ORDER NO. MSD 861002703

Application Manual

Flexible Disk Storage Drive

JU-475-2

Panasonic

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INTRODUCTION

1.1 GENERAL DESCRIPTION

The JU-475-2 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-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 MFM double density recording), and when high density mini-floppy diskette is employed. Thus, JU-475-2 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 DRIVE

	DISKETTE WRITTEN			READ BY JU-475-2	
FDD USED	DISKETTE	CAPACITY	ROTATIONAL SPEED	ROTATIONAL SPEED	TRANSFER RATE
Double Sided 48 TPI (JU-455)	MD	0.5 MB	300 rpm	360 rpm	300 kbits/sec
				300 rpm	250 kbits/sec
Double-Sided 96 TPI (JU-465)	MD	1.0 MB	300 rpm	360 rpm	300 kbits/sec
				300 rpm	250 kbits/sec
Single-Sided (JU-200)	MD	0.25 MB	300 rpm	360 rpm	300 kbits/sec
				300 rpm	250 kbits/sec
Dual-Speed (JU-475)	HD	1.6 MB	360 rpm	360 rpm	500 kbits/sec
	MD	1.0 MB	360 rpm	360 rpm	300 kbits/sec
				300 rpm	250 kbits/sec
			300 rpm	360 rpm	300 kbits/sec
				300 rpm	250 kbits/sec

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
- 15,000 hours MTBF
- Dual read channels
- 250/300/500 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 (MFM)		
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 (FM)		
Per Drive	500,000	833,333/802,083
Per Surface	250,000	416,666/401,041
Per Track	3,125	5,208
IBM Format (MFM)	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
IBM Format (FM)	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 (kbits/sec)		
MFM Recording	250/300	500
FM Recording	125/150	250
Access time (msec)		
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

* IBM is the registered trade mark of International Business Machines; IBM Corp.

1.2.2 Functional Specifications

Rotational Speed	300 rpm	360 rpm
Recording Density (inner most track)		
MFM Recording	5,922 bpi	9,870/9,642 bpi
FM Recording	2,961 bpi	4,935/4,821 bpi
Flux Density (inner most track)		
MFM Recording	5,922 fci	9,870/9,642 fci
FM Recording	5,922 fci	9,870/9,642 fci
Track Density	96 tpi	96 tpi
Cylinders	80	80/77
Tracks	160	160/154
Read/Write Head	2	2
Encoding Method	FM/MFM	FM/MFM
Media Requirements		650 Oe HIGH Density/ANSI SPEC

1.2.3 Reliability Specifications

MTBF	10,000 POH
MTTR	30 minutes
Component life	15,000 POH 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	3.5×10^6
Number of Media Clamps	3.0×10^4

1.2.4 Physical Specifications

Environmental Limits	Shipping	Storage	Operating
Ambient Tenmperature	-40 to 144°F (-40 to 62.2°C)	-8 to 117°F (-22.2 to 47.2°C)	50° to 115°F (10 to 46.1°C)
Relative Humidity	1 to 90%	1 to 95% RH	20 to 80% RH
Max. Wet Bulb Temp. (Non-Condensing)	No condensation	85°F (112.4°C)	85°F (112.4° C)
Vibrations	≦5G (5 to 55 Hz)	≦3 G (5 to 55 Hz)	≦0.5 G (5 to 55 Hz)
Shock	≦40G (10 m Sec)	≦40 G (10 m Sec)	≦0.5 G (10 m Sec)

Power Supply

+12V DC:	Voltage	±10%
	Max. Ripple	100 mVp-p
	Current	0.27A (Typical) 0.6A (Max.)
+5V DC	Voltage	±5%
	Max. Ripple	50 mVp-p
	Current	0.47A (Typical) 0.6A (Max.)

Mechanical Dimension

Width = 5.75 inches (146.1 mm)
Height = 1.63 inches (41.5 mm)
Depth = 8.00 inches (203.2 mm)
Weight = 3.3 pounds (1.5 kg)

Power Dissipation

19.1 BTU/Hr (5.6 Watts) Continuous
9.9 BTU/Hr (2.9 Watts) Stand-by

(Note)
*Stand-by: Drive motor off, drive select off, and stepper at reduced current.

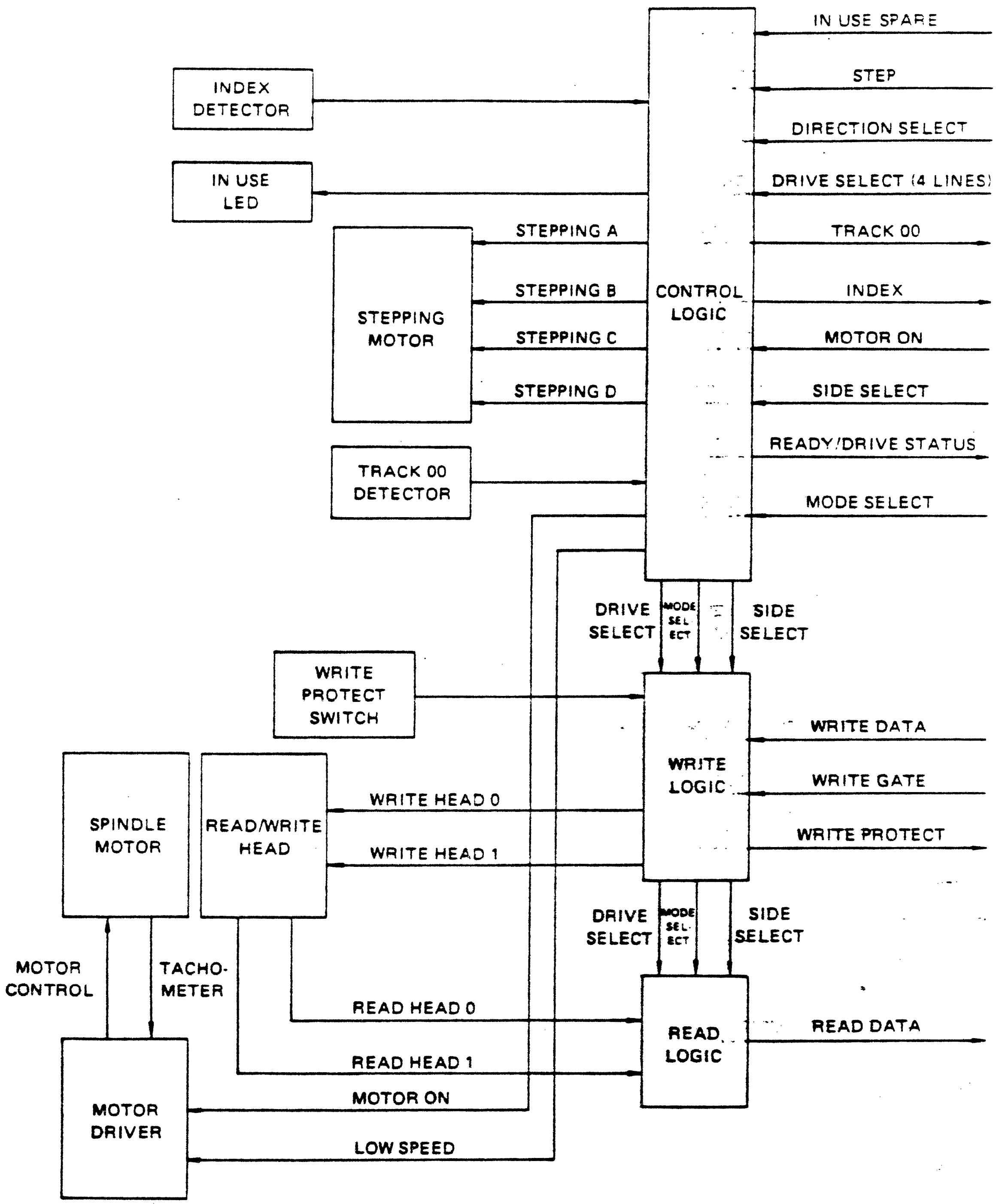


FIGURE 1-1 FUNCTIONAL DIAGRAM

1.3 FUNCTIONAL CHARACTERISTICS

The JU-475-2 consists of read/write and control electronics, drive mechanism, read/write heads, and precision track positioning mechanism. These components perform the following functions:

a. Interrupt 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 positioning 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 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 interchange ability 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.

