

# OEM Manual

Flexible Disk  
Storage Drive

## JU-475

**Panasonic**

Matsushita Communication  
Industrial Co., Ltd.  
Memory Systems Division  
3-1, 4-chome Tsunashima-Higashi  
Kohoku-ku, Yokohama 223 JAPAN

## TABLE OF CONTENTS

	Page
SECTION I INTRODUCTION .....	1 - 1
1.1 GENERAL DESCRIPTION .....	1 - 1
1.2 SPECIFICATION SUMMARY .....	1 - 3
1.2.1 Performance Specification .....	1 - 3
1.2.2 Functional Specifications .....	1 - 3
1.2.3 Reliability Specifications .....	1 - 4
1.2.4 Physical Specifications .....	1 - 4
1.3 FUNCTIONAL CHARACTERISTICS .....	1 - 6
1.3.1 Read/Write and Control Electronics .....	1 - 6
1.3.2 Drive Mechanism .....	1 - 6
1.3.3 Positioning Mechanics .....	1 - 6
1.3.4 Read/Write Heads .....	1 - 7
1.3.5 Recording Formats .....	1 - 7
SECTION II ELECTRICAL INTERFACE .....	2 - 1
2.1 SIGNAL INTERFACE .....	2 - 3
2.2 INPUT LINES .....	2 - 3
2.2.1 Drive Select 1, 2, 3, or 4 (J1 Pins 10, 12, 14, and 6) .....	2 - 3
2.2.2 Direction (J1 Pin #18) .....	2 - 4
2.2.3 Motor On (J1 Pin #16) .....	2 - 4
2.2.4 Step (Pin #20) .....	2 - 4
2.2.5 Write Data (J1 Pin #22) .....	2 - 5
2.2.6 Write Gate (J1 Pin #24) .....	2 - 5
2.2.7 Side Select (J1 Pin #32) .....	2 - 5
2.2.8 In Use (J1 Pin #4) .....	2 - 6
2.2.9 Mode Select (J1 Pin #2) .....	2 - 6
2.3 OUTPUT LINES .....	2 - 6
2.3.1 Index (J1 Pin #8) .....	2 - 6
2.3.2 Track 00 (J1 Pin #26) .....	2 - 6
2.3.3 Write Protect (J1 Pin #28) .....	2 - 7
2.3.4 Read Data (J1 Pin #30) .....	2 - 7
2.3.5 Ready/Latched Ready/Latched Door Open/Latched Door Disturb/Door Open (J1 Pin #34) .....	2 - 8
2.4 POWER INTERFACE .....	2 - 8
2.5 FRAME GROUND .....	2 - 8
2.6 SYSTEM POWER AND GROUND DISTRIBUTION .....	2 - 8
2.7 FUNCTIONAL OPERATIONS .....	2 - 10
2.7.1 Power Sequencing .....	2 - 10
2.7.2 Read Operation .....	2 - 10
2.7.3 Write Operation .....	2 - 11

SECTION III	CUSTOMER UNSERVICEABLE OPTIONS	3 - 1
3.1	PLUGGABLE/TRACE OPTIONS	3 - 1
3.2	JUMPER OPTION (JU-475-1)	3 - 5
3.2.1	AX/BX/CX/JUMPERS	3 - 5
3.2.2	UA/DA/OA/HA/HH JUMPERS	3 - 5
3.2.3	MS/MM JUMPER	3 - 6
3.2.4	MX/DS JUMPER	3 - 6
3.2.5	DX/GX JUMPER	3 - 6
3.2.6	EX/FX JUMPERS	3 - 7
3.2.7	IRD/DR/RDY/LR/DC/DO/LX/DD/SP JUMPERS	3 - 7
3.2.8	AR/NO JUMPER	3 - 9
3.2.9	+WP JUMPER	3 - 9
SECTION IV	OPERATION PROCEDURES AND PRECAUTIONS	4 - 1
4.1	POWER-ON PROCEDURE	4 - 1
4.2	DRIVE SELECTION	4 - 1
4.3	DRIVE MOTOR TURN-ON	4 - 1
4.4	PRECAUTIONS	4 - 1
SECTION V	TIMING DIAGRAM	5 - 1
SECTION VI	PHYSICAL SPECIFICATION	6 - 1
6.1	J1 CONNECTOR (SIGNAL)	6 - 2
6.2	J2 CONNECTOR (POWER)	6 - 2
6.3	FRAME GROUNDING	6 - 2
6.4	MECHANICAL DIMENSIONS	6 - 3
6.5	DESCRIPTION OF THE TEST POINTS (T.P.)	6 - 4
6.6	MOUNTING	6 - 4

---

SECTION I

INTRODUCTION

1.1 GENERAL DESCRIPTION

The JU-475 is a high density, dual speed, double-sided 5.25 inch mini-floppy. The speed is controlled by pin 2 of the interface connector. When this pin is at logical low, the transfer rate is low and when at logical high, the transfer rate is high. At logical high an 8 1/4 inch floppy capacity can be mapped on this 5.25-inch half height mini-floppy, if the transfer rate is at 500K bits/sec (for M.F.M. double density recording), and when high density mini-floppy diskette is employed. Thus, JU-475 can be used as a high density 1.6 Mbyte drive. When at logical low this drive can be used as a standard 1.0 Mbyte drive.

TABLE 1.1 COMPATIBILITY WITH OTHER MODEL DRIVES

DISKET WRITTEN				READ BY JU-475	
FDD USED	DISKET	CAPACITY	ROTATIONAL SPEED	ROTATIONAL SPEED	TRANSFER RATE
Double Sided 48 TPI (JU-455)	MD	0.5 MB	300 rpm	360 rpm	300 kb/s
				300 rpm	250 kb/s
Double-Sided 96 TPI (JU-475)	MD	1.0 MB	300 rpm	360 rpm	300 kb/s
				300 rpm	250 kb/s
Single-Sided (JU-200)	MD	0.25 MB	300 rpm	360 rpm	300 kb/s
				300 rpm	250 kb/s
Dual-Speed (JU-475)	HD	1.6 MB	360 rpm	360 rpm	500 kb/s
				360 rpm	300 kb/s
	MD	1.0 MB	360 rpm	300 rpm	250 kb/s
				360 rpm	300 kb/s
MD	1.0 MB	300 rpm	360 rpm	300 kb/s	
			300 rpm	250 kb/s	

## Key Features

- . Compact half-height size
- . 1.0 or 1.6 Mbytes storage capacity
- . Backward compatibility to 48 tpi
- . 3 msec track accessing time
- . Brushless dual-speed direct drive dc motor
- . Low power consumption
- . 10,000 hours MTBF
- . Dual read channels
- . 250/500 kbits per second transfer rate

## 1.2 SPECIFICATION SUMMARY

### 1.2.1 Performance Specification

	Mini Mode (Low Transfer rate)	Maxi Mode (High Transfer rate)
Capacity (bytes)		
Unformatted (M.F.M.)		
Per Drive	1,000,000	1,666,666/1,604,167
Per Surface	500,000	833,333/802,083
Per Track	6,250	10,416
Unformatted (F.M.)		
Per Drive	500,000	833,333/802,083
Per Surface	250,000	416,666/401,041
Per Track	3,125	5,208
I.B.M. Format (M.F.M.)		
	16 Sectors/Track	15 Sectors/Track
Per Drive	655,360	1,228,800/1,182,720
Per Surface	327,680	614,400/591,360
Per Track	4,096	7,680
Per Sector	256	512
I.B.M. Format (F.M.)		
	16 Sectors/Track	15 Sectors/Track
Per Drive	327,680	614,400/591,360
Per Surface	163,840	307,200/295,680
Per Track	2,048	3,840
Per Sector	128	256
Transfer Rate (k Bits/Sec)		
M.F.M. Recording	250/300	500
F.M. Recording	125/150	250
Access Time (m sec)		
Track to Track	3	3
Settle Time	15	15
Average Access	94	94/91
Average Latency	100/83	83
Motor Start Time	500	500
Motor Speed Change Time	500	500

### 1.2.2 Functional Specifications

	300 R.P.M	360 R.P.M
Rotational Speed		
Recording Density (inner most track)		
M.F.M. Recording	5,922 B.P.I.	9,870/9,642 B.P.I.
F.M. Recording	2,961 B.P.I.	4,935/4,821 B.P.I.
Flux Density (inner most track)		
M.F.M. Recording	5,922 F.C.I.	9,870/9,642 F.C.I.
F.M. Recording	5,922 F.C.I.	9,870/9,642 F.C.I.
Track Density	96 T.P.I.	96 T.P.I.
Cylinders	80	80/77
Tracks	160	160/154
Read/Write Heads	2	2
Encoding Method	F.M./M.F.M.	F.M./M.F.M.
Media Requirements		650 Oe High Density/ANSI SPEC.

### 1.2.3 Reliability Specifications

M.T.B.F.	10,000 P.O.H.
M.T.T.R.	30 Minutes
Component Life	15,000 P.O.H. or 5 years
Error Rates	
Soft Error Rate	1 per $10^9$ bits read
Hard Error Rate	1 per $10^{12}$ bits read
Seek Error	1 per $10^6$ seeks
Media Life	
Number of Passes per Track	<del><math>3.5 \times 10^6</math></del>
Number of Media Clamps	$3 \times 10^4$

### 1.2.4 Physical Specifications

	Storage	Operating
Environmental Limits		
Ambient Temperature	$-8^{\circ}$ to $117^{\circ}\text{F}$	$50^{\circ}$ to $115^{\circ}\text{F}$
Relative Humidity	1 to 95% RH	20 to 80% RH
Max. Wet Bult Temp. (Non-Condensing)	$85^{\circ}\text{F}$	$85^{\circ}\text{F}$
Vibration	$< 3\text{G}$ ( $5 - 55\text{ Hz}$ )	$< 0.5\text{G}$ ( $5 - 55\text{ Hz}$ )
Shock 10 (MS)	$< 40\text{G}$	$\leq 0.5\text{G}$
Power Supply		
+12 V.D.C.: Voltage	$+10\%$	
Max. Ripple	$100\text{ mVp-p}$	
Current	$0.33\text{A}$ (Typical)	
	$1.2\text{A}$ (Max.)	
+ 5 V.D.C.: Voltage	$+5\%$	
Max. Ripple	$50\text{ mVp-p}$	
Current	$0.65\text{A}$ (Typical)	
	$0.8\text{A}$ (Max.)	
Mechanical Dimension		
Width = 5.75 Inches (146.1 mm)		
Height = 1.63 Inches ( 41.5 mm)		
Depth = 8.000 Inches (203.2 mm)		
Weight = 3.3 pounds ( 1.5 kg)		
Power Dissipation		
24.6 BTU/Hr (7.2 Watts) Continuous		
13.0 BTU/Hr (3.8 Watts) Stand-By		

(Note)

Stand-By: Drive motor off, drive select off, and stepper at reduced current.

