ORDER NO. MSD850501900

OEM Manual

Flexible Disk Storage Drive

JU-314/JU324/JU364

3.5 INCH

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INTRODUCTION

1.1 INTRODUCTION

The newly designed JU-3X4 series of microfloppy disk drive offers the high performance with the slim, smart body and realized drastic space saving and weight reduction. In addition to this, low power consumption was achieved.

The current product range of JU-3X4 is three models, they are Model JU-314 with the memory capacity of 250 K bytes, JU-324 with 500 K bytes and JU-364 with 1 M bytes.

They are all the same size in dimensional structure such as 1.25 inches thick, 4.0 inches wide, 6.0 inches long in the same mounting holes.

In addition, the interface signals are compatible to 5.25-inch drives and at TTL level driving and receiving. And several customer-installable options are provided for systems.

The newly developed high technological LSI chips are adapted for electronic circuits such as Read/Writed, Control logic and Motor control and driving. Those circuits are integrated in each one chip and are on the smallest size printed circuit board with chip resistors and capacitors.

Anti-EMI noise and shock protection can be achieved by the unique mechanical construction with aluminum shield cover and mounting brackets.

The diskettes can be operated in light touch at any time.

1.2 SPECIFICATIONS SUMMARY

1.2.1 Performance Specifications

Item				Rating		
				JU-314	JU-324	JU-364
Capacity	Total storage capacity/disk	Unformated (K bytes)	FM MFM	125 250	250 500	500 1000
		Formated (K bytes)	FM MFM	82 164	164 328	328 656
	Storage capacity/ track	Unformated (bytes)	FM	3125		
			MFM	6250		
		Formated (bytes)	FM	2048		
			MFM	4096		
Recording density	Number of heads			1	1	2
	Number of tracks			40	80	160
	Recording density (BPI)		FM	4093		4358
			MFM	8186		8717
	Track density (TPI)			67.733	135.466	
	Data transfer rate K bit/s		FM	125		
			MFM	250		
Access	Rotational speed (R.P.M.)			300		
	LSV (%) ISV (%)			±1 ±1.5		
	Track to track seek (ms)			6	3	
	Settling time (ms)			15		
	Motor start time (ms)			500		

1.2.2 Installation Requirement

Item			Rating		
Power requirement	12 VDC	Voltage	12 V ± 10% Max ripple 100 mVp-p		
		Current	During operating	Seek	0.21 A (Max) 0.19 A (Typ)
				Read	0.125 A (Max) 0.12 A (Typ)
				Write	0.14 A (Max) 0.125 A (Typ)
			At motor start	0.20 A	
	5 VDC	Voltage	5 V ± 5% Max ripple 50 mVp-p		
		Current	During operating	Seek	0.16 A (Max) 0.15 A (Typ)
				Read	0.23 A (Max) 0.22 A (Typ)
				Write	0.25 A (Max) 0.24 A (Typ)
	Power dissipation		Seek/motor start	3.6 W (at 12 V ± 10%) (Max) 3.5 W (at 12 V ± 5%) (Max) 3.0 W (Typ)	
			Read	3.0 W (Max) 2.5 W (Typ)	
			Write	3.2 W (Max) 2.7 W (Typ)	
			Stand by	1.55W (Max) 1.40W (Typ)	

Note: Calculation Method of Power Consumption:
Our voltage specification is subject to 12 VDC ± 10%, accordingly, in case of calculating maximum figure, it becomes larger than that of other competitor's by ±5%.

(In case of ±5%) W = Typ. × 1.1
(In case of ±10%) W = Typ. × 1.2

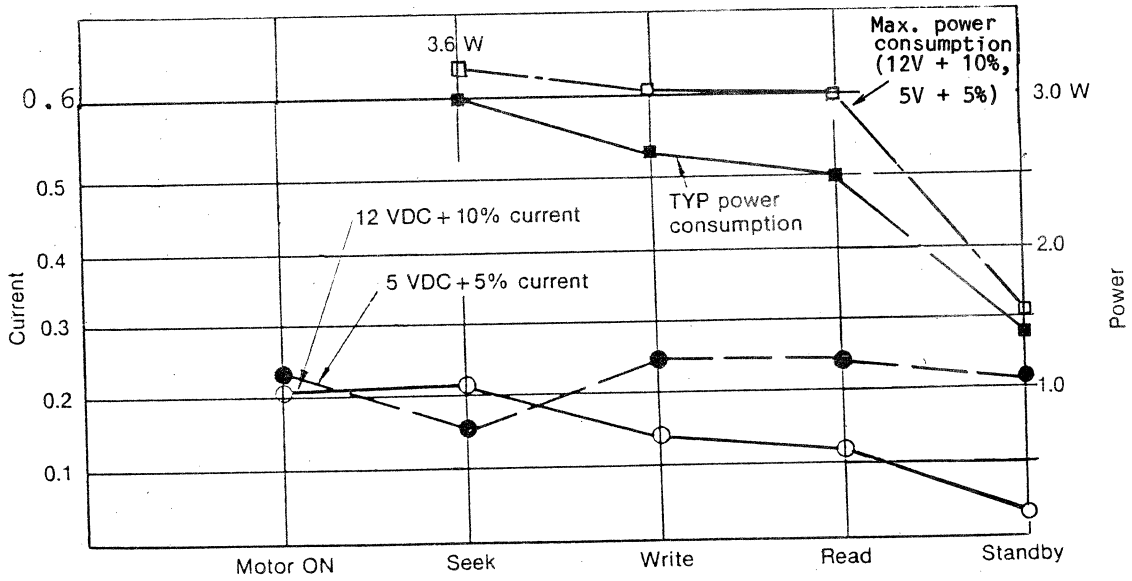


FIGURE 1-1 CALCULATION METHOD OF POWER CONSUMPTION

(continued)

Item		Rating	
Environment	Temperature	Operating	5 to 45°C
		Storage	−40 to 60°C
		Shipping	−40 to 60°C
		Temperature gradient	20°/H
	Humidity	Operating	20 to 80% RH No condensation
		Non Operating	5 to 90% RH No condensation
		Maximum wet bulb	29°C
Vibration	Operating	Acceleration	0.5 G (No soft error)
		Frequency	10 to 500 Hz (Except resonant point)
	Non Operating	Acceleration	1.0 G
		Frequency	10 to 500 Hz (Except resonant point)
Shock	Operating	Acceleration	3.0 G (No hard error)
		Interval	20 ms (Square wave)
	Non Operating	Acceleration	40G
		Interval	20 ms (Square wave)
Mechanical dimension		Width	101.6 mm (Except front bezel)
		Height	32 mm
		Depth	150 mm
		Weight	550 g
Mounting angle		Vertical	0° to 20°
		Horizontal	0° to 20°
Media operating force		Inserting	600 gf
		Ejecting	1200 gf
Acoustic noise		55 dB Afast	100 cm from drive
Dielectrical withstanding voltage		Between the mounting bracket and signal ground	250 VDC (1 minute)
Insulation resistance		Between the mounting bracket and signal ground	250 VDC > 50 MΩ

1.2.3 Life

Item		Rating
Drive	Disk insertion/removal	80,000 cycles (or more)
	Seek	10,000,000 cycles (or more)
	Head	15,000 hours (or more)
Disks	Insertion/removal	10,000 cycles (or more)
	Single-track wear	3,500,000 passes (or more)
	Seek wear	10,000,000 passes (or more)

1.2.4 Reliability Specifications

Item		Rating
Drive	MTBF	10,000 POH
	MTTR	0.5 hours
	Drive life	5 years or 20,000 POH
Error rate	Software errors	10^{-9}/bit
	Hardware errors	10^{-12}/bit
	Seek errors	10^{-6}/seek

1.2.5 Exterior View and Miscellaneous Specifications

See page 4-2 for exterior view of drive.

1.3 INTERFACE

1.3.1 Voltage Level

Signals exchanged between the controller and drive are all at TTL levels (low true).

	High	Low
Output level	2.4 V minimum 5.25 V maximum	0 minimum 0.4 V maximum
Input level	2.4 V minimum 5.25 V maximum	0 minimum 0.8 V maximum

Input impedance: 1 kΩ
Output sink current: 48 mA

1.4 FUNCTIONAL CHARACTERISTICS

The JU-3X4 drives consist of:

a. Read/Write and Control Electronics

b. Drive Mechanism

c. Precision Track Positioning Mechanism

d. Read/Write Head(s)

The interface signals and their relationship to the internal functions are shown in figure 1-2.

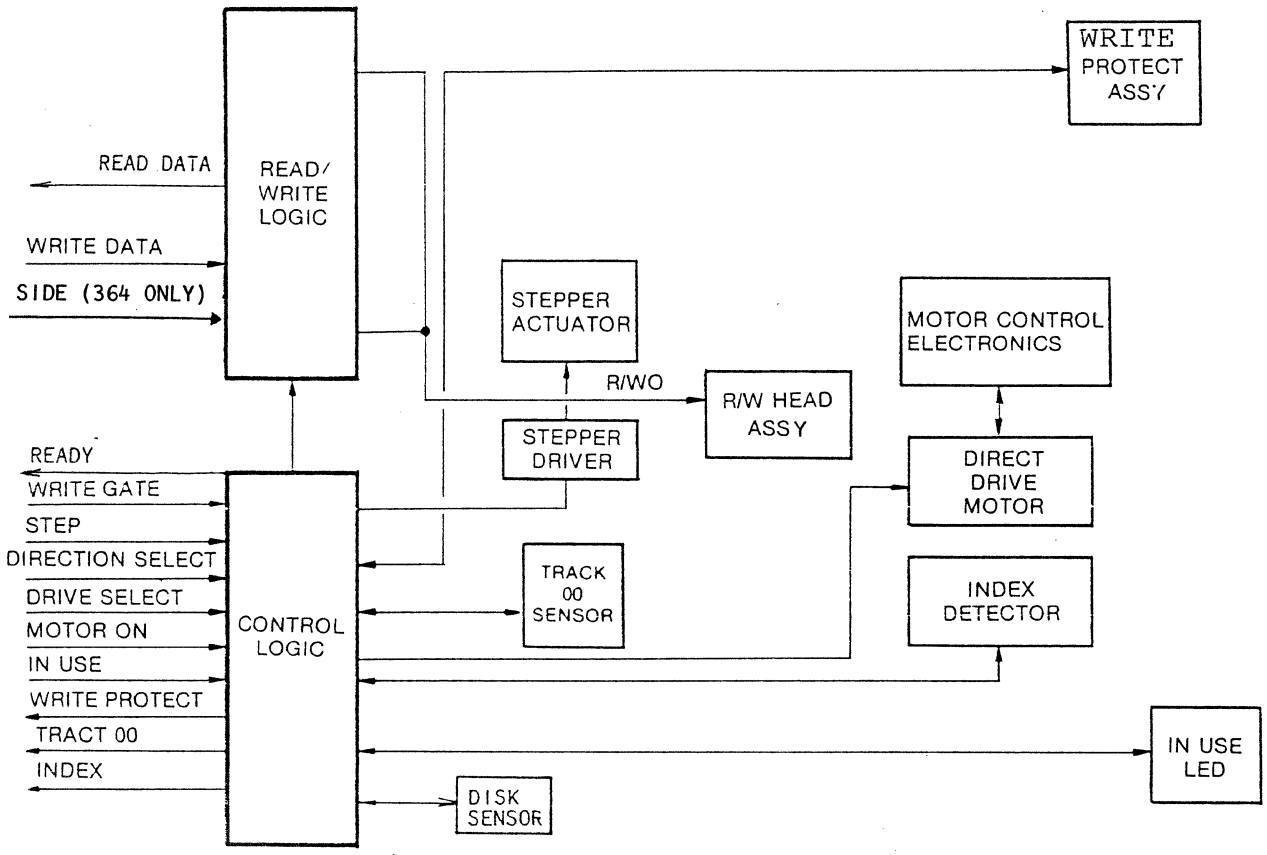


FIGURE 1-2 JU 3X4 FUNCTIONAL DIAGRAM

1.4.1 Read/Write and Control Electronics

The following electronics are packaged on the main PCB which contains:

a. Head Position Actuator Driver

b. Read/Write Amplifier and Transition Detector

c. Drive Select Circuits

d. Control Logic

e. Side Select Circuitry (JU-364 only)

and the following electronics are packaged on the PCB with Spindle Motor which contains:

f. Index Detector Circuits

g. Write Protect Circuits

h. Spindle Motor Drive and Control Circuits

The Head Positioning Actuator moves the read/write head(s) to the desired track on the diskette. The media cartridge is loaded onto the read/write head(s) by an elevator mechanism when the carriage is inserted.

