1-4 Open	Add	Delete	Add

When this type of installation is used, the HEAD SELECT
line (Line 14) is not required and becomes available as an alter-
nate Input/Output pin by removing Jumper J-11.

It is also possible to expand this installation configura-
tion to up to four double-sided MFE FDD units by using the BINARY
SELECT option described in Section 5.0 of this manual.

4.0 OPERATION

4.1 General

The functional operation of the MFE Series 700 and 500 FDDs is controlled by the host controller. This includes initialization, control, and termination of operation of the FDD. Thus, the FDD is totally dependent upon the host controller and requires no operator interface other than the insertion and removal of the diskette. The manner in which the host controller controls the operation of the FDD is discussed in Section 4.2, while the proper methods and operator precautions required for disk handling are covered in Section 4.3.

4.2 Host Controller - FDD Sequence of Operations

The operation and control of the MFE Series 700 and 500 FDDs is accomplished through the control and data interface lines described in Section 3.4. The characteristics and sequence of application of these signals, which are described below, can be considered as five primary operations. These are:

- Initialization
- Head Positioning
- Read Operation
- Write Operation
- Status Monitoring

4.3 Initialization

The application of AC and DC power can be effected in any sequence. There is, however, a two-second time delay requirement between the time the spindle motor power is applied on any model or the power reduction feature is turned off (logical one) on DC models before a READ or WRITE function can be attempted. This delay permits the disk drive assembly to achieve a stabilized rotational speed. A second time-related constraint is a requirement for a minimum of 90 milliseconds to have elapsed from the application of DC power to the

initiation of a READ, WRITE, or HEAD POSITIONING operation, or before
valid FDD output signals can be processed. Since the "POWERING ON"
action will leave the read/write (R/W) head in a random and indeter-
minant position, a known reference must be established before accu-
rate head positioning can be attempted. To establish this reference,
the host controller performs a DIRECTION and STEP operation until the
Track 00 index is reached and the Track 00 indicator becomes active.
The sequence and timing of the events that result in the FDD being
initialized and placed in an operational status are shown in Figure
4-1. This diagram, as well as all subsequent timing diagrams in this
section, includes a logical one and zero on all waveforms. The speci-
fic signals levels associated with these logic states are described in
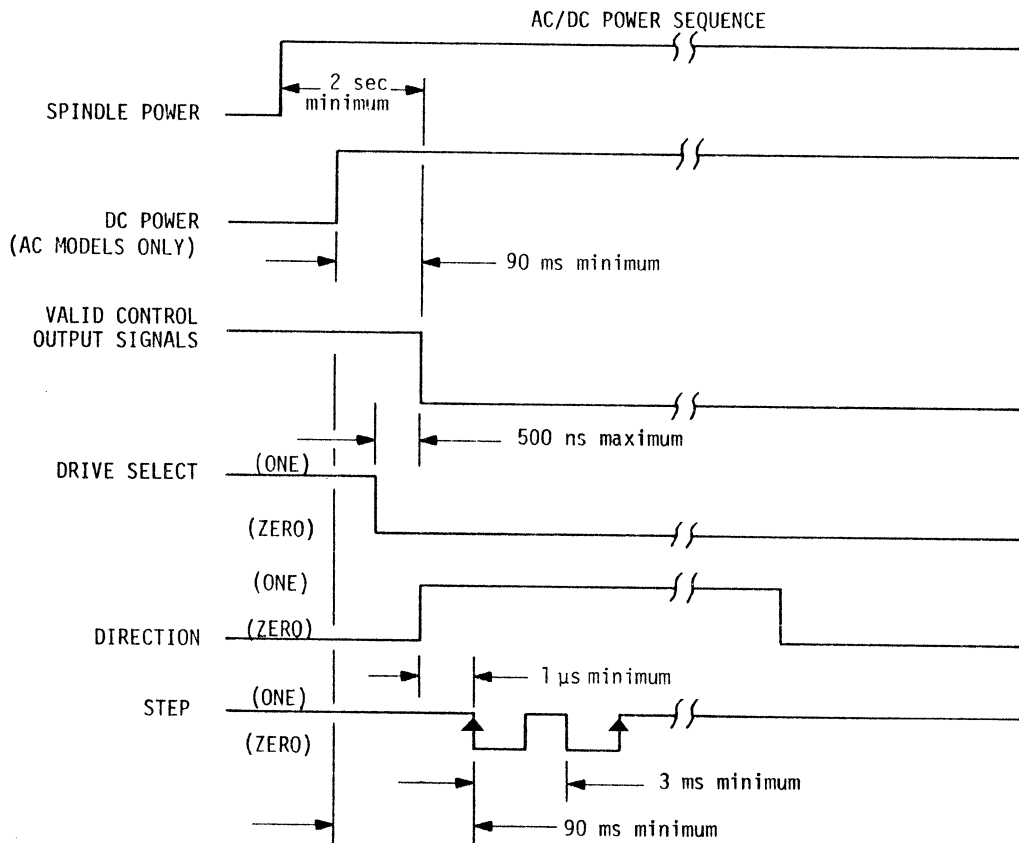Section 3.0.

FIGURE 4-1: TIMING DIAGRAM FOR INITIALIZATION OPERATION

4.2.2   Head Positioning

The head positioning operation involves moving the read-write (R/W) head from one track to another until the desired track has been located. By using the DIRECTION and STEP lines, head movement, either toward or away from the center of the disk, can be achieved. Head movement always occurs in one track increments and at the rate of one track per step pulse. Four specific actions and/or conditions must be effected to perform the head positioning operation. These are:

- Activate DRIVE SELECT
- Select desired direction by setting the DIRECTION line
- Insure that the WRITE GATE line is inactive
- Pulse the STEP line

Figure 4-2 displays the timing characteristics for the head positioning operation. The head is moved away from the center of the disk by activating the DIRECTION line with a logical one signal and pulsing the STEP line. To move the head toward the center of the disk a logical zero signal is applied to the DIRECTION line and the STEP line is pulsed. The characteristics of the pulses applied to the STEP line must be as shown in Figure 4-2. Head movement is always started on the trailing edge of the STEP pulse.
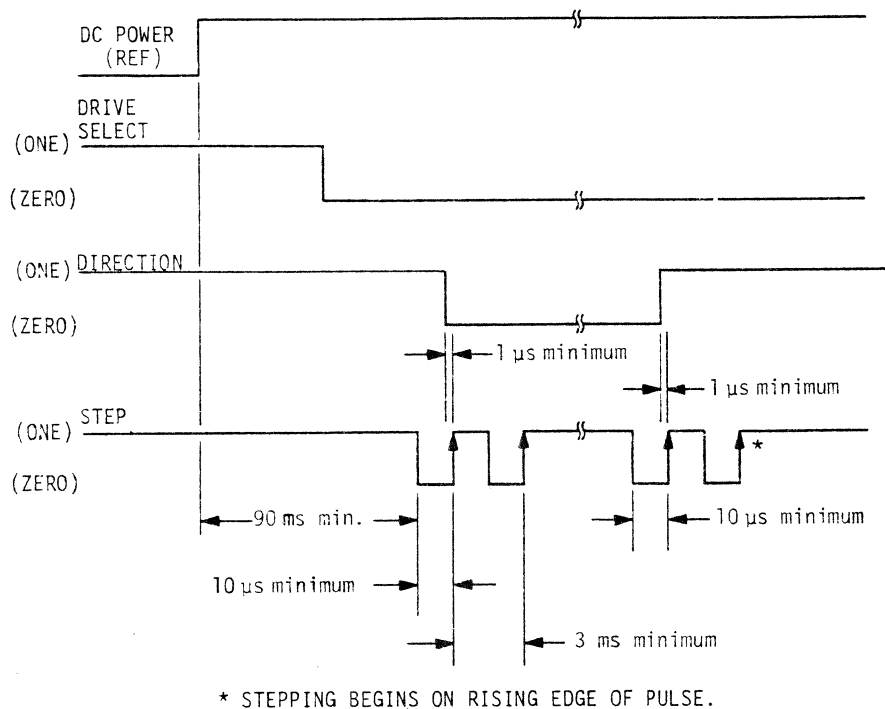

* STEPPING BEGINS ON RISING EDGE OF PULSE.

FIGURE 4-2:   TIMING DIAGRAM FOR HEAD POSITIONING OPERATION

4-3

4.2.3   Read Operation

Once the head has been positioned to the desired track, a
READ or WRITE operation can be initiated. A READ operation is accom-
plished by following the timing relationships shown in Figure 4-3.
There is no specific read command. The READ operation will commence,
and valid data will be read from the disk whenever the timing rela-
tionships have been satisfied and the WRITE GATE is off. It will be
noted that the head is automatically loaded with the activation of
the DRIVE SELECT line. Alternate means of loading the head are avail-
able by implementing the user options described in Section 5.0.

The DRIVE SELECT signal should be applied 35 milliseconds
before valid read data or the beginning of a write cycle. This allows
time for the read/write head to load (if the head is loaded with DRIVE
SELECT); otherwise, eight milliseconds is required.
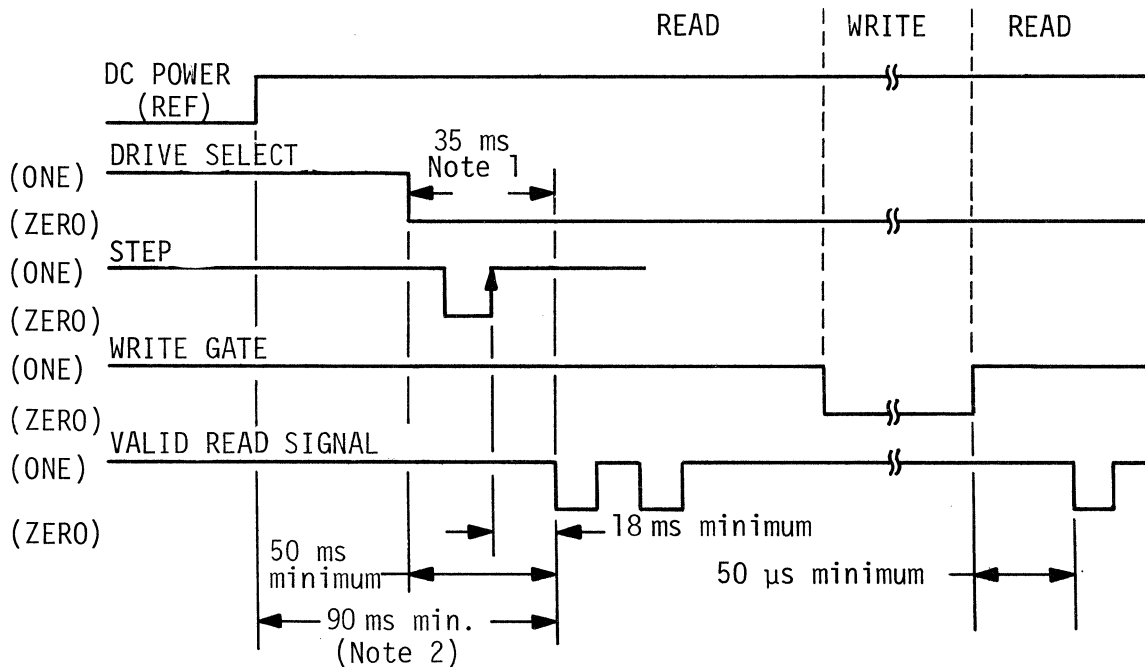
NOTES: 1. Two seconds for DC Spindle Motor models with optional power re-
            duction signal on (logical zero).

        2. Two seconds for DC Spindle Motor models.

FIGURE 4-3:   TIMING DIAGRAM FOR READ OPERATION

The read signals consist of data and clock pulses. The timing relationships of this signal in the raw data state and when the DATA SEPARATOR factory option is used are shown in Figure 4-4.
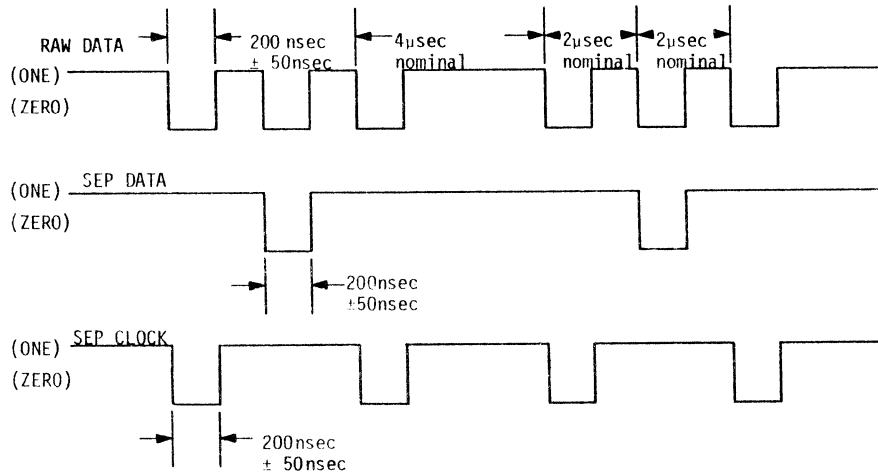