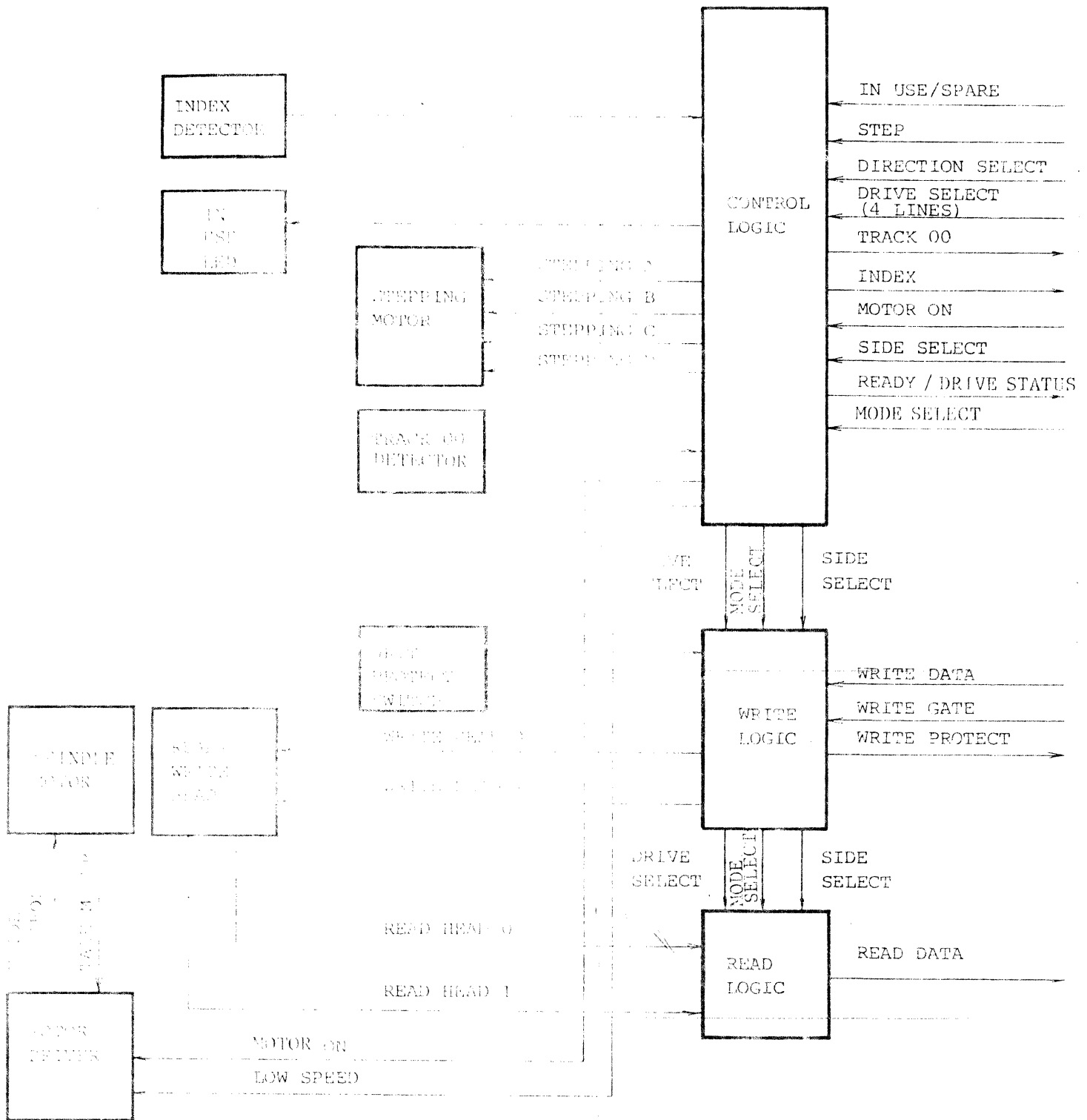


FIGURE 1-1 FUNCTIONAL DIAGRAM



### 1.3 FUNCTIONAL CHARACTERISTICS

The JU-475 consists of read/write and control electronics, drive mechanism, read/write heads, and precision track positioning mechanism. These components perform the following functions:

- a. Interpret and generate control signals.
- b. Move the read/write heads to the desired track.
- c. Read and write data.

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

#### 1.3.1 Read/write and Control Electronics

The electronics package contains:

- a. Index detector circuits
- b. Heads position actuator driver
- c. Read/write amplifier and transition detector
- d. Write protect detector
- e. Drive select circuit
- f. Drive motor control

#### 1.3.2 Drive Mechanism

The dc drive motor, under servo speed control (using an integral tachometer), rotates the spindle at 300 or 360 revolutions per minute through a direct drive system. An expandable collet/spindle assembly provides precision media positioning to ensure data interchange.

#### 1.3.3 Positioning Mechanics

The read/write heads assembly is accurately positioned through the use of a band positioner which is attached to the heads carriage assembly. Precise track location is accomplished as this positioner is rotated in discrete increments by a stepping motor.

#### **1.3.4 Read/Write Heads**

The proprietary heads are a single element glass-bonded ceramic read/write head with tunnel erase elements to provide erased areas between data tracks. The normal interchange tolerances between media and drives will not degrade the signal-to-noise ratio and diskette interchangeability is ensured.

The read/write heads are mounted on a carriage which is located on precision carriage rails. The diskette is held in a plane perpendicular to the read/write heads by a platen located on the base casting. This precise registration assures perfect compliance with the read/write heads. The heads 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.

#### **1.3.5 Recording Formats**

The formats of the data recorded on the diskette are totally a function of the host system. These formats 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.

SECTION II  
ELECTRICAL INTERFACE

The following section provides the electrical definition for each line. Figure 2-1 shows all of the interface connections with respect to the host system.

The signal interface consists of the following two categories:

- a) Control Lines
- b) Data transfer Lines

all lines in the signal interface are digital in nature and either provides signals to the drive (input), or provide signals to the host (output), by way of the interface connector J1.

The DC power connector, J2, provides +5V DC and +12V DC power.

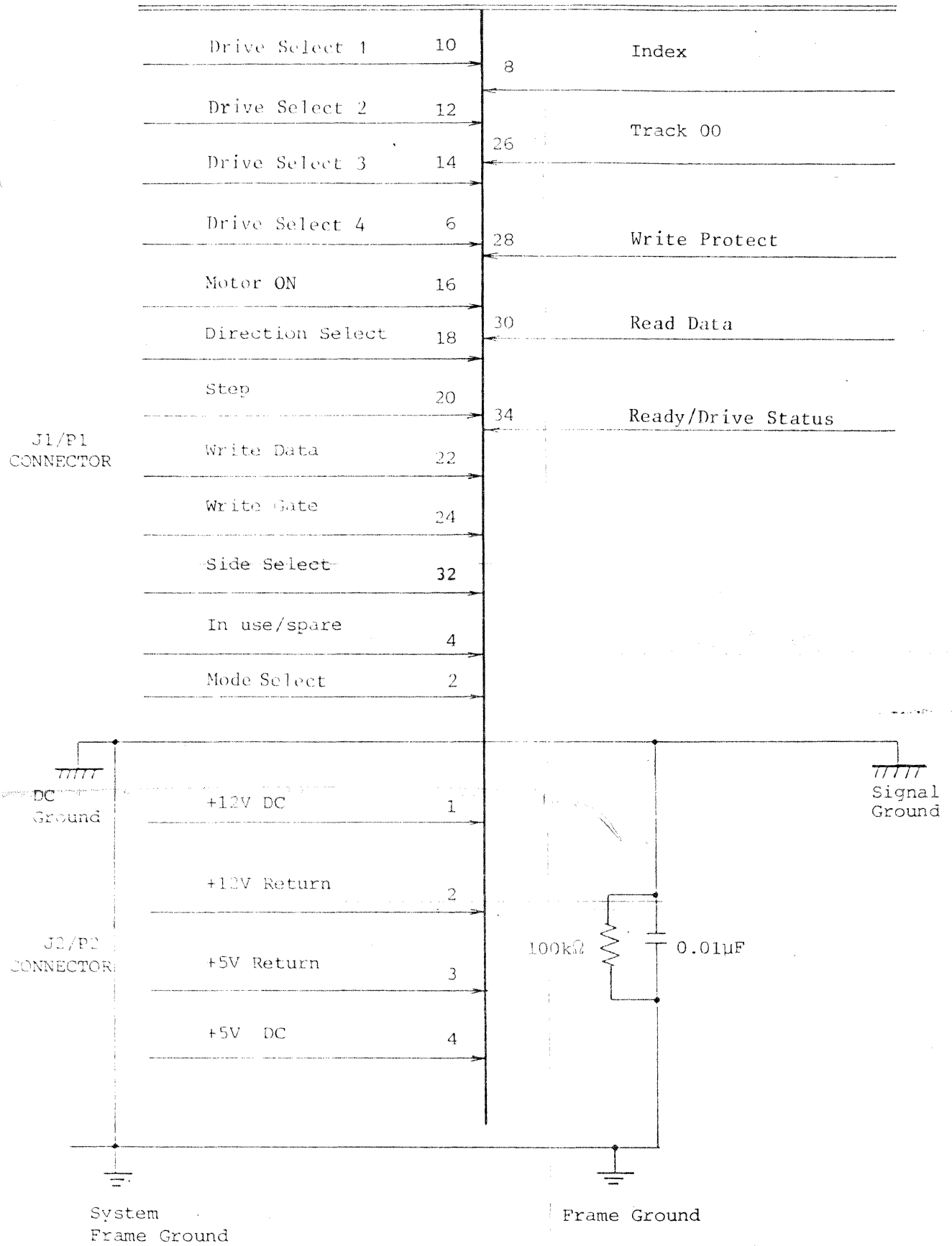


FIGURE 2-1 INTERFACE CONNECTION

## 2.1 SIGNAL INTERFACE

The JU-475 uses the industry standard open collector, low level - true, multiplexed interface convention. The industry standard open-collector, 40 milliamp current sink, TTL driver 7438 or equivalent, is used to transmit the I/O signals. The transmitted signals are detected by the industry standards, hysteresis input inverter, 7414 or equivalent. A 150 ohm pull-up resistor between the signal line and +5 volts is necessary on the receiving PCB. The input of each receiver is terminated through a 150 ohm resistor pack. When using two or more drives on a daisy chain, remove all termination resistor packs except for last drive on daisy chain.

