UGD-0489A

3.5 INCH FLEXIBLE DISK DRIVE
STANDARD SPECIFICATIONS
MF355B

SEP. 1986

MITSUBISHI ELECTRIC CORPORATION

CONTENTS

1. INTRODUCTION

The Mitsubishi MF355B is a high-performance,double-sided,2M bytes flexible disk drive using a high density 3.5-inch disk,that provides maximum customer satisfaction with high reliability and long service life.

1.1 General Description

* MF355B can perform read/write operation both with high density and normal density media.

* Uses industry standard 3.5" media.

* LSIs have been used to reduce the size of the drive and increase reliability.

* The height is only 32 mm.

* Has an unformatted capacity of two mega-bytes.

* Includes a disk ejector for easy disk removal.

* The high precision stepping-motor and lead-screw system are adopted for the head positioning provides high positioning accuracy. The shortest intertrack access time is 3 ms.

* The drive uses a DC brushless,direct-drive motor so that no maintenance is required.

* Excellent media interchangeability,wide off-track window time margin,and high performance are maintained over wide ambient temperature and relative humidity ranges.

* Only one quarter the volume of a standard mini-flexible disk drive.

* The interface is compatible with 5.25 inch mini flexible disk drives and the signal connector is a pin header type. A smaller power connector is used.

* The DRIVE SELECT signal input conditions,MOTOR ON/OFF control conditions and READY signal output conditions are selectable by jumper plugs or jumper wire as optional functions.

* Consumes just 0.02 watts in stand-by mode.

1.2 Specifications

1.2.1 Performance Specifications (Table 1-1)

	High Density	Normal Density
Memory capacity		
Unformatted		
Disk	2000 k bytes	1000 K bytes
Per surface	1000 k bytes	500 K bytes
Per track	12.5 k bytes	6.25 K bytes
Formatted	(512 bytes/sector)	(512 bytes/secter)
Disk	1474.5 k bytes	732 K bytes
Per surface	737.2 k bytes	368.6 K bytes
Per track	9216 bytes = 512 bytes x 18 sectors	4608 bytes = 512 bytes x 9 sectors
Transfer rate	500 k bits/second	250 K bits/second
Average latency time	100 ms	
Access time		
Track to track	3 ms minimum (unsettled)	
Average	94 ms (including settling time)	
Settling time	15 ms	
Motor starting time	400 ms (max. 700 ms up to Ready output)	

Table 1-1 Performance Specifications

1.2.2 Functional specifications (Table 1-2)

	High Density	Nomal Density
Recording density	17434 bits per inch	8717 bits per inch
Magnetic flux inversion density	17434 FCI	8717 FCI
Encording Method	MFM	
Track density	135 tracks per inch	
Number of cylinders	80	
Number of tracks	160	
Number of heads	2	
Rotation speed	300 RPM	
Rotation period	200 msec	
Index	1	
Media	3.5 inch High Density Disk Cartridge	3.5 inch Nomal Density Disk Cartridge

Table 1-2 Functional Specifications

1.2.3 Physical specifications (Table 1-3)

DC power requirements	
+5 V	+5 V ±5%,0.08A typical, Read/Write Ripple 100mV p-p Max.
+12V	+12V ±5%,0.12A typical,Read/Write Ripple 200mV p-p Max.
Operating environmental conditions	
Ambient temperature	5 °C to 45 °C (41 °F to 113 °F)
Relative humidity	20% to 80 % [Maximum wet bulb temperature: 29 °C (85 °F)]
Shock	2.5G Max.(10ms)
Vibration	0.25G Max.(5-100Hz)
Altitude	-300 to 3000 meters
Non-operating environmental conditions	
Ambient temperature	-20 °C to 51 °C (-4 °F to 125 °F)
Relative humidity	5% to 95% , non-condensing
Shock	30 G Max. (10 msec)
Vibration	3.0 G Max. (5-100 Hz)
Altitude	-300 to 3000 meters
Transportation environmental conditions (max 72 hours)	
Ambient temperature	-40 °C to 62 °C (-40 °F to 144 °F)
Relative humidity	1% to 95%, non-condensing