FIGURE 4-4: TIMING DIAGRAM - DATA SIGNALS

4.2.4   Write Operation

With the head in the desired position the WRITE operation is accomplished by activating the WRITE GATE line and introducing data on the WRITE DATA line. The specific timing relationships that must be observed are indicated in Figure 4-5. Proper timing of input signals from the host controller is necessary to insure that the read/write head has stabilized prior to writing.
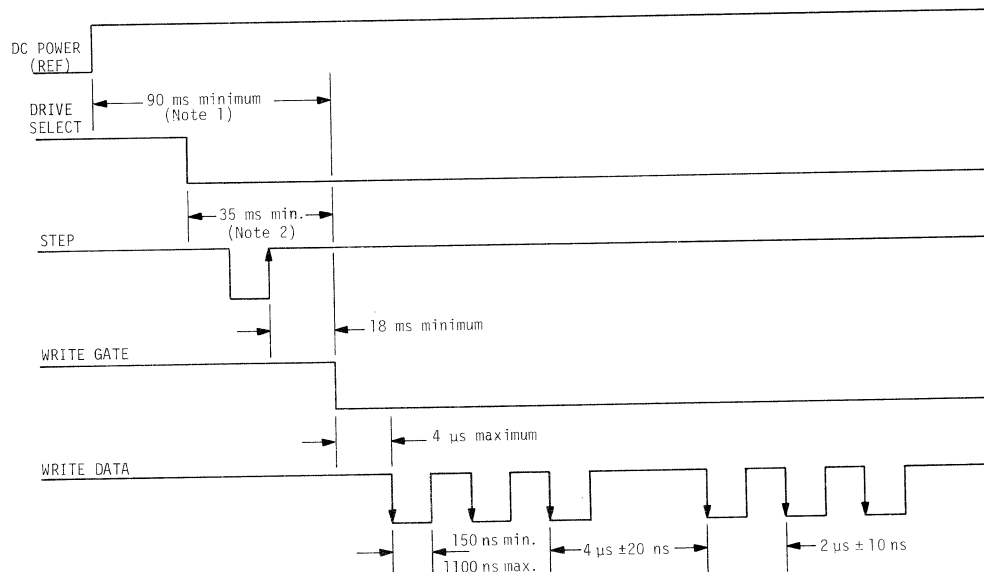
NOTE 1: Two seconds for DC Spindle Motor Models.
NOTE 2: Two seconds for DC Spindle Motor Models with power reduction feature on (logical zero).
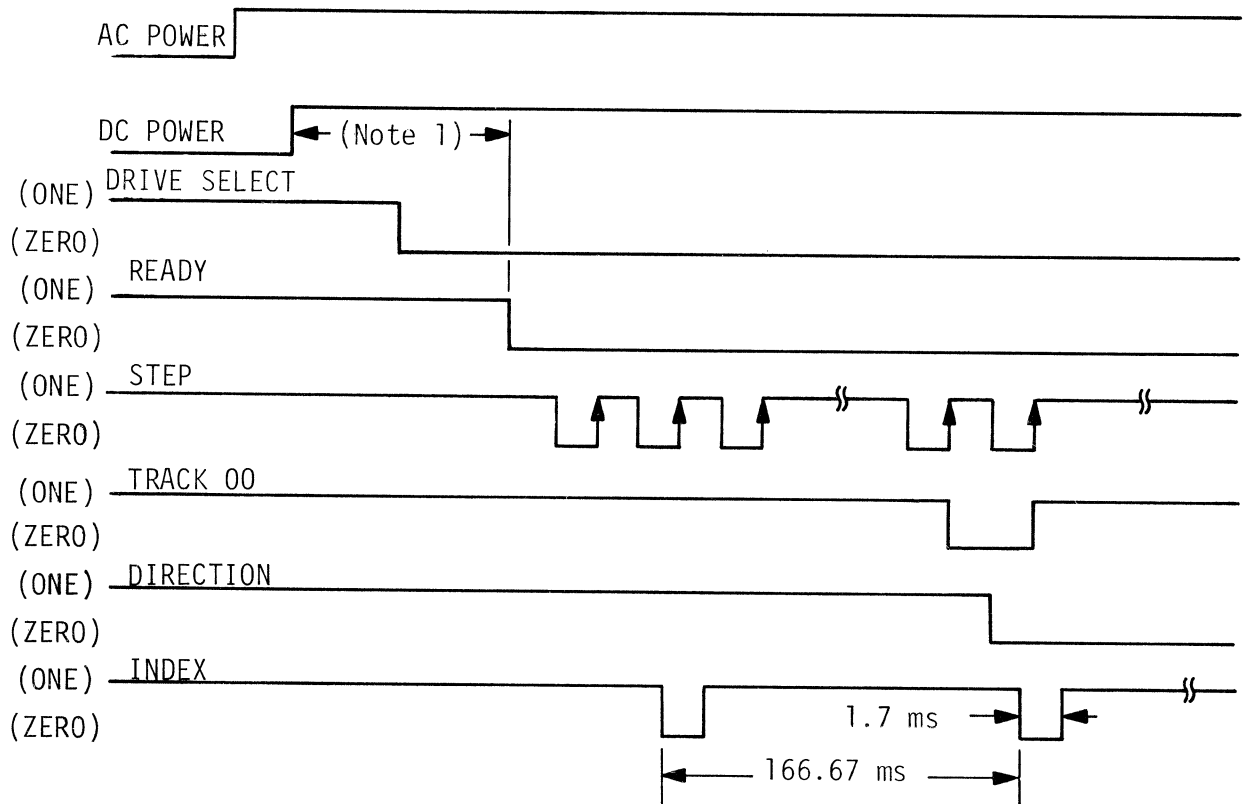
FIGURE 4-5: TIMING DIAGRAM - WRITE OPERATION

4-5

4.2.5   Status Monitoring Operation

The MFE Series 700 and 500 FDDs provide three standard status signals during operation:

- TRACK 00: Indicates when head is positioned at Track 00
- READY: Indicates when disk is operating at proper speed
- INDEX: Indicates when index mark is detected on disk

Each of these lines will be driven at a logical zero level when the particular status condition has been reached and the drive is selected. A nominal representation of the characteristics and sequence of these signals is shown in Figure 4-6.
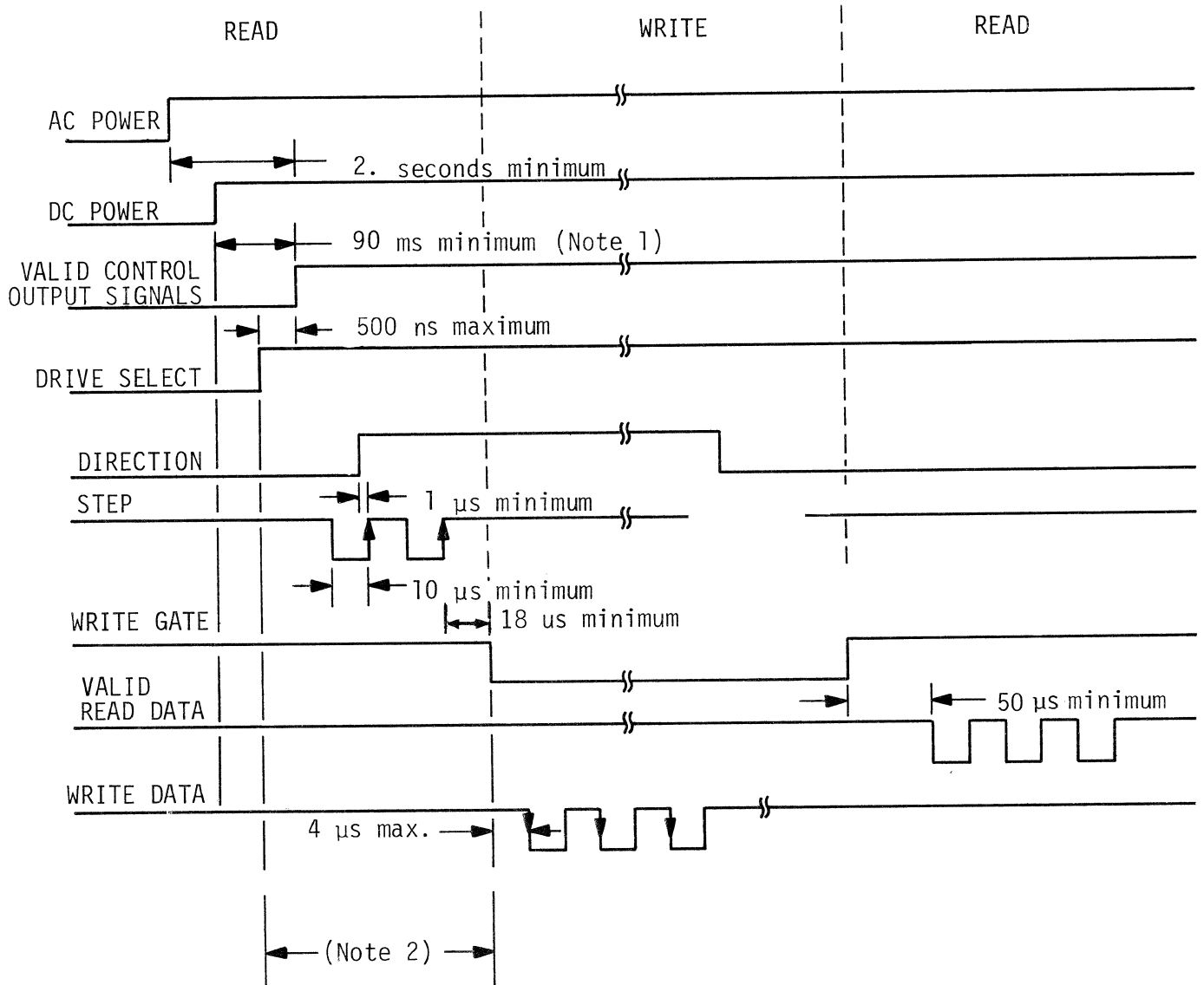

NOTE 1: Two seconds for models
with DC Spindle Motors

FIGURE 4-6: TIMING DIAGRAM - STATUS SIGNALS

4.2.6   Operational Sequence

A simplified representation of a complete initialization, head positioning, write, and read operational cycle is given in Figure 4-7.

NOTE 1: Two seconds for DC Spindle Motor models.

NOTE 2: Two seconds for DC Spindle Motor models with power reduction feature ON (Logical zero).

FIGURE 4-7:   SIMPLIFIED TIMING DIAGRAM - COMPLETE OPERATING CYCLE

4.3   Diskette Handling

4.3.1   Diskettes

The MFE Series 700 and 500 Flexible Disk Drives are designed to accept the IBM or MFE approved Diskette suited to the particular application and intended use. Diskettes consist of a flexible disk enclosed in a protective plastic jacket. The interior surfaces of the jacket are specially treated to provide a wiping action that helps keep the diskette free of foreign material.

Figure 4-8 presents a sketch of the several conventional diskette configurations that can be used with the MFE Series 700 and 500 FDDs. These include:

- Single Sided - Hard or Soft Sectored
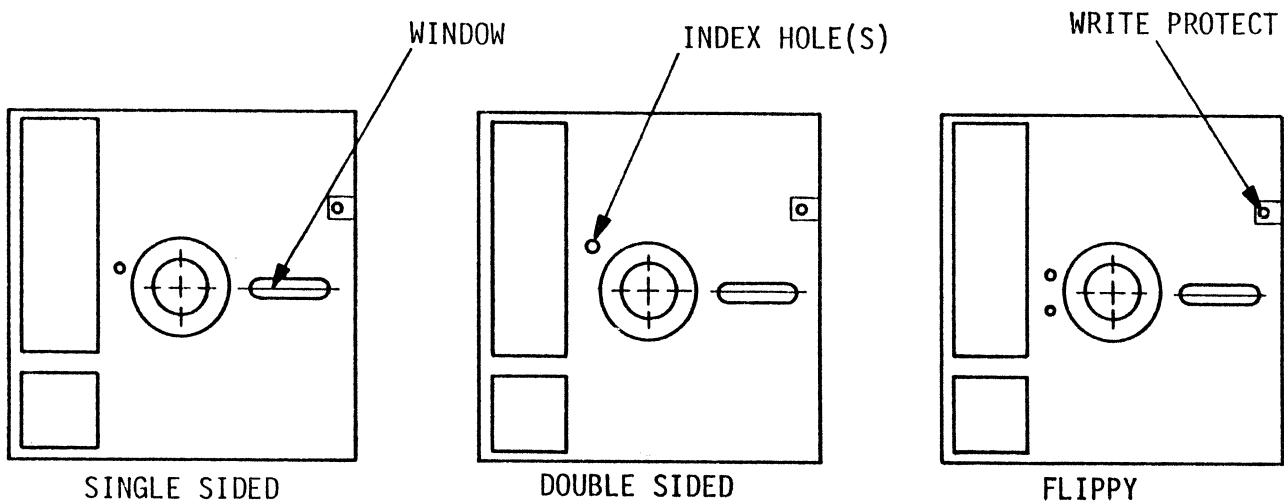- Double Sided - Hard or Soft Sectored
- Flippy   - Hard or Soft Sectored

WINDOW   INDEX HOLE(S)   WRITE PROTECT

SINGLE SIDED   DOUBLE SIDED   FLIPPY

FIGURE 4-8:   DISKETTE CONFIGURATIONS

4-8

Hard and soft sectored configurations can be distinguished by the index hole patterns. Soft sectored diskettes will have a maximum of one index hole; while hard sectored diskettes will have 33 holes consisting of 32 sector holes and one index hole. Further identification of diskette type and side is usually printed on labels attached to the jacket. It is important to identify the type of diskette and to make certain that the FDD is configured to accept that particular diskette. Refer to Table 4-1 for a quick cross-reference that shows the MFE Series 700 and 500 models and the corresponding diskettes that can be used with each model.

TABLE 4-1

FDD - DISKETTE CONFIGURATION CROSS REFERENCE

MODELS / OPTIONS	DOUBLE SIDED SOFT SECTOR	DOUBLE SIDED HARD SECTOR	SINGLE SIDED SOFT SECTOR	SINGLE SIDED HARD SECTOR	FLIPPY SOFT SECTOR	FLIPPY HARD SECTOR
700 / 750	●					
701 / 751		●				
700C/750C			●		●	
701C/751C				●		●
500 / 550			●		●	
501 / 551				●		●
					.	

Diskettes represent delicate devices and should be handled with reasonable caution. Additionally, mishandling can damage the integrity of the data stored on the disks. Accordingly, the following precautions should be observed:

● AVOID HANDLING THE DISKETTE IN THE AREA OF THE WINDOW OR INDEX/ SECTOR ACCESS HOLES.

● RETURN THE DISKETTE TO ITS STORAGE FOLDER OR FILE WHEN NOT IN USE.

● KEEP THE DISKETTE AWAY FROM MAGNETIC FIELDS.

● DO NOT WRITE ON THE DISKETTE WITH PENCIL OR HARD TIP PENS. USE ONLY FELT TIP PENS.

● DO NOT EXPOSE DISKETTE TO HEAT OR SUNLIGHT.

● DO NOT ATTEMPT TO TOUCH OR CLEAN THE DISK SURFACE.

4.3.2   Loading and Unloading the Flexible Disk Drive

The proper method of inserting a diskette into the FDD is shown in Figure 4-9. To load the diskette into the FDD, pull the handle forward until the door latches, and place the diskette in the slot with the labeled edge toward the top cover of the drive. Gently push the diskette fully into the slot until it will not go any further. Note that when the door latches in the full open position, a swing of about 40 degrees occurs. Do not attempt to force the door open beyond this limit. Once the diskette is firmly seated, push the door back into the closed position. All MFE Series 700 and 500 FDDs are equipped with a door activated mechanism that will prevent the door from being closed until the diskette is fully inserted. This feature·will prevent damage to the disk. Therefore, do not attempt to force the door into a closed position. If the door will not close easily, check to see that the diskette has been properly inserted and seated.
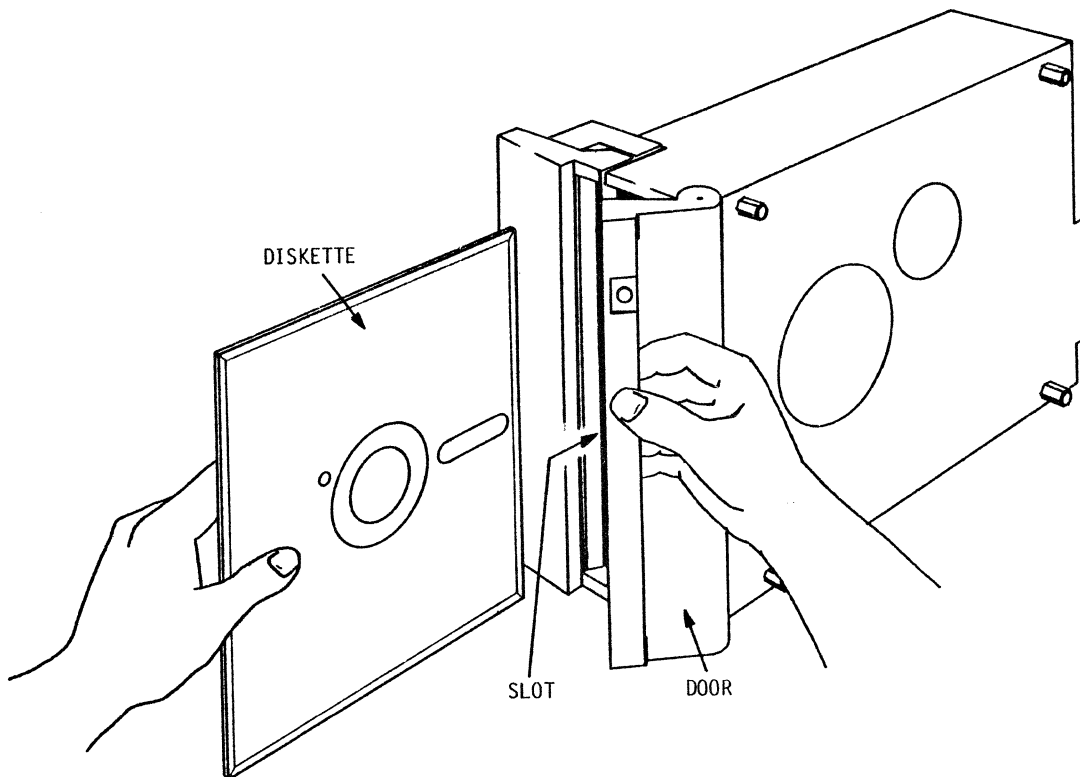

DISKETTE

SLOT   DOOR

FIGURE 4-9:   DISKETTE LOADING

To remove the diskette, simply pull the door handle for-
ward and the diskette will eject about one inch. Grasp the diskette
along the exposed (labeled) edge and carefully remove it from the
FDD. Always store diskettes in their folder or file when not in
use.