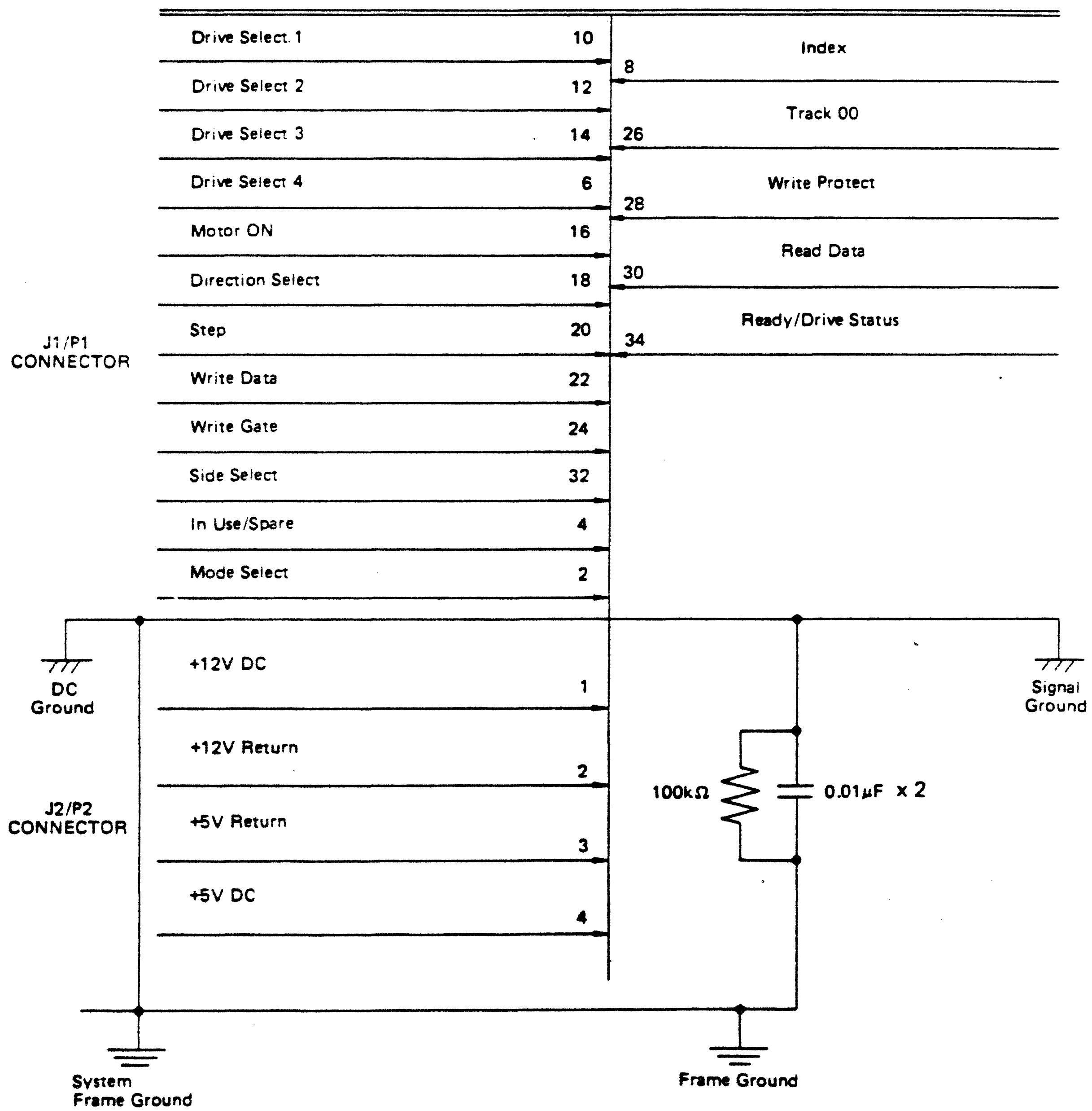


FIGURE 2-1 INTERFACE CONNECTION

2.1 SIGNAL INTERFACE

The JU-475-2 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 and diode resistor pack. When using two or more drives on a daisy chain, remove all termination resistors 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 = Vin + 0.0 to + 0.4V @I_{IN} = 40 mA (MAX.)
False = Logical one = Vin + 2.5 to 5.25V @I_{IN} = 250 μA (OPEN)
Input impedance = 150 ohms

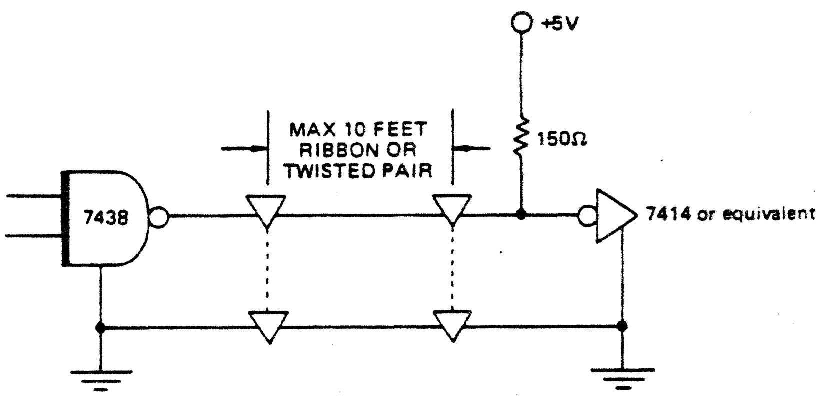


FIGURE 2-2 INTERFACE SIGNAL DRIVE/RECEIVER

2.2 INPUT LINES

The are twelve active low TTL input lines to the JU-475-2 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 DS closed and MS 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-475-2 is properly selected, and when step pulses with the proper timing are sent to the JU-475-2. 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.

2.2.3 Motor On (J1 Pin =16)

The 'motor on' signal causes the JU-475-2's spindle drive motor to turn on. In standard configuration (jumpers MM closed and MS open), this input signal line when the (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 (J1 Pin =20)

When the JU-475-2 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 milli-seconds. 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-475-2 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-475-2 flexible disk drive.

Driving the head-carriage assembly of the JU-475-2 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, check-ing 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-475-2 has been selected, 'side select' determines which side of the disk is to be activated. A logic low (true or logical zero) selects side 1; a logic high (false or logical one) selects side 0.

When switching from one side to another, a 100 microseconds 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.

2.2.8 In Use (J1 Pin #4)

Using appropriate jumper options, this line can monitor the IN USE LED light. See UA/DA/OA/HA/HH jumper option section for detail description of IN USE LED 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-475-2 drive has five active signal lines as output. 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 ±3 milliseconds. In the standard configuration, when FX jumper is opened, 'index' pulses will be present at the interface connector only when:

A) The proper DC power is applied to the 'DC 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 +5V DC. When the jumper FX is closed, 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 FX 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 #28)

An active low level on this signal line indicates that a 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 opened, data from the diskette is outputted to the host system in the same form at 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 valid. When GX jumper is closed, 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 Disk Change 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 IRD DR RDY/LR/DC/DO/IX/DD/SP jumper option section.

1) Disk Change: Pin =34 is latched low during power up or when the door is open and drive is selected. To unlatched the logic level the drive should step a track while it is selected, powered up.

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

3) 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.

4) 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.

5) Latched door Distub: 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.

6) 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 JU475-2 drive requires only DC power for operation. DC power to the drive is provided by J2 power interface. The two DC voltages, their specifications and their J2 pin designators are outlined below:

TABLE 2-1 DC POWER REQUIREMENTS

J2 Pin =	DC Voltage	Tolerance	Current	Max. Ripple
4	+5V DC	±5%	0.47A TYP	50 mVp-p
3	+5V Return	*	0.6A MAX	
2	+12V Return	*	0.27A TYP	100 mVp-p
1	+12V DC	±10%	0.6A MAX	

* +12V DC and +5V DC ground returns are tired together at drive PCB

2.5 FRAME GROUND

Frame ground for the JU-475-2 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-475-2 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-475-2 drive and other system components to 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-475-2 PCB by a 0.01 μF 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-475-2 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.