Heat dissipation	2.0 watts typical, Read/Write
Physical dimensions	(Except for front panel)
Height	32 mm
Width	101.6 mm
Depth	150 mm
Front panel dimensions	32 mm(H) x 101.6 mm(W)
Weight	500 g

Table 1-3 Physical Specifications

1.2.4 Reliability specifications (Table 1-4)

MTBF	10,000 hours
MTTR	30 minutes
Unit life	5 years or 20,000 energized hours, whichever comes first
Media life	
Rotational life	3.5×10^6 pass/track
Insertion	30,000 times
Error rate	
Soft read error	10^{-9} bit (Minimum 2 retries)
Hard read error	10^{-12} bit
Seek error	10^{-6} seek

Table 1-4 Reliability Specifications

2. GENERAL OPERATION

2.1 System Operation

The MF355B Flexible Disk Drive consists of a medium rotating mechanism, a read/write head, an actuator to position the read/write head on tracks, electronic circuits to read and write data, and to drive these components.

The rotation mechanism clamps the medium inserted into the drive to the spindle, which is directly coupled to the DC brushless motor, and rotates it at 300 rpm. The positioning actuator moves the read/write head to the desired track of the medium. Reading and writing can then occur after a settling delay.

2.2 Electronic Circuits

The electronic circuits driving the individual mechanisms of the MF355B are located on a single printed-circuit board, which consists of the following circuits:

* Line drivers and receivers that exchanges signals with the host system
* Drive selection circuit
* Index detection circuit
* Head positioning actuator drive circuit
* Spindle motor control circuit
* Read/write circuit
* Write protect circuit
* Track 00 detection circuit
* Drive ready detection circuit
* Head selection circuit
* In use and panel indicator LED drive circuit

The printed-circuit board for the spindle motor consists of a motor drive circuit, speed sensor and hall element sensor.

2.3 Rotation Mechanism

The disk rotation mechanism uses a DC brushless direct-drive motor to directly rotate the spindle at 300 rpm.

2.4 Positioning Mechanism

The read/write head is positioned as follows.

A carriage assembly needle is fitted in the lead screw groove on the stepping motor output shaft and, as the stepping motor rotates by 36°, the read/write head moves by one track in the specified direction, thus positioning the read/write head.

2.5 Read/Write Head

The head consists of a read/write head and a erase head (tunnel erase) that erases data on both sides of each track.

The two heads facing each other over a disk are attached to soft circular gimbal springs and each head closely follows the disk surface so as to obtain the greatest read signals from the contacting disk. Also, since the gimbal spring has good follow-up performance, no stress is applied to the disk surface, resulting in a longer life of the disk.