1.4.2 Drive Mechanism

The dc drive motor under servo speed control (using an integral tachometer) rotates the spindle at 300 rpm through a direct-drive system. A magnetic chucking device in conjunction with a metallic hub on the media provides precision media positioning to ensure data interchange. A mechanical interlock ensures proper media insertion, thus eliminating media damage. The motor control electronics are contained as part of the spindle motor assembly.

1.4.3 Precision Track Positioning Mechanism

The read/write head(s) assembly is accurately positioned through the use of a metal band which is attached to the head carriage assembly. Precise track location is accomplished by a precise stepping motor.

1.4.4 Read/Write Head(s)

The specially bonded ceramic and ferrite read/write head(s) contain erase elements to provide erased areas between data tracks. Thus, normal interchange tolerances between media and drives will not degrade the signal-to-noise ratio and diskette interchangeability is ensured.

The read/write head(s) are mounted on a carriage which is located on a precision carriage way. The diskette is held in a plane perpendicular to the read/write head(s) by pins located on the base casting. This precise registration assures perfect compliance with the read/write head(s). The read/write head(s) are in direct contact with the diskette. The head surfaces have been designed to obtain maximum signal transfer to and from the magnetic surface of the diskette with minimum head/diskette wear.

1.4.5 Recording Formats

The format of the data recorded on the diskette is totally a function of the host system. This format can be designed around the user's application to take maximum advantage of the total available bits that can be written on any one track.

For a detailed discussion of the various recording formats, refer to Section VI.

1.5 FUNCTIONAL OPERATIONS

1.5.1 Power Sequencing

Applying dc power to the JU-3X4 can be done in any sequence. However, during power up the WRITE GATE line must be held inactive or at a high level. After application of dc power, a 500-ms delay should be introduced before any operation is performed.

1.5.2 Drive Selection

Drive selection occurs when the DRIVE SELECT line is activated. Only the drive with this line active will respond to input lines or gate output lines. Under normal operation, the DRIVE SELECT line enables the input and output lines and lights the activity LED on the front of the drive.

1.5.3 Side Select (JU-364 only)

This interface line defines which side of a two-sided diskette is used for reading or writing. An open circuit, or logical one, selects the read/write head on the side 0 surface of the diskette. A short to ground, or logical zero, selects the read/write head on the diskette's side 1 surface. When switching from one head to the other, a 100-μs delay is required before any read or write operation can be initiated.

1.5.4 Motor ON

In order for the host system to read or write data, the dc drive motor must be turned on. This may be accomplished by activating the MOTOR ON line. A 500 ms delay must be introduced after activating this line to allow the motor to come up to speed before reading or writing can be accomplished.

The motor must be turned off by the host system by deactivating the MOTOR ON line.

NOTE

All motors in a daisy chain configuration are activated by MOTOR ON (refer to paragraphs 2.2.3 and 2.2.4). Another ways of controlling MOTOR ON are shown at SECTION VII.

1.5.5 Track Accessing

Seeking the read/write head(s) from one track to another is accomplished by:

a. Activating the DRIVE SELECT line.

b. Selecting the desired direction using the DIRECTION SELECT line.

c. WRITE GATE being inactive.

d. Pulsing the STEP line.

Multiple track accessing is accomplished by repeated pulsing of the STEP line until the desired track has been reached. Each pulse on the STEP line will cause the read/write head(s) to move one track either in or out, depending on the DIRECTION SELECT line. Head movement is initiated on the trailing edge of the step pulse. See figure 1-3.

1.5.6 Step Out

The STEP line causes the read/write heads to move in the direction defined by the DIRECTION SELECT line. Any change in the DIRECTION SELECT line must occur at least one µsec before the trailing edge of the step pulse.
With the DIRECTION SELECT line at a plus logic level (2.4 to 5.25 V), a pulse on the STEP line will cause the read/write head(s) to move one track away for the center of the disk.
With the DIRECTION SELECT line at a minus logic level (0 to 0.8V), a pulse on the STEP line will cause the read/write head(s) to move one track closer to the center of the disk. The pulse(s) applied to the STEP line must have the timing characteristics shown in Figure 1-3.

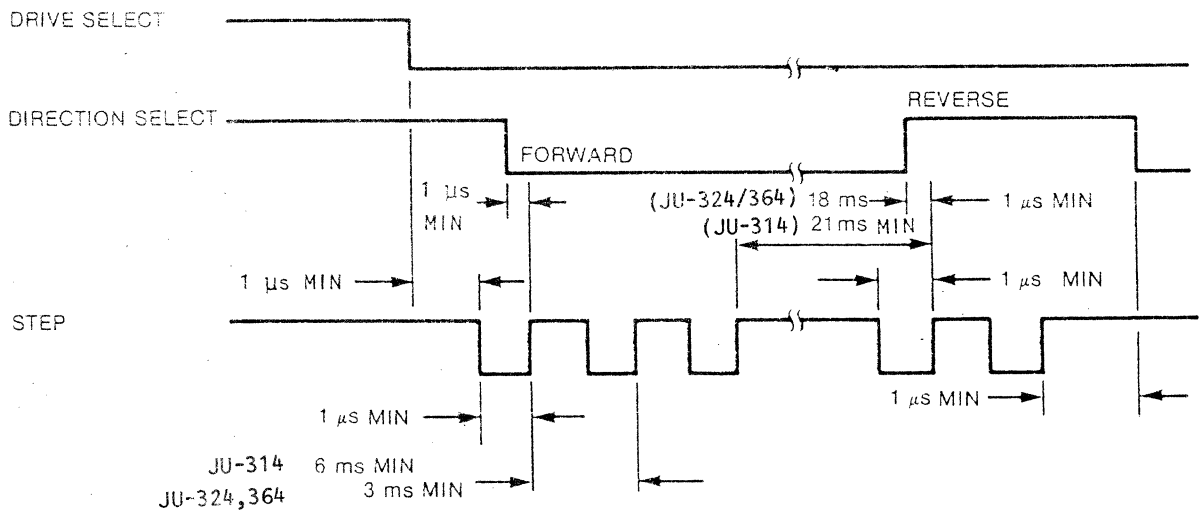


FIGURE 1-3 TRACK ACCESS TIMING

1.5.7 Normal Step Mode

In normal step mode, the read/write head(s) will move at the rate of the incoming step pulses. Motion is initiated at each true to false transition. The minimum time between successive steps is three ms with a minimum pulse width of one µs. See figure 1-4.

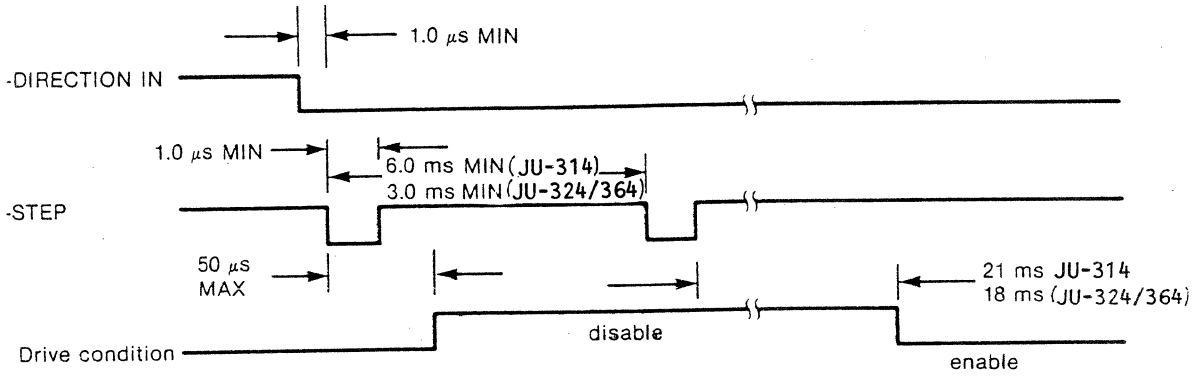


FIGURE 1-4 NORMAL STEP MODE

1.5.8 Read Operation

Reading data from the JU-3X4 is accomplished by:

a. Activating DRIVE SELECT line.
b. Activating Side Select Line (363 only)
c. WRITE GATE being inactive.

The timing relatioships requried to initiate a read sequence are shown in figure 1-5. These timing specifications are required in order to guarantee that the read/write head(s) position has stabilized prior to reading.

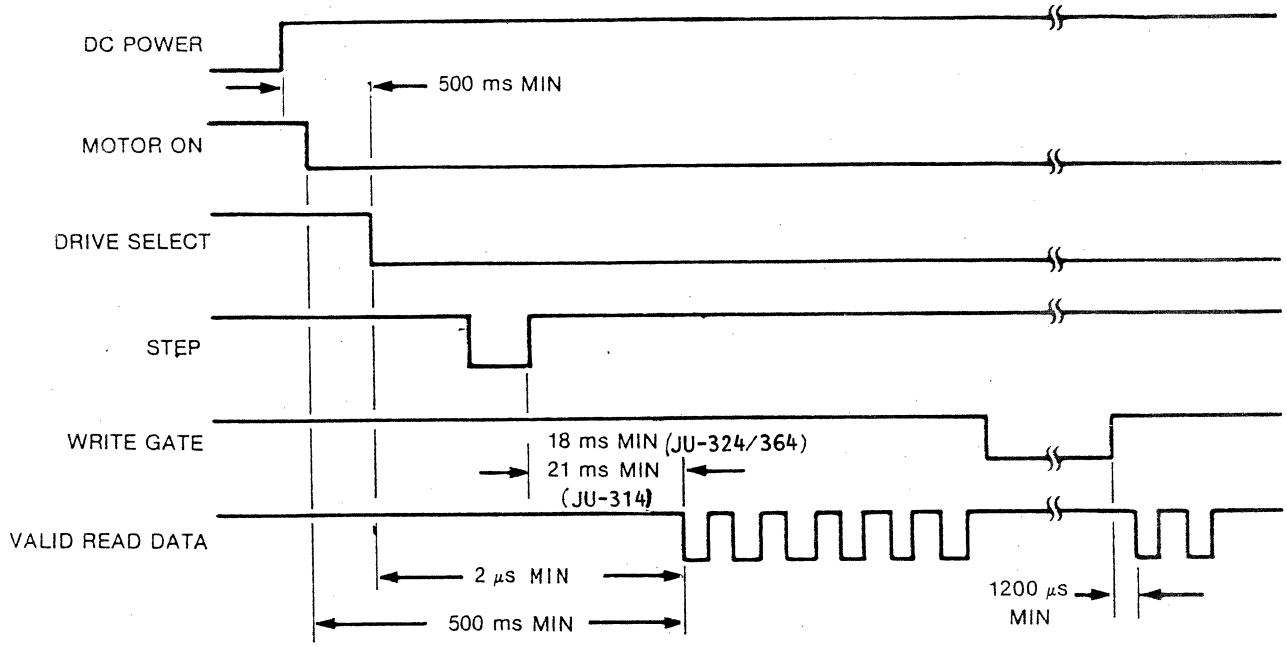


FIGURE 1-5 READ INITIATE TIMING

The timing of read data (FM) is shown in figure 1-6.

The encoding scheme of the recorded data can be either FM or MFM. FM encoding rules specify a clock bit at the start of every bit cell (see figure 1-6). MFM encoding rules allow clock bits to be omitted from some bit cells if the preceding bit cell or the current bit cell contains a data or clock bit. See figure 1-7.

In the above mentioned encoding schemes, clock bits are written at the start of their respective bit cells, and data bits at the centers of their bit cells.