The input signal lines which are not multiplexed are MOTOR ON and IN USE. The input lines have the following electrical specifications. See Figure 2-2 for the recommended circuits.

True = Logical zero =  $V_{in} + 0.0$  to  $+0.4$  V @  $I_{IN} = 40$  mA (MAX.)  
False = Logical one =  $V_{in} + 2.5$  to  $5.25$  V @  $I_{IN} = 250$   $\mu$ A (open)  
Input impedance = 150 ohms

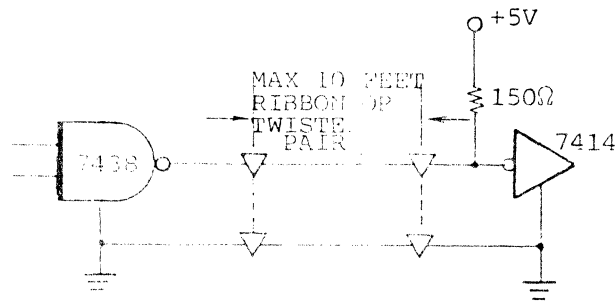


Fig. 2-2 INTERFACE SIGNAL DRIVE/RECEIVER

## 2.2 INPUT LINES

There are twelve active low TTL input lines to the JU-475 drive. Individual signal line characteristics are described below.

### 2.2.1 Drive Select 1, 2, 3, or 4 (J1 Pins #10, 12, 14, and 6)

Four separate input lines, drive select 1, drive select 2, drive select 3, and drive select 4 are provided so that in standard configuration (jumper D.S. closed and M.S. open) up to four drives may be multiplexed together in a system and have separate drive select lines. Traces DS1, DS2, DS3, DS4 have been provided to select which drive select line will activate the interface signals for a unique drive. Drive select, when activated to logical zero level, enables the multiplexed I/O lines.

### 2.2.2 Direction Select (J1 Pin #18)

'Direction select' determines the direction the head-carriage assembly will move when the JU-475 is properly selected, and when step pulses with the proper timing are sent to the JU-475. If 'direction select' is a logic low, the head-carriage assembly will seek toward the center of the diskette and away from the center when high.

'Direction select' must be stable at its correct logic state for at least 1 microsecond before each occurrence of the trailing edge of the step pulse, as measured at the drive interface connector, J1.

If the drive is not selected or a write operation is in process, 'direction select' is ignored by the JU-475.

### 2.2.3 Motor On (J1 Pin #16)

The 'motor on' signal causes the JU-475's spindle drive motor to turn on. In standard configuration (jumpers MM closed and MS open), this input signal line when true (logic low), will activate the motor if +5V DC and +12V DC are applied to the drive, whether or not the drive is selected. A minimum delay of 500 milliseconds must be allowed by the host system after activating this line before attempting to read or write, to allow the diskette to attain proper speed.

It is recommended that the spindle drive motor be turned off when the drive has not been selected for 10 revolutions or more. This will extend motor and diskette life and decrease power consumption. Host system workload must be analyzed to determine optimum delay between deselection of the drive and turning off the spindle drive motor.

### 2.2.4 Step (Pin #20)

When the JU-475 is properly selected and the trailing edge (a low-to-high transition) of the 'step' signal occurs, the head-carriage assembly will move one track in the direction selected by 'direction select' J1 pin 18.

'Step' and its timing are generated by the host system controller.

The controller timing requirements for 'drive select', 'direction select', and 'step' are shown on the following page.

First the drive should be selected, then 'direction select' should be set to its correct logic level, then 'step' should be set to a logic low level. A minimum of 1 microsecond later 'step' may make its low-to-high transition (trailing edge of 'step') to initiate head-carriage movement. The minimum allowable time between trailing edges of 'step' is 3 milliseconds. The minimum allowable pulse width for 'step' is 1 microsecond.

Each trailing edge of 'step' is used internal to the drive to latch 'direction select'. Therefore, 'direction select' may be changed immediately after the trailing edge of 'step'.

If the JU-475 flexible disk drive is not properly selected or a write operation is in process, the 'step' pulses from the host system will be ignored.

If 'direction select' is a logic low level and the drive is at the inside track, track 79, and a 'step' pulse is issued by the host system, the head-carriage assembly will attempt to move until stopped by the mechanical safety stop installed on the JU-475 flexible disk drive.

Driving the head-carriage assembly of the JU-475 flexible disk drive into the safety stops is not recommended. The host system controller should know the position of the head-carriage assembly at all times by reading the sector or track ID address field. In the event that the controller should lose track of the head-carriage assembly's location, it is recommended that 'direction select' be set to a logic high level and single 'step' pulses be issued, one at a time, checking after the proper delay each time for the 'track 00' signal to return to a true state (logic low).

#### **2.2.5 Write Data (J1 Pin #22)**

This interface line provides the data to be written on the diskette in the appropriate sector. Each transition from a high logic level to a low logic level on this line causes write current to be reversed through the head. If the drive is not properly selected, a write protected diskette is installed.

#### **2.2.6 Write Gate (J1 Pin #24)**

A low logic level on this line enables the write current source provided the drive is selected, diskette used is not write protected and seek operation completed. Hence allows data to be written from the write data line.

#### **2.2.7 Side Select (J1 Pin #32)**

When the JU-475 has been selected, 'side select' determines which side of the disk is to be activated. A logic low (true or logic zero) selects side 1; a logic high (false or one) selects side 0.

When switching from one side to another, a 100 micro seconds delay is required before a read or write operation can be initiated.

If the drive is not selected or a write operation is in process, 'side select' is ignored by the JU-475.

### 2.2.8 In Use (J1 Pin #4)

Using appropriate jumper options, this line can monitor the activity L.E.D. light. See UA/DA/OA/IU/HD jumper option section for detail description of activity L.E.D. functions.

### 2.2.9 Mode Select (J1 Pin #2)

Using the appropriate jumper option, spindle speed can become the function of the logic level on pin #2. When such an option is chosen and a logic low is present on pin #2 and the drive is selected from deselected state the Mode is selected low transfer rate. When a logic high is present on pin #2 and the drive is selected from deselected state the Mode is selected high transfer rate. (see AX/AT/BX/CX jumper option section).

## 2.3 OUTPUT LINES

The JU-475 drive output five active signal lines. Each output line is driven by a 7438 open collector output gate. Individual signal line characteristics are described below:

### 2.3.1 Index (J1 Pin #8)

'Index' signal is generated once each revolution of the diskette and indicates the beginning of a track. When the 'index' signal is true, the signal is a logic low level. The 'index' signal pulse width is 4.0 milliseconds + 2 milliseconds. In the standard configuration, when EX jumper is closed, 'index' pulses will be present at the interface connector only when:

- A) The proper D.C. power is applied to the 'D.C. power' connector, J2.
- B) The drive is properly selected.
- C) Diskette is installed, clamped and rotating.
- D) The 'index' signal line is properly terminated at the host system controller with a 150 ohm resistor to +5 V D.C. When the jumper EX is open, index pulse is masked as long as the drive is 'internally' not ready (i.e., either the carriage is seeking or the head has not settled on a track). See also EX jumper option.

### 2.3.2 Track 00 (J1 Pin #26)

An active low on this signal line indicates that the read/write head is positioned at track zero.



### 2.3.3 Write Protect (J1 Pin #23)

An active low level on this signal line indicates that write protected diskette has been installed. Under normal operation, the drive will inhibit writing when a write protected diskette has been installed.

### 2.3.4 Read Data (J1 Pin #30)

In standard configuration, when GX jumper is closed, data from the diskette is outputted to the host system in the same form as it was received on the write data line. Each flux reversal that is sensed on the diskette produces a transition to active low level. The leading edge of this signal is the only transition that is sensed. When GX jumper is open, the read data signal is inhibited as long as the drive is 'internally' not ready (i.e., either the carriage is seeking or the head has not settled on a track). See also GX jumper option section.

### 2.3.5 Ready/Latched Ready/Latched Door Open/Latched Door Disturb/Door Open (J1 Pin #34)

By choosing appropriate jumper options, the following definitions at pin #34 could be achieved. Also see TRD/DR/RDY/LR/DC/DO/IX/DO/SP jumper option section.

- a) Ready: Pin #34 is active low when the media is clamped, motor up to speed (at least two inter pulses sensed) and drive selected. Otherwise, pin #34 logic level would be high.
- b) Latched Ready: Pin #34 is latched low when the media is inserted, door is closed, drive is selected and motor up to speed. The logic level is unlatched by opening the door.
- c) Latched Door Open: Pin #34 is latched low during power up or when the door is open. To unlatch the logic level, the drive has to be deselected from selected state while the door is closed and drive powered up.
- d) Latched Door Disturb: Pin #34 is latched low during power up or when the door is open. To unlatch the logic level the drive should step a track while it is selected, powered up and door closed.
- e) Door Open: Pin #34 is direct function of door open status. It is active low when the door is open; otherwise it remains high.