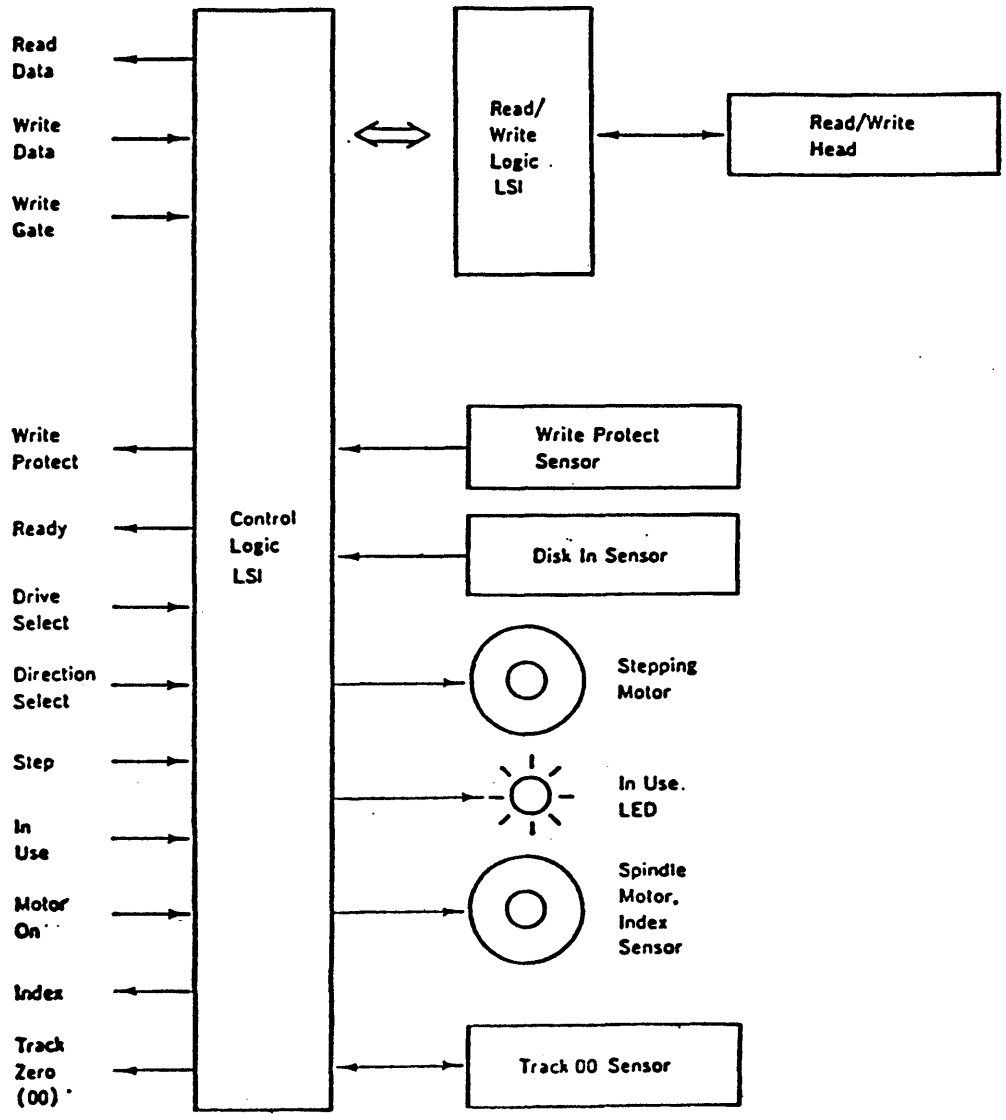


Figure 2-1 MF355B Functional Diagram

3. ELECTRICAL INTERFACE

There are two kinds of electrical interfaces: Signal interface and DC power interface.

The signal inetrface sends and receives control signals and read/write data between the MF355B and the host system via the J1/P1 connector.

The DC power interface drives the spindle drive motor of the MF355B , supplies power to the electonic circuits and the stepping motor which drives the read/write head positioning mechanism via the J2/P2 connector.

The signals and pin arrangement of these two types of interfaces are shown in Tables 3-1, 3-2 and Figure 3-1.

Source voltage	Pin number
+12 V DC	1
+12 V DC RETURN	2
+5 V DC RETURN	3
+5 V DC	4

Table 3-1 DC Power Connector Pin Arrangement (J2/P2)

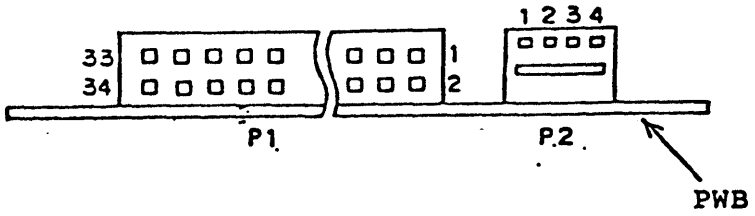


Figure 3-1 Connector P1 and P2 Pin Numbers

Signal	Type	Signal Pin No.	Ground/Return Pin No.
HIGH DENSITY SELECT*1	Input	2	1
SPARE*2	-----	4	3
DRIVE SELECT 3	Input	6	5
INDEX	Output	8	7
DRIVE SELECT 0	Input	10	9
DRIVE SELECT 1	Input	12	11
DRIVE SELECT 2	Input	14	13
MOTOR ON	Input	16	15
DIRECTION SELECT	Input	18	17
STEP	Input	20	19
WRITE DATA	Input	22	21
WRITE GATE	Input	24	23
TRACK 00	Output	26	25
WRITE PROTECT	Output	28	27
READ DATA	Output	30	29
SIDE ONE SELECT	Input	32	31
READY *3	Output	34	33