4.3.3   Write Protect

The MFE and other qualified diskettes have the capability
of being write protected. As shown in Figure 4-10, the write protect
feature can be implemented by removing the tab over the write protect
hole/slot. The hole/slot is covered by placing a tab over the front
of the hole and folding the tab over the edge of the diskette to cover
the rear of the hole. When the tab is removed the diskette is write
protected and the data stored on the disk cannot be erased. The de-
tail pattern of the write protect slot is shown in Figure 4-11.

The write protect feature is available only if a write pro-
tect diskette and a drive with the WRITE PROTECT option (option E)
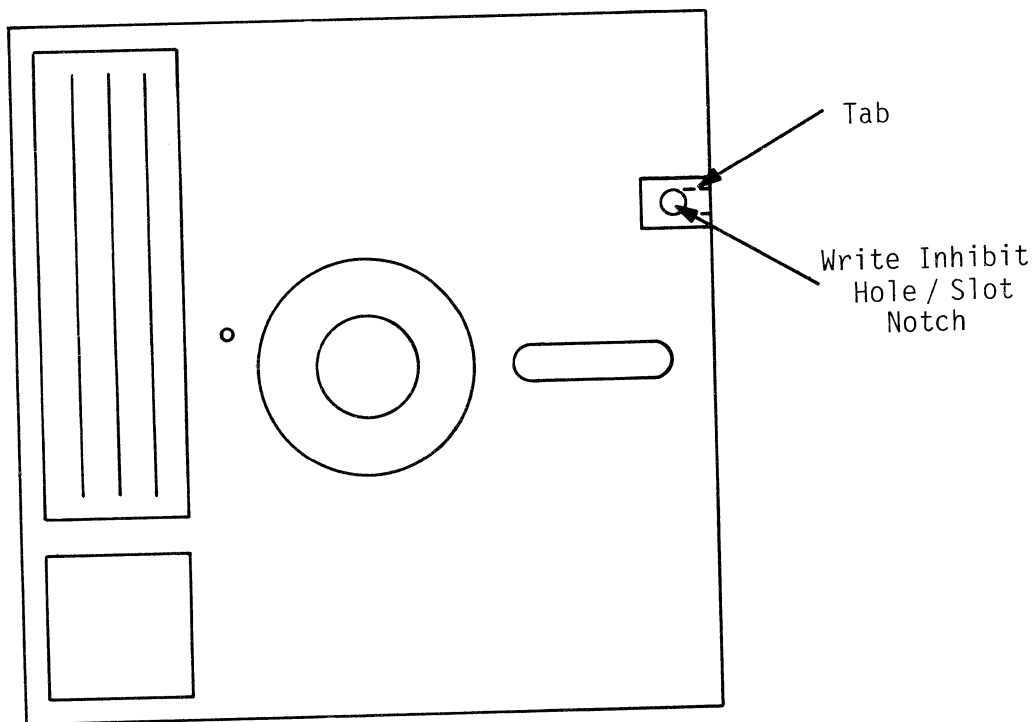which has not been disabled is installed (see Section 5.0).
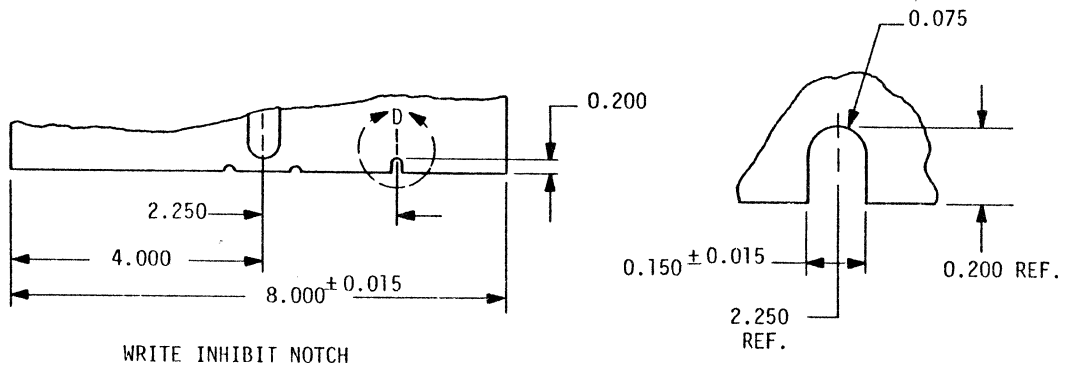

FIGURE 4-10: WRITE PROTECT DISKETTE

WRITE INHIBIT NOTCH

FIGURE 4-11:   WRITE INHIBIT NOTCH

5.0   USER INSTALLED OPTIONS

5.1   General

The MFE Series 700 and 500 Flexible Disk Drives are designed and configured to satisfy a wide variety of OEM/user operating requirements. Through a combination of user selected factory options and a series of simple user installed uptions, up to twenty-four different operating features are available. These features extend the basic capabilities described in Sections 3.0 and 4.0 of this manual and permit personalizing the FDD to the needs of a particular host system and controller.

Since several of the user installed options are dependent on a particular factory option, not all options are available on all models. Table 3-2 presents a convenient method of identifying the specific user options that can be used with: (A) all models; (B) specific models; and (C) models which contain factory installed options. To determine the available user options for a particular FDD just identify the specific model and factory options (if any) using the procedure outlined in Section 3.1 of this manual. Next, refer to Table 3-2 and list in the following order the available user options that: (A) appear in the ALL MODELS column; (B) appear in column for that specific model; and (C) are adjacent to the required factory-installed option. As an example, for a Model 701 with factory options D (TRACK 43 SENSOR), F (FRONT PANEL LED), and H (DOOR LOCK), the OEM/user could install any or all of the following options:

- Daisy Chain Interface
- Select Drive without Loading Head
- Select Drive w/o Loading Head and Enabling Stepper Motor
- Load Head without Selecting Drive
- Radial Ready
- Radial Index Sector
- Schmitt Trigger Input
- Disk Change
- Step In/Step Out
- Binary Select
- Alternate Input/Output Pins
- Minus 5 Volt

- 8/16/32 Sectors
- Hard Sector/Soft Sector
- Activity Light
- In Use/Door Lock

All user installed options are implemented by making minor modifications to the electronics assembly (printed circuit board). These modifications consist of setting switches and/or adding or deleting jumpers and by using available input/output pins on connector J1 (refer to Section 3.3.2 for a description of the optional input/output lines/connectors). To locate a trace or jumper that is referenced for a particular option refer to Figure 5-1, which shows the location of each trace/jumper on the PCB. Once a jumper location is found, the jumper can be deleted or added (as required) with a PCB soldering iron. All jumpers are accessible on the exposed surface of the PCB, and all user installed options can be implemented without removing the PCB or disassembling the FDD unit.
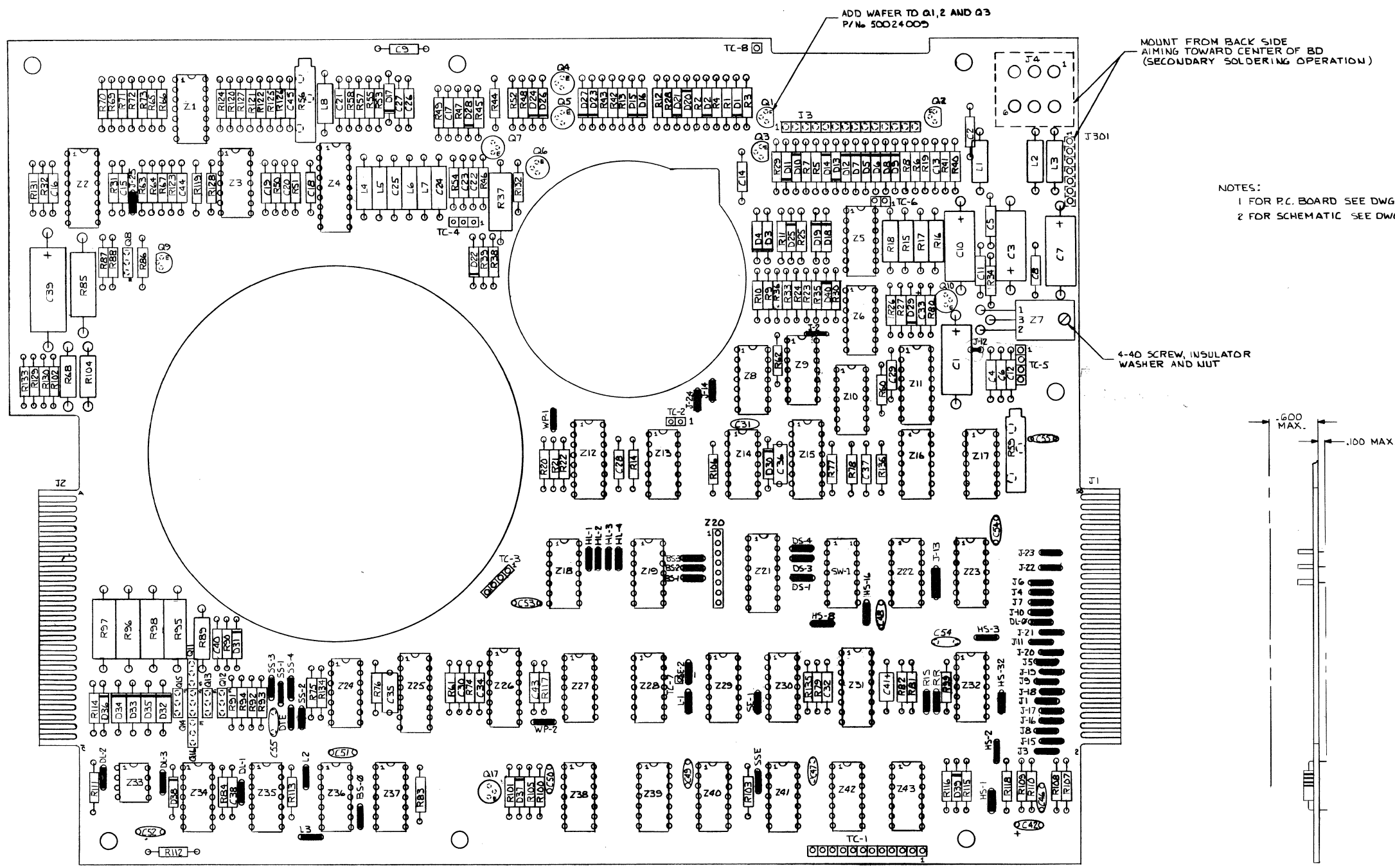
5.2   User Installed Options

This section describes each of the twenty-four available user installed options and the method by which each of these options can be implemented.

5.2.1   Eight, Sixteen, or Thirty-two Sector Option (Hard Sector)

The MFE models 701, 751, 501 and 551 are configured at the factory to provide 32 sector pulses per revolution of the diskette. In addition to the standard 32 sector monitoring, the user can reconfigure these models for 8 or 16 sector monitoring by performing the following steps:

a)   For 16 sector operation, cut jumper HS-32 and add jumper HS-16.

b)   For 8 sector operation, cut jumpers HS-32 and HS-16 (if installed) and add jumper HS-8.

ADD WAFER TO Q1,2 AND Q3
P/N° 50024005

MOUNT FROM BACK SIDE
AIMING TOWARD CENTER OF BD
(SECONDARY SOLDERING OPERATION)

NOTES:
1 FOR P.C. BOARD SEE DWG 40506024
2 FOR SCHEMATIC SEE DWG 00377028

4-40 SCREW, INSULATOR
WASHER AND NUT

.600 MAX.
.100 MAX.

This drawing contains information which is proprietary and the property of M.F.E. Corporation and may not be used in whole or part for any purpose without that corporations express approval.

REVISION RECORD

| NO | DATE | REVISION RECORD |
| A | ?nd77 | EWR S-2935 3.0 NEW RELEASE |

MATERIAL
TREATMENT

MFE CORPORATION
KEEWAYDIN DRIVE
SALEM, NEW HAMPSHIRE 03079
U.S.A.

P.C.B. F.D.
ASSEMBLY

DRAWN
CHECKED
APPROVED

CODE IDENT. 31252
SCALE 2/1
SIZE D
DRAWING NUMBER 1155017
REV. A

SHEET NO. 1 OF 1

5.2.2   Activity Light Option (Option F)

The activity Light Emitting Diode (LED), when ordered as a factory installed option, is located on the front door of the FDD (see Figure 2-2). This light is connected at the factory to indicate (light-on) when the drive is selected. It is possible to use this light to indicate other status conditions by making the following changes. Refer to Table 5-1 and Figure 5-2 for instructions to implement the following status indications:

- HEAD LOAD - Indicates (light-on) when R/W head is loaded.
- IN USE SIGNAL - Indicates (light-on) when a logical zero is transferred by the host controller on line 16 of J1.

TABLE 5-1

LED INDICATOR RECONFIGURATION

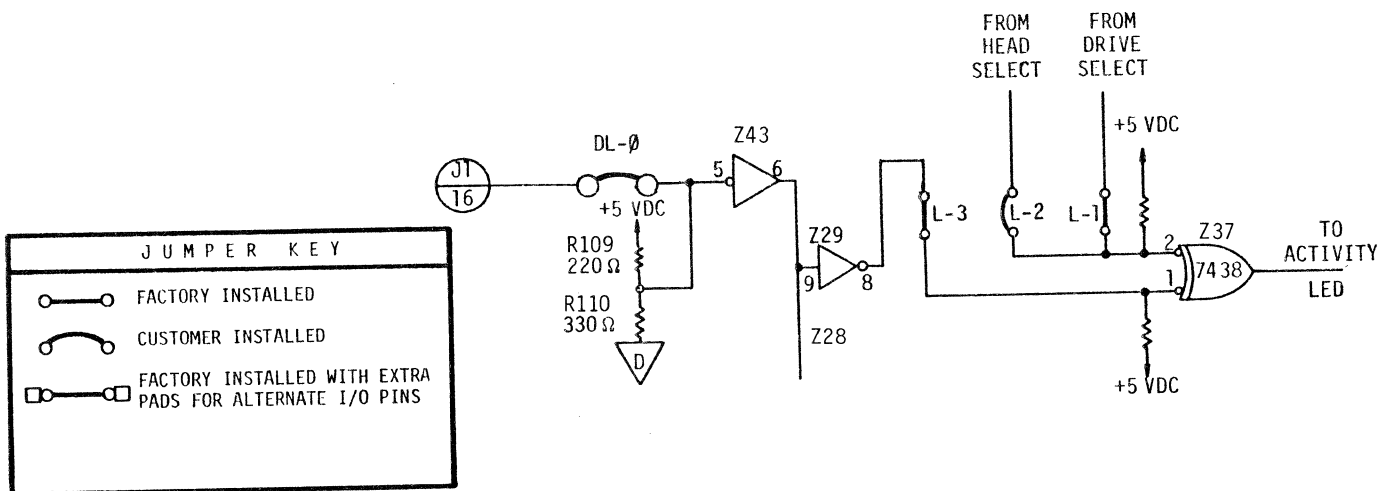| LED INDICATOR	JUMPER			
	L-1	L-2	L-3	DL-∅
DRIVE SELECT	FACTORY INSTALLED	—	—	—
HEAD LOADED	DELETE	ADD	—	—
IN USE (J1-16)	DELETE	—	ADD	ADD

FIGURE 5-2:   IN USE/ACTIVITY LED CIRCUIT

5-4

5.2.3 Daisy Chain Interface

Multiple FDD units can be connected to a single host controller via a common cable and daisy chain connections from one FDD to the next FDD. When FDDs are configured in this fashion only the last FDD in the chain (farthest from the host controller) requires a terminator. Since each FDD is shipped from the factory with a terminating resistor network installed (Z22), this network should be removed from its socket for all except the last FDD in the chain. The terminating resistor circuit, Z22, consists of a 220 ohm resistor connected to +5 V and a 330 ohm resistor connected to ground for each input line.