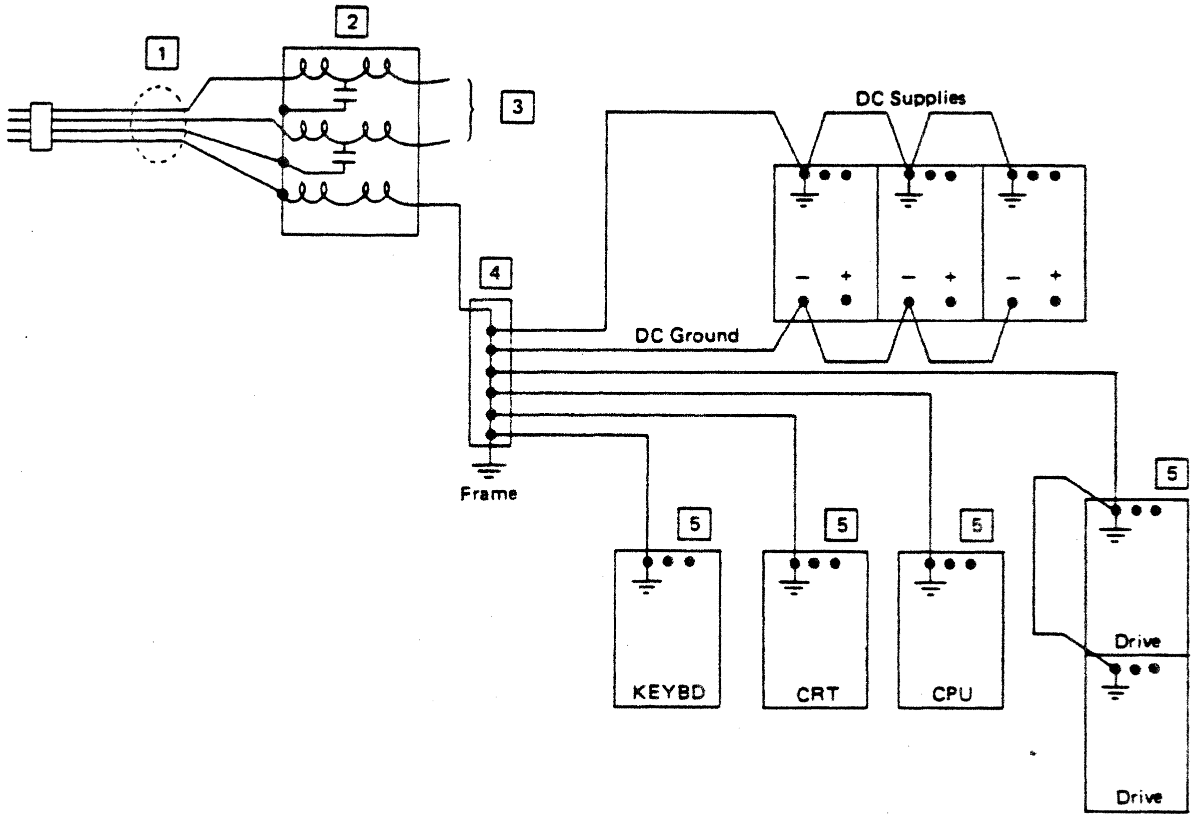


FIGURE 2-3 RECOMMENDED POWER AND GROUND DISTRIBUTION

NOTE:

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

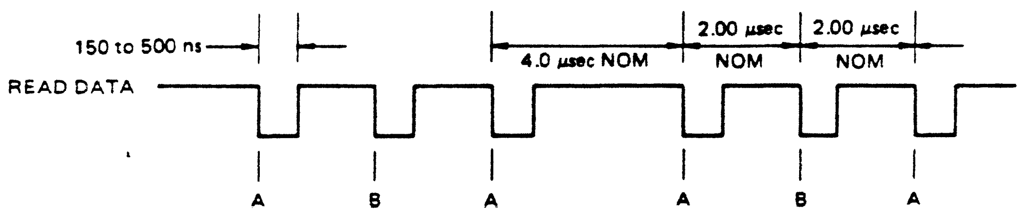
Applying DC power to the drive can be done in any sequence. However, during power up, the WRITE GATE line must be held inactive or at a high level. This will prevent possible "glitching" of the media. After application of DC power, a 500 milliseconds delay should be introduced before any operation is 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:

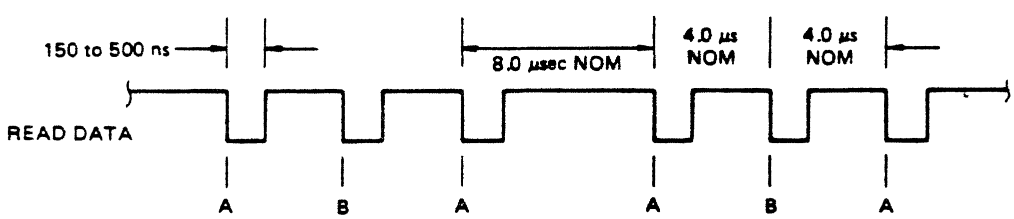
a. Activating the DRIVE SELECT line.
b. Selecting the head.
c. WRITE GATE being inactive.

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 ±400 ns FROM ITS NOMINAL POSITION.
B = LEADING EDGE OF BIT MAY BE ±200 ns FROM ITS NOMINAL POSITION.

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



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

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

2.7.3 Write Operation

Writing data to the drive is accomplished by:

a. Activating the DRIVE SELECT line.
b. Selecting the head.
c. Activating the WRITE GATE line.
d. Pulsing 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 encoding can be FM or MFM. The write data should be precompensated by 100 nanoseconds for high speed operation and 200 nanoseconds for low speed operation starting at 43 track to counter the effects of bit shift. The above values for precompensation may vary due to the products of customerized specification. The direction of compensation required for any given bit in the data stream depends on the pattern it forms with nearby bits.

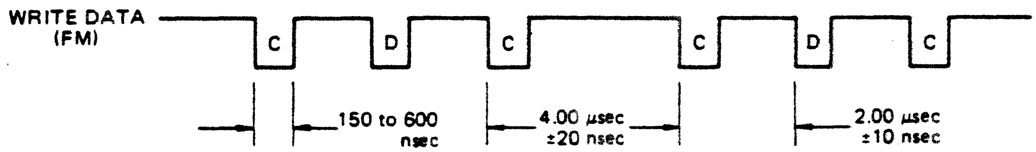


FIGURE 2-6 HIGH SPEED WRITE DATA TIMING (FM ENCODING 1.6M BYTES)

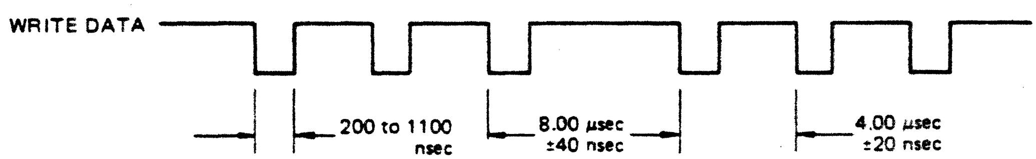


FIGURE 2-7 LOW SPEED WRITE DATA TIMING (FM ENCODING 1.0M BYTES)

SECTION III
CUSTOMER INSTALLABLE OPTIONS

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

3.1 PLUGGABLE/TRACE OPTIONS

The JU-475-2 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.