Table 3-2 Signal Connector Pin Arrangement (J1/P1)

*1: This line is used for switching between high and normal density.

*2: This line can be used as IN USE with the jumper plug setting on the PCB.

*3: This line can be used "DISK CHANGE" instead of "STANDARD READY" by the jumper wire setting on the printed-circuit board.

3.1 Signal Interface

The signal interface is classified into control signals and data signals. These interface signal lines are all TTL levels. The meanings and characteristics of the signal levels are as follows:

* True = Logical "0" = VL 0 V to +0.4 V
  Iin 6mA maximum

* False = Logical "1" = VH +3.8 V to 5.25 V
  Iin 6mA

* Input impedance = 10 Kohms

3.1.1 Cabling method and input line termination

The MF355B uses a daisy chain cabling system. A single ribbon cable or twisted-pair cable may be fitted with multiple connectors to permit connection of up to four drives.

The connected drives are multiplex-controlled by drive select lines, and any one of the drives can be accessed.

The cabling method is shown in Figure 3-2. A maximum of seven input signal lines, pluse the drive select lines, are terminated at the MF355B.

The drive contains resistors to be mounted on its printed-circuit board to terminate these input signal lines.

The drive is delivered from the factory with resistors of 10 kohms.

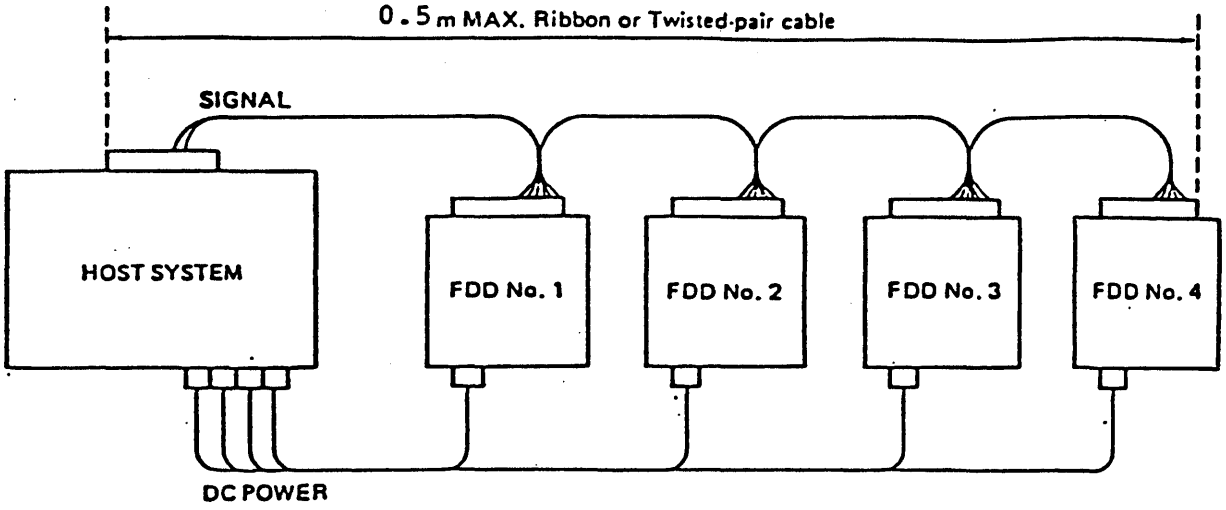


Figure 3-2 Cable connection (Schematic diagram)

3.1.2 Line driver and line receiver

The recommended interface line driver and line receiver circuits for the host system and the drives are shown in Figure 3-3.