The two radial input lines that might exist in a daisy chain configuration, Head Load and In Use/Door Lock, have terminating resistors which are separate from Z22. These resistors can be retained or removed independent of Z22. A typical terminator circuit is shown in Figure 5-3.
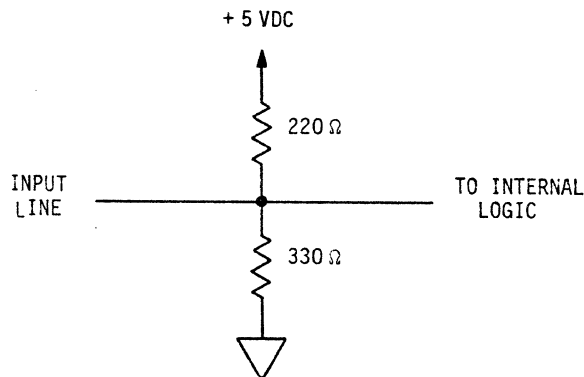
```
                        + 5 VDC

                          ↑
                          ⌇  220 Ω
                          ⌇

      INPUT ───────────────●───────────── TO INTERNAL
      LINE                                    LOGIC
                          ⌇  330 Ω
                          ⌇
                          ▽
```

FIGURE 5-3: TERMINATOR CIRCUIT

5.2.4 Head Load Options

All MFE Series 700 and 500 FDD units are configured at the factory so that the R/W head will be loaded and the stepper motor will be energized when the drive is selected. Three possible variants to this operational sequence can be implemented by the user. These are:

- HEAD LOAD OPTION 1 - Select drive without loading read/write head or enabling stepper motor.
- HEAD LOAD OPTION 2 - Select drive and enable stepper motor without loading head.
- HEAD LOAD OPTION 3 - Load head without selecting drive or enabling stepper motor.

5.2.4.1 Head Load Option 1

This mode of operation is useful when a drive must be selected at all times and head wear is to be minimized. In this mode the host controller would monitor the status outputs by selecting the drive and the read/write head would be loaded and the stepper motor energized by activating FDD input line 18, Head Load.

5.2.4.2 Head Load Option 2

This mode of operation permits a drive to be selected and a head positioning operation to be performed without loading the head, or with the door open and without a diskette installed. In this mode, Track 00 status can be monitored and the read/write head can be loaded by the host controller activating FDD input line 18, Head Load.

5.2.4.3 Head Load Option 3

This option is particularly useful for circumstances which require heads to be frequently loaded and unloaded and it is desirable to eliminate the resulting 35 millisecond delay. In this mode, drive select is "AND"ed with the head load, and the head is loaded and the stepper enabled by the host controller activating FDD input line 18, Head Load. Thus, whenever the controller attempts to select the drive, the drive will not actually be selected until the head load line, J1-18, is brought to a logical zero level.

5.2.4.4 Head Load Option Implementation

All head load options can be implemented by configuring the appropriate jumpers on the Printed Circuit Board (PCB). Table 5-2 and Figure 5-4 provide the information required to reconfigure these jumpers for each of the three options cited above.

TABLE 5-2

HEAD LOAD OPTION IMPLEMENTATION CHART

| HEAD LOAD OPTION	JUMPERS					
	HL-1	HL-2	HL-3	HL-4	SE-1	SE-2
STANDARD	---	FACTORY INSTALLED	FACTORY INSTALLED	FACTORY INSTALLED	FACTORY INSTALLED	---
1 SELECT DRIVE WITHOUT LOADING HEAD OR STEPPER. DRIVE SELECT ENABLES HEAD LOAD AND STEPPER.	ADD	DELETE	KEEP	KEEP	DELETE	ADD
2 SELECT DRIVE AND ENABLE STEPPER WITHOUT LOADING HEAD. HEAD IS LOADED FROM J1-18.	ADD	KEEP	DELETE	KEEP	KEEP	---
3 LOAD HEAD WITHOUT SELECTING DRIVE OR ENABLING STEPPER. LOAD HEAD AND ENABLE STEPPER FROM J1-18. DRIVE SELECT ENABLED WITH HEAD LOAD.	ADD	KEEP	KEEP	DELETE	DELETE	ADD
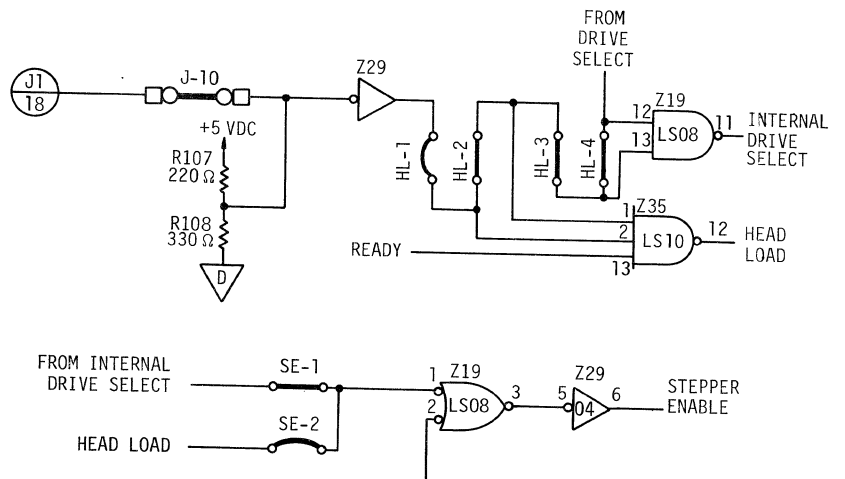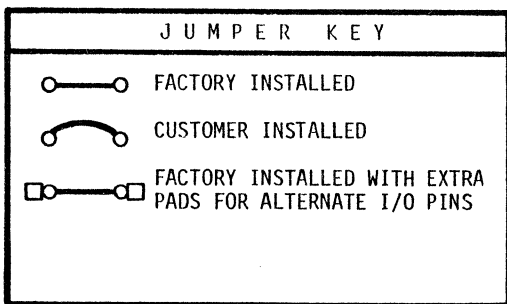
FIGURE 5-4: HEAD LOADING CIRCUITS

5.2.5   Radial Ready, Index, and Sector Options

The MFE Series 700 and 500 FDD units are configured at the factory to permit the host system to multiplex the Ready, Index, and Sector FDD output lines onto a three-line bus. These lines are multiplexed onto the bus when the drive is selected. The radial option permits all these lines to be enabled and available to the host system at all times. This feature can prove useful in detecting when an operator has removed or installed a diskette in any FDD unit. Also, with this option, average latency time can be reduced by monitoring the index/sector status signals at all times and selecting a drive just prior to the disk sector that is to be processed.

To install the radial ready option (refer to Figure 5-5):

     a)   Delete Jumper RR
   *b)   Delete Jumper J-4

To install the radial sector/index option (refer to Figure 5-5):

     a)   Delete Jumper RIS
   *b)   Delete Jumper J-6
   *c)   Delete Jumper J-7

*NOTE: When multiple FDDs are used in a radial output configuration, one unit need not have these jumpers removed. All other FDDs must have their outputs tied to alternate input/output pins. In this mode of operation two drives cannot share a common ready, index/sensor line. Jumpers J-4, J-6, and J-7 may be retained with the radial option only if independent (non-bussed) wires are assigned to every other FDD radial output.
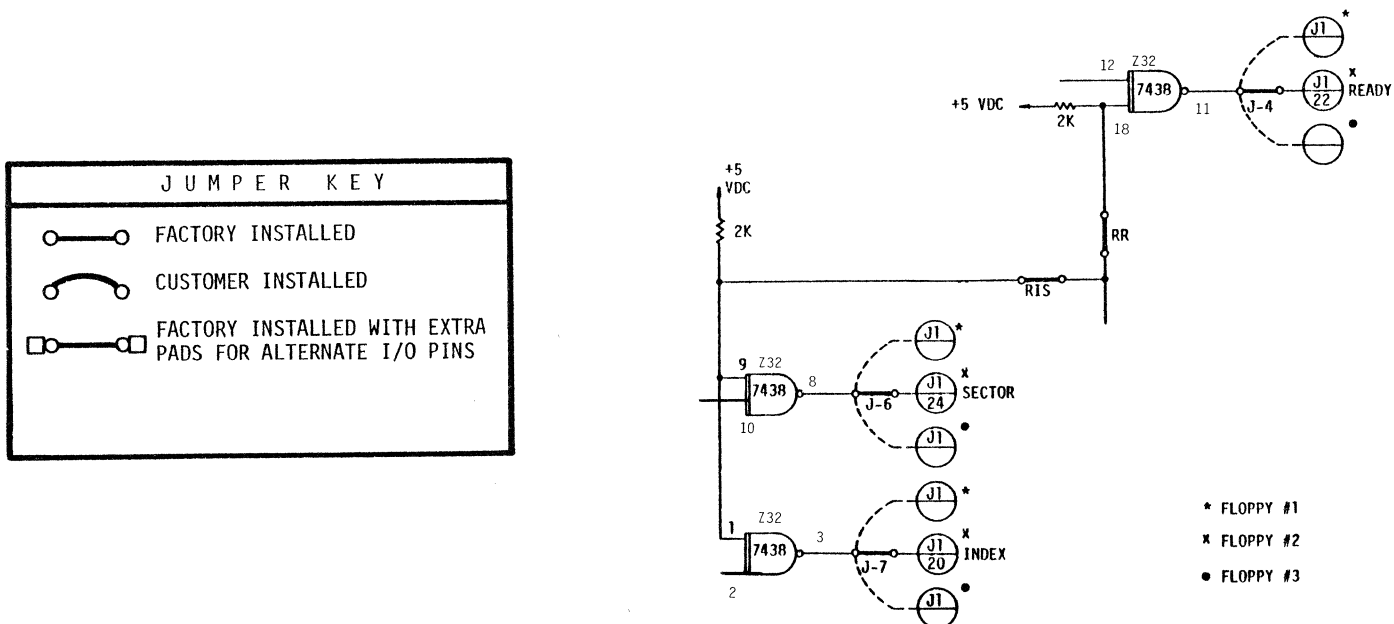

FIGURE 5-5:   RADIAL/SECTOR CIRCUIT

5-8

5.2.6   Schmitt Trigger Input Option

All MFE Series 700 and 500 FDD units come equipped with 7404 input buffers. For situations requiring greater noise immunity, these buffers can be replaced with 7414 buffers. To implement this option, simply locate circuits Z29 and Z43 on the PCB (refer to Figure 5-1 for exact location of these circuits), remove the 7404 dual in-line packaged integrated circuits (ICs) and insert the 7414 ICs.

5.2.7   In Use/Door Lock Option

If equipped with factory options G or H, the MFE Series 700 and 500 FDD units are set up so that when the drive is selected, the door solenoid will be activated. The user has the option of using line 16 to remotely control the locking (unlocking) of the FDD door. These options allow the user to either lock or unlock the door on the FDD by the use of a remote signal. The solenoid that is used to lock or unlock the door when power is applied is installed at the factory.

If the Door Lock option is installed, the user can remove the diskette if the system is shut down or loses power. If the Door Unlock option is installed, the diskette is locked in the FDD if power is removed for any reason. As shipped from the factory, the door will lock when the drive is selected (DOOR LOCK option only). With either factory option the user can control the solenoid remotely and has the choice (option) of whether a logical one or logical zero on line 16 will activate the solenoid.

To implement the control logic option, the following steps should be accomplished:

   A)   For a logical one control (from J1-16):
          1)   Delete/remove Jumpers DL-1 and DL-3
          2)   Add Jumper DL-2

   B)   For a logical zero control (from J1-16):
          1)   Add Jumper DL-3
          2)   Delete/remove Jumpers DL-1 and DL-2

   C)   For either option: add Jumper DL-∅.

Refer to Figure 5-6 for the circuit and Figure 5-1 for the physical location of these jumpers, respectively. (Jumper Key legend of Figure 5-7 applies.)

ADDENDUMTO SERIES 700/500 INTERFACE AND INSTALLATION MANUAL

MODEL 750/550 SERIES DRIVES MUST HAVE BASE PLATE RETURNED TO SYSTEM GROUND VIA THE QUICK DISCONNECT PROVIDED AT THE REAR OF THE DRIVE.

THE 24V RETURN AND THE $\pm$ 5V RETURN MUST BE CONNECTED TOGETHER AT THE SYSTEM POWER SUPPLY.

TK $\emptyset\emptyset$ IS VALID (LO @ J1 - 42) ON RESTORE AFTER TIME T ELAPSED, WHERE 1/T IS THE STEP RATE.
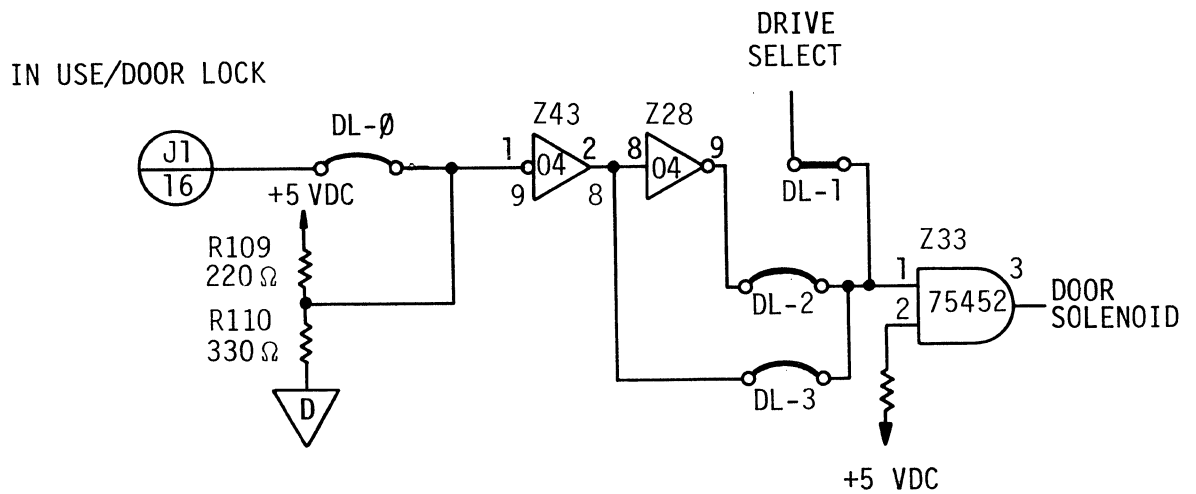
FIGURE 5-6: IN USE / DOOR LOCK CIRCUIT

5.2.8   Diskette Change

With this option, a status signal is transferred to the host controller via line 12, DISK CHANGE, when the drive changed from a READY to a NOT READY condition subsequent to the selection of the drive. To install this option refer to Figures 5-1 and 5-7 below and locate circuits Z41 and Z42. Insert IC 74LS74 into the Z41 location and IC 7438 into the Z42 location. Finally, add jumper J-5 as indicated.
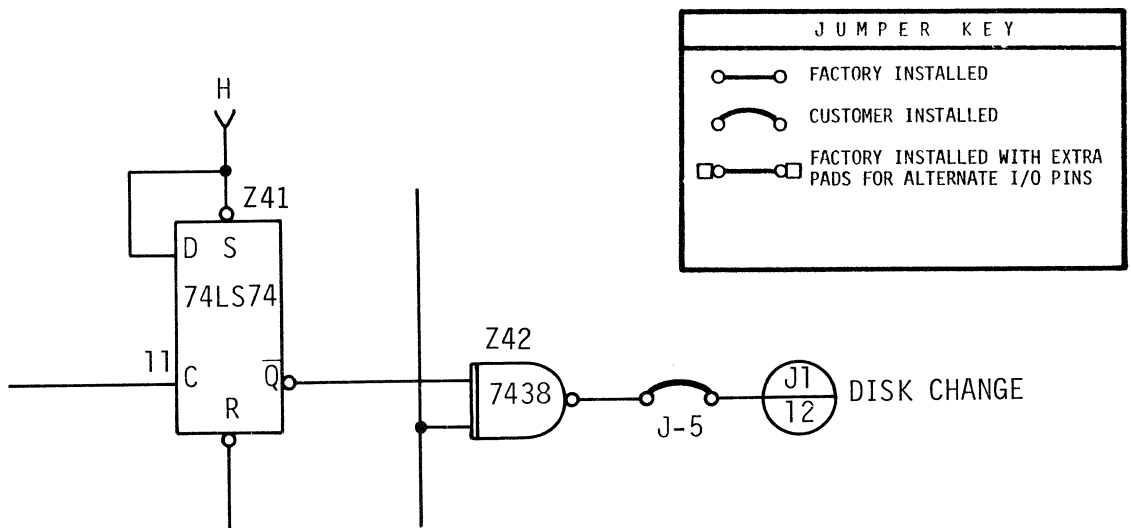

FIGURE 5-7: DISK CHANGE

5.2.9   Power Saver Option

On MFE Series 700 and 500 FDD units with brushless DC motors (Models 550, 551, 750, 751), the user has the ability to install an option that will disconnect the motor when the drive is not selected. This feature reduces the load on the 24 VDC power source and lowers the power dissipation of the drive assembly. To install this option, refer to Figures 5-1 and 5-8 below and identify the location of circuit Z42. Insert IC 7438 into the location of Z42 and add jumper J-9 as indicated. The power saving feature is enabled from the host controller by applying a logical zero to line 10, Power Reduction, when the drive is de-selected.