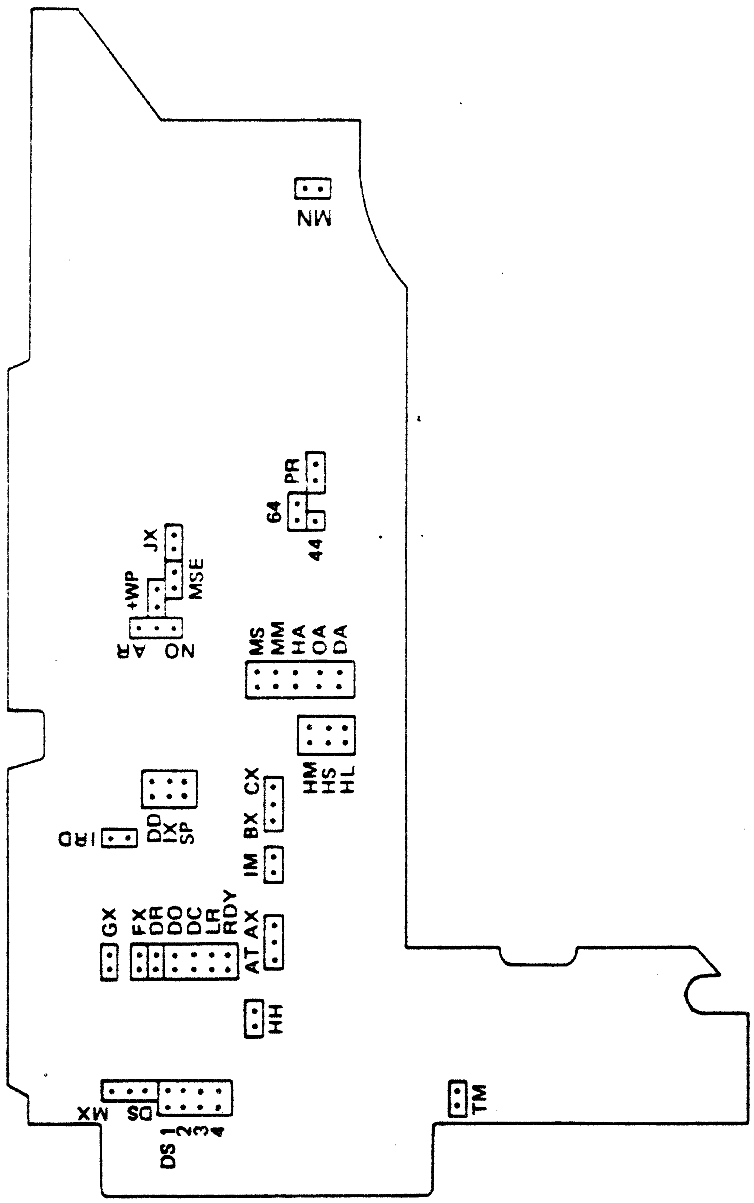
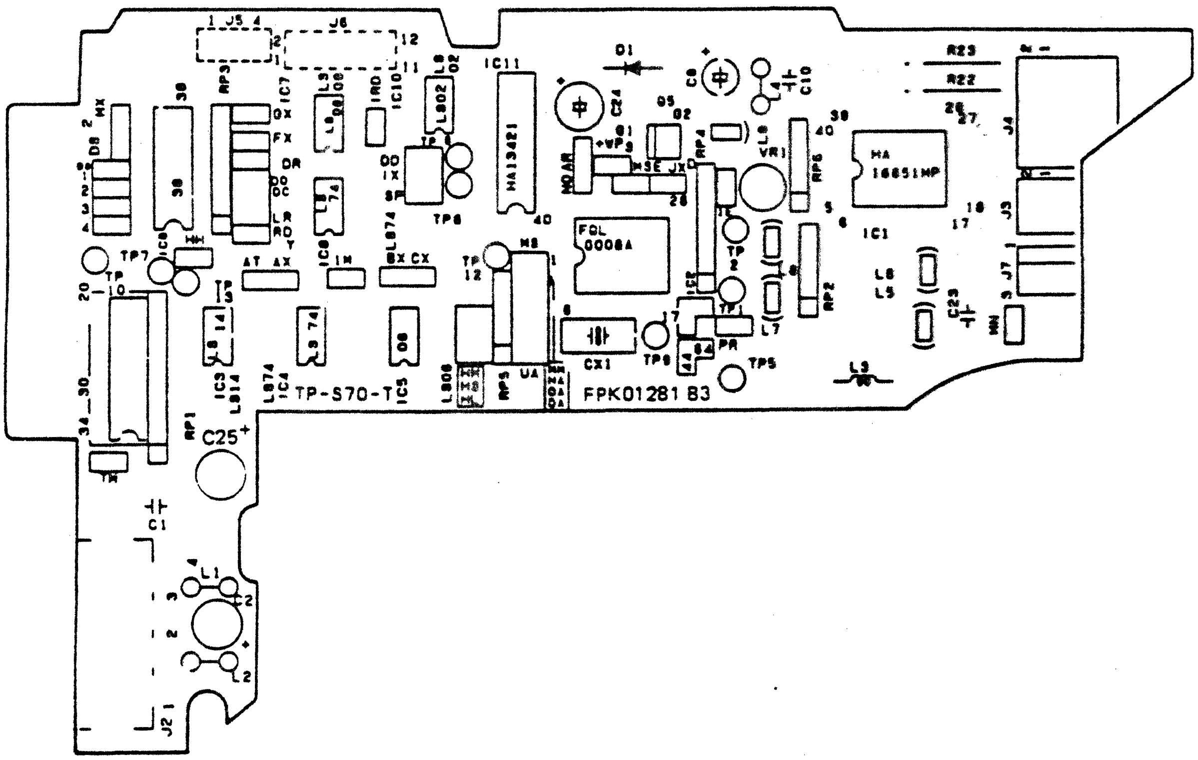


FIGURE 3-1 JUMPER LOCATION

3.2 CIRCUIT BOARD

Component Side



Solder Side

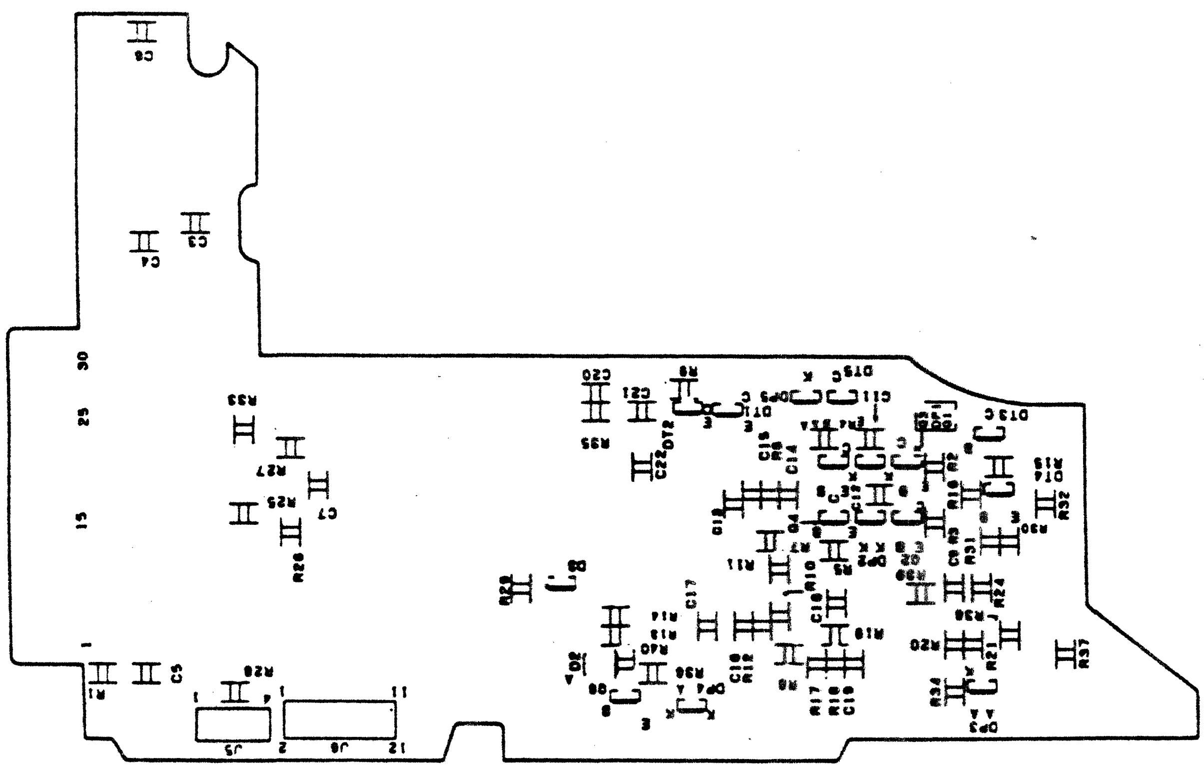


TABLE 3-1 PLUGGABLE OPTIONS

JUMPER DESIG-NATION	DESCRIPTION	SHIPPED FROM FACTORY			
		JU-475-2AEG		JU-475-2AGG	
		OPEN	SHORT	OPEN	SHORT
DS2	DRIVE SELECT 2	X			X
DS1	DRIVE SELECT 1		X	X	
DS3, 4	DRIVE SELECT 3, 4	X		X	
DS	ENABLE DRIVE SELECT IN A MULTI-DRIVE SYSTEM		X		X
MX	CONSTANT DRIVES SELECT USED IN A SINGLE DRIVE SYSTEM ONLY	X		X	
UA	ACTIVITY LED WITH LATCHED FUNCTION OF IN USE	X		X	
DA	ACTIVITY LED WITH DRIVE SELECT		X		X
OA	ACTIVITY LED WITH IN USE OR DRIVE SELECT	X		X	
HA	ACTIVITY LED WITH DRIVE SELECT & IN USE	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	
AT	ENABLE 475 FOR PC/AT	X			X
AX	LATCHED BY DS SIGNAL		X	X	
MN*	MONO COLOR ACTIVITY LED (Mainly Factory Purpose)		X		X
DD	DISK CHANGE DRIVE SELECT	X		X	
IX	DISK CHANGE INDEX		X	X	
SP	DISK CHANGE STEP	X			X
LR	LATCHED READY	X		X	
DC	LATCHED DOOR DISTURB	X			X
DO	DOOR OPEN	X		X	
IRD	INTERNAL READY	X		X	
BX	DUAL SPEED		X	X	
CX	SINGLE SPEED	X			X
PR*	DISABLE PORT COMPENSATION (Mainly Factory Purpose)	X		X	