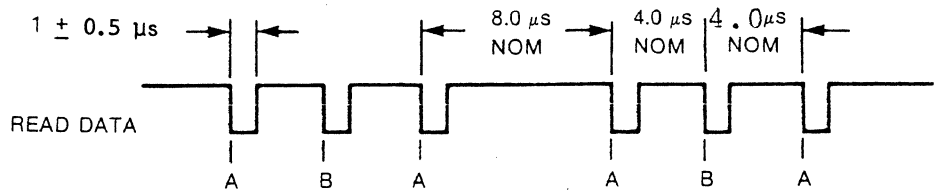


FIGURE 1-6 READ DATA TIMING (FM)

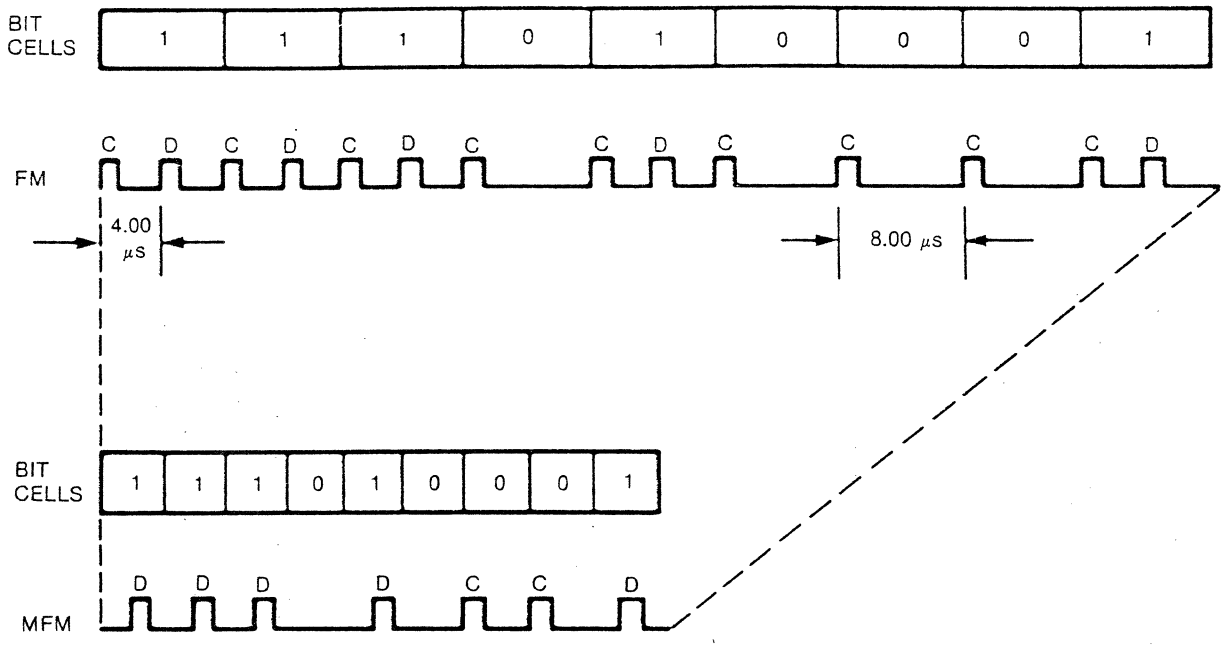


FIGURE 1-7 FM AND MFM CODE COMPARISONS

1.5.9 Write Operation

Writing data to the :U-3X4 is accomplished by:

a. Activating the DRIVE SELECT line.

b. Activating Side Select Line (364 ONLY).

c. Activating the WRITE GATE line.

d. Pulsing the WRITE DATA line with the data to be written.

The timing relationships required to initiate a write data sequence are shown in figure 1-8. These timing specifications are required in order to guarantee that the position of the read/write head(s) has stabilized prior to writing. The timing specifications for the write data pulses are shown in figure 1-9.

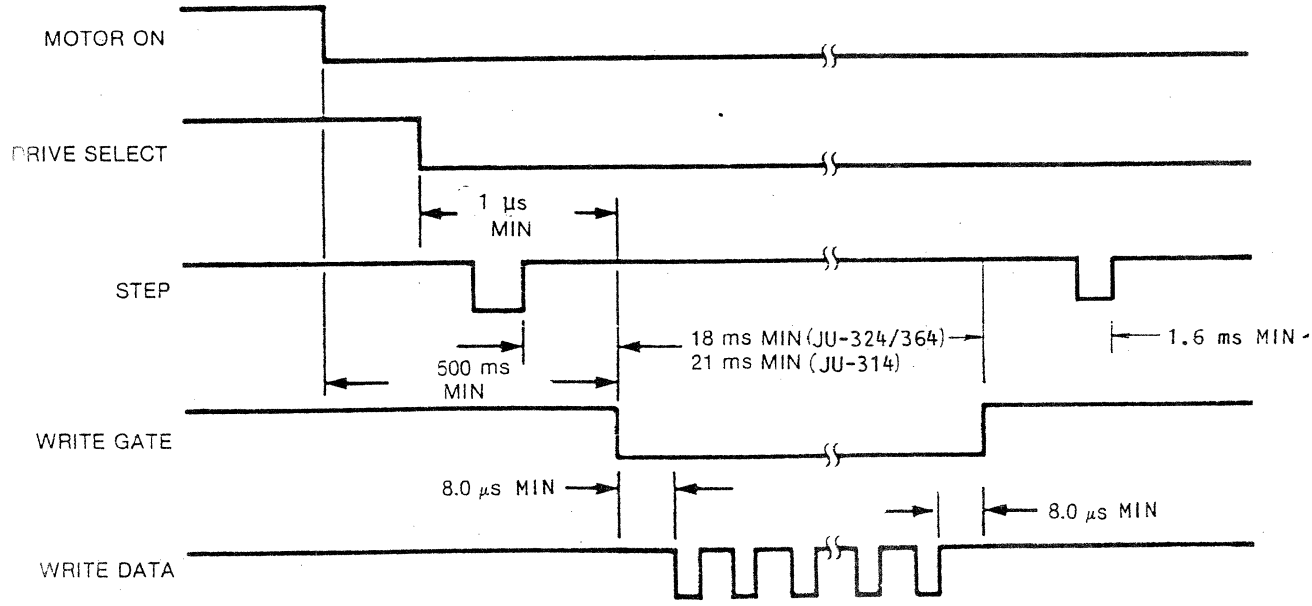


FIGURE 1-8 WRITE INITIATE TIMING

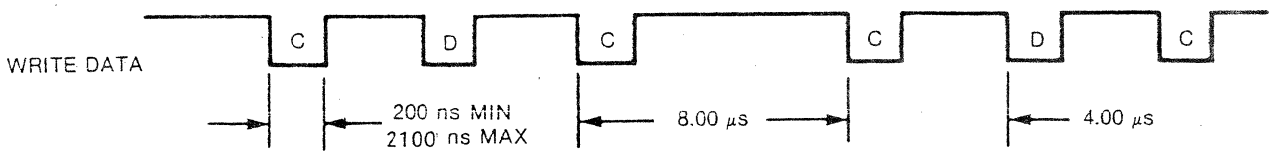
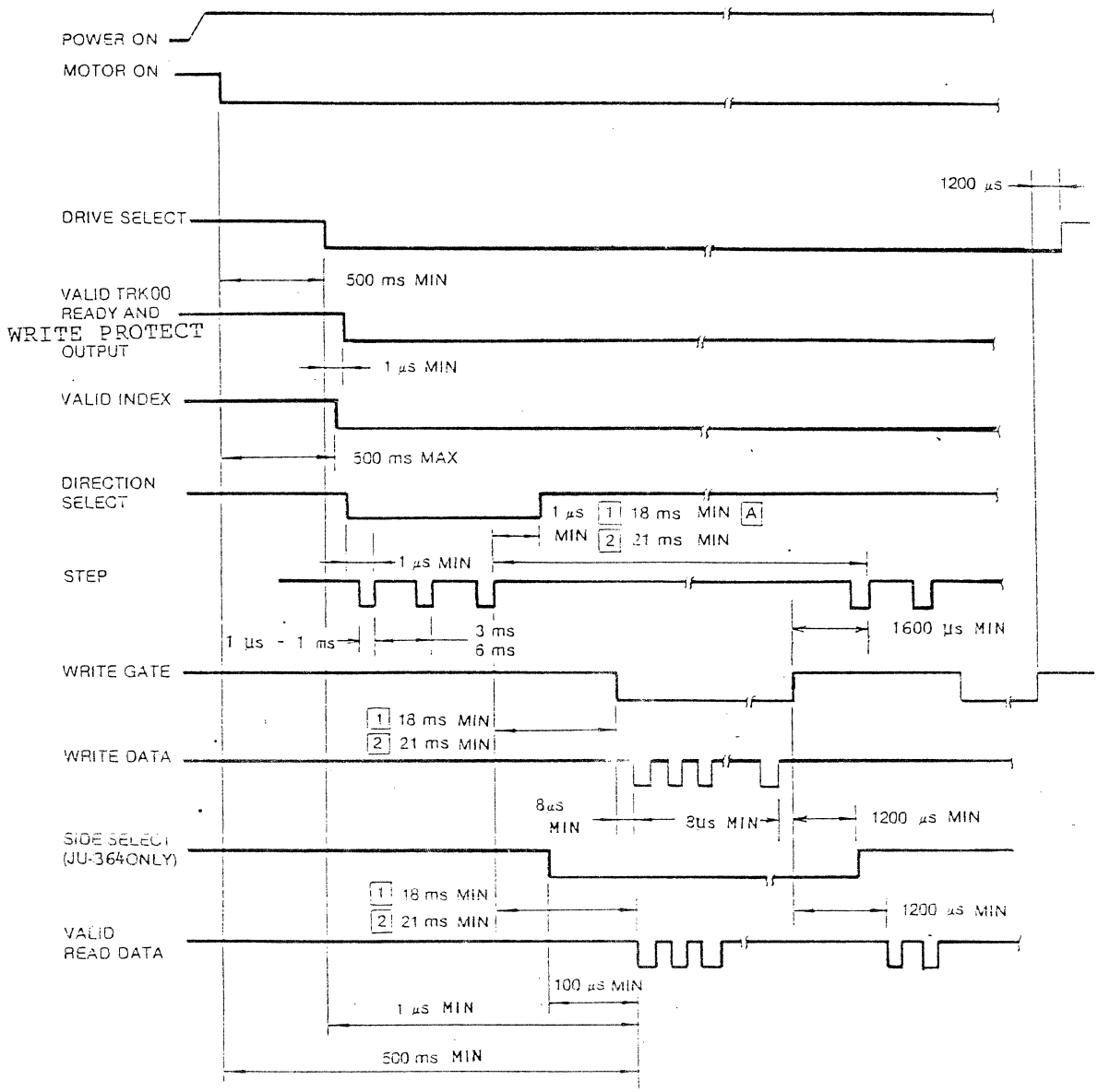


FIGURE 1-9 WRITE DATA TIMING (FM)

Write data encoding can be FM or MFM. The write data precompensation is recommended 200 ns, starting at track 43 (JU-314;22). The direction of compensation required for any given bit in the data stream depends on the pattern it forms with nearby bits.

1.5.10 Sequence of Events

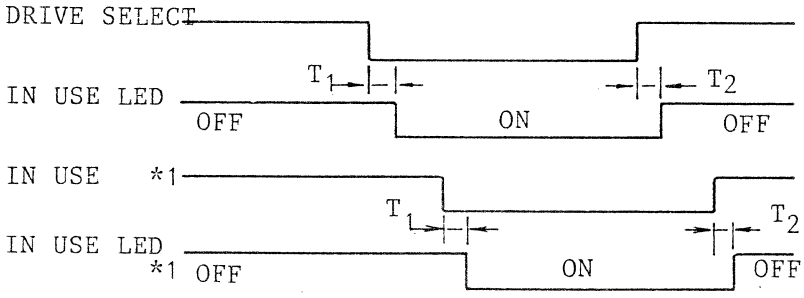
The timing diagram shown in figure 1-10 shows the necessary sequence of events with associated timing requirements for proper operation.



Note: [1] JU-324 ,364 [2] JU-314
[A] The delay from the last step to read, write or direction change is 18 ms (JU-324, 364) 21 ms (JU-314) minimum in normal mode.