WHEN THE DRIVE IS RE-SELECTED, THE HOST CONTROLLER MUST WAIT TWO SECONDS BEFORE ANY VALID CONTROL OR DATA SIGNALS CAN BE PROCESSED.
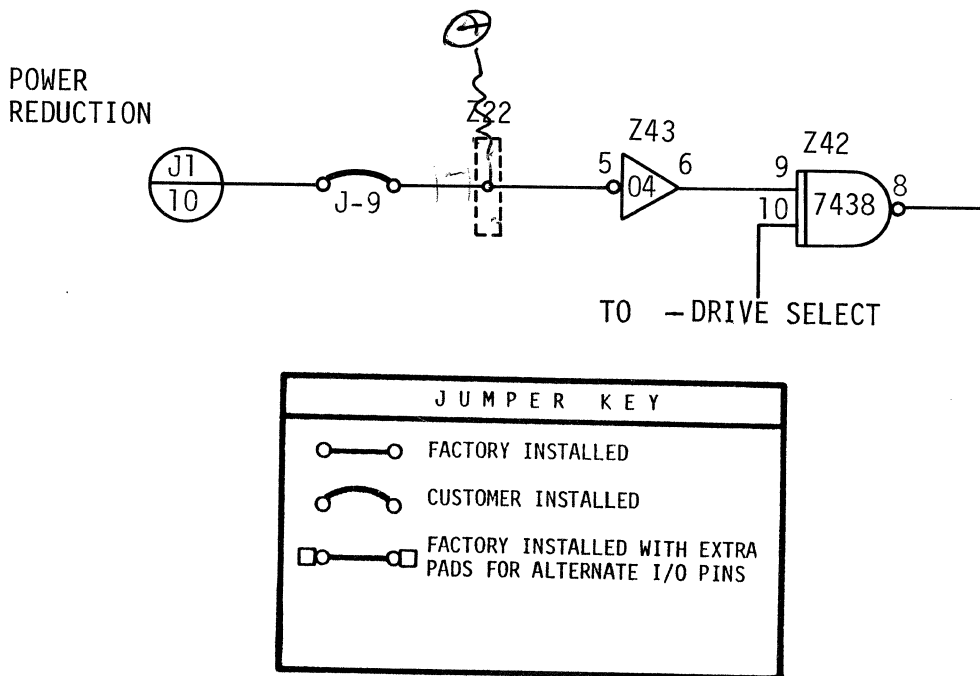

FIGURE 5-8:   POWER SAVER OPTION

5.2.10   Step In / Step Out Option

The standard head positioning operation of the MFE Series 700 and 500 FDDs involves the use of a direction signal on input line 34 followed by a STEP pulse on input line 36. The user has the option of re-configuring the FDD circuit to accept a STEP-IN pulse on line 36 and a STEP-OUT pulse on line 34. Thus, head position in one direction can be accomplished by activating only one line. To implement this option refer to Figure 5-9 below and:

a)   Add Jumper SS-3
b)   Add Jumper SS-4
c)   Delete/remove Jumper SS-1
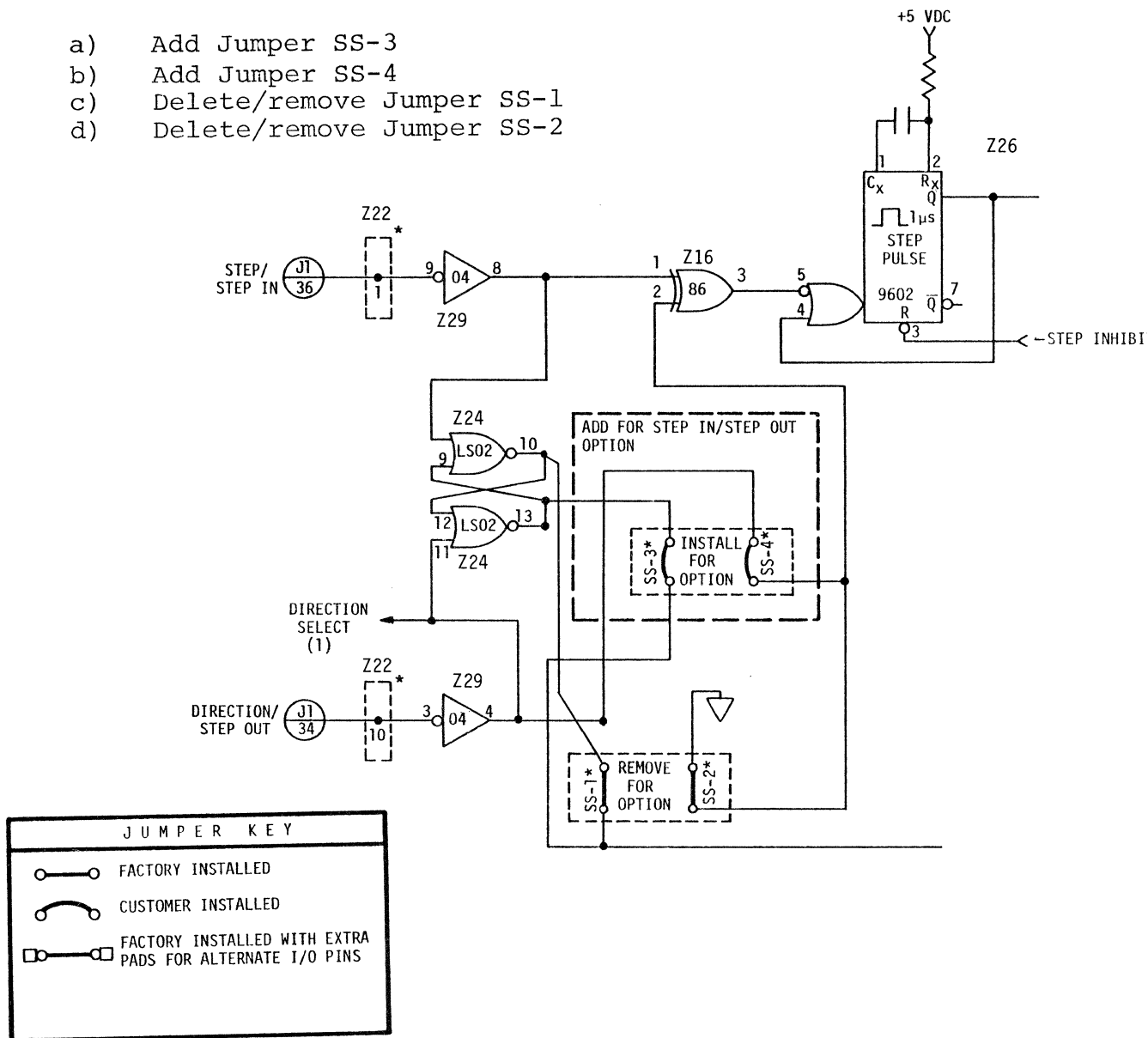d)   Delete/remove Jumper SS-2

FIGURE 5-9: STEP-IN / STEP-OUT OPTION

5.2.11   Write Protection (Inhibit) Option

When the factory installed WRITE PROTECT Sensor option has been implemented, the FDD will provide a write protect status signal via output line 44 and will be inhibited from writing when a write protected diskette is used (refer to Section 4.0). The user has the option of disabling the inhibit function and using the output of the write protect sensor only as a status signal.

To delete the inhibit function on an FDD that contains the WRITE PROTECT sensor factory option, the following jumpers should be modified:

a)   Delete/remove Jumper WP-1
b)   Add Jumper WP-2

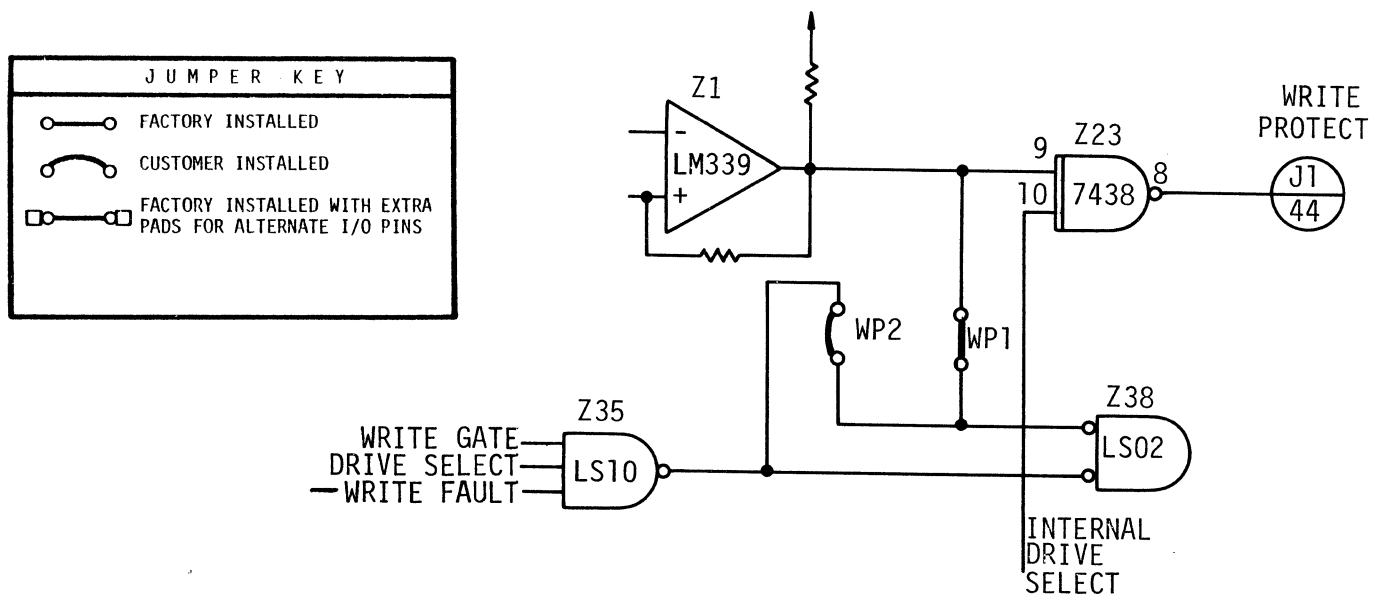Figure 5-10 illustrates the key features of the applicable circuit.

FIGURE 5-10:   WRITE PROTECTION (INHIBIT) CIRCUIT

5.2.12   Diskette Type Option

The MFE Series 700 double-sided FDD units have, as factory options, the ability to use single-sided disketts and/or flippy diskettes (Option C). With this option, an additional LED-photo-transistor assembly is installed at the factory. When the drive is equipped with this option it may be helpful to the user to know if a double-sided or single-sided/flippy diskette is installed. This option will provide a logical level one on FDD output line 2 when a double-sided diskette has been inserted. The absence of a logical one on this line will indicate that a single-sided or flippy diskette is in the FDD. (The FDD will not differentiate between single-sided and flippy diskettes.)

To install this user option on an FDD that has been equipped with a SINGLE SIDE / FLIPPY DISK Sensor, the following actions are required:

a)   Identify and locate circuit Z41 on the PCB and insert IC 74LS74 into this location.

b)   Identify and locate circuit Z42 on the PCB and insert IC 7438 into this location.

c)   Add Jumper J-3.

Figure 5-11 indicates the circuit modifications required to effect this option.
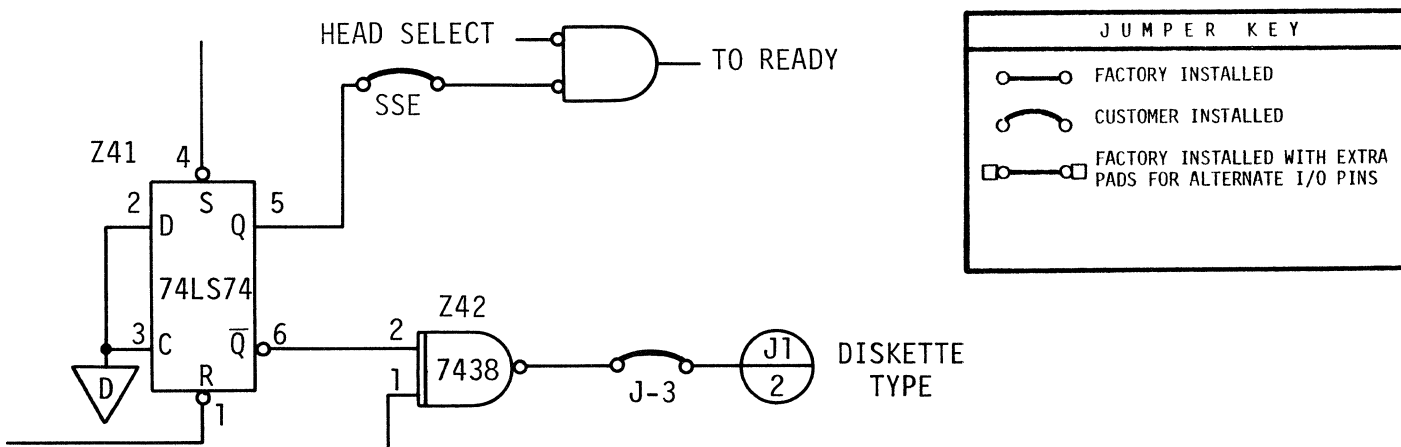

FIGURE 5-11:   DISKETTE TYPE OPTION

If Jumper SSE is installed along with the addition of Z36, and an attempt is made to read or write on side 1 of a single-sided or flippy diskette, the READY signal on J1-22 will change to a logical one (NOT READY). In this application, an additional/alternate input/output line is not required to detect diskette type.

5.2.13   Write Fault Output Option

All MFE Series 700 and 500 FDD units have an integral write fault circuit. This circuit detects errors that might occur during the WRITE operation and causes the READY line to change to a NOT READY state. Errors that will cause this circuit to indicate a NOT READY condition are:

- Multiple heads selected (700 Series Only)
- No erase current
- No data written
- Head not loaded
- Attempting to step while writing or erasing.

The write fault latch is cleared when the drive is de-selected and then re-selected, provided the fault has been removed.