## 2.4 POWER INTERFACE

The JU-475 drive requires only D.C. power for operation. D.C. power to the drive is provided by J2 power interface. The two D.C. voltages, their specifications and their J2 pin designators are outlined below:

TABLE 2-1 DC POWER REQUIREMENTS

J2 Pin #	D.C. Voltage	Tolerance	Current	Max. Ripple
4	+5 V D.C.	+ 5%	0.65A. TYP	50 mVp-p
3	+5 V Return	*	0.8A. MAX	
2	+12 V Return	*	0.33A. TYP	100 mVp-p
1	+12 V D.C.	+10%	1.2A. MAX	

\* +12 V DC and +5 V DC ground returns are tied together at

## 2.5 FRAME GROUND

Frame ground for the JU-475 is provided by a push-on tab terminal, mounted on the rear of the drive directly behind the stepper motor.

When the host system's input power is AC, the JU-475 drive frame must be grounded to the third wire safety ground. If the host system is DC powered, the frame ground may be tied to the DC power ground.

## 2.6 SYSTEM POWER AND GROUND DISTRIBUTION

To provide optimum performance and noise immunity, extreme care must be used to provide low noise grounds. Independent frame ground wires should run from each JU-475 drive and other system components to a single point system frame ground.

The 5 volt and 12 volt return lines should be connected together at the host system, but these DC power supply return lines should be isolated from the system frame (AC) ground. These return lines are isolated from frame ground on the JU-475 PCB by a 0.01 uF capacitor and 100k ohm resistor in parallel. The network is provided to suppress differential noise between the DC and AC grounds while providing a DC connection.

Grounding for the TTL signal lines between the JU-475 PCB logic ground and host system (controller) PCB logic ground should be provided by the 17 signal ground pins of the J1 connector. All odd pins, 1 through 33, should be connected to the controller signal ground plane.

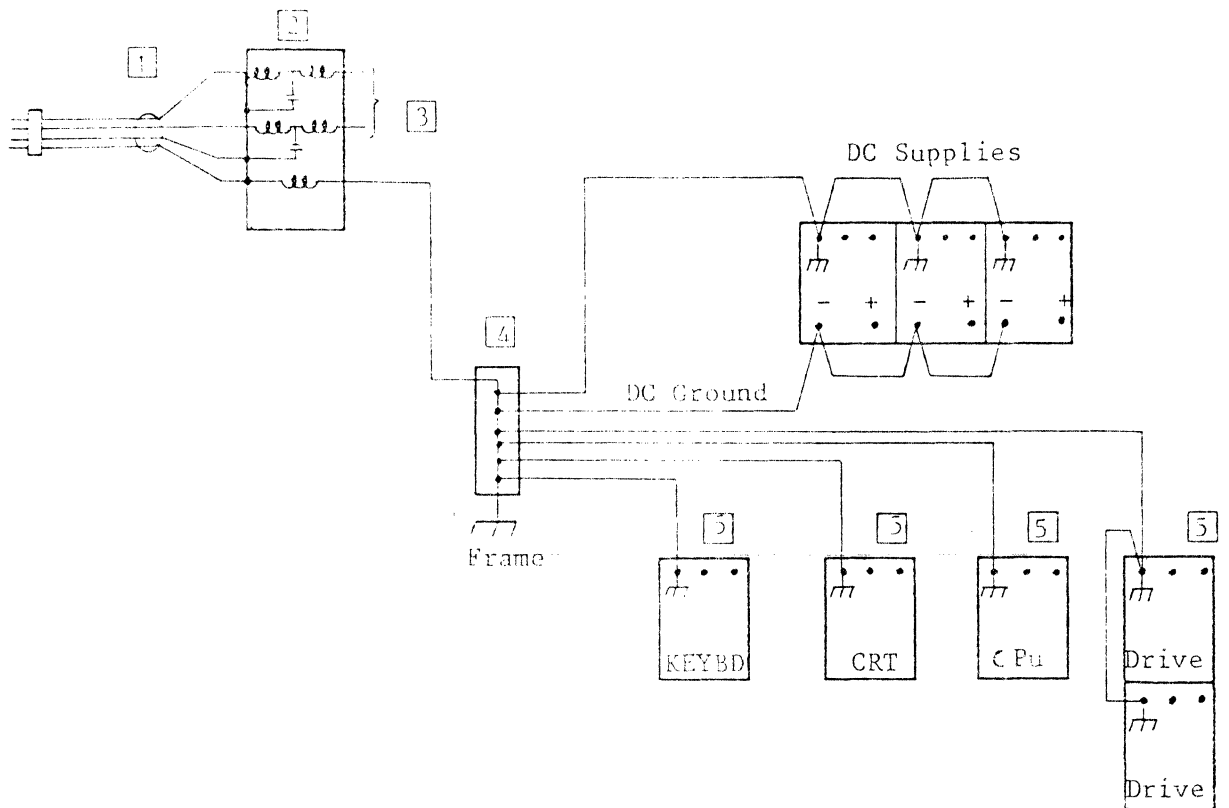


FIGURE 2-3 RECOMMENDED POWER AND GROUND DISTRIBUTION

**NOTES**

1. Shield power cable - Should be only one and tied to ground at filter end only.
2. Line filter - Isolated from frame with system ground filtered.
3. AC distribution - Twisted pair cable including ground wire (as shown in 5 places). Wire size large enough to maintain less than 25 mV/ft drop.
4. AC ground TB - Only one connection to frame for all dc grounds and one ac ground.
5. DC distribution - Separate twisted pair cable from each device to the dc supplies (as shown in four places). Wire size large enough to maintain less than 10 mV/ft drop.

## 2.7 FUNCTIONAL OPERATIONS

### 2.7.1 Power Sequencing

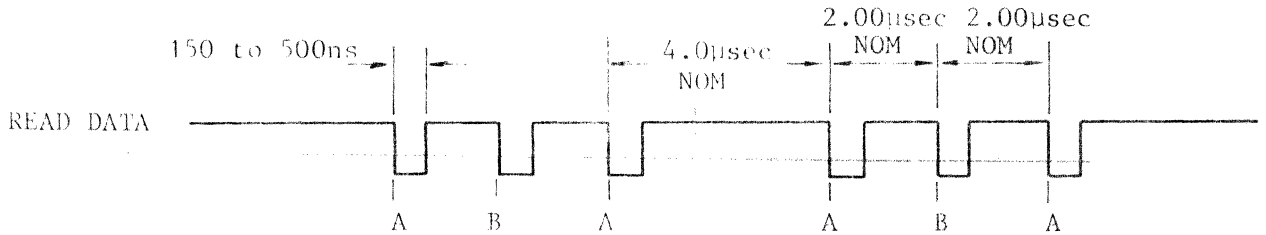
Applying dc power to the drive can be done in any sequence. However, during power up, the WRITE GATE line must be held inactive or at a high level. This will prevent possible "glitching" of the media. After application of dc power, a 500 millisecond delay should be introduced before any operation is performed. After powering on, initial position of the read write head are at track 00. Because of this, a recalibrate operation should not be required. And initial drive Mode is the MINI MODE. (See 3.2.8)

### 2.7.2 Read Operation

Reading data from the drive is accomplished by:

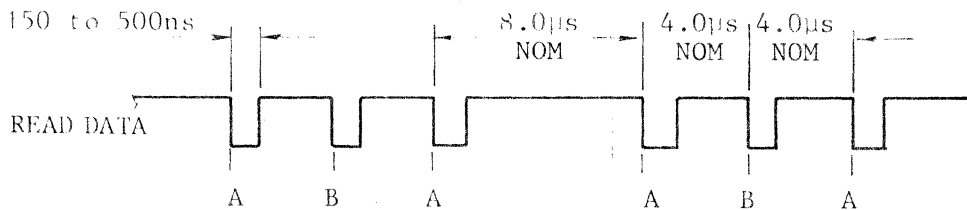
- a. Activating the DRIVE SELECT line.
- b. Selecting the head.
- c. WRITE GATE being inactive.

The timing requirements for the Read operation for both high speed and low speed operation are shown in Figures 2-4 and 2-5 respectively.



A = LEADING EDGE OF BIT MAY BE  $\pm$  400 nsec FROM ITS NOMINAL POSITION.  
 B = LEADING EDGE OF BIT MAY BE  $\pm$  200 nsec FROM ITS NOMINAL POSITION.

FIGURE 2-4 HIGH SPEED READ DATA TIMING (FM ENCODING 1.6 M BYTES)



A = LEADING EDGE OF BIT MAY BE  $\pm$  800 ns FROM ITS NOMINAL POSITION.  
 B = LEADING EDGE OF BIT MAY BE  $\pm$  400 ns FROM ITS NOMINAL POSITION.

FIGURE 2-5 LOW SPEED READ DATA TIMING (FM ENCODING 1.0 M BYTES)

### 2.3 Write operation

2.3.1 Write data is transferred to the disk as follows:

- a. Addressing the WRITE SELECT line.
- b. Setting the WRITE DATA line.
- c. Addressing the READ DATA line.
- d. Putting the WRITE DATA line with the data to be written.

The timing specifications for the write data pulse are shown in Figure 2-6 for high speed operation, and Figure 2-7 for low speed operation. Write data pulse width is 100 nsec. The write data should be precompensated 175 nsec and starting at track 43 to counter the effects of bit shift. The amount of compensation required for any given bit in the data stream is dependent on the position of this bit with nearby bits.