FIGURE 1-10 GENERAL CONTROL AND DATA TIMING REQUIREMENT

(Suppliment)



*1) PIN11 & 12 (Pin Post P2 on PCB) shorted. T_1, $T_2 \leqq 0.5$mS

SECTION II
ELECTRICAL INTERFACE

2.1 INTRODUCTION

The interface of the JU-3x4 can be divided into two categories.

a. Signal Lines

b. Power Lines

The following paragraphs provide the electrical definition for each line. See figure 2-1 for all interface connections.

2.2 SIGNAL INTERFACE

The signal interface consists of two categories:

a. Control Lines

b. Data Transfer Lines

All lines in the signal interface are digital in nature and provide signals to the drive (input) or to the host (output) via interface connector P1/J1.

2.2.1 Input Lines

The input signals are of three types: those intended to be multiplexed in a multiple drive system, those which will perform the multiplexing, and those signals which are not multiplexed and affect all the drives in a daisy chain system.

The input signals to be multiplexed are:

a. DIRECTION SELECT

b. STEP

c. WRITE DATA

d. WRITE GATE

e. SIDE SELECT (JU-364 only)

The input signals which are intended to do the multiplexing are:

a. DRIVE SELECT 0

b. DRIVE SELECT 1

c. DRIVE SELECT 2

d. DRIVE SELECT 3

The signals which are not multiplexed are IN USE and MOTOR ON.

The input lines have the following electrical specifications. See figure 2-2 for the recommended circuit.

True = Logical zero = Vin +0.0 to +0.8 V @ Iin = 48mA (max)

False = Logical one = Vin +2.4 to +5.25 V @ Iin = 250µA (open)

Input impendance = 1 k ohms

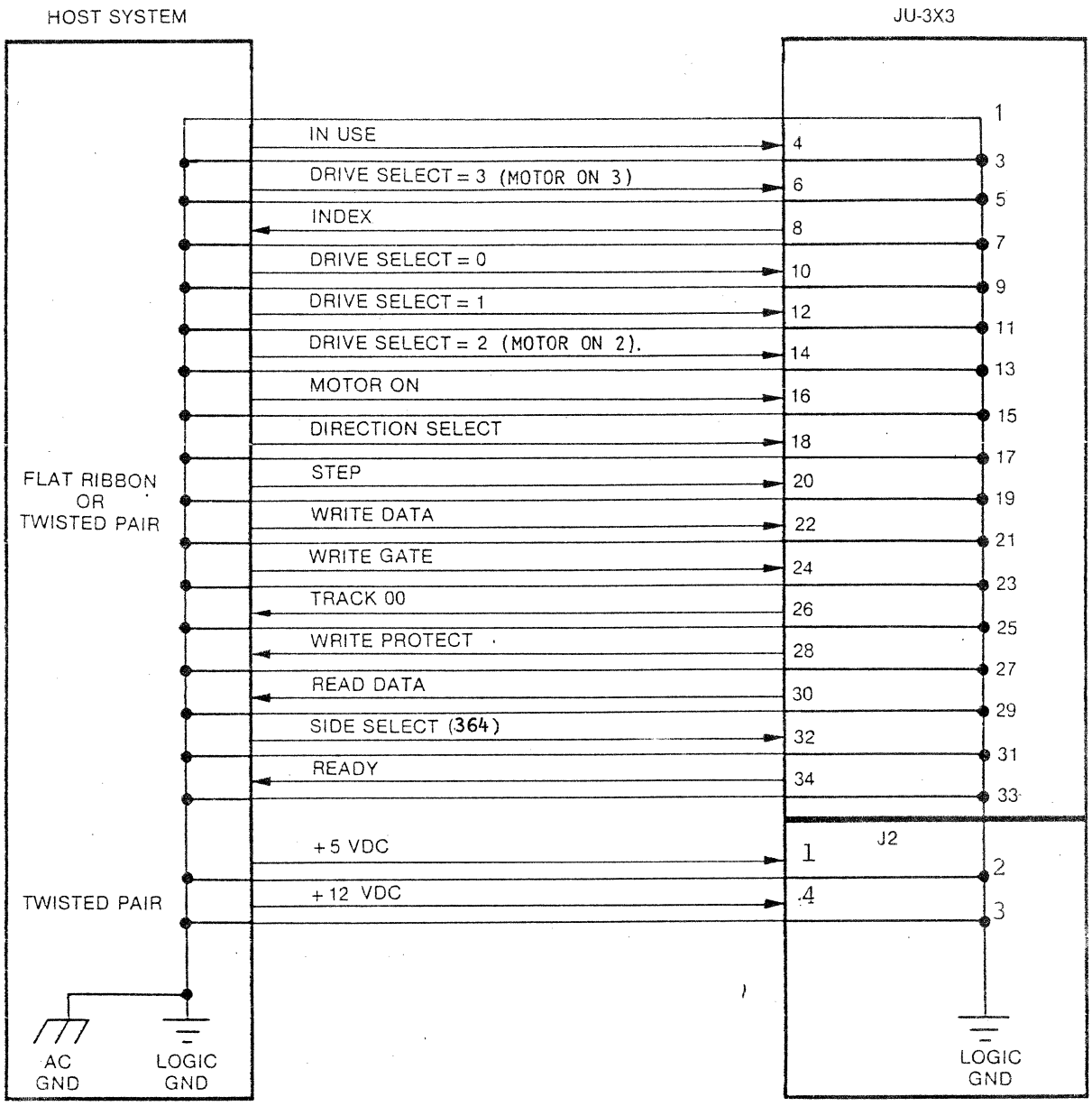


FIGURE 2-1 INTERFACE CONNECTIONS

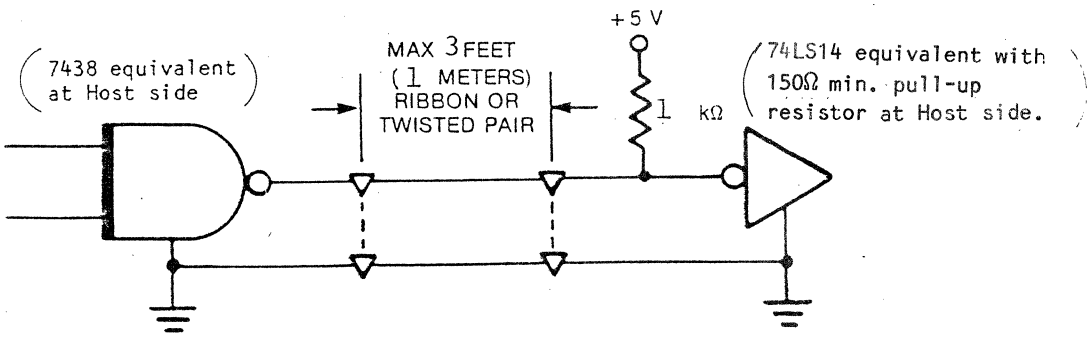


FIGURE 2-2 INTERFACE SIGNAL DRIVER/RECEIVER

2.2.2 Input Line Termination

The JU-3X4 has been provided with the capability of terminating the six input lines (seven input lines at JU-364) listed below.

a. MOTOR ON

b. DIRECTION SELECT

c. STEP

d. WRITE DATA

e. WRITE GATE

f. IN USE

g. SIDE SELECT (for JU-364 only)

These lines are terminated through 1 k ohm resistor arrays installed on all PCB.

In a single drive system, this resistor array provides 1 k ohm input impedance for input lines. In a multiple drive system, the input impedance is varied in value from 250 ohms to 500 ohms depending on the number of used drives.

2.2.3 Drive Select 1—4

Four separate input lines (DRIVE SELECT 0 through DRIVE SELECT 3) are provided so that up to four drives in a multiplexed system may have separate input pins. Only the drive with a unique DRIVE SELECT line active will allow the drive to respond to multiplexed input lines and enable the outputs to drive their respective signal lines. A logical zero on the inteface selects a unique drive select line for the drive.

2.2.4 Motor ON

This input, when activated to a logical zero level, will turn on the drive motor allowing reading or writing on the drive. A 0.5-second delay after activating this line must be allowed before reading or writing.

2.2.5 Direction Select

This interface line defines the direction of motion the read/write head(s) will take when the STEP line is pulsed. An open circuit, or logical one, defines the direction as "out." If a pulse is applied to the STEP line, the read/write head(s) will move away from the center of the disk. Conversely, if this input is shorted to ground or a logical zero level, the direction of motion is defined as "in." If a pulse is applied to the STEP line, the read/write head(s) will move towards the center of the disk.

2.2.6 Side Select (JU-364 only)

This interface line defines which side of a two-sided diskette is used for reading or writing. An open circuit, or logical one, selects the read/write head(s) on the side 0 surface of the diskette. A short to ground, or a logical zero, selects the read/write head on the diskette's side 1 surface. When switching from one head to the other a 100 µs delay is required before any read or write operation can be initiated.

2.2.7 Step

This interface line ia a control signal which causes the read/write head(s) to move in the direction of motion defined by the DIRECTION SELECT line. This signal must be a logical zero-going pulse with a minimum pulse width of 1 µs. Each subsequent pulse must be delayed by 3 ms (JU-324, 364), 6 ms (JU-314) minimum from the preceeding pulse for normal mode.

The access motion is initiated on each logical zero to logical one transition, or at the trailing edge of the signal pulse. Any change in the DIRECTION SELECT line must be made at least 1 µs before, and must be maintained 1 µs after the trailing edge of the step pulse. See Figure 1-3 for these timers.

2.2.8 Write Gate

The active state of this signal, or logical zero, enables write data to be written on the diskette. The inactive state, or logical one, enables the read data logic and stepper logic. See figure 1-8 for timing.

2.2.9 Write Data

This interface line provides the data to be written on the diskette. Each transition from a logical one level to a logical zero level will cause the current through the read/write head to be reversed, thereby writing a data bit. This line is enabled by WRITE GATE being active. WRITE DATA must be inactive during a read operation. See Figure 1-9 for timings.

2.2.10 In Use

Normally, the activity LED on the selected drive will turn on when the corresponding DRIVE SELECT signal is active. The IN USE input instead of the DRIVE SELECT signal can activate the LED too.

2.2.11 Output Lines

The output control lines have the following electrical specifications. See figure 2-2 for the recommended circuit.

True = Logical zero = Vout +0.0 to +0.4 V @ Iout = 48 mA (max)

False = Logical one = Vout +2.4 to +5.25 V (open collector) @ Iout = 250 µA (max)

2.2.12 Track 00

The active or logical zero state of this interface signal indicates when the read/write head of the drive is positioned at track zero (the outermost track) and the stepper is locked on track. This signal is at a logical one level, or inactive state, when the read/write head is not at track 00. When the read/write head is at track 00 and an additional step out pulse is issued to the drive, LSI logic will keep the read/write head positioned at track 00.

2.2.13 Index

This interface signal is provided by the drive each motor revolution. Normally, this signal is at a logical one level and makes the transition to the logical zero level each time a reflector is sensed.

With soft sectored media, there is one pulse on this interface signal per revolution of the diskette (200 ms). This pulse indicates the physical beginning of a track. See figure 2-4 for timing.

When using the INDEX signal, look for an edge or transition rather than a level for determining the status.

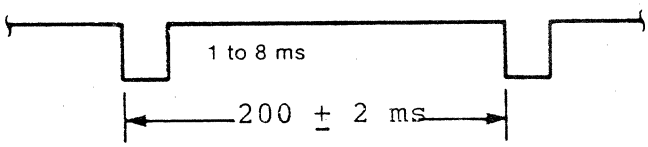


FIGURE 2-4 INDEX TIMING

2.2.14 Read Data

This interface line provides the "raw data" (clock and data together) as detected by the drive electronics. Normally, this signal is a logical one level and becomes a logical zero level for the active state. See Figure 1-6, 1-7 for the timing.

2.2.15 Write Protect

This interface signal is provided by the drive to indicate to the user that a write protected cartridge is installed. The signal is logical zero level when it is protected. The drive will inhibit writing with a protected diskette insatalled and, additionally, notifies the interface.