The user has, as an option, the ability to have a write fault condition transferred as a separate signal on a dedicated status line (FDD output line 4). The circuit changes, which are shown in Figure 5-12, require only the addition of Jumper J-8 and the addition of Z42, a 7438 IC.
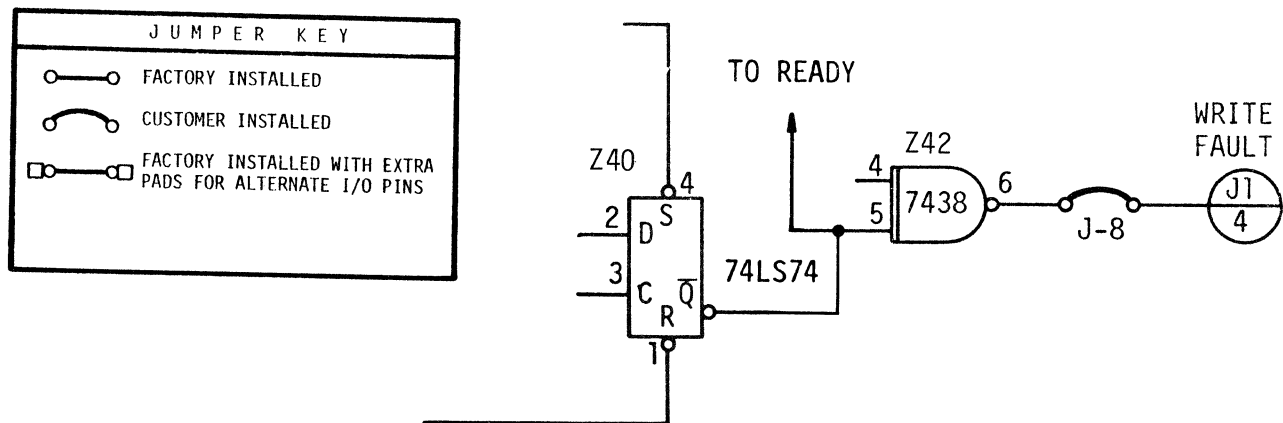

FIGURE 5-12: WRITE FAULT CIRCUIT

5-15

5.2.14   Separated Data Option (Option A)

All MFE Series 700 and 500 FDD units have, as a factory option, the capability of providing separate data and clock signals. This feature, which is in addition to the standard combined clock and data (raw data) signal, is applicable only when a FM (single density) recording scheme is used. The use of the separate data and clock outputs is available to the user when the Data Separator, factory option A, has been implemented. No further user installed options are required and the separate data and clock signals appear on FDD output line 49 (SEP DATA), and line 50 (SEP CLOCK).

The data separator circuit has one standard and one optional, customer enabled mode of operation. Figure 5-13 displays the data pulse trains appearing at the Read Data (Line 46) and also at output lines 49 and 50 when the data separator options are used.

The Mode 1 operation detects and allows for up to four missing clocks; while Mode 2 configuration delivers clock and data signals that are compatible with older FDDs.
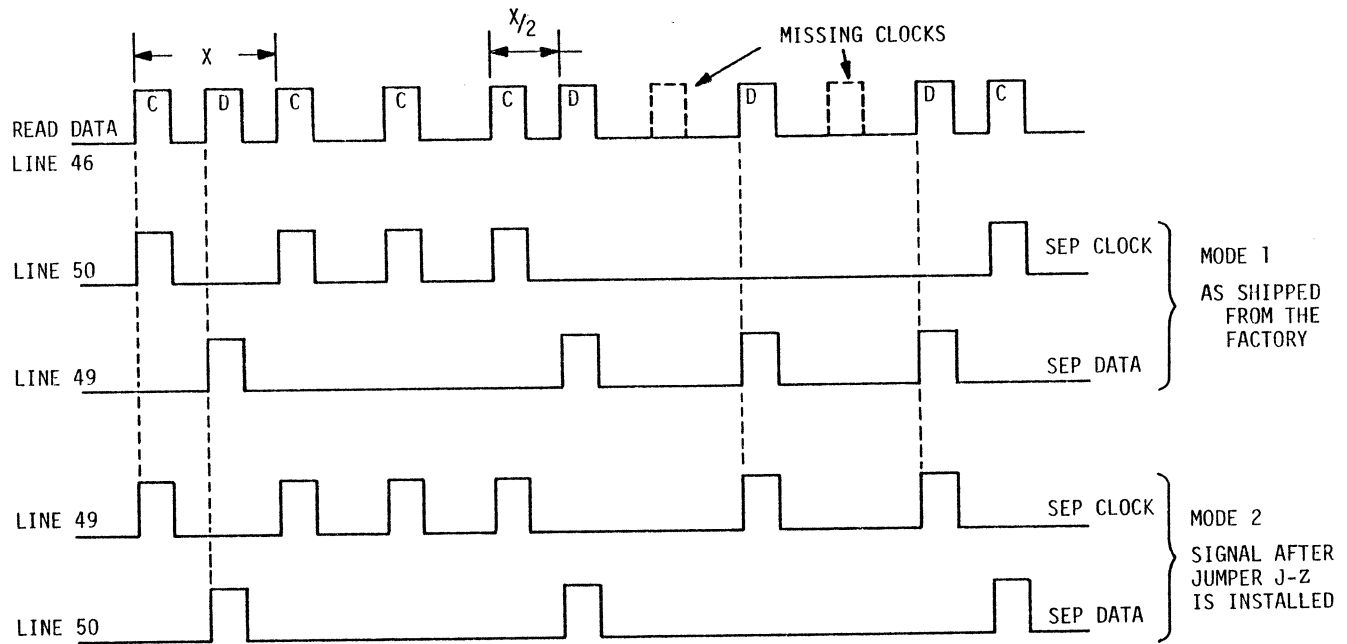

FIGURE 5-13:   DATA PULSE TRAINS

5-16

5.2.15 Hard to Soft Sector Conversion Option

All MFE Models 701, 751, 501, and 551 are universal from a standpoint of accepting hard or soft sectored disks. Although these models are configured for operation with hard sectored disks, they can be easily converted to a soft sectored disk capability that is IBM 3740 compatible.

Conversion can be accomplished by the user by simply re-adjusting the settings of switch S1 as follows:

- To enable soft sectoring:
  1) Set S1-5 to ON position
  2) Set S1-6 to OFF position

- To enable hard sectoring:
  1) Set S1-6 to ON position
  2) Set S1-5 to OFF position

NOTE: S1-5 and S1-6 should not be placed in the ON position at the same time.

5.2.16 Minus Five Volt Option

All MFE Series 700 and 500 FDD units are configured to operate with a -5 VDC ± 5% input. These units are, however, capable of operating with an unregulated input from -7 to -17 volts DC in lieu of the -5 VDC source. To enable this optional feature, the user simply must remove Jumper J-12.

5.2.17   Alternate Data and Control Signal Input/Output Pins (J1)

As indicated in Figure 3-2, all active lines on the data and control signal interface between the FDD and host controller system have been assigned to a standard or optional function. If additional input/output lines are required, pins 3, 5, 7, 9, 11, 13, 15, 25, and 27 can be used. These pins have been connected to ground at the factory with jumpers J-15 through J-23 which can be cut to free the pin.

TABLE 5-3

ALTERNATE PIN IMPLEMENTATION

PIN	ASSIGNED OPTIONAL USE
2	Diskette Type
4	Write Fault Output
6	Low Current Input
8	Double Track Enabled
10	Power Saver
14	Head Select

5.2.18   Alternate Head Select Option

On all MFE Series 700 FDD units, the user has an option of using the "DIRECTION" control line (line 34) to select the read/write head in addition to controlling the direction of head motion when step pulses are applied. A logical zero on line 34 selects side 1 read/write head, while a logical one selects side 0 read/write head.

THIS OPTION CANNOT BE USED WHEN THE STEP-IN / STEP-OUT
OPTION (see Paragraph 5.2.10) IS USED.

To implement this option:

    a)   Add Jumper HS-3
    b)   Delete/remove Jumper HS-1
    c)   Delete/remove Jumper J-11
    d)   Delete/remove Jumper HS-2 if installed

5-18

When the Alternate Head Select Option is installed, the head select control line (line 14) is not required and can be used as an alternate input/output pin.

5.2.19   Binary Option

The selection of FDD units in a multiple drive configuration using the four standard drive select lines is discussed in Sections 3.5 and 3.6 of this manual. The binary select option enables the customer to use the same four basic select lines (lines 26, 28, 30, and 32) to select and control up to eight different drives.

Implementation of the binary select option requires the addition of Z21, which is an SN74LS85 digital comparator IC, and the addition of appropriate jumpers. Switch S1, Sections 1 through 4, must also be completely opened.

When binary selection is employed drive select lines 4, 3, and 2 (interface lines 32, 30, 28) are used as a parallel binary address bus having eight states or counts (0 —7). Drive select line 4 represents the MSB and drive select line 2 represents the LSB. The fourth line, drive select line 1, is employed as an enable line and inhibits drive selection when at a logical one.

Each drive may be configured by jumpers BS1, BS2, and BS3 to respond to any one of the eight possible counts or addresses. Table 5-4 indicates the proper jumper installation for address assignment, and Figure 5-14 presents a schematic representation of an eight-drive arrangement with binary select. In this configuration, either the head select line (j1-14) or the alternate head select via the direction line must be used (700 Series models only).

TABLE 5-4

BINARY SELECT OPTION IMPLEMENTATION CHART

ADDRESS NUMBER	DRIVE SELECT LINE STATES			JUMPER INSTALLATION		
	DRIVE SEL 4 J1-32	DRIVE SEL 3 J1-30	DRIVE SEL 2 J1-28	BS 3	BS 2	BS 1
0	HIGH	HIGH	HIGH			
1	HIGH	HIGH	LOW			X
2	HIGH	LOW	HIGH		X	
3	HIGH	LOW	LOW		X	X
4	LOW	HIGH	HIGH	X		
5	LOW	HIGH	LOW	X		X
6	LOW	LOW	HIGH	X	X	
7	LOW	LOW	LOW	X	X	X

JUMPER BS-0 must also be installed.
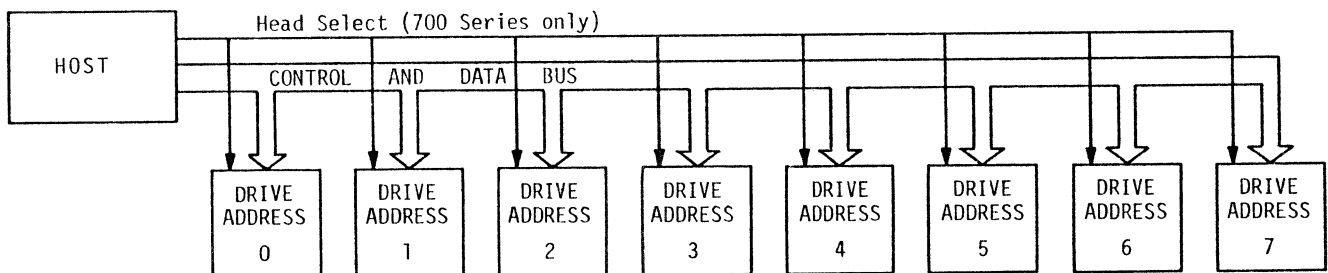
FIGURE 5-14: BINARY SELECT OPTION CONFIGURATION

5.2.20   Binary Select with Alternate Head Select

The binary select option described in Paragraph 5.2.19 can also be used to allow four Series 700 double-sided FDDs to replace eight single-sided drives. In this configuration, which is shown in Figure 5-15, Switch S1-7 is closed (ON) and each double-sided drive will function as two single-sided drives.
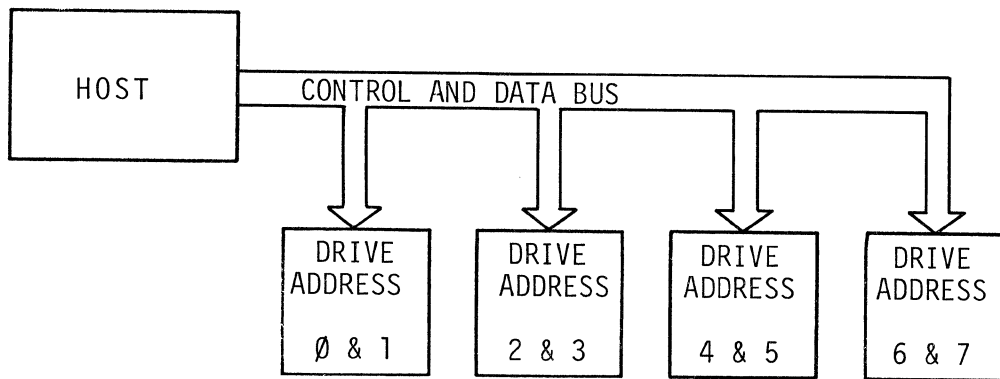

FIGURE 5-15:   BINARY SELECT WITH ALTERNATE
                HEAD SELECT CONFIGURATION

To implement this option, S1-7 should be ON in each double-sided drive and the BS jumpers should be added per the instructions contained in Table 5-5.

TABLE 5-5

BINARY SELECT WITH ALTERNATE HEAD SELECT OPTION
IMPLEMENTATION CHART

ADDRESS NUMBER	DRIVE SELECT LINE STATES			JUMPERS INSTALLED			DRIVE NUMBER / SIDE
	SELECT 4 J1-32	SELECT 3 J1-38	SELECT 2 J1-28	BS-3	BS-2	BS-1	
0	HIGH	HIGH	HIGH				Drive 1 / Side 0
1	HIGH	HIGH	LOW				Drive 1 / Side 1
2	HIGH	LOW	HIGH		X		Drive 2 / Side 0
3	HIGH	LOW	LOW		X		Drive 2 / Side 1
4	LOW	HIGH	HIGH	X			Drive 3 / Side 0
5	LOW	HIGH	LOW	X			Drive 3 / Side 1
6	LOW	LOW	HIGH	X	X		Drive 4 / Side 0
7	LOW	LOW	LOW	X	X		Drive 4 / Side 1

5.3   Manual Erase

For application requiring more precise control of the tunnel erase function, manual erase control via J1-6 is available. To use this option, factory option D must be installed, automatic Track 43 Switch. To enable J1-6 to be used for erase control the following actions must be accomplished:

   a) Delete J-13
   b) Delete J-25
   c) Add J-24
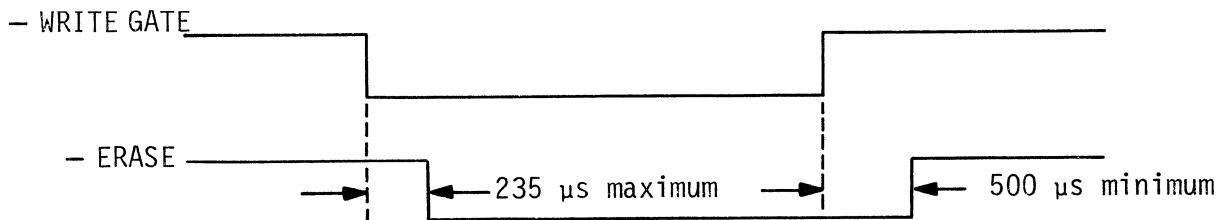   d) Delete C-14

FIGURE 5-16: MANUAL ERASE CONFIGURATION

5.4   Double Track Density Option (Future)

In the near future, MFE will introduce a new high performance double track density carriage assembly. With this new carriage assembly and the addition of a jumper to the PCB, the storage capacity of any Series 700 or 500 FDD can be doubled. When this option is installed, the number of available tracks per side of each diskette is increased from 77 to 154.