It is suggested that a Schmitt trigger circuit with a hysteresis characteristic at the switching level be used for the line receiver to improve the noise resistance of the interface lines.

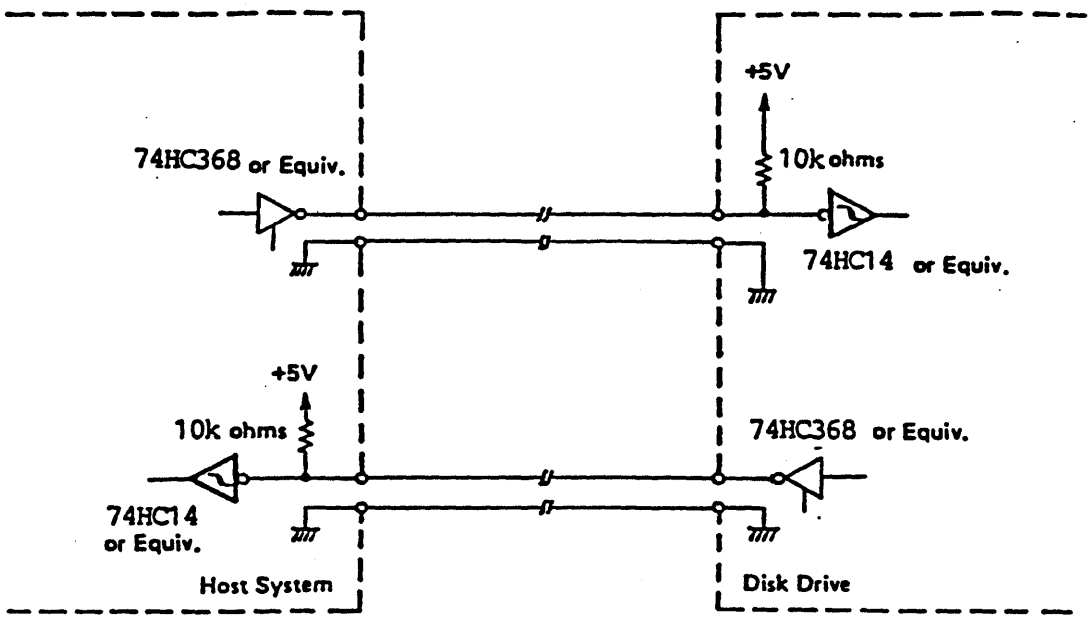


Figure 3-3 Recommended Line Drive and Receiver Circuit

3.1.3 Input signal lines

The MF355B has 11 input signal lines. Input signals can be classified into two types: One is multiplexed in a multi-drive system; and the other performs a multiplex operation.

The multiplexing signals are:

* Drive select 0

* Drive select 1

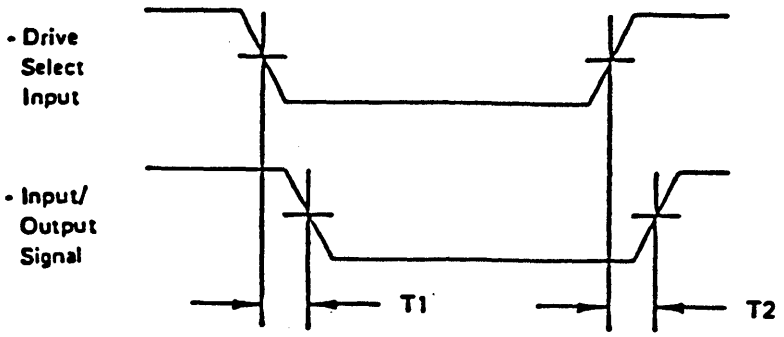
* Drive select 2

* Drive select 3

3.1.3.1 Drive select 0 to drive select 3

When one of these drive select lines are at logical "0" level, the multiplexed I/O lines become active to enable read/write operation. These four separate input signal lines, drive select 0 to drive select 3, are provided for connecting four drives to one system and multiplexing them. Jumper pins DS0,DS1,DS2, and DS3 on the printed-circuit board are used to select the drives to be made active, corresponding to drive select lines. See Figure 3-4.