TABLE 3-1 PLUGGABLE OPTIONS (Cont'd)

JUMPER DESIG-NATION	DESCRIPTION	SHIPPED FROM FACTORY			
		JU-475-2AEG		JU-475-2AGG	
		OPEN	SHORT	OPEN	SHORT
HH*	HEAD LOAD WITH DRIVE SELECT & IN USE	**	**	**	**
MSE*	CONTROLLED FUNCTION (Mainly Factory Purpose)		X		X
AR*	AUTO RECAL		X		X
NO*	NO AUTO RECAL	X		X	
+WP*	SRITE PROTECT 5.1/4" STD		X		X
RDY	STANDARD READY		X	X	
DR*	READY ENABLE FROM DRIVE SELECT		X		X
FX*	ENABLE TURE READY (INDEX)		X		X
GX*	ENABLE TRUE READY (READ DATA)		X		X
JX*	HIGH SPEED MODE ONLY	X		X	
44*	ENABLE POST COMPENSATION FROM TRK44 (Mainly Factory Purpose)		X		X
64*	ENABLE POST COMPENSATION FROM TRK64 (Mainly Factory Purpose)	X		X	
IE*	ERASE TIMING (Mainly Factory Purpose)	X		X	

Note, *: SOLDER JUMPER

** : Don't Care

3.3 JUMPER OPTION (JU-475-2)

3.3.1 AX/BX/CX Jumpers

AX	AT	BX	CX	SPINDLE SPEED	WRITE CURRENT
OPEN	OPEN	OPEN	CLOSED	HIGH	HIGH
OPEN	OPEN	CLOSED	OPEN	HIGH	HIGH
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.

3.3.2 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.

3.3.3 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.

3.3.4 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.

3.3.5 GX Jumper

GX	READ DATA (PIN #30 of J1 I/O INTERFACE)
OPEN	"READ DATA" is enabled by 'proper' logic levels of "WRITE GATE", "WRITE PROTECT" and "DRIVE SELECT" signals.
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 date 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: GX: Solder jumper option.

3.3.6 FX Jumper

FX	INDEX (PIN #8 of J1 I/O INTERFACE)
OPEN	"INDEX" is generated once each revolution of the diskette, when "DRIVE SELECT" line of J1 I/O interface is low.
CLOSED	"INDEX" is generated one 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: FX: Solder jumper option.

3.3.7 IRD/DR/RDY/LR/DC/DO/IX/DD/SP Jumper

(1) 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.

(2) Ready

Status	Jumpers
Open	LR, DC, DO
Closed	RDY, DR
Con'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: Solder jumper option.
Note 2: IRD/LR/DC/DO/IX/DD/SP/RDY: Shorted plug installed option.

(3) Latched Ready

Status	Jumpers
Open	DR, RDY, DC, DO, 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.

(4) 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.

(5) 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.

(6) 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.

3.3.8 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.

3.3.9 +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
OPERATION 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 milliseconds 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 500 milliseconds 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 switching power supply or CRT.

2) JU-475-2 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.

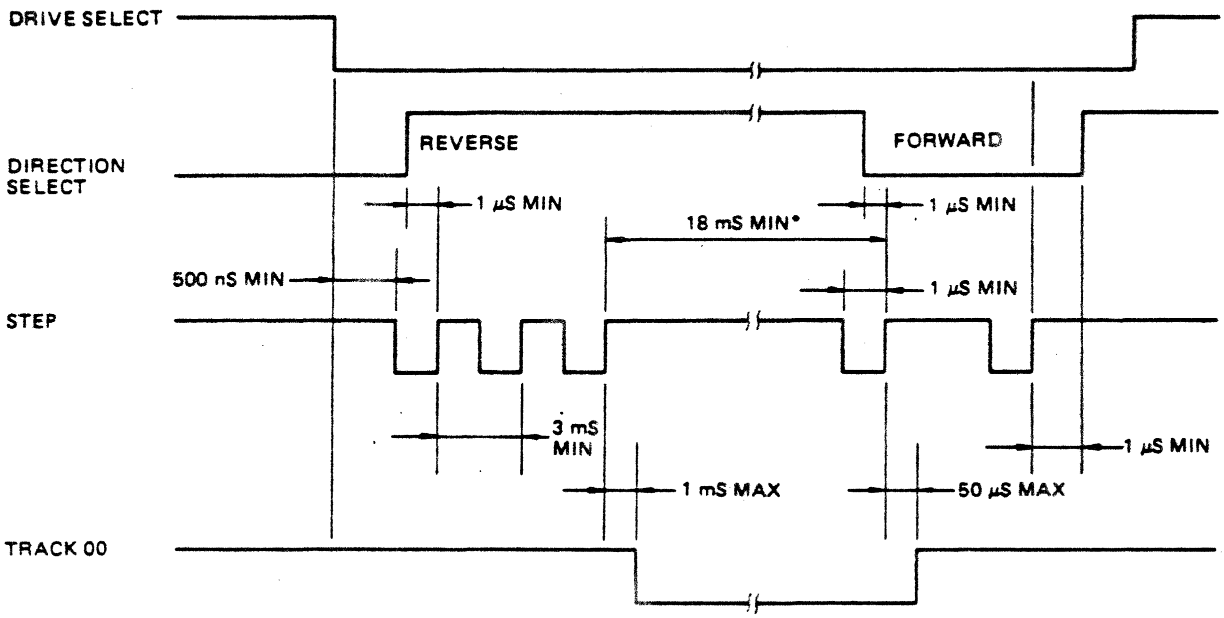
SECTION V
TIMING DIAGRAM

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 to 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