To implement this option, the OEM/user will need only replace the existing carriage assembly with the new carriage assembly and add jumper DTE to the PCB. The installation of this jumper will enable the FDD to accept the 154-track stepping feature and will also increase the stepping rate from 3 to 1.5 milliseconds per track.
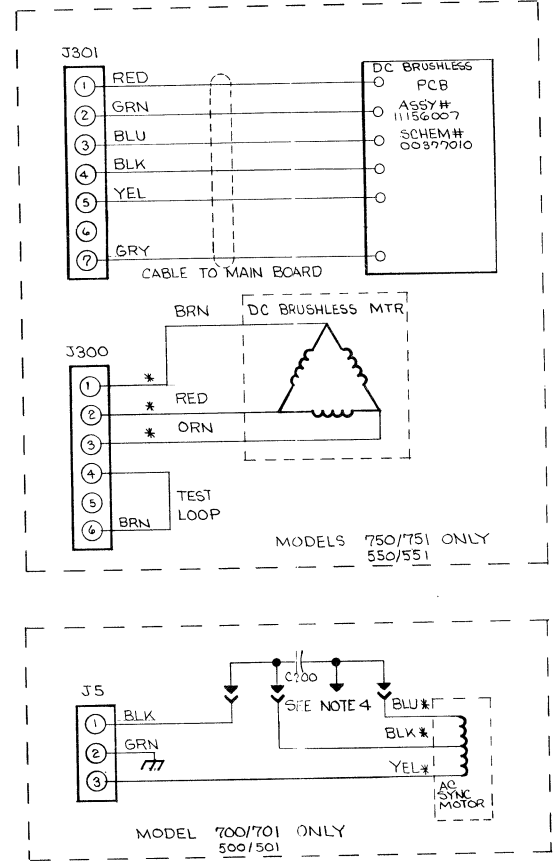
6.0 SCHEMATIC

This section contains schematic diagrams for all the electronic circuits used in the MFE Series 700 and 500 Flexible Disk Drives.

DIAGRAM INTERCONNECTION FD
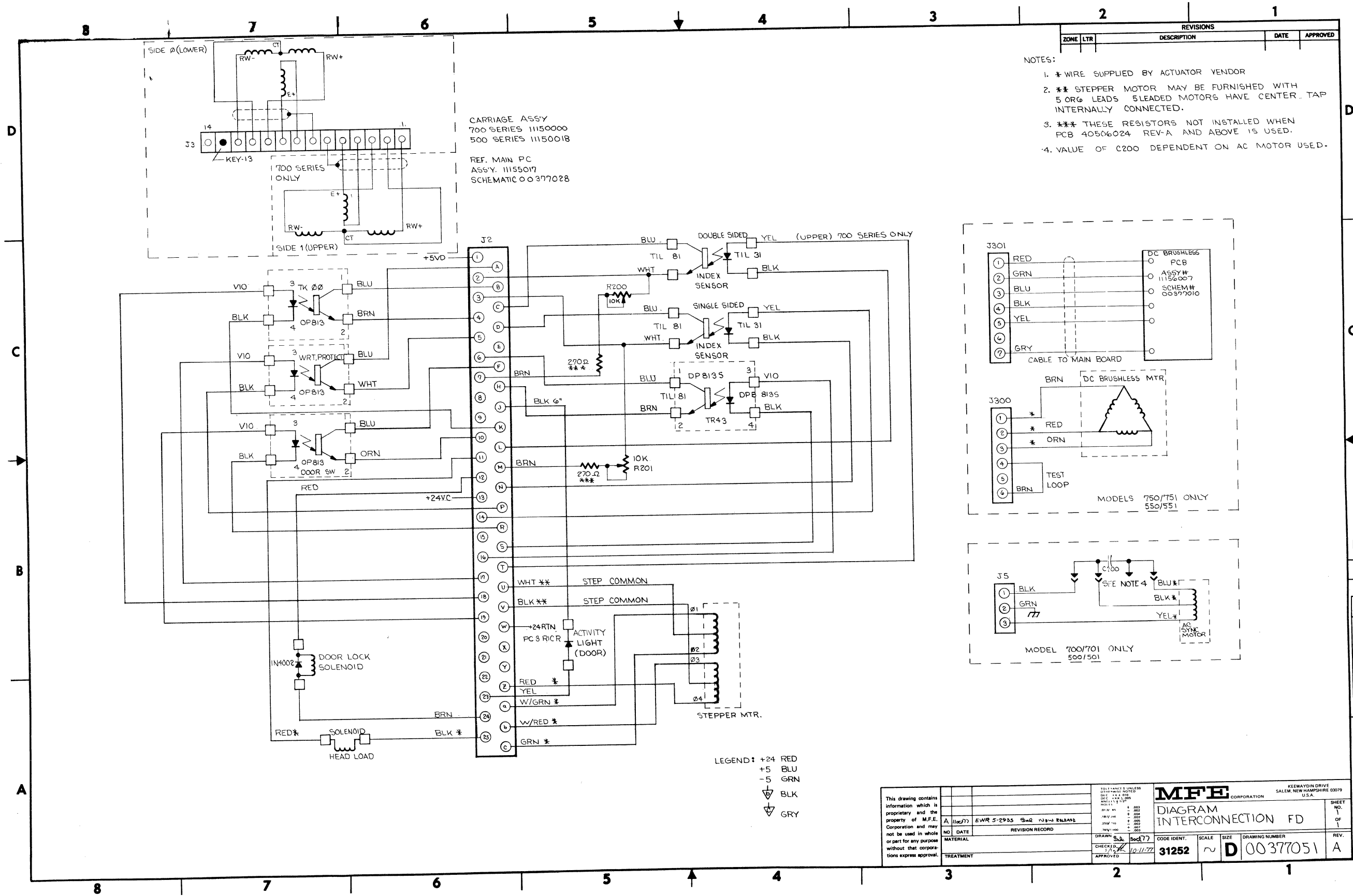
NOTES:
1. ✳ WIRE SUPPLIED BY ACTUATOR VENDOR
2. ✳✳ STEPPER MOTOR MAY BE FURNISHED WITH 5 ORG LEADS 5 LEADED MOTORS HAVE CENTER TAP INTERNALLY CONNECTED.
3. ✳✳✳ THESE RESISTORS NOT INSTALLED WHEN PCB 40506024 REV-A AND ABOVE IS USED.
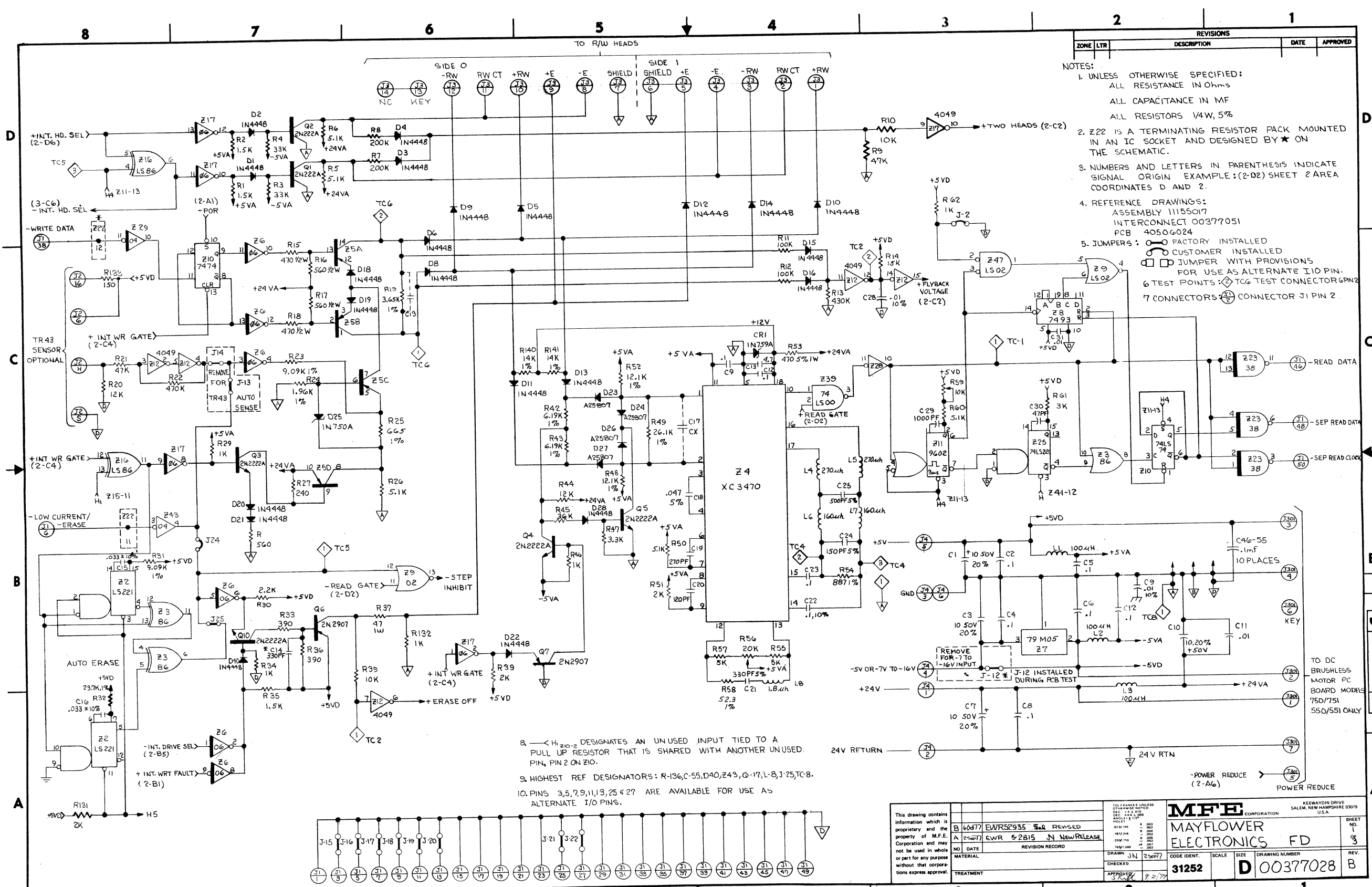4. VALUE OF C200 DEPENDENT ON AC MOTOR USED.

CARRIAGE ASS'Y
700 SERIES 11150000
500 SERIES 11150018

REF. MAIN PC
ASS'Y. 1155017
SCHEMATIC 00377028

LEGEND: +24 RED
+5 BLU
-5 GRN
▽ BLK
▽ GRY

MODELS 750/751 ONLY 550/551

MODEL 700/701 ONLY 500/501

STEPPER MTR.

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U.S.A.

DIAGRAM INTERCONNECTION FD

CODE IDENT. 31252   SCALE ~   SIZE D   DRAWING NUMBER 00377051   REV. A

SHEET NO. 1   OF 1

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	EWR 5-2933 ___ NEW RELEASE		

Mayflower Electronics FD — Schematic Drawing No. D 00377028, Rev. B, Sheet 1 of 3. MFE Corporation, Keewaydin Drive, Salem, New Hampshire.

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTANCE IN Ohms
   ALL CAPACITANCE IN MF
   ALL RESISTORS 1/4W, 5%
2. Z22 IS A TERMINATING RESISTOR PACK MOUNTED IN AN IC SOCKET AND DESIGNED BY ★ ON THE SCHEMATIC.
3. NUMBERS AND LETTERS IN PARENTHESIS INDICATE SIGNAL ORIGIN EXAMPLE: (2-D2) SHEET 2 AREA COORDINATES D AND 2.
4. REFERENCE DRAWINGS:
   ASSEMBLY 1155017
   INTERCONNECT 00377051
   PCB 40506024
5. JUMPERS: FACTORY INSTALLED / CUSTOMER INSTALLED / JUMPER WITH PROVISIONS FOR USE AS ALTERNATE I/O PIN.
6. TEST POINTS: TC6 TEST CONNECTOR 6PIN2
7. CONNECTORS: CONNECTOR J1 PIN 2
8. DESIGNATES AN UNUSED INPUT TIED TO A PULL UP RESISTOR THAT IS SHARED WITH ANOTHER UNUSED PIN. PIN 2 ON Z10.
9. HIGHEST REF DESIGNATORS: R-136, C-55, D40, Z43, Q-17, L-8, J-25, TC-8.
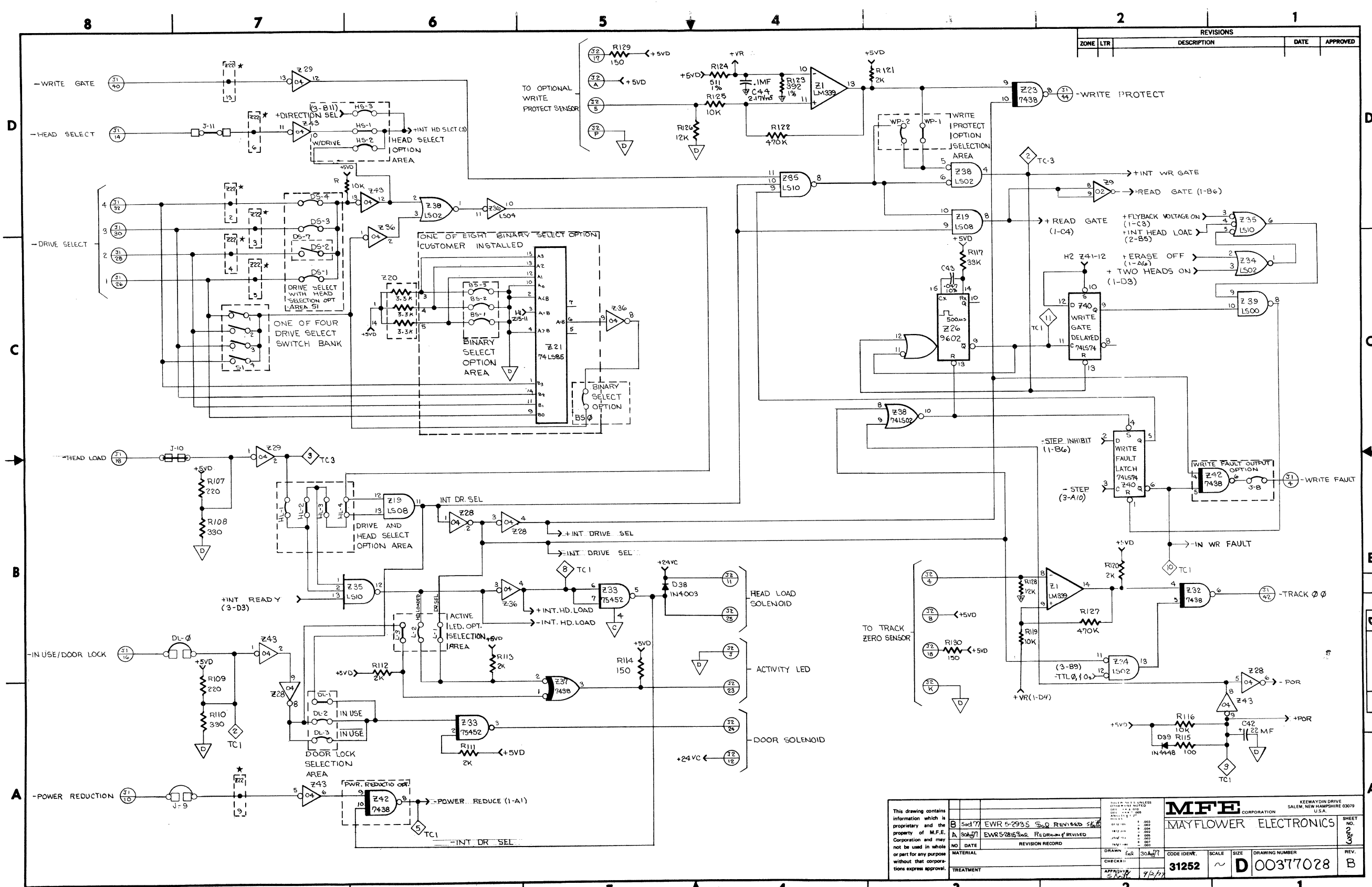10. PINS 3,5,7,9,11,13,25 & 27 ARE AVAILABLE FOR USE AS ALTERNATE I/O PINS.