DS0 is shorted before shipment from the factory, so this setting must be changed when establishing other drive identifications.



T1 > 1 μs

T2 > 1 μs

Figure 3-4 Drive Select Timing

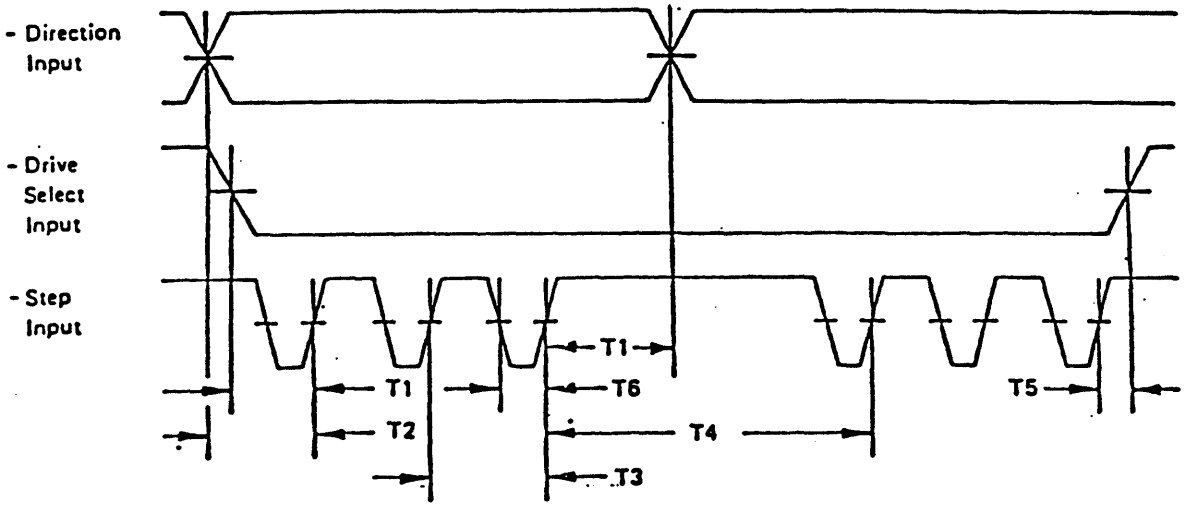


Figure 3-5 Step Timing

T1 > 1 μSec
T2 > 1 μSec
T3 > 3 mSec
T4 > 18 mSec
T5 > 1 μSec
1 μSec < T6 < 1 mSec

3.1.3.2 Side one select

This interface line is used to select which of the two sides of the disk should be read or written. When this line is at logical "1", the side 0 head is selected; or when it is at logical "0", the side 1 head is selected. If the polarity of the side 1 select signal is reversed, delay read/write operation by at least 100 us before execution.

Upon completion of a write operation, reverse the polarity of the side one select signal after a delay of at least 1.2 ms. The heads are tunnel erase type, with a physical core gap separation between the read/write head and the erase heads so with no delay, non-erased areas would be generated on the diskette due to a timing difference between the write data area and the erase area during write operation. This is prevented by delaying the erase current cutoff time of a few hundred microseconds within the MF355B . Therefore, the head select must not be reversed during this delay time. Also, the track access operation (giving a step signal pulse) must not be conducted for at least 1.2 ms after completing a write operation for the same conditions as described in the above.