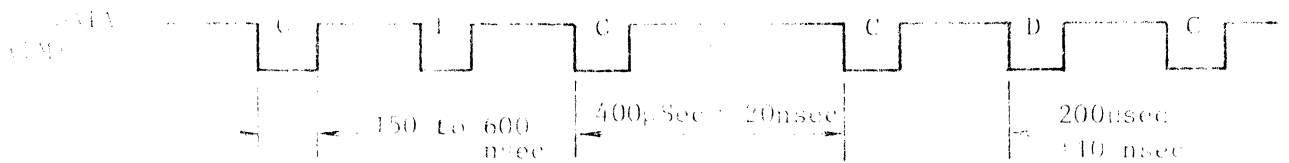


FIGURE 2-6 HIGH SPEED WRITE DATA TIMING (FM ENCODING 1.6 M BYTES)

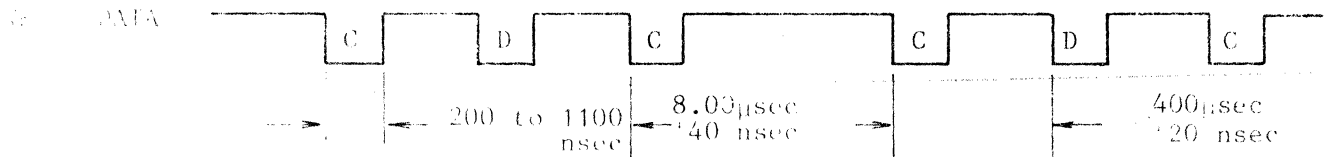


FIGURE 2-7 LOW SPEED WRITE DATA TIMING (FM ENCODING 1.0 M BYTES)

SECTION III  
CUSTOMER INSTALLABLE OPTIONS

This section discusses examples of modifications and how to implement them.

**3.1 PLUGGABLE/TRACE OPTIONS**

The JU-475 can be modified by the user to suit individual need. These modifications can be implemented by adding, changing, or deleting connections. These changes can be accomplished by the use of a shorting plug (See Table 3-1) or by shorting a trace (See Table 3-2).

Option shorting Plug: 0.100 inch centers, Honda Part Number Z-252.

TABLE 3-1 PLUGGABLE OPTIONS

JUMPER DESIGNATION	DESCRIPTION	SHIPPED FROM FACTORY			
		JU-475-0		JU-475	
		OPEN	SHORT	OPEN	SHORT
DS2	DRIVE SELECT 2		x		x
DS 1,3,4	DRIVE SELECT 1, 3, 4	x		x	
DS	ENABLE DRIVE SELECT IN A MULTI-DRIVE SYSTEM		x		x
MX	CONSTANT DRIVE SELECT USED IN A SINGLE DRIVE SYSTEM (ONLY)	x		x	
LA	LATCHED ACTIVITY LED	x		x	
DA	ACTIVITY LED WITH DRIVE SELECT		x		x
OA	ACTIVITY LED WITH IN USE OR DRIVE SELECT	x		x	
MS	ENABLES DRIVE MOTOR WITH DRIVE SELECT	x		x	
MM	ENABLES DRIVE MOTOR WITH MOTOR ON		x		x
HL	HEAD LOAD WITH IN USE (Not Used)	x		x	
HS	HEAD LOAD WITH DRIVE SELECT (Not Used)	x		x	
HM	HEAD LOAD WITH MOTOR ON (Not Used)	x		x	
AX	SPARE IF JUMPER REMOVED	x		x	
		(TRACE CUT)			
AT	ENABLES 475 USED AT	-	x (JUMPER)		x
HA	ACTIVITY LED WITH DRIVE SELECT & IN USE	-	-	x	

FUNCTION	DESCRIPTION	FUNCTIONS			
		Jumper		Pin	
		ON	OFF	ON	OFF
DD	DISK CHANGE DETECT	X		X	
IX	DISK CHANGE INDEX	X		X	
→ SP	DISK CHANGE STEP		X		X
LR	LATCHED READY	X		X	
→ DC	LATCHED DOOR DISABLE		X		X
DO	DOOR OPEN	X		X	
IRD	INTERNAL READY	X		X	
→ BX	TWO SPEED	X		X	
CX	SENSE SELECT		X		X
IU	IN USE FROM DRIVE SELECT		X	-	-
HD	IN USE FROM IN USE	X		-	
HH	HEAD LOAD WITH DRIVE SELECT & IN USE	-	-		X
AX	SPARE IF JUMPER REMOVED	X		X (JUMPER)	
MSE	CONTROLLED FUNCTION (Not Custom Used)		X		X
AR	AUTO RECAL		X		X
NO	NO AUTO RECAL	X		X	
WP	WRITE PROTECT 5.1/4 STD		X		X
RDY	STANDARD READY	X		X	
DR	READY ENABLE FROM DRIVE SELECT		X		X
DX	DISABLE TRUF READY (Not Used)	X		X	



JUMPER DESIGNA- TION	DESCRIPTION	SHIPPED FROM FACTORY			
		JU-475-0		JU-475	
		OPEN	SHORT	OPEN	SHORT
EX	DISABLE TRUE READY (Not Used)	x		x	
FX	ENABLE TRUE READY	-	-		x
GX	ABLE TRUE READY	-	-		x
JX	HIGH SPEED MODE ONLY (Not Used)	-	-	x	

### 3.2 JUMPER OPTION (JU-475-1)

#### 3.2.1 AX/AT/BX/CX JUMPERS

AX	AT	BX	CX	SPINDLE SPEED	WRITE CURRENT
CLOSED	OPEN	OPEN	CLOSED	HIGH	L - #2
CLOSED	OPEN	CLOSED	OPEN	L - #2	L - #2
OPEN	CLOSED	OPEN	CLOSED	HIGH	#2
OPEN	CLOSED	CLOSED	OPEN	#2	#2

Note 1: L - #2: This is the latched value of Pin #2 logic level of J1 I/O interface. The latching operation occurs when the drive is selected from a deselected state.

Note 2: #2 : This is Pin #2 logic level of J1 I/O interface.

Note 3: AX/AT/BX/CX - Shorted plug installed option.

#### 3.2.2 UA/DA/OA/HA/HH JUMPERS

UA	DA	OA	HA	HH	IN USE LED
OPEN	OPEN	CLOSED	OPEN	DON'T CARE	IN USE LED is a direct function of "IN USE" line only of J1 I/O.
OPEN	CLOSED	CLOSED	OPEN	DON'T CARE	IN USED LED is the function of "DRIVE SELECT" or "IN USE" line of J1 I/O.
OPEN	CLOSED	OPEN	OPEN	DON'T CARE	IN USE LED is a direct function of "DRIVE SELECT" line only of J1 I/O.
OPEN	OPEN	OPEN	CLOSED	CLOSED	IN USE LED is function of "DRIVE SELECT" and "IN USE" line of I/O.
CLOSED	OPEN	OPEN	OPEN	DON'T CARE	IN USED LED is a latched function of "IN USE" line. Latching operation is achieved by selecting the drive from a deselected state.

Note 1: HH: Solder jumper option

Note 2: UA/DA/OA/HA: Shorted plug installed option.

### 3.2.3 MS/MM JUMPER

MS	MM	SPINDLE MOTOR
OPEN	CLOSED	Spindle motor is a function of "MOTOR ON" line of J1 I/O. Motor is turned on when there is logical "Low" on "MOTOR ON" signal.
CLOSED	OPEN	Spindle motor is not a function of "MOTOR ON" line, instead the motor is turned on when the drive is settled.

Note 1: MS/MM: Shorted plug installed option.

### 3.2.4 MX/DS JUMPER

MX	DS	DRIVE SELECTION
OPEN	CLOSED	Drive is selected, when "DRIVE SELECT" line of J1 I/O interface is low.
CLOSED	OPEN	Drive is always selected irrespective of any logic level on "DRIVE SELECT" line of J1 I/O interface.

Note 1: DS/MX: Shorted plug installed option.

### 3.2.5 DX/GX JUMPER

DX	GX	READ DATA (PIN #30 of J1 I/O INTERFACE)
CLOSED	OPEN	"READ DATA" is enabled by 'proper' logic levels of "WRITE GATE", "WRITE PROTECT" and "DRIVE SELECT" signals.
OPEN	CLOSED	"READ DATA" is enabled by 'proper' logic levels of "WRITE GATE", "WRITE PROTECT" and "DRIVE SELECT" signals, and also when the head has 'settled' on a track. This mode is usable in Seeking process to inhibit the host system from reading any data if the drive is 'internally' not ready yet (i.e., either the carriage is seeking or the head has not yet settled on a track.

Note 1: DX/GX: Solder jumper option.

### 3.2.6 EX/FX JUMPERS

EX	FX	INDEX (PIN #34 J1 I/O INTERFACE)
CLOSED	OPEN	"INDEX" is generated once each revolution of the diskette, when "DRIVE SELECT" line of J1 I/O interface is low.
OPEN	CLOSED	"INDEX" is generated once each revolution of the diskette, only after the read/write head has 'settled' on a track. This mode is usable in seeking process to tell the host system (via latent index) that the drive is 'internally' not ready yet for the host system to perform any read or write operation on it.

Note 1: EX/FX: Solder jumper option.

### 3.2.7 IRD/DR/RDY/LR/DC/DO/IX/DD/SP JUMPERS

#### (1) Latched Ready

Status	Jumpers
Open	DR, RDY, DC, DD, DD, SP
Closed	IRD, LR, IX

#### DEFINITION OF PIN #34 (J1 I/O INTERFACE)

Latched Ready: Pin #34 is latched low when the media is inserted, door is closed, drive is selected and motor up to speed. The logic level is unlatched by opening the door.

#### (2) Latched Door Open

Status	Jumpers
Open	IRD, DR, RDY, LR, DO, IX, SP
Closed	DD, DC

#### DEFINITION OF PIN #34 (J1 I/O INTERFACE)

Latched Door Open: Pin #34 is latched low during power up or when the door is open. To unlatch the logic level, the drive has to be deselected from selected state while the door is closed and drive powered up.

(3) Latched Door Disturb

Status	Jumpers
Open	IRD, DR, RDY, LR, DO, IX, DD
Closed	SP, DC

DEFINITION OF PIN #34 (J1 I/O INTERFACE)

Latched Door Disturb: Pin #34 is latched low during power up or when the door is open. To unlatch the logic level the drive should step a track while it is selected, powered up and door closed.

(4) Door Open

Status	Jumpers
Open	IRD, DR, RDY, LR, DC
Closed	DO
Don't Care	IX, DD, SP

DEFINITION OF PIN #34 (J1 I/O INTERFACE)

Door Open: Pin #34 is direct function of door open status. It is active low when the door is open; otherwise it remains high.