NOTES:
SPECIAL INSTRUCTIONS

1. Q307 DO NOTE INSTALL UNTIL AFTER WAVE, SOLDER FROM BOTTOM.

2. E301-E306 INSTALL AFTER WAVE SOLDER FROM BACK SIDE OF BOARD.

3. INSTALL BRACKET AFTER WAVE SOLDER WITH SENSOR PRE ASSEMBLED TO BRACKET AND SPACER'S UNDER P303(32144065) QTY(2) UNDER 20237012 SENSOR

4. INSTALL Q301-306 FACE DOWN WITH PLASTIC SCREWS 50068006 AND NUTS 50029029

5. FOR P.C. BOARD SEE DWG. 40506016.

6. FOR SCHEMATIC SEE DWG. 00377010.

SEE NOTE 3

SEE NOTE 4

SEE NOTE 1

REVISION RECORD

NO	DATE	
A		EWR 52951 JN RELEASE
		2M 106 8Ω

MATERIAL

TREATMENT

TOLERANCES UNLESS OTHERWISE NOTED

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PCB BRUSHLESS MOTOR ASSEMBLY

DRAWN
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CODE IDENT.	SCALE	SIZE	DRAWING NUMBER	REV.
31252	2/1	D	11156007	A

SHEET NO. OF 4

SCHEM DC BRUSHLESS

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U.S.A.

CODE IDENT. 31252 SIZE D DRAWING NUMBER 00377010 REV. A

MFE
MAYFLOWER ELECTRONIC

31252 ~ E 003770028 B

MFE CORPORATION
Keewaydin Drive
Salem, NH 03079

603-893-1921

Enclosed are instructions for the implementations of CUSTOMER
INSTALLED OPTIONS for MFE Flexible Disk Drive P.C.B. Assembly
#11155009 Only.

Table of Contents

SPEC # 06001374

INSTRUCTIONS FOR IMPLEMENTATION OF CUSTOMER INSTALLED OPTIONS FOR FDD PCB ASSY 11155009

- REFER TO THE INSTRUCTION MANUAL FOR FURTHER DETAILS -

SEP 15 1978

NO	DATE	REVISION RECORD
A	12·20·77	EWR 53305

MATERIAL

TREATMENT

TOLERANCES UNLESS OTHERWISE NOTED		
DEC. XX ± .010		
DEC. XXX ± .005		
ANGLES ± 1/2°		
HOLES:		
.013/.185	+	.003
	−	.002
.187/.246	+	.004
	−	.002
.250/.750	+	.005
	−	.002
.765/1.000	+	.007
	−	.003

DRAWN cmc 1/17/77

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U.S.A.

CUSTOMER INSTALLED OPTIONS

CODE IDENT.	SCALE	SIZE	DRAWING NUMBER	REV.
31252		A	06001374	A

SHEET NO.
1 OF 12

OPTIONS MARKED WITH ASTERISK (*) INDICATE AS SHIPPED CONFIGURATION.

SELECT DRIVE

DESC	JUMPERS		CUST. OPT. NO.
	ADD	DELETE	
1. * Select drive from drive select lines (SD Ø selected)	SW1, 2, 3 or 4 (one only) on		3
2.* Select drive SD 1 from drive select lines. (One double side drive looks like two single side drives.) Used with 1 above	DS-1, DS-2, DS-3 or DS-4 HS-2 (only one)	HS-1, HS-3	3
3. Binary select code from drive select lines (SD Ø selected.)	BS-1, BS-2, BS-3 or desired combinations, and BSØ	SW-1,2,3,&4 must be open	18

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NO	DATE	REVISION RECORD
A	12·20·77	EWR 53305 Clal

MATERIAL

TREATMENT

TOLERANCES UNLESS OTHERWISE NOTED
DEC. XX ± .010
DEC. XXX ± .005
ANGLES ± 1/2°
HOLES:

.013/.186	+	.003
	−	.002
.187/.246	+	.004
	−	.002
.250/.750	+	.005
	−	.002
.765/1.000	+	.007
	−	.003

DRAWN ᴊᴍˢ 11/17/77
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CUSTOMER INSTALLED OPTIONS

SHEET NO. 2 OF 12

CODE IDENT.	SCALE	SIZE	DRAWING NUMBER	REV.
31252		A	06001374	A

HEAD LOAD

DESC	JUMPERS		CUST. OPT. NO.
	ADDED	DELETED	
1.* Head loaded when drive is selected	HL-4, HL-3, HL-2, J-10	HL-1	5
2. Head loaded when Head Load input, J1-18, activated. Head load independent of drive sel	HL-1, HL-2 HL-4 J-10	HL-3	6
3. Head loaded when Head Load input, J1-18 activated and drive is selected	HL-1, HL-3 H-4 J-10	HL-2	4
4. Int. Drive Select is enabled when the head is loaded from J1-18 Head Load input and the drive is selected via J1. (Pins 26-32)	HL-1, HL-2 HL-3, J-10	HL-4	3

SEP 15 1978

NO	DATE	REVISION RECORD
A	12-20-77	EWR 53305

MATERIAL

TREATMENT

TOLERANCES UNLESS OTHERWISE NOTED
DEC. XX ± .010
DEC. XXX ± .003
ANGLES ± 1/2°
HOLES:

.013/.185	+	.003
	−	.002
.187/.246	+	.004
	−	.002
.280/.750	+	.005
	−	.002
.765/1.000	+	.007
	−	.003

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CUSTOMER INSTALLED OPTIONS

SHEET NO. 3 OF 12

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CODE IDENT.	SCALE	SIZE	DRAWING NUMBER	REV.
31252		A	06001374	A

ACTIVITY LED/DOOR LOCK

DESC	JUMPERS		CUST. OPT. NO.
	ADDED	DELETED	
1.* LED activated by drive select	L-1	L-2, L-3	2
2. LED activated by In Use input J1-16	L-3, DL-Ø	L1, L2	2 .14
3. Door solenoid activated by drive select	DL-1	DL-2, DL-3	14
4.* Door solenoid activated by In Use input J1-16 (active low input)	DL-3 DL-Ø	DL-1, DL-2	14
5. Same as above except active high input	DL-2 DL-Ø	DL-3 DL-1	14
6. Led activated by head load	L-2	L-1, L-3	2

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NO	DATE	REVISION RECORD
A	12/20/77	EWR 53305

MATERIAL

TREATMENT

TOLERANCES UNLESS OTHERWISE NOTED
DEC. .XX ± .010
DEC. .XXX ± .005
ANGLES ± 1/2°
HOLES:

.013/.185	+	.003
	−	.002
.187/.246	+	.004
	−	.002
.250/.750	+	.005
	−	.002
.765/1.000	+	.007
	−	.003

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CUSTOMER INSTALLED OPTIONS

SHEET NO. 4 OF 12

CODE IDENT.	SCALE	SIZE	DRAWING NUMBER	REV.
31252		A	06001374	A

STEPPER ENABLE

| DESC | JUMPERS | | CUST. OPT. NO. |
	ADDED	DELETED	
1.* Stepper enabled when drive is selected	SE-1	SE-2	3
2. Stepper enabled when head is loaded	SE-2	SE-1	3

SEP 15 1978

NO	DATE	REVISION RECORD
A	12/23/77	EWR 53305

MATERIAL

TREATMENT

TOLERANCES UNLESS OTHERWISE NOTED
DEC. .XX ± .010
DEC. .XXX ± .005
ANGLES ± 1/2°
HOLES:

.013/.185	+ .003 / − .002
.187/.246	+ .004 / − .002
.250/.750	+ .005 / − .002
.765/1.000	+ .007 / − .003

DRAWN

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CUSTOMER INSTALLED OPTIONS

SHEET NO. 5 OF 12

CODE IDENT.	SCALE	SIZE	DRAWING NUMBER	REV.
31252		A	06001374	A

INDEX/SECTOR

DESC		JUMPERS		CUST. OPT. NO.
		ADDED	DELETED	
1. Soft sectored 700/750		SW-5 on	SW-6 off	
2. Hard sectored 701/751 Select One { 32 sectors * 16 sectors 8 secotrs a 701/751 can be converted to soft sectoring by changing to the switch to configuration #1 above		SW-6 on HS-32 HS-16 SW-7 ON	SW-5 off SW-7 off SW-7off, HS-16 HS-32, SW-7 off HS-16, HS-32	1

SEP 15 1978

NO	DATE	REVISION RECORD
A	12/20/7?	ENR 53305

MATERIAL

TREATMENT

TOLERANCES UNLESS OTHERWISE NOTED
DEC. .XX ± .010
DEC. .XXX ± .005
ANGLES ± 1/2°
HOLES:

.013/.125	+	.003
	−	.002
.187/.246	+	.004
	−	.002
.250/.750	+	.005
	−	.002
.765/1.000	+	.007
	−	.003

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CUSTOMER INSTALLED OPTIONS

SHEET NO. 6 OF 12

DRAWN

CHECKED

APPROVED

CODE IDENT.	SCALE	SIZE	DRAWING NUMBER	REV.
31252		A	06001374	A

WRITE PROTECT

DESC	JUMPERS		CUST. OPT. NO.
	ADDED	DELETED	
1.* Prevent writing on a write protected diskette when this option is installed controller is notified	WP-1	WP-2	16
2. Write on a write protected diskette and notify controller	WP-2	WP-1	16

SEP 15 1978

NO	DATE	REVISION RECORD
A	12/30/77	EWIR 53305

MATERIAL

TREATMENT

TOLERANCES UNLESS OTHERWISE NOTED
DEC. .XX ± .010
DEC. .XXX ± .005
ANGLES ± 1/2°
HOLES:

.013/.185	+	.003
	±	.002
.187/.246	+	.004
	±	.002
.250/.750	+	.005
	±	.002
.765/1.000	+	.007
	±	.003

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KEEWAYDIN DRIVE
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CUSTOMER INSTALLED OPTIONS

DRAWN

CHECKED

APPROVED

CODE IDENT.	SCALE	SIZE	DRAWING NUMBER	REV.
31252		A	06001374	A

STEP IN/STEP OUT

DESC	JUMPERS		CUST. OPT. NO.
	ADDED	DELETED	
1. Accept step pulses on J1-36 and direction commands * on J1-34	SS-1 SS-2	SS-3 SS-4	3
2. Accept step in pulses on J1-36 and step out pulses on J1-34	SS-3 SS-4	SS-1 SS-2	15

SEP 15 1978

NO	DATE	REVISION RECORD
A	12/20/77	EWR 53305 Val

MATERIAL

TREATMENT

TOLERANCES UNLESS OTHERWISE NOTED
DEC. .XX ± .010
DEC. .XXX ± .005
ANGLES ± 1/2°
HOLES:

	+	.009
.013/.185	−	.002
.187/.248	+	.004
	−	.002
.250/.750	+	.005
	−	.002
.765/1.000	+	.007
	−	.003

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U.S.A.

CUSTOMER INSTALLED OPTIONS

SHEET NO. 8 OF 12

DRAWN

CHECKED

APPROVED

CODE IDENT.	SCALE	SIZE	DRAWING NUMBER	REV.
31252		A	06001374	A

DESC	JUMPERS		CUST. OPT. NO.
	ADDED	DELETED	
1. Produce an active low signal on J1-2 when a single sided diskette is installed	J-3		17
2. Deactivate Ready if an attempt is made to write on SD 1 of a single sided diskette	SSE		17
3. Notify the controller if the drive went from Ready to Not Ready since the last time the drive was selected	J-5		12

SEP 15 1978

NO	DATE	REVISION RECORD
A	12-20-77	EWR 53305

TOLERANCES UNLESS OTHERWISE NOTED
DEC. .XX ± .010
DEC. .XXX ± .008
ANGLES ± 1/2°
HOLES:

.013/.189	+ .003 − .002
.187/.249	+ .004 − .002
.250/.780	+ .005 − .002
.765/1.000	+ .007 − .003

MATERIAL

TREATMENT

DRAWN

CHECKED

APPROVED

MFE CORPORATION

KEEWAYDIN DRIVE
SALEM, NEW HAMPSHIRE 03079
U.S.A.

CUSTOMER INSTALLED OPTIONS

CODE IDENT.	SCALE	SIZE	DRAWING NUMBER	REV.
31252		A	06001374	A

SHEET NO. 9 OF 12

RADIAL
(Refer to schematic before cutting jumpers)

DESC	JUMPERS		CUST. OPT. NO.
	ADDED	DELETED	
1. Radial Ready	If J-4 Deleted route ready to alternate I/O	RR,J-4 If alternate I/O line desired	7
2. Radial Index/Sector	If J6 and J7 deleted route Ind/Sector to alternate I/O pins.	RIS,J-6 Sector J-7 Index,If alternate I/O line desired	8
3. Radial Head Load (STD)	If J-10 or DL-10 deleted route head load or In/Use door lock to alternate I/O pins	J-10, If alternate I/O required	11
Radial In Use/Door Lock (STD)		DL-Ø, If alternate I/O required	10

NOTE:

For daisy chained operation, delete R93 and R97 for head load and R99 and R100 for In Use in all but the drive furthest from the controller.

SEP 15 1978

NO	DATE	REVISION RECORD
A	12-20.77	EWR 53305

TOLERANCES UNLESS OTHERWISE NOTED
DEC. .XX ± .010
DEC. .XXX ± .008
ANGLES ± 1/2°
HOLES:

.013/.188	+ .003
	+ .002
.187/.246	+ .004
	+ .012
.250/.750	+ .005
	+ .002
.705/1.000	+ .007
	+ .008

MATERIAL

TREATMENT

DRAWN

CHECKED

APPROVED

CUSTOMER INSTALLED OPTIONS

SHEET NO. 10 OF 12

CODE IDENT.	SCALE	SIZE	DRAWING NUMBER	REV
31252		A	06001374	A

HEAD SELECT

DESC	JUMPERS		CUST. OPT. NO.
	ADDED	DELETED	
1. Select head from J1-14 Head Select input	J-11 HS-1	HS-2, HS-3	23
2.* Select head from Drive select - See section on Drive Select DESC. #2.			3
3. Select head from Direction input J1-34 This option cannot be used with the Step IN Step Out Option	HS-3	HS-1 HS-2	

SEP 15 1978

NO	DATE	REVISION RECORD
A	3/20/77	EWR 53305

MATERIAL

TREATMENT

TOLERANCES UNLESS OTHERWISE NOTED
DEC. .XX ± .010
DEC. .XXX ± .005
ANGLES ± 1/2°
HOLES:

	+	.003
.013/.185	−	.002
.187/.246	+	.004
	−	.002
.250/.750	+	.005
	−	.002
.765/1.000	+	.007
	−	.003

DRAWN

CHECKED

APPROVED

MFE CORPORATION

KEEWAYDIN DRIVE
SALEM, NEW HAMPSHIRE 03079
U.S.A.

CUSTOMER INSTALLED OPTIONS

SHEET NO. 11 OF 12

CODE IDENT.	SCALE	SIZE	DRAWING NUMBER	REV.
31252		A	06001374	A

DESC	JUMPERS		CUST. OPT. NO.
	ADDED	DELETED	
1. *The write fault signal is available at J1-4	J-8		19
2. The FDD requires a regulated -5Volts. To use the on board regulator so that -7 to -16 volts may be applied to J4-4		J-12	21
3. *On 750 and 751 Models the DC motor may be stopped when the drive is not selected by applying an active low signal to J1-10	J-9		13
If additional I/O pins are required use pins 29 thru 43 odd.		J15 thru J23 as required	

SEP 15 1978

NO	DATE	REVISION RECORD
A	12/	EWR 53305

MATERIAL

TREATMENT

TOLERANCES UNLESS OTHERWISE NOTED
DEC. .XX ± .010
DEC. .XXX ± .005
ANGLES ± 1/2°
HOLES:

.013/.185	+	.003
	−	.002
.187/.248	+	.004
	−	.002
.250/.750	+	.006
	−	.002
.765/1.000	+	.007
	−	.003

DRAWN

CHECKED

APPROVED

MFE CORPORATION

KEEWAYDIN DRIVE
SALEM, NEW HAMPSHIRE 03079
U.S.A.

CUSTOMER INSTALLED OPTIONS

SHEET NO. 12 OF 12

CODE IDENT.	SCALE	SIZE	DRAWING NUMBER	REV.
31252		A	06001374	A