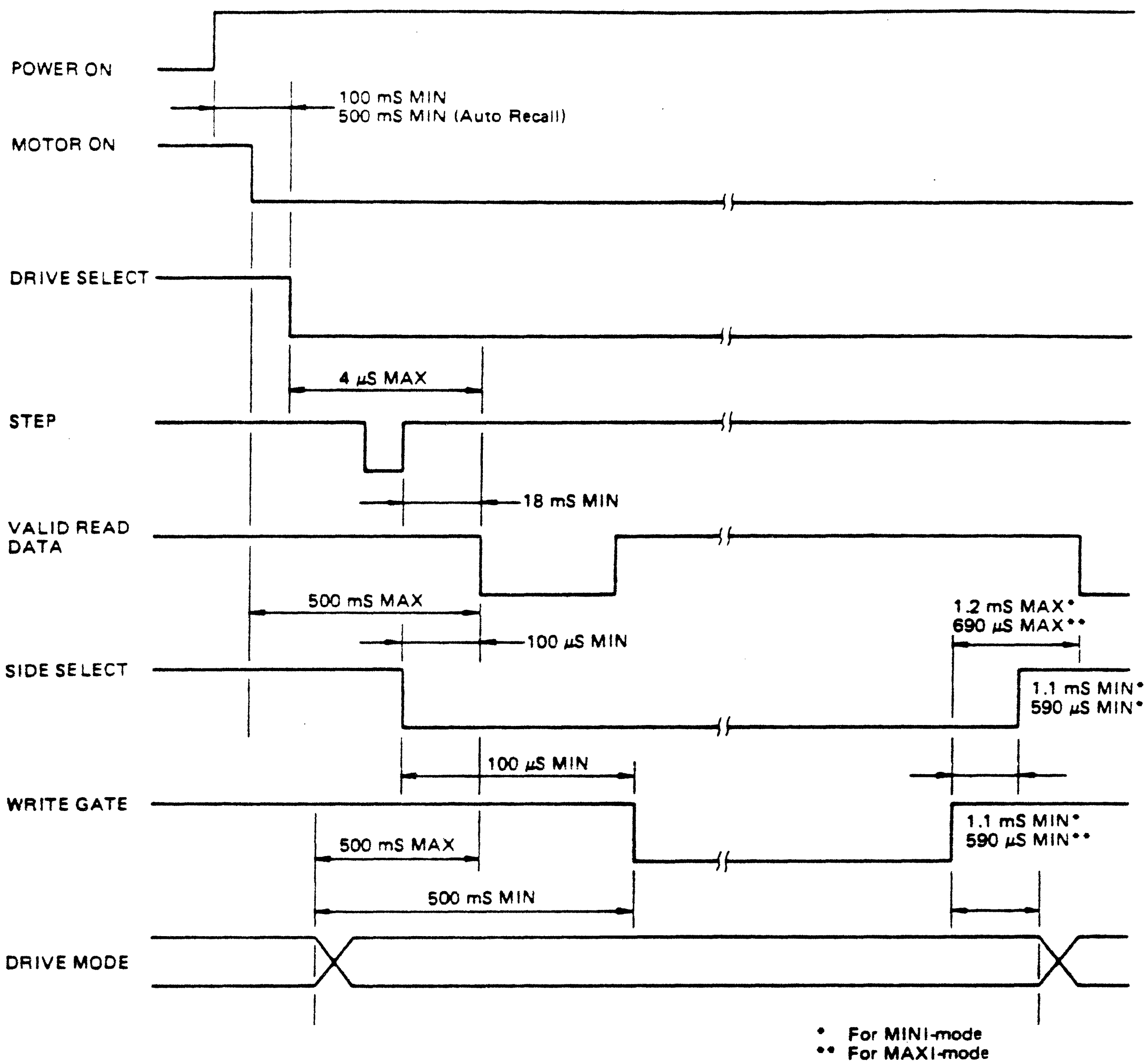


FIGURE 5-2 READ INITIATE TIMING

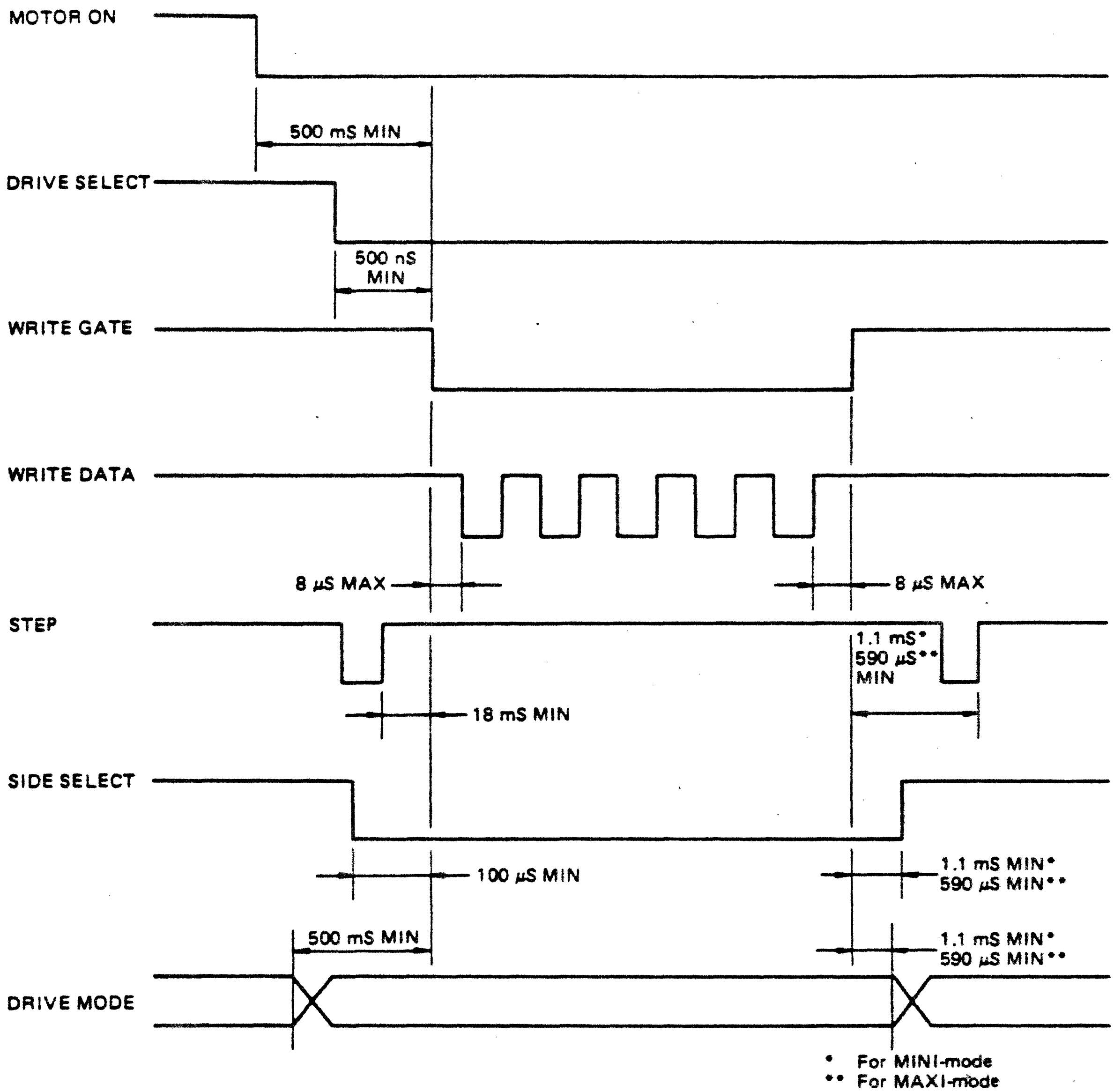


FIGURE 5-3 WRITE INITIATE TIMING

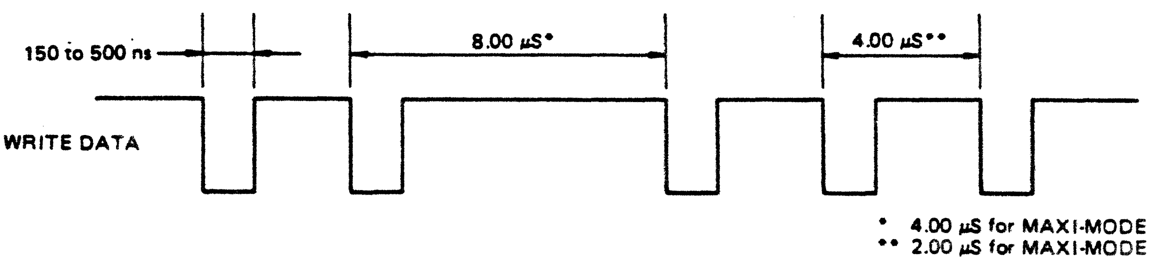


FIGURE 5-4 WRITE DATA TIMING

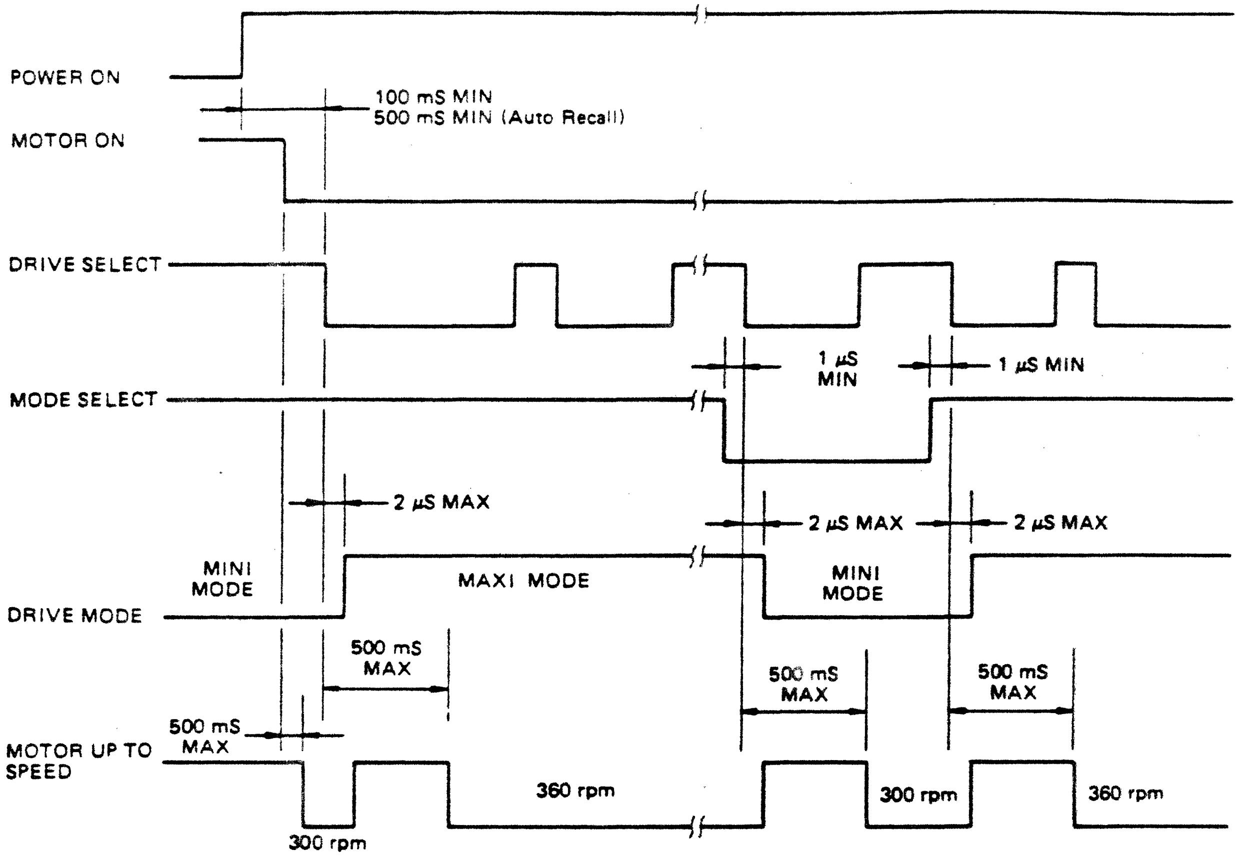


FIGURE 5-5 MODE SELECTION TIMING

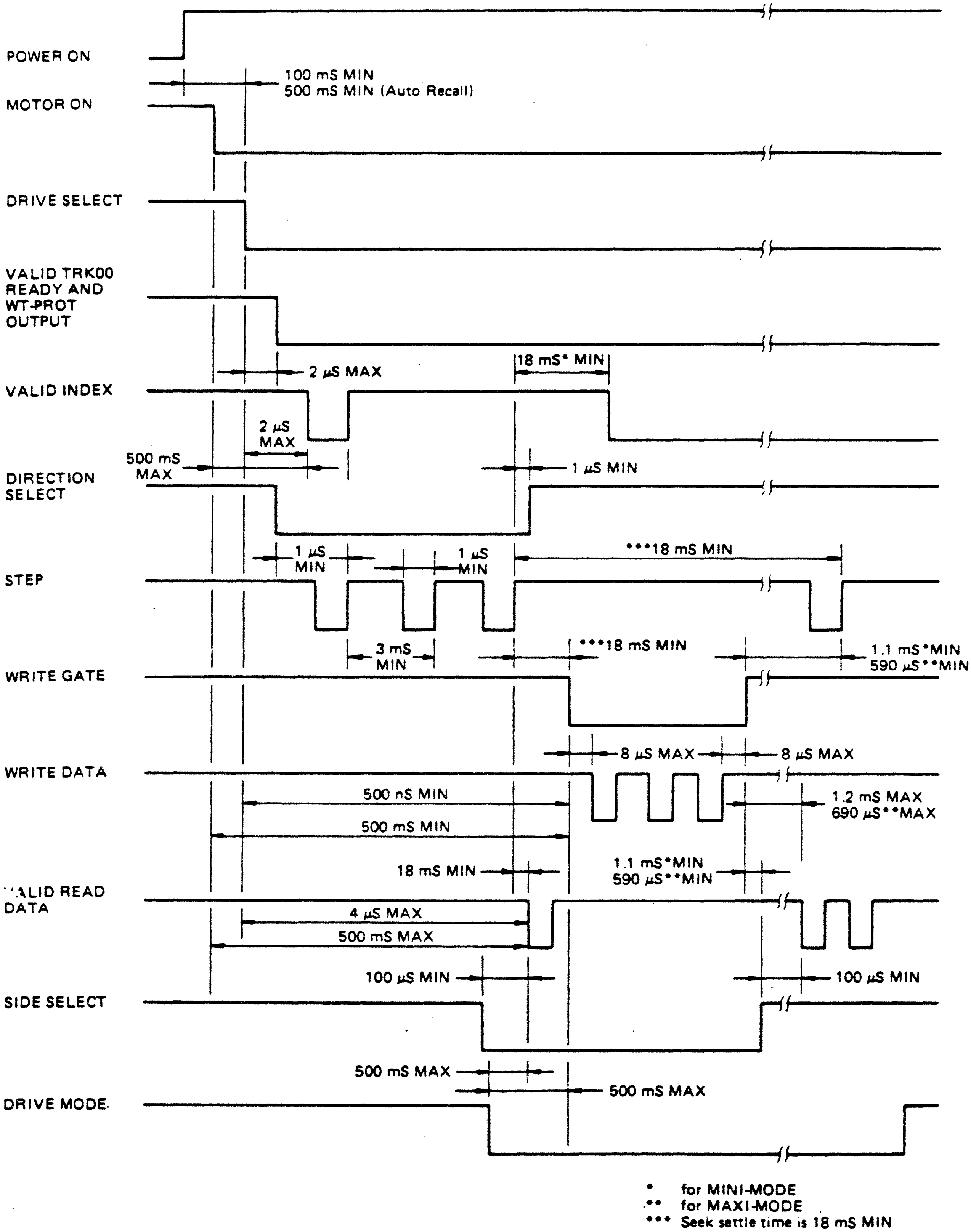


FIGURE 5-6 GENERAL CONTROL AND DATA TIMING

SECTION VI
PHYSICAL SPECIFICATION