(5) Ready

Status	Jumpers
Open	LR, DC, DO
Closed	RDY, DR
Don't Care	IRD, DO, IX, SP

DEFINITION OF PIN #34 (J1 I/O INTERFACE)

Ready: Pin #34 is active low when the media is clamped, motor up to speed (at least two index pulses sensed) and drive selected. Otherwise, pin #34 logic level would be high.

Note 1: DR/RDY: Solder jumper option.

Note 2: IRD/LR/DC/DO/IX/DD/SP: Shorted plug installed option.

(6) Disk Change

Status	Jumpers
Open	IRD, RDY, LR, DO, IX, DD
Closed	DR, SP, DC

DEFINITION OF PIN #34 (J1 I/O INTERFACE)

Disk change: Pin #34 is active unless a diskette is clamped and a step pulse is received when the drive is selected.

3.2.8 AR/NO JUMPER

AR	NO	AUTO RECALIBRATE
CLOSED	OPEN	When DC power is turned on, the read/write head is automatically positioned to the track zero. (Auto recall)
OPEN	CLOSED	AUTO RECALL is disabled. Instead the host system must step the read/write head out until the track zero signal goes low and must perform track zero positioning, when DC power is turn on.

Note 1: AR/NO: Solder jumper option.

3.2.9 +WP JUMPER

+WP	WRITE PROTECT
CLOSED	An active low level on this signal line (J1 #28) indicates that write protected diskette has been installed.
OPEN	An active high level on this signal line (J1 #28) indicates that write protected diskette has been installed.

Note 1: +WP: Solder jumper option.

## SECTION IV

### OPERATON PROCEDURES AND PRECAUTIONS

#### 4.1 POWER-ON PROCEDURE

The DC power supply can be turned on in any order. The write gate signal should be held at high level, however, so that the power on action does not cause illegal writing. An interval of 500 ms is necessary between power-on time and operation start time.

#### 4.2 DRIVE SELECTION

The drive is selected when the drive select signal goes to low level.

#### 4.3 DRIVE MOTOR TURN-ON

Throughout data reading and writing, the drive motor must rotate at a constant speed. The drive motor is activated when the motor on signal is set at low level, and requires 0.5 second to reach constant speed. When the motor on signal changes to high level, the drive motor stops in about 4 seconds. When the write-protect detector detects a change point due to insertion or removal of the diskette, the drive motor rotates for 10 seconds.

#### 4.4 PRECAUTIONS

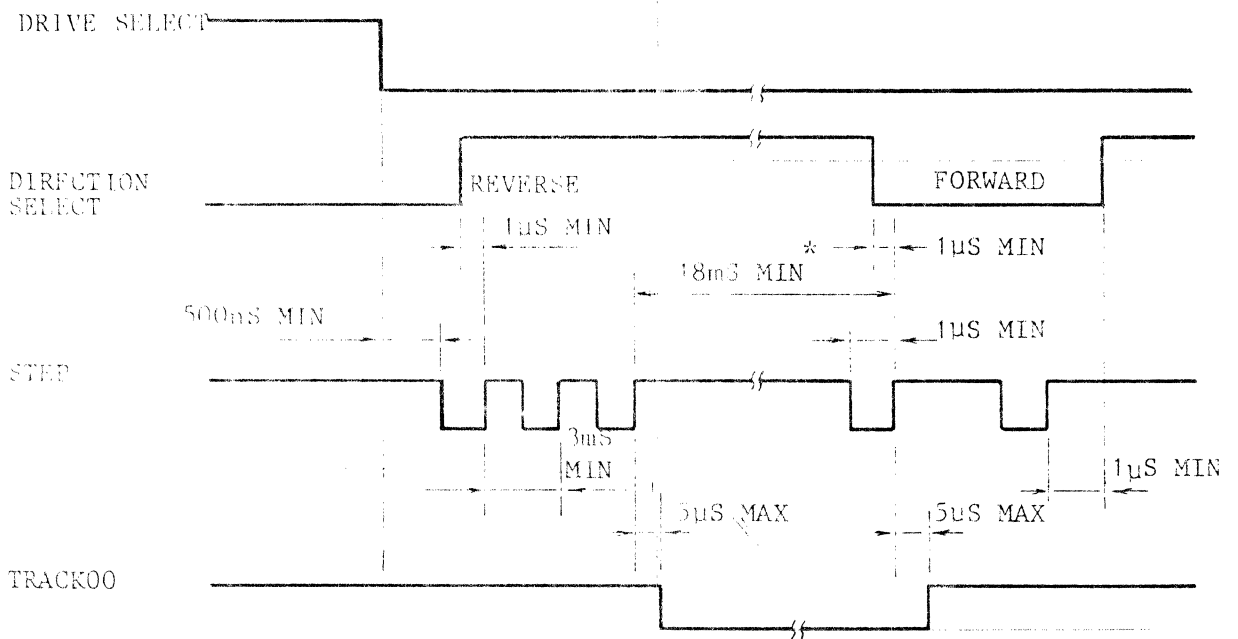
- 1) Upon installation, pay close attention to the ambient electrical noise, such as the noise from the power supply or CRT.
- 2) JU-475 automatically rotates the spindle motor for a certain time (about 10 seconds) when a diskette is inserted to prevent the diskette from being damaged upon clamping. For full use of this feature, turn power on before inserting a diskette, and clamp the diskette within 10 seconds after insertion.

SECTION V  
TIMING DIAGRAM

The step, read, write, mode select and general control timings are given on the following pages.

Note: MIN = The minimum amount of time (or longer) the controller must wait for the execution of the next operation.  
MAX = The maximum amount of time required by the drive to complete on operation.

The Maximum amount of time delay allowed by the controller for next operation. i.e. The controller must execute (start or stop) on operation within the maximum limit amount of time.



\*Note: Turn around time is 18 mS (MIN) when direction is changed.