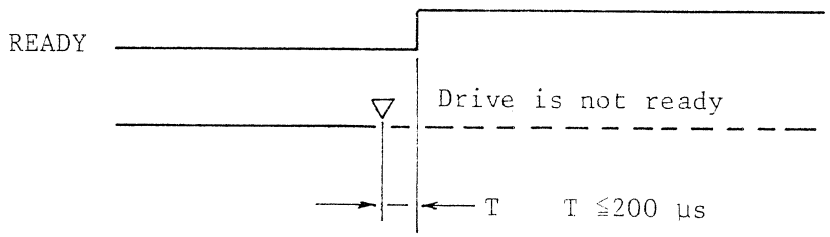
2.2.16 Ready

This interface line provides information on the status of the drive that allow the controller to operate, all the functions of the drive under the following conditions.

a. A cartridge is inserted in the drive.

b. The motor is on and up to speed.

c. DC power is supplied to the drive.



2.3 POWER INTERFACE

The JU-3X4 requires only dc power for operation. DC power to the drive is provided via J2 located on the component side of the PCB. The two dc voltages, their specifications and their J2 pin designations are outlined in Table 2-1. The specifications outlined on current requirements are for one drive. For multiple drive systems, the current requirements are a multiple of the maximum current times the number of drives in the system. Figure 2-5 illustrates the JU-3X4 dc power profile.

2.4 FRAME GROUND AND SIGNAL GROUND

The aluminum base plate of the drive is at the same electrical level as signal ground. Only the mounting bracket is contracted to the frame ground. This provides protection against radiation noise from outer systems.

TABLE 2-1. DC POWER REQUIREMENTS

J2 PIN	DC VOLTAGE	TOLERANCE	CURRENT	MAX RIPPLE (p to p)
1	+ 5 VDC	± 0.25 VDC	0.25 A MAX 0.22 A TYP	50 mV MAX ALLOWABLE
2	+5 RETURN			
3	+12 RETURN			
4	+12 VDC	± 1.2 VDC	0.21 A MAX 0.12 A TYP	100 mV MAX ALLOWABLE

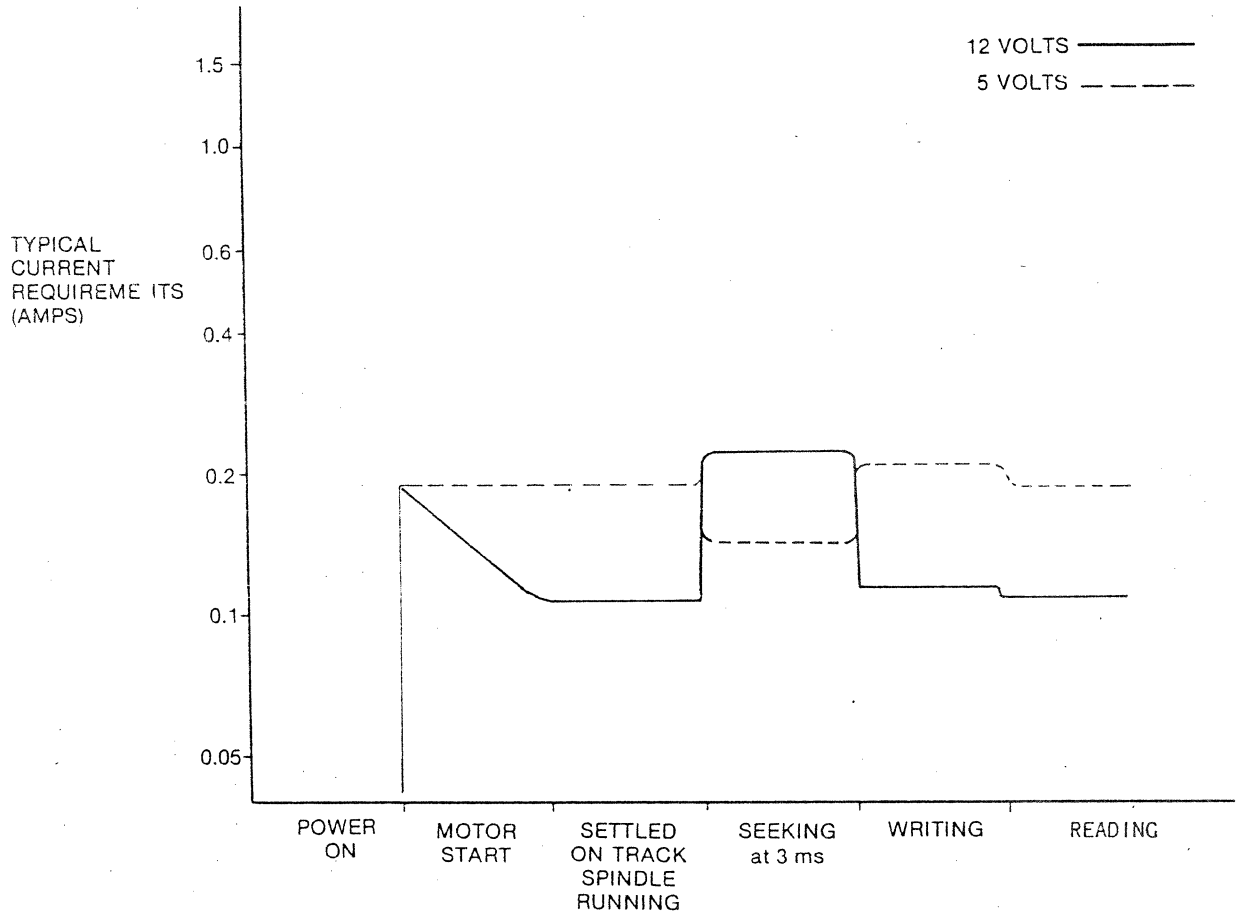


FIGURE 2-5 DC POWER PROFILE

SECTION III
PHYSICAL INTERFACE

3.1 INTRODUCTION

The electrical interface between the JU-3X4 and the host system is via two connectors. The first connector, J1, provides the signal interface and the second connector, J2, provides the dc power.

This section describes the physical connectors used on the drive and the recommended connectors to be used with them. See figure 3-1 for connector locations.

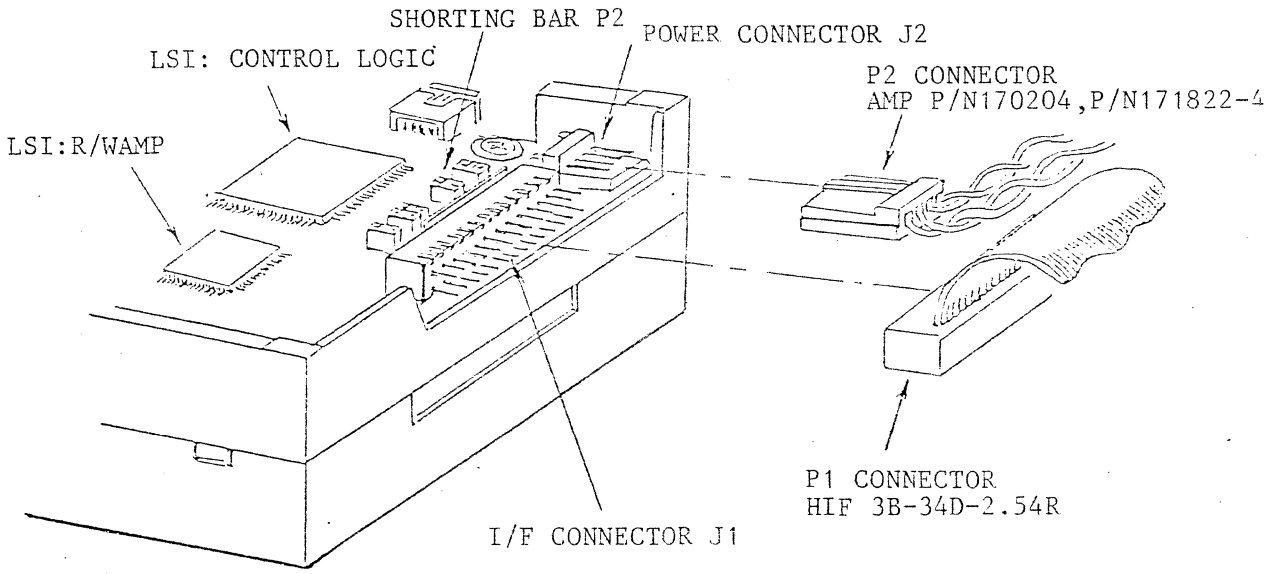


FIGURE 3-1 INTERFACE CONNECTORS LOCATIONS

3.2 J1/P1 CONNECTOR (I/F CONNECTOR)

Connection to J1 is through a PCB pin type connector. The dimensions and location of J1 for the connector are shown in figure 3-2. Pins are numbered 1 through 34 with the even-numbered pins on the top row. Pins 1, 2, and 34 are numbered on the PCB. Keying is not available with this connector. The recommended connectors for J1/P1 are shown in table 3-1.

TABLE3-1. RECOMMENDED J1/P1 CONNECTORS

J1 (DRIVE)	P1 (HOST)	MANUFACTURER
MIF3-34PA-2.54DS	HIF 3B-34D-2.54R	HIROSE

Recommended the few of other connectors.
AMP: 172533-5 OR 172534-5
3M : 3414-6500 OR 3414-6000

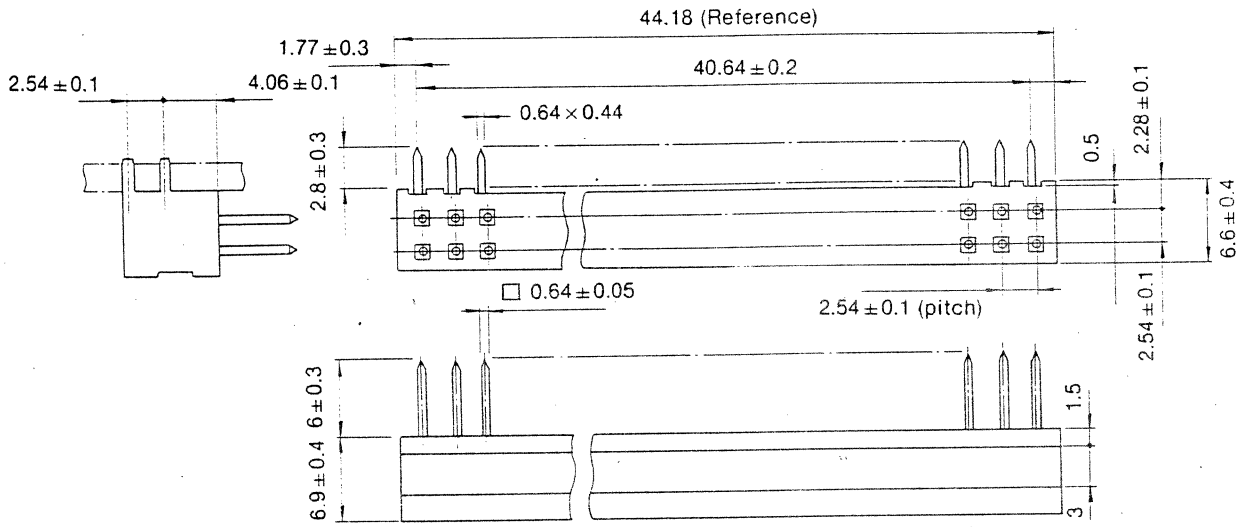
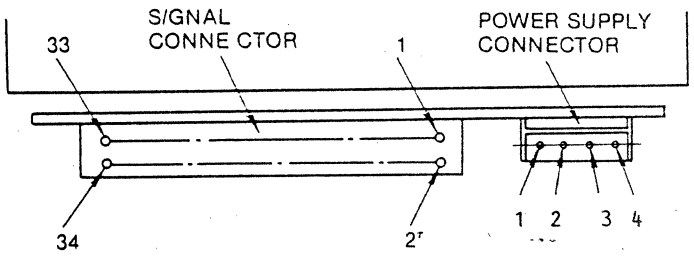


FIGURE 3-2. J1 CONNECTOR

3.3 J2/P2 CONNECTOR (POWER CONNECTOR)

The dc power connector, J2, is mounted on the component side of the PCB and is located opposite the side of the stepper motor. J2 is a 4-pin AMP data connector P/N 171826-4. The recommended mating connector (P2) is AMP P/N 171822-4 utilizing AMP pins P/N 170204-2. J2, pin 1, is labeled on the component side of the PCB.