The electrical interface between the JU-475-2 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 DC power for the drive from the host system. The third connector, a push-on tab terminal, provides a frame ground for the drive.

See Figure 6-1 for connector locations.

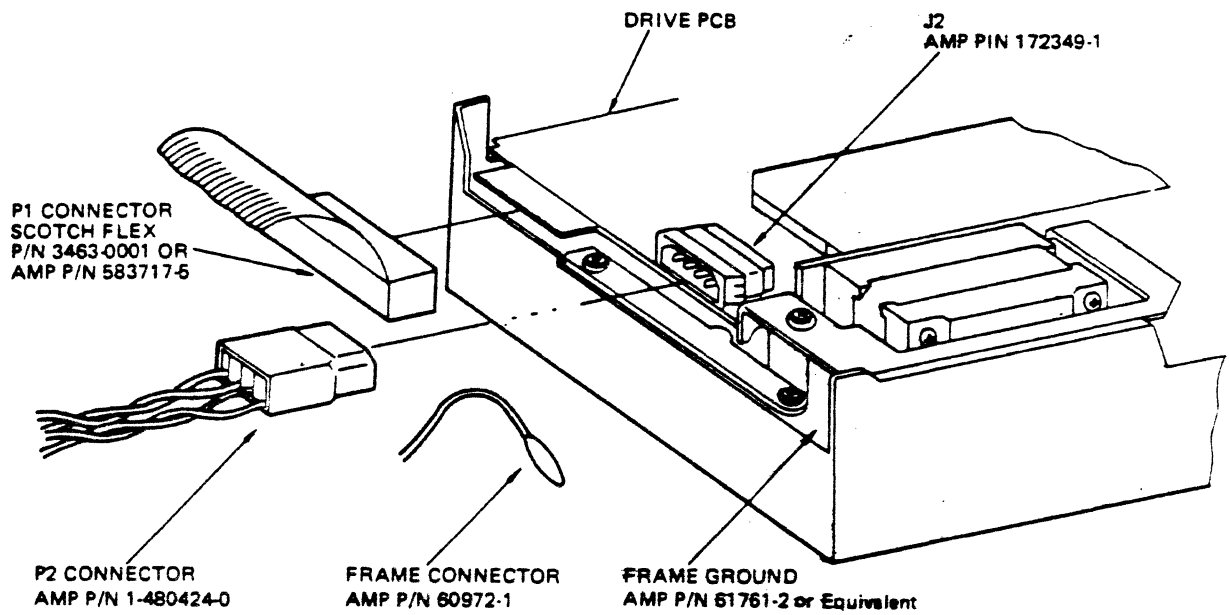


FIGURE 6-1 INTERFACE CONNECTORS LOCATIONS

6.1 J1 CONNECTOR (SIGNAL)

Connection to J1 is through a 34 pin PCB 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.