FIGURE 5-1 STEP TIMING



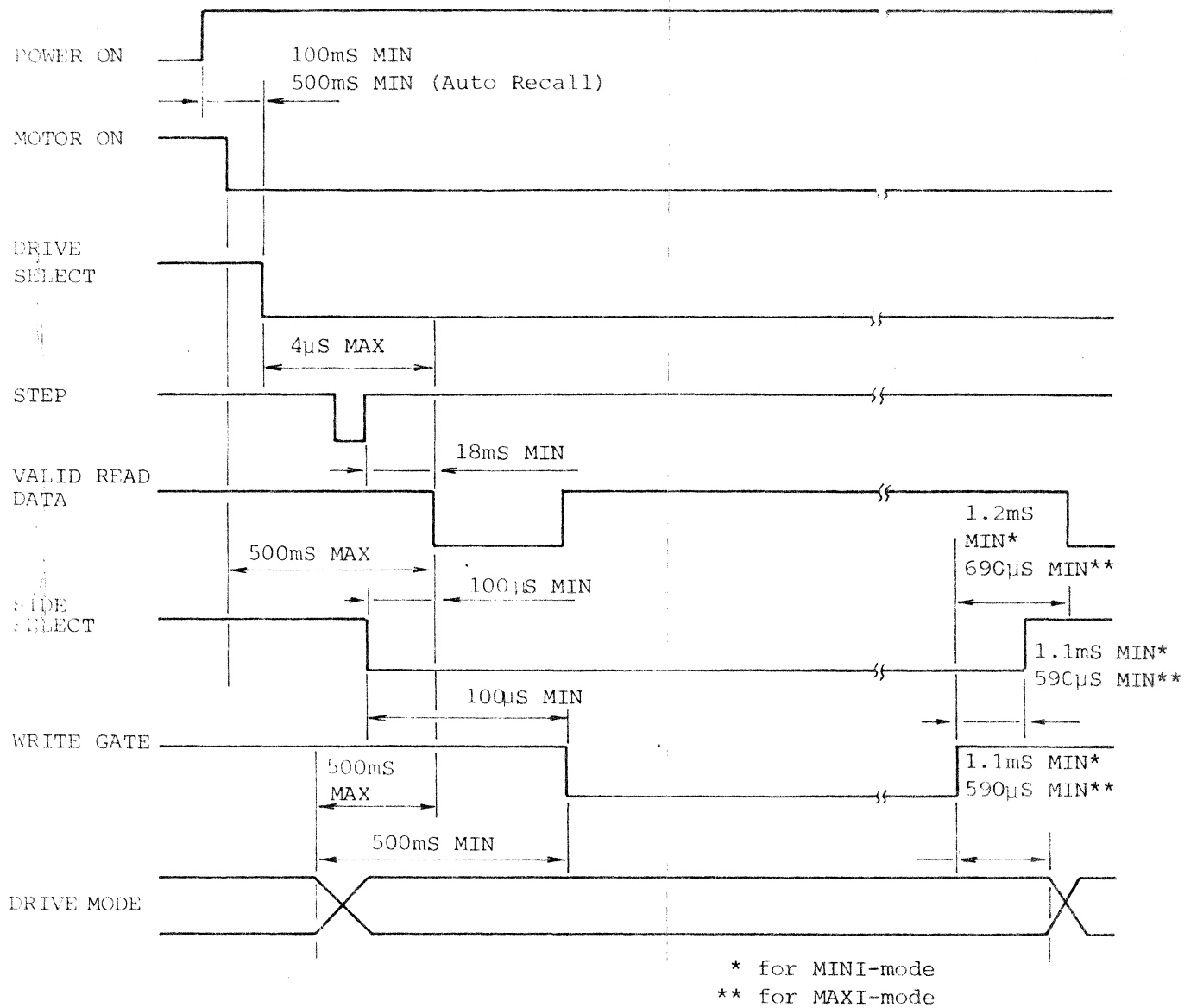


FIGURE 5-2 READ INITIATE TIMING

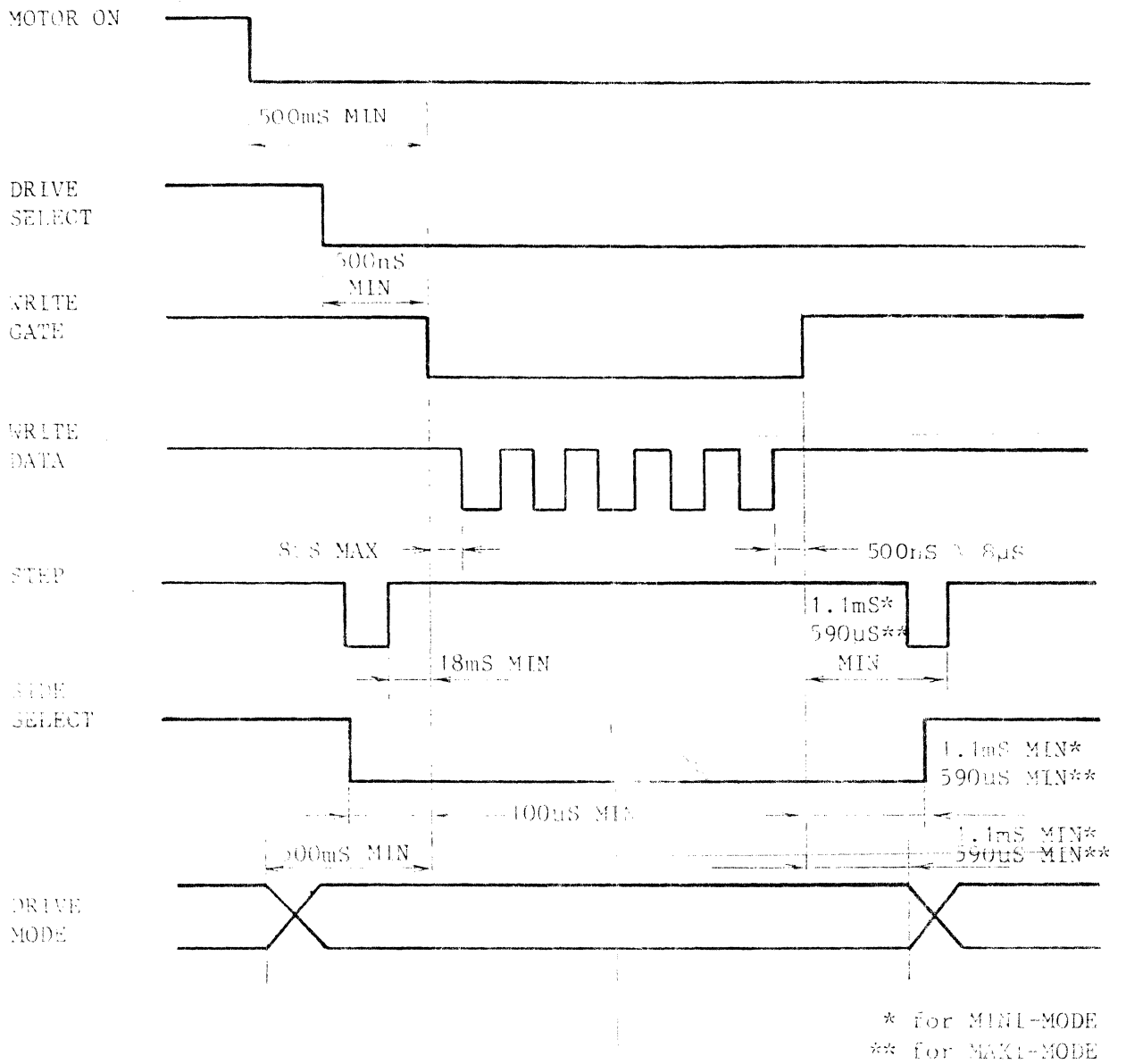


FIGURE 5-3 WRITE INITIATE TIMING

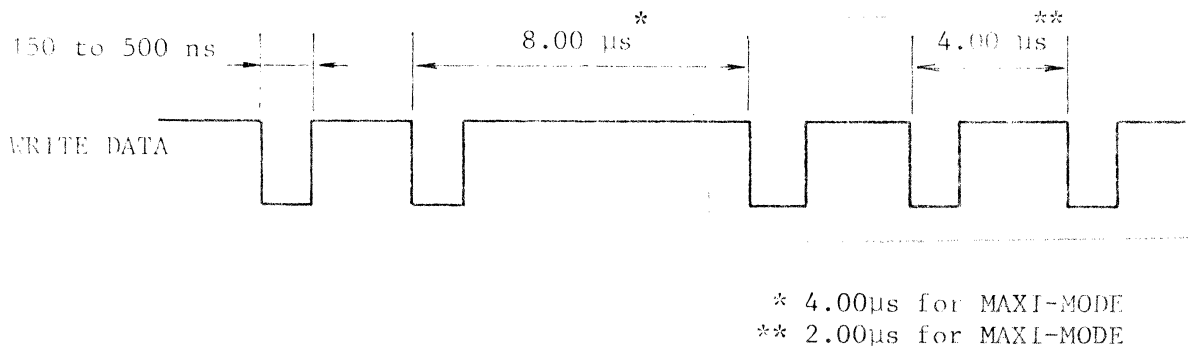


FIGURE 5-4 WRITE DATA TIMING

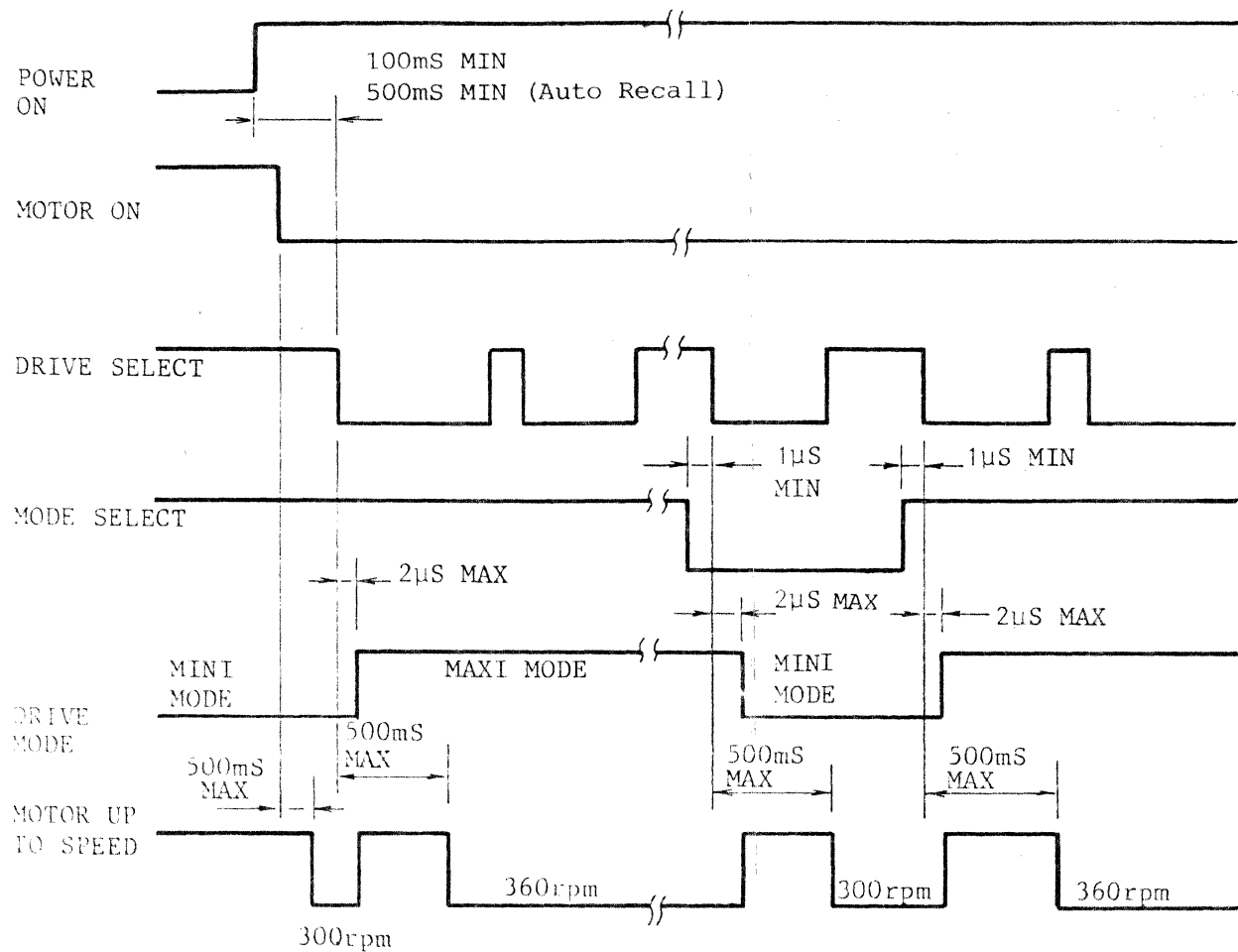
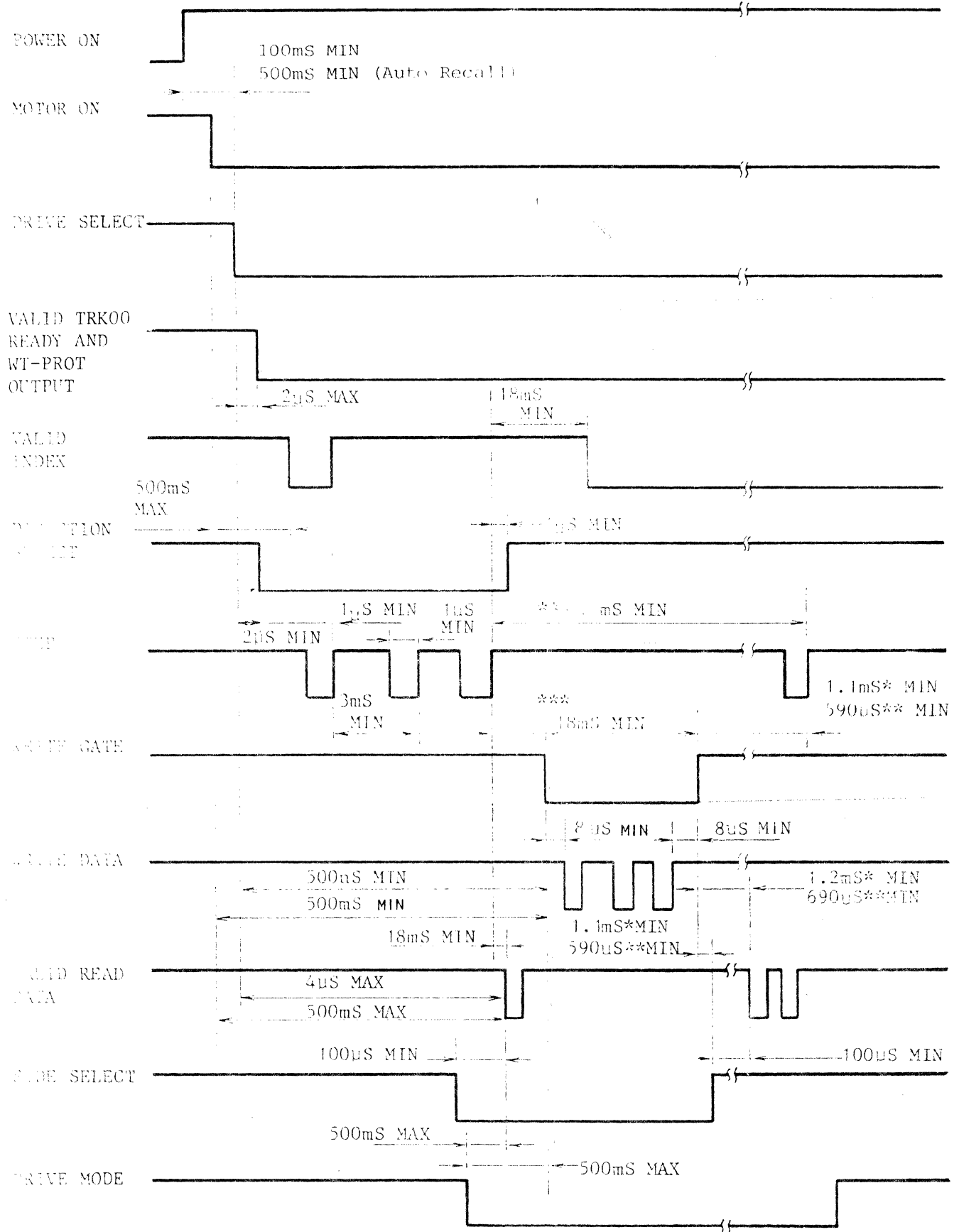