J2 CONNECTOR PIN

1	+5 VDC
2	+5 RETURN
3	+12 RETURN
4	+12 VDC

FIGURE 3-3. J1/J2 CONNECTOR

SECTION IV
DRIVE PHYSICAL SPECIFICATIONS

4.1 GENERAL

This section contains the mechanical dimensions and mounting recommendations for the JU-3X4

4.2 MOUNTING

NOTE

DO NOT MOUNT HORIZONTALLY WITH PCB UP
DO NOT MOUNT VERTICALLY WITH FRONT BEZEL UP/DOWN

The drive is capable of being mounted in either of the following positions (see figure 4-1).

1. Front Loading - mounted vertically with door opening left or right.
   - mounted horizontally with PCB up.

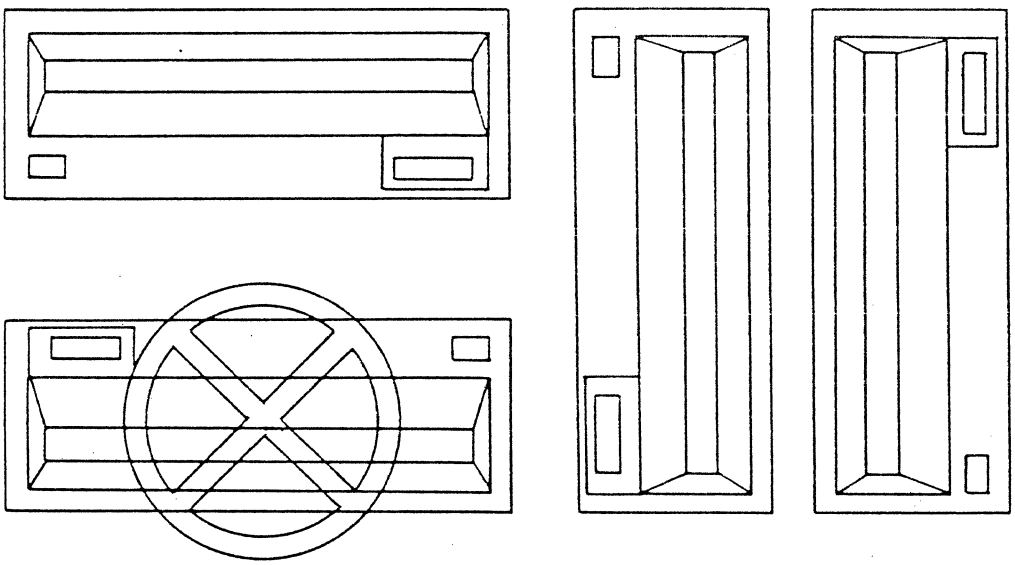


FIGURE 4-1. RECOMMENDED MOUNTING POSITIONS

4.3 MECHANICAL DIMENSIONS

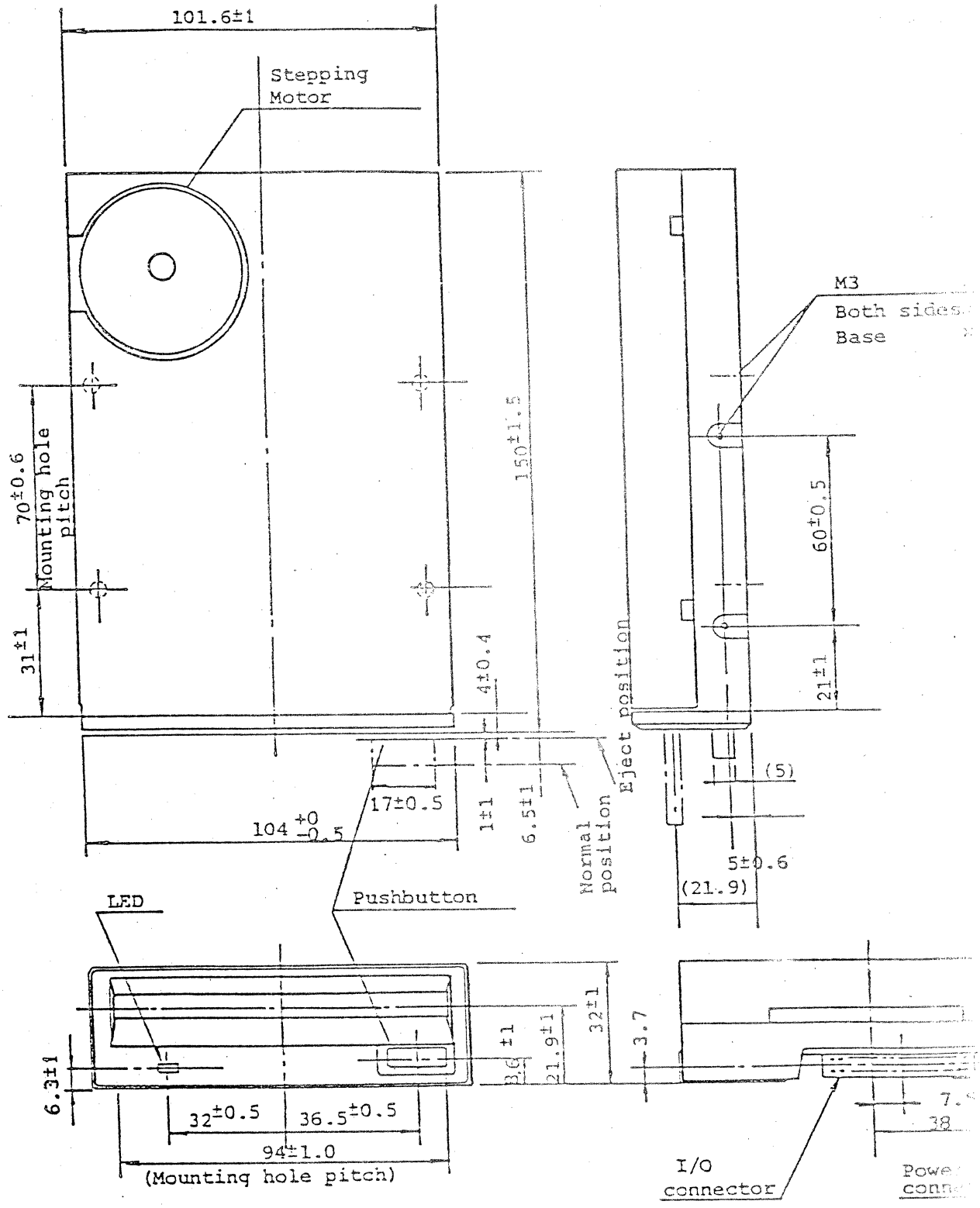


FIGURE 4-2 MECHANICAL DIMENSIONS

SECTION V
ERROR RECOVERY

5.1 WRITE ERROR

If an error occurs during a write operation, this error will be detected on the next revolution by doing a read operation (commonly called a "write check"). To correct the error, another write and write check operation must be done. If the write operation is not successful after 10 attempts have been made, a read operation should be attempted on another track. This is done to determine if the media or the drive is failing. If the error still persists, the disk should be considered defective and discarded.

5.2 READ ERROR

Most errors that occur will be "soft" errors. Soft errors are usually caused by the following:

a. Airborne contaminants passing between the read/write head and the disk. The contaminant will generally be removed by the cartridge self-cleaning wiper.

b. Random electrical noise which usually lasts for a few microseconds.

c. Small defects in the written data and/or track not detected during the write operation which may cause a soft error during a read.

The following procedure is recommended to recover from errors:

a. Reread the track 10 times or until such time as the data is recovered.

b. If data is not recovered after using step a, access the head to the adjacent track in the same direction previously moved. Return to the desired track.

c. Repeat step a.

d. If data is not recovered, the error is not recoverable.

5.3 SEEK ERROR

Seek errors are detected by reading the ID field after the seek is completed. The ID field contains the track address. If a seek error is detected, the host system should issue a recalibrate operation (step out until the TRACK 00 line goes active) and seek back to the original track.

SECTION VI
RECORDING FORMAT

6.1 GENERAL

The format of the data recorded on the diskette is totally a function of the host system. Data can be recorded on the diskette using FM or MFM encoding. In these encoding techniques, clock bits are written at the start of their respective bit cells and data bits at the centers of their bit cells.

Byte

A byte, when referring to serial data (being written onto or read from the disk drive), is defined as eight consecutive bit cells. The most significant bit cell is defined as bit cell 0 and the least significant bit cell is defined as bit cell 7. When reference is made to a specific data bit (e.g... data bit 3), it is with respect to the corresponding bit cell (bit cell 3).

During a write operation, bit cell 0 of each byte is transferred to the disk drive first with bit cell 7 being transferred last. Correspondingly, the most significant byte of data is transferred to the disk first and the least significant byte is transferred last.

When data is being read back from the drive, bit cell 0 of each byte will be transferred first with bit cell 7 last. As with reading, the most significant byte will be transferred first from the drive to the user.

Figure 6-1 illustrates the relationship of the bits within a byte and figure 6-2 illustrates the relationship of the bytes for read and write data.

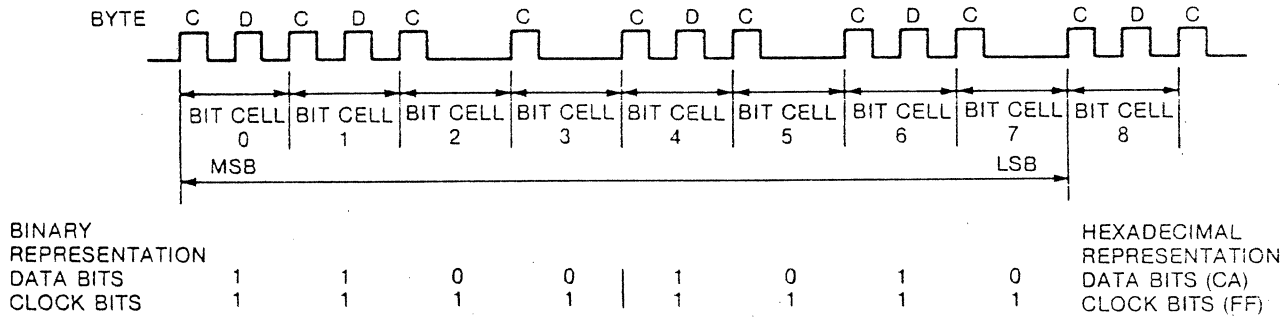


FIGURE 6-1. BYTE (FM ENCODING)

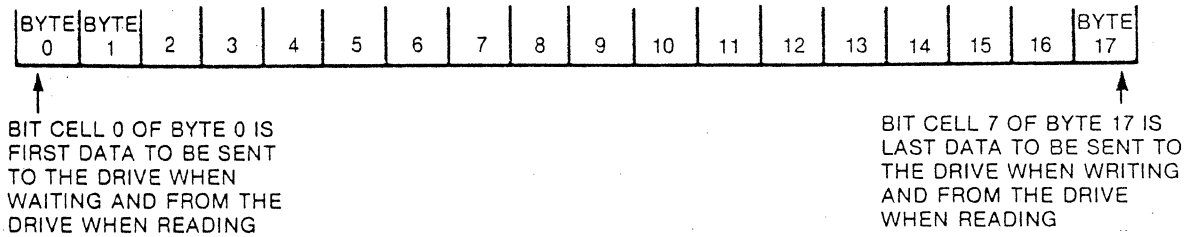
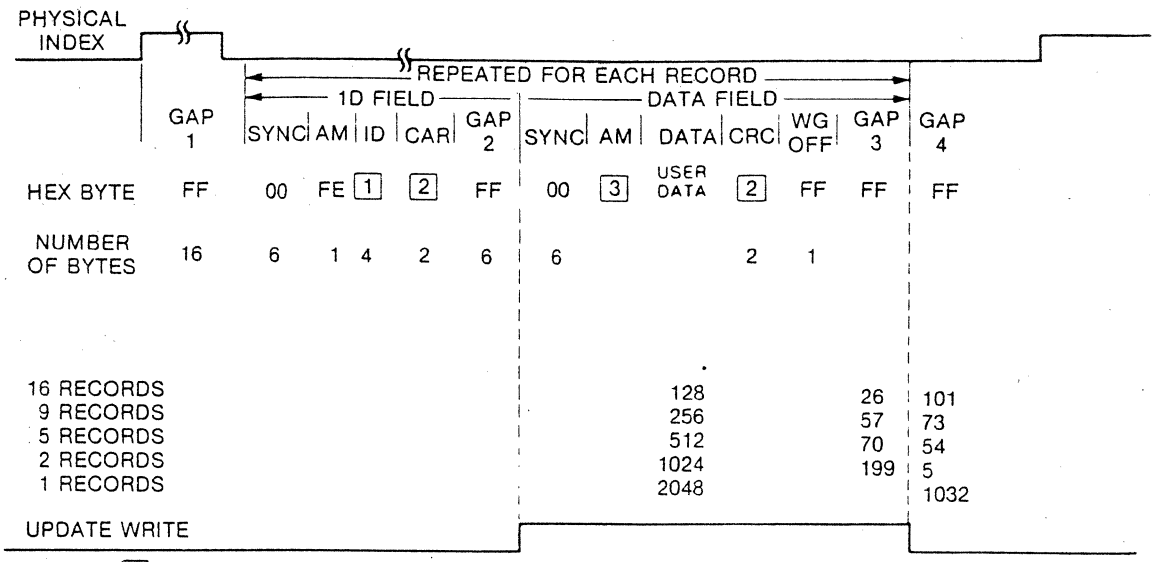