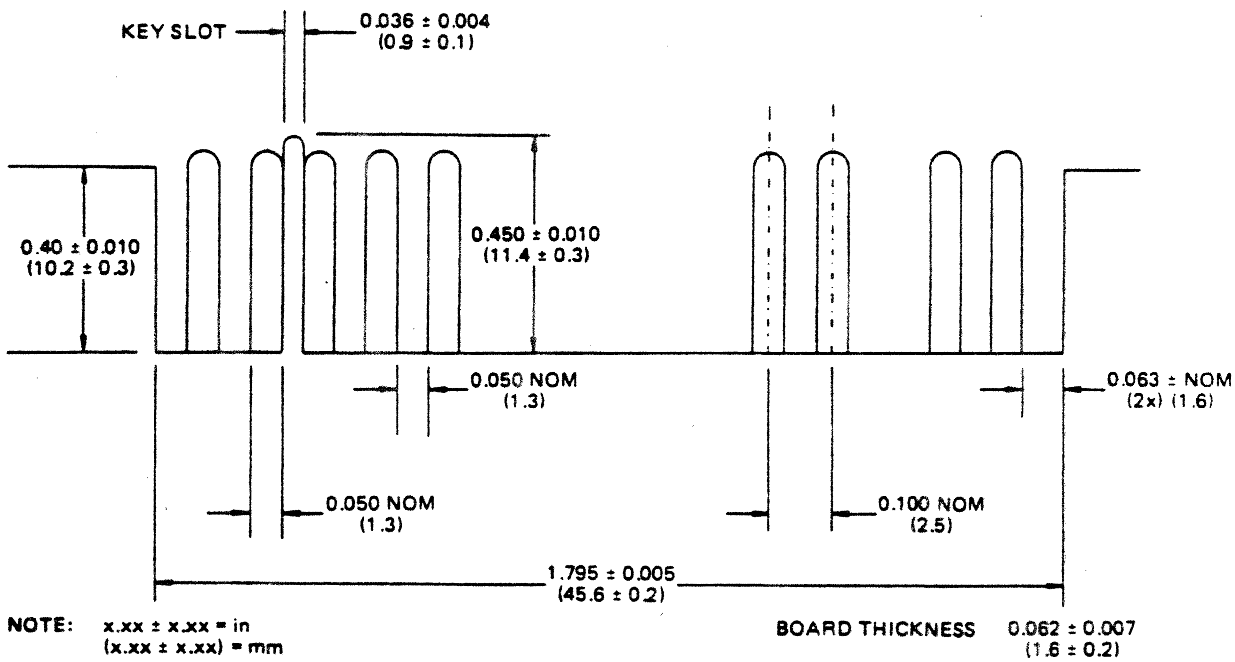


FIGURE 6-2 J1 CONNECTOR DIMENSIONS

6.2 J2 CONNECTOR (POWER)

The DC power connector, J2, is located in the rear of the drive. J2 is a four pin AMP connector P/N 172294-1. The recommended mating connector is AMP P/N 1-480424-0 utilizing amp pins P/N 170121-1.

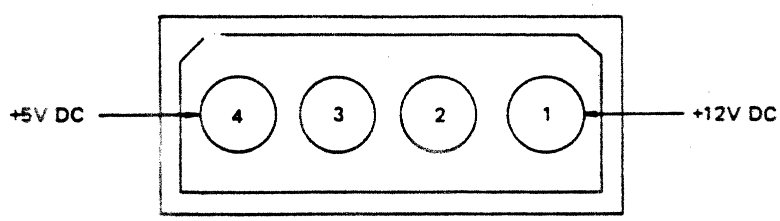


FIGURE 6-3 J2 CONNECTOR

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 61761-2 and its mating connector is AMP P/N 60972-1.

6.4 MECHANICAL DIMENSIONS

See Figure 6-4 for the dimensions of JU-475-2.

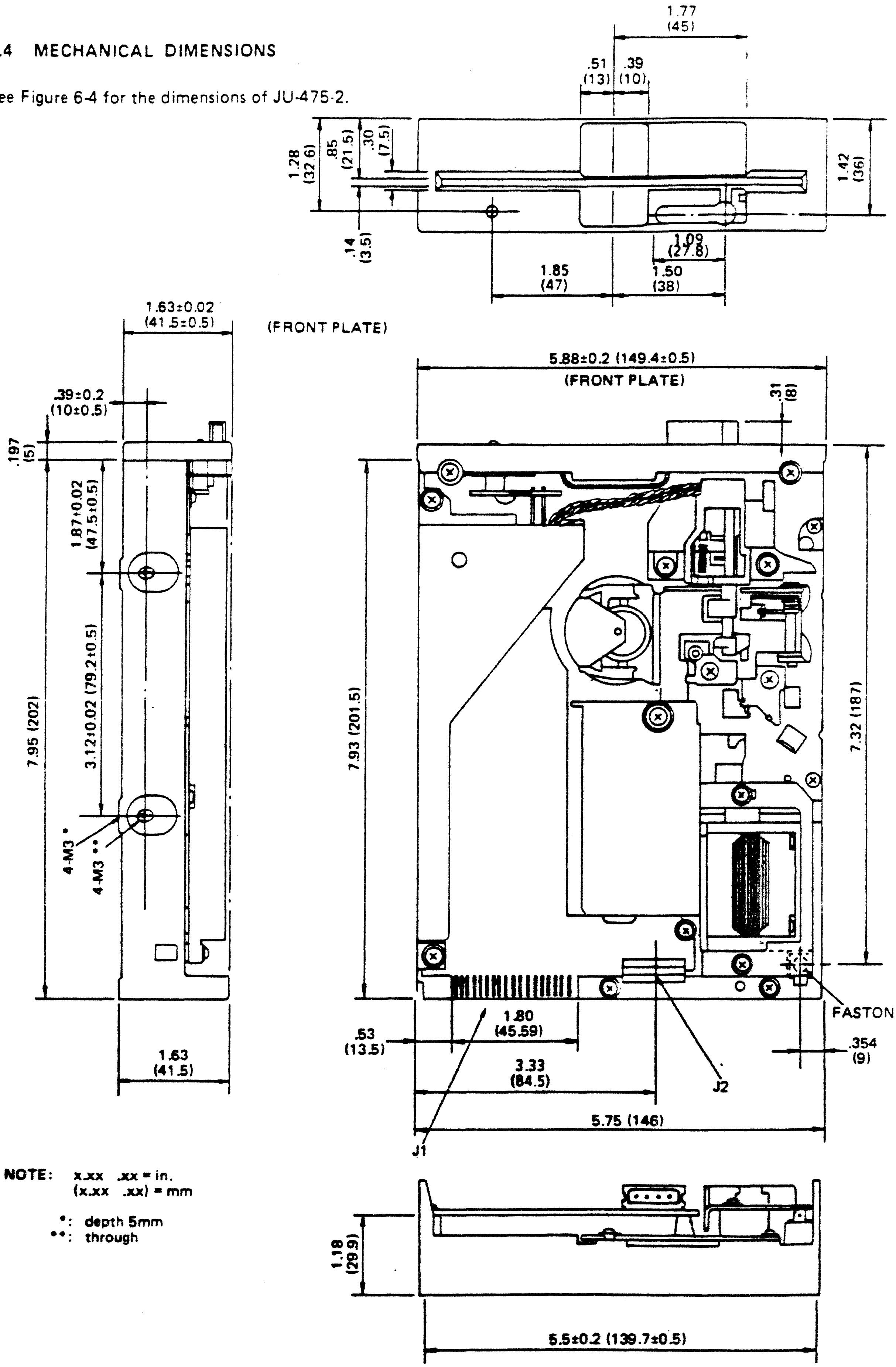


FIGURE 6-4 MECHANICAL DIMENSIONS

6.5 DESCRIPTION OF THE TEST POINTS (TP)

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

6.6 MOUNTING

The JU-475-2 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-475-2 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.

SECTION VII
ERROR RECOVERY

7.1 WRITE ERROR

If an error occurs during a write operation, it 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 ten 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.

7.2 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 contaminants 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 ten 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 it was moved previously. Return to the desired track.

c. Repeat step "a."

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

7.3 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 VIII
ABBREVIATIONS / MNEMONICS

BPI	:	Bits Per Inch
BTU	:	British Thermal Unit
FCI	:	Flux Changes Per Inch
FM	:	Frequency Modulation
GND	:	Ground
I/O	:	Input/Output
MFM	:	Modified FM
MTBF	:	Mean Time Between Failures
MTTR	:	Mean Time to Repair
PCB	:	Printed Circuit Board
PM	:	Preventive Maintenance
POH	:	Power On Hours
TP	:	Test Point
TPI	:	Tracks Per Inch
TRK	:	Track
1F	:	Single Density
2F	:	Double Density