FIGURE 5-5 MODE SELECTION TIMING



\* for MINI-MODE  
 \*\* for MAXI-MODE  
 \*\*\* Seek settle time is 18ms MIN

SECTION VI

PHYSICAL SPECIFICATION

The electrical interface between the JU-475 and the host system is via three connectors. The first connector, J1, provides all of the TTL level I/O control signals for the host system and the drive. The second connector J2, provides D.C. power for the drive from the host system. The third connector, a pushon tab terminal, provides a frame ground for the drive. See Figure 6-1 for connector locations.

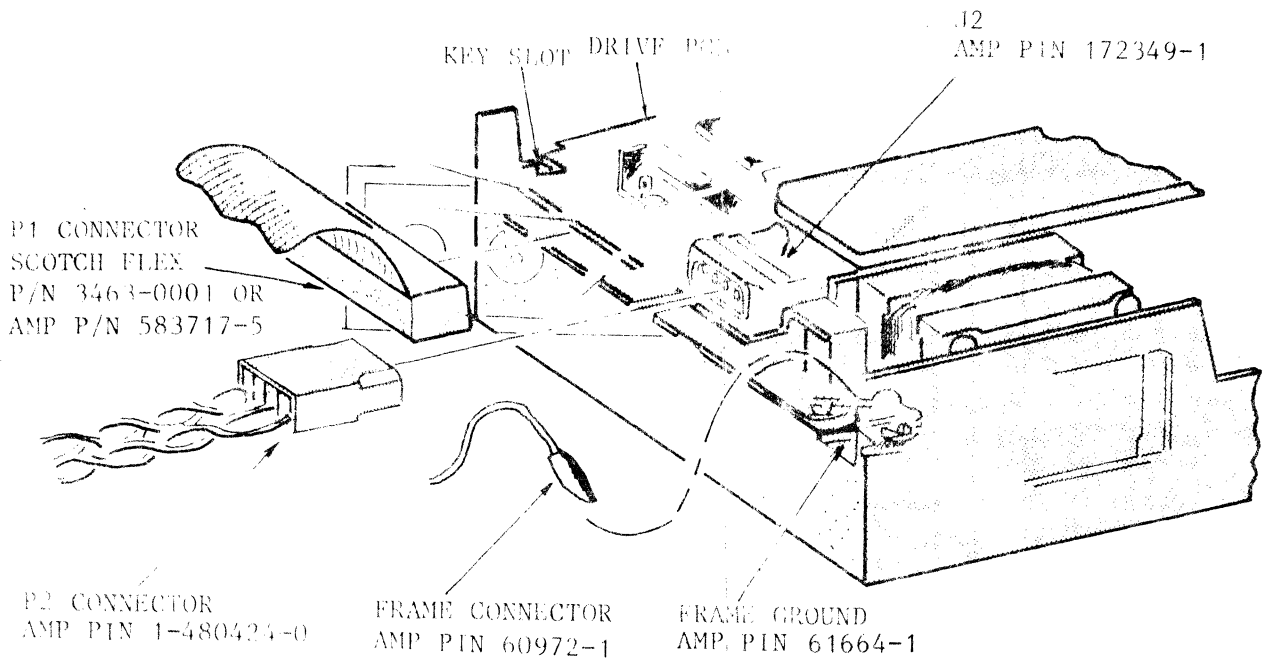


FIGURE 6-1 INTERFACE CONNECTORS LOCATIONS

### 6.1 J1 CONNECTOR (SIGNAL)

Connection to J1 is through a 34 pin P.C.B. edge connector. The dimensions for this connector are shown below. The pins are numbered 1 through 34 with the even numbered pins containing control and data signals and the odd pins being ground. A key slot is provided between pins 4 and 6 for optional connector keying.

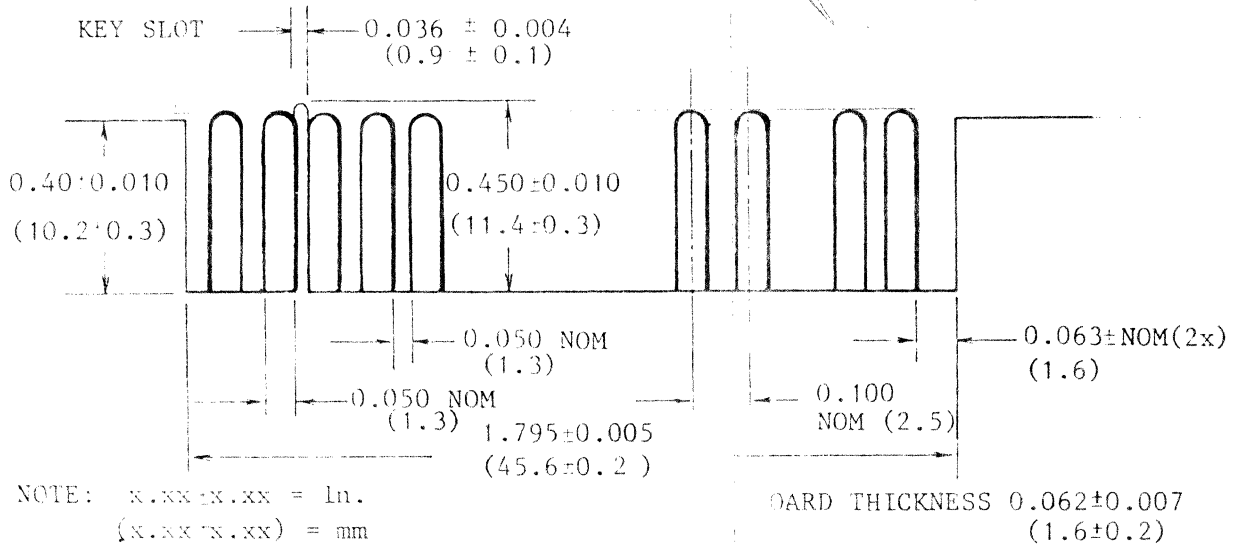


FIGURE 6-2 J1 CONNECTOR DIMENSIONS

### 6.2 J2 CONNECTOR (POWER)

The D.C. power connector, J2, is located in the rear of the drive. J2 is a four pin AMP connector P/N 172349-1. The recommended mating connector is AMP P/N 1-480424-0 utilizing amp pins P/N 61473-1.

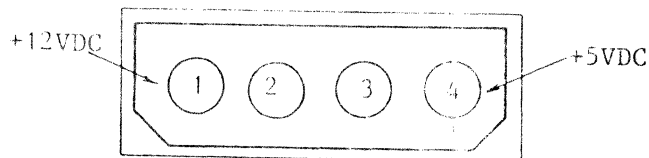


FIGURE 6-3 J2 CONNECTOR

### 6.3 FRAME GROUNDING

#### CAUTION

The drive must be frame grounded to the host system to ensure proper operation. If the frame of the drive is not fastened directly to the frame of the host system with a good ac ground, a wire from the system ac frame ground must be connected to the drive. For this purpose, a faston tab is provided on the drive near the motor control PCB where a faston connector can be attached or soldered. The tab is an AMP P/N 61664-1 and its mating connector is AMP P/N 60972-1.



## 6.5 DESCRIPTION OF THE TEST POINTS (T.P.)

T.P. 1 & T.P. 2 : Differential Analog Read Data Signal  
T.P. 7 : Index  
T.P. 8 : Track Zero  
T.P. 9 : Write Protect  
T.P. 12 : Step  
T.P. 6 : Digital Read Data  
T.P. 5, T.P. 10 & T.P. 15: Ground

## 6.6 MOUNTING

The JU-475 is capable of being mounted in any of the following positions.

1. Front Loading - mounted vertical with door opening left or right.  
- mounted horizontal with PCB up.

### CAUTION

Do not mount the JU-475 horizontally with the PCB down and Top Loading (mounted upright). Such a configuration could cause damage to the drive.

The mounting hardware for the bottom and side holes is to be #3 metric.