FIGURE 6-2. DATA BYTES

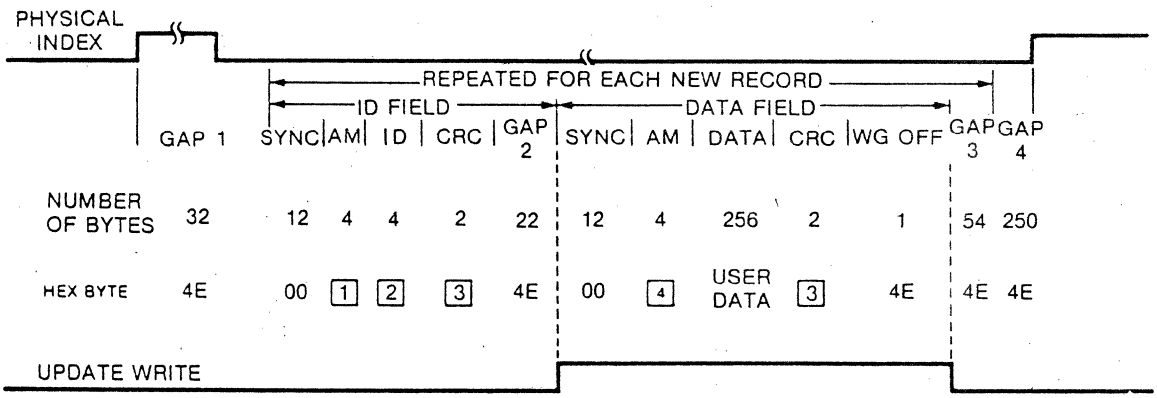
6.2 JU-3X4 SOFT SECTORED RECORDING FORMAT

In this format, the using system may record one long record or several smaller records. Each track is started by a physical index pulse and then each record is preceded by a unique recorded identifier. This type of recording is called soft sectoring. Figure 6-3 illustrates the recommended single-density (FM) formats. Figure 6-4 shows the recommended double-density (MFM) formats.



NOTES: [1] Track Number, Hard Number, Sector Number, Sector Length.
[2] IBM or Equivalent CRC Generator.
[3] FB for Data or FB for Deleted Data.

FIGURE 6-3. RECOMMENDED FM SOFT SECTOR SINGLE DENSITY (EVEN BOUNDARIES)



NOTES: [1] FIRST THREE BYTES ARE HEX A1 WITH MISSING CLOCK TRANSITIONS BETWEEN BITS 4 AND 5. LAST BYTE IS HEX FE.
[2] TRACK NUMBER, HEAD NUMBER, SECTOR NUMBER, SECTOR LENGTH (HEX 01).
[3] IBM OR EQUIVALENT CRC GENERATOR.
[4] SAME AS NOTE 1, EXCEPT LAST BYTE = HEX FB.

FIGURE 6-4 MFM RECOMMENDED IBM TYPE FORMAT, 256 BYTES/16 RECORDS PER TRACK

6.3 TRACK LAYOUT

Index — **Index** is the physical detector indicating one revolution of the media. Index is used to initiate format operations, generate the READY signal in the storage device, ensure one complete revolution of the media has been searched, and for a deselect storage device signal after a certain number of revolutions.

Gap 1 — **Gap 1** is from the physical index mark to the ID field address mark sync. Gap 1 allows for physical index variation, speed variation, and interchange between storage devices.

ID Field — **Sync** is a fixed number of bytes for separator synchronization prior to AM. Sync includes a minimum of two bytes plus worst case separator sync up requirements.

ID Pre Address Mark (MFM) is three bytes A1 with unique clock bits not written per encode rules.

ID Address Mark (FM) is a unique byte to identify the ID field and is not written per the encode rules.

ID Address Mark (MFM) is one byte of FE and is written per the encode rules.

ID is a four byte address containing track number, head number, record number, and record length.

CRC is two bytes for cyclic redundancy check.

Gap 2 — **Gap 2** is from ID CRC to data AM sync. Gap 2 allows for speed variation, oscillator variation, and erase core clearance of ID CRC bytes prior to Write Gate turn on for an update write.

Sync is a fixed number of bytes for separator synchronization prior to the AM. Sync includes a minimum of two bytes plus worst case separator sync up requirements.

Pre Data Address Mark (MFM) is three bytes of A1 with unique clock bits not written per the encode rules.

Data Address Mark (FM) is a unique byte to identify the data field and is not written per the encode rules.

Data Address Mark (MFM) is one byte of FB or F8 and is written per the encode rules.

Data is the area for user data.

CRC is two bytes for cyclic redundancy check.

WG OFF (Write Gate Off) is one byte to allow for Write Gate turn-off after an update write.

Gap 3 — **Gap 3** is from WG OFF to next ID AM sync. Gap 3 allows the erase core to clear the data field CRC bytes, speed and write oscillator variation, read preamplifier recovery time, and system turnaround time to read the following ID field.

Gap 4 — **Gap 4** is the last gap prior to physical index. Gap 4 allows for speed and write oscillator variation during a format write and physical index variation.

SECTION VII
CUSTOMER INSTALLABLE OPTIONS

7.1 GENERAL

The JU-3x4 can be modified by the user to function differently than the standard specification. These modifications can be implemented by adding or deleting connections. Options can be selected by use of a shorting bar. This section discusses the following modifications and how to install them.

TABLE 7-1 CUSTOMER PLUGGABLE OPTIONS

Trace Designator	Description	P2 pin Number		Shipped from Factory
D0	DRIVE SELECT 0 INPUT LINE	1	2	Plugged
D1, 2, 3	DRIVE SELECT 1, 2, 3 input line	3 5 9	4 6 10	Open
MO	MOTOR ON from MOTOR ON	7	8	Plugged
IU	In Use LED is lit with IN USE *	11	12	Open
(MD2)	MOTOR ON from DRIVE SELECT 2	5	7	Open
(MD3)	MOTOR ON from DRIVE SELECT 3	7	9	Open

△ **Note: 1. MD2, MD3 are not printed its character on PCB.**

Note: 2. When Pin 5 and Pin 8 in P2 are shorted, motor on is controlled by the signal of DRIVE SELECT 0. This will be re-designed in the future to a pluggable jumper at the different location.

* When the shorting Pin 11, 12 of P2 are shorted, IN USE LED is lit with low of IN USE signal. IN USE signal is only available cutting the pattern of "IUS". (See: shorting bar P2 pin assignment) When the △ shorting Pin 11, 12 of P2 are opened, IN USE LED is lit with DRIVE SELECT.

△

7.2 DRIVE SELECT

The Drive Select shorting bar. (D0, 1, 2, 3), as the drive is shipped is in position D0 (see figure 7-2). The JU-3x4 configured to operate alone in a single drive system. The JU-3X4 can be easily modified to operate with other drives in a daisy chained, multiplexed drive system. This is done by selecting a specific drive address and jumpering the appropriate Drive select line.

7.3 DRIVE STATUS

As described in paragraph 2.2.16, the READY interface pin 34 is determined by the following condition:

a. A cartridge is in the drive.

b. the spindle motor is on and up to speed.

c. DC power is supplied

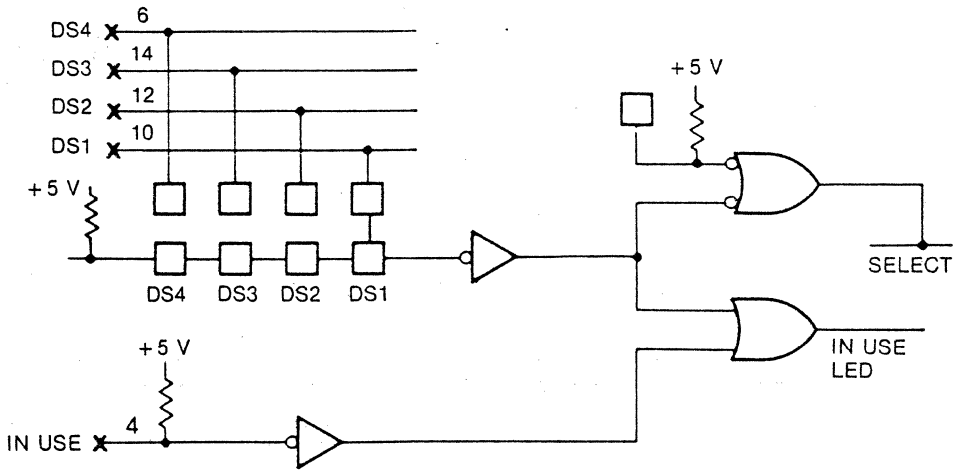


FIGURE 7-1 DRIVE SELECT LOGIC

7.4 OTHER OPTIONS

7.4.1 MOTOR ON 2, 3

Normally the drive is provided to activate the drive motor with MOTOR ON. But in some cases, that the systm needs to power the different drive motor sequencially. The shorted pin MD2, MD3 provide the solution for this problem. If the MD2 and MD3 are plugged and MO is removed, two drive motor can be activated differently with D/S2 and D/S3 lines.

7.4.2 IN USE

Normally IN USE LED is lit when the drive received the DRIVE SELECT, if the customer meets the requirement to light the IN USE LED, the pin 11. 12 of P2 shorted and the pattern "IUS" cut provide to activate LED with IN USE.

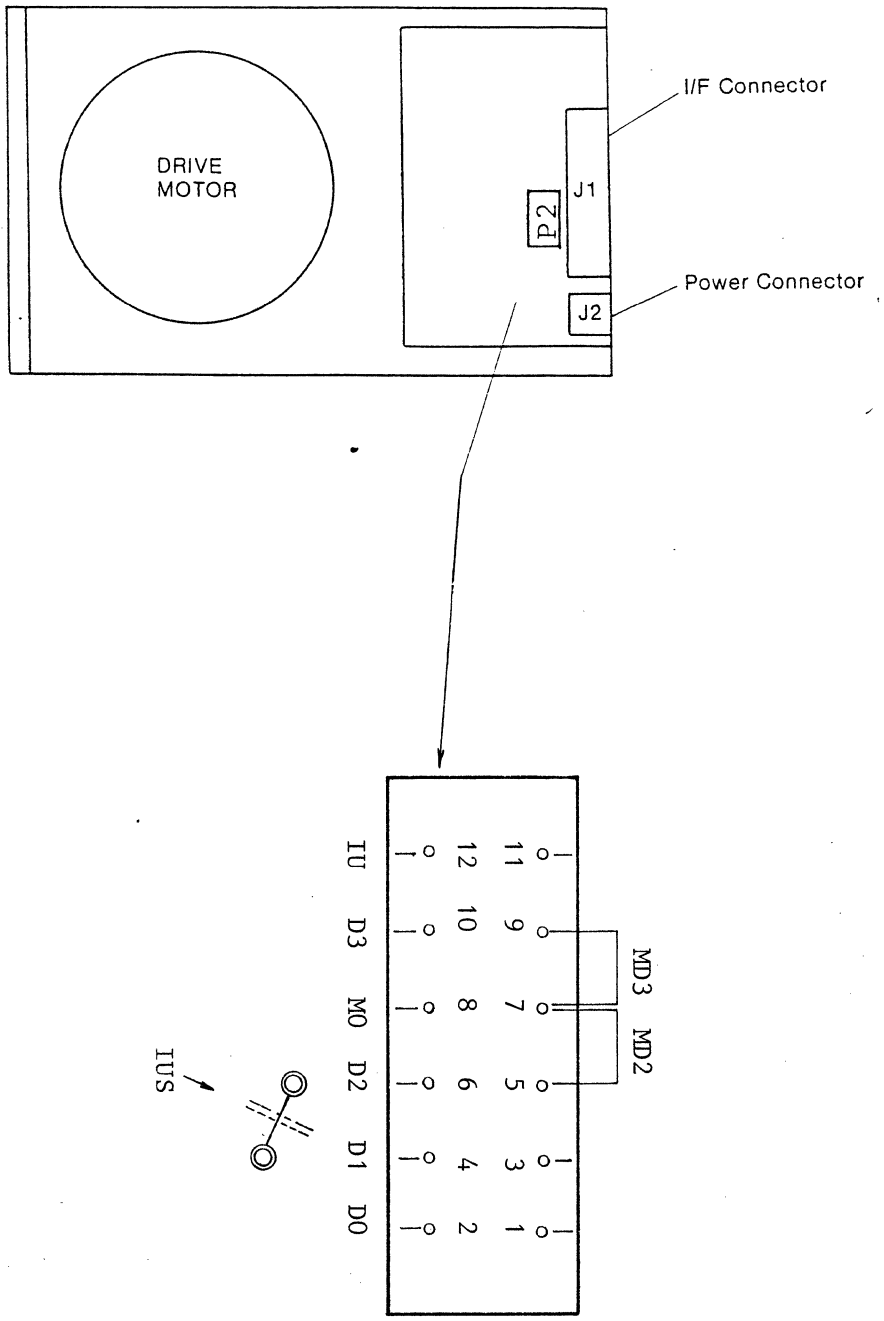


FIGURE 7-2 SHORTING BAR P2 PIN ASSIGNMENT

SECTION VIII
OPERATION PROCEDURES

8.1 INTRODUCTION

The JU-3X4 are designed for ease of operator use to facilitate a wide range of operator-oriented applications. The following paragraphs are a guide for the handling procedures on the microcartridge and microfloppy drive.

8.2 MICROCARTRIDGE LOADING

To load the microcartridge, insert the cartridge auto-shutter first, with the label facing up or opposite the eject button in HORIZONTAL mounting applications. Push in the cartridge. A mechanical interlock ensures proper media insertion. See Figure 8-1 for insertion illustration. Figure 8-2 provides nomenclature descriptions.

If the cartridge fails to load, press the eject button, then reinsert the cartridge.

To remove the cartridge, push the eject button. The cartridge will automatically eject.

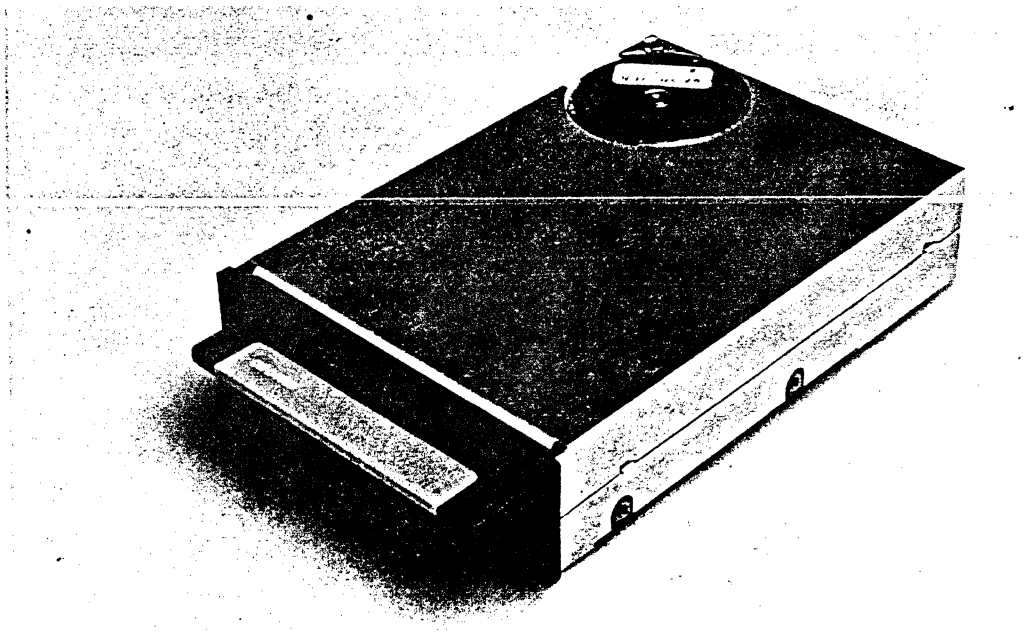


FIGURE 8-1 MICROCARTRIDGE LOADING

8.3 MICROCARTRIDGE HANDLING

To protect the cartridge, the same care and handling procedures specified for computer magnetic tape apply. These precautionary procedures are as follows:

a. Cartridges not intended for immediate use should be stored in the box.

b. Keep cartridges away from magnetic fields and from ferromagnetic materials which might become magnetized. Strong magnetic fields can distort recorded data on disk.

c. Place ID labels in correct location, never use in reverse.

d. Do not use erasers.

f. Heat and contamination from carelessly dropped ash could damage disk.

e. Do not expose cartridge to heat or sunlight.

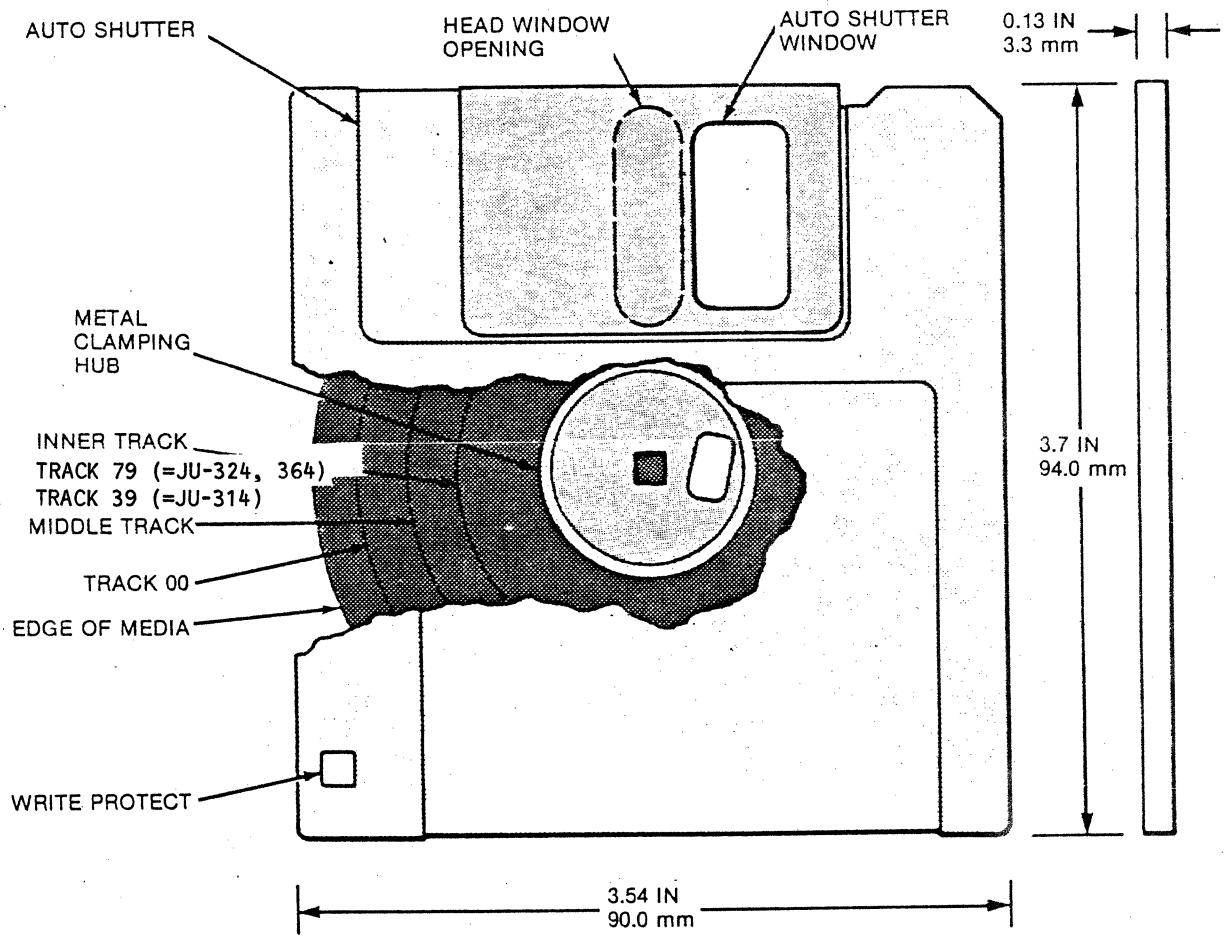


FIGURE 8-2 MICROCARTRIDGE NOMENCLATURE

8.4 WRITE PROTECT FEATURE

The microcartridge comes with a mechanical write protect tab. To write protect the cartridge, turn the mechanical tab as shown in figure 8-3 to uncover the write protect hole.

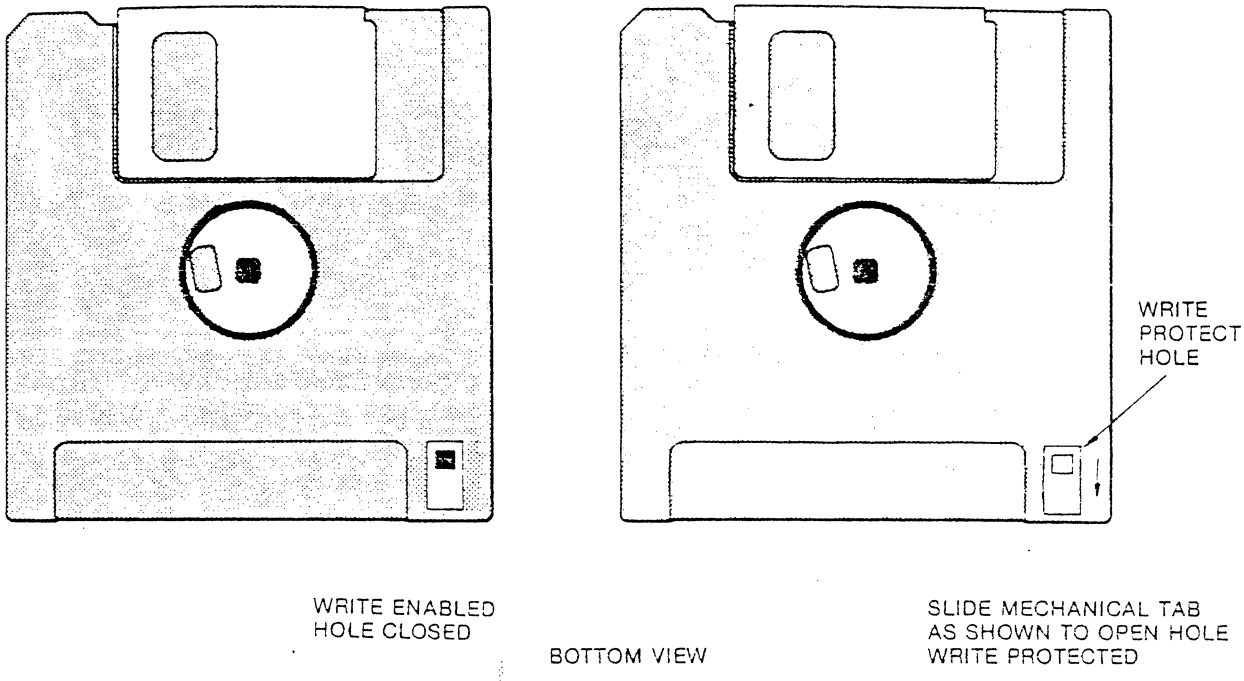


FIGURE 8-3 WRITE PROTECT OPERATION