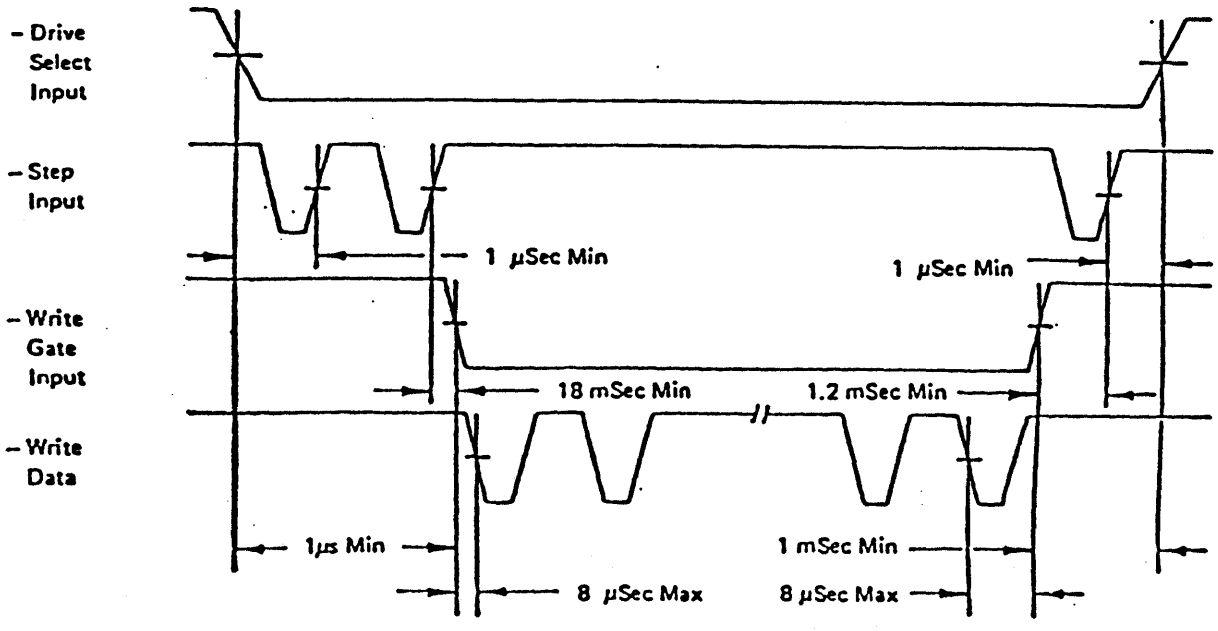


Figure 3-6 Write Gate Timing

3.1.3.3 Direction Select

This interface line controls the direction (inward or outward) in which the read/write head should be moved when a step signal pulse is applied.

If the signal is at logical "1", the read/write head moves from the center of the disk out-ward; if it is at logical "0", the head moves inward.

3.1.3.4 Step

This interface line is a pulsed signal for moving the read/write head in the direction defined by the direction select line. The read/write head moves by one track each time when a signal pulse is applied to the step line. The step operation starts with the trailing edge of a negative-going pulse (reversal from logical "0" to logical "1").

The direction select line must be reversed more than 1 us before the trailing edge of the step pulse. See Figure 3-5.

3.1.3.5 Write gate

When this interface line goes to logical "0", the write driver becomes active and the data given to the write data line is written on the selected side of the disk. When the interface line goes to logical "1", the write driver becomes inactive to enable the read data logic. The verified read data is obtained 1200 us (maximum) after the write driver becomes inactive. See Figure 3-6.

3.1.3.6 Write data

Data to be written on the disk is sent to this interface line, which is enabled to receive data when the Write Gate input is at a logical "0" state.

This line is normally at logical "1", and reverses the write current at the leading edge of a negative-going data pulse (reversal from logical "1" to logical "0") to write data bits. See Figure 3-9 for timing.

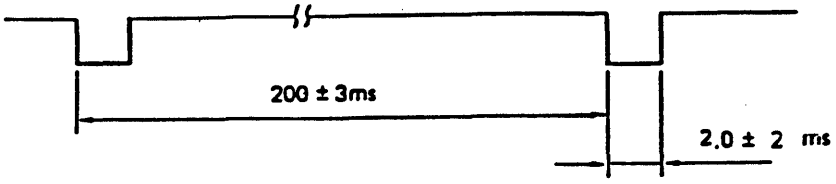


Figure 3-7 Index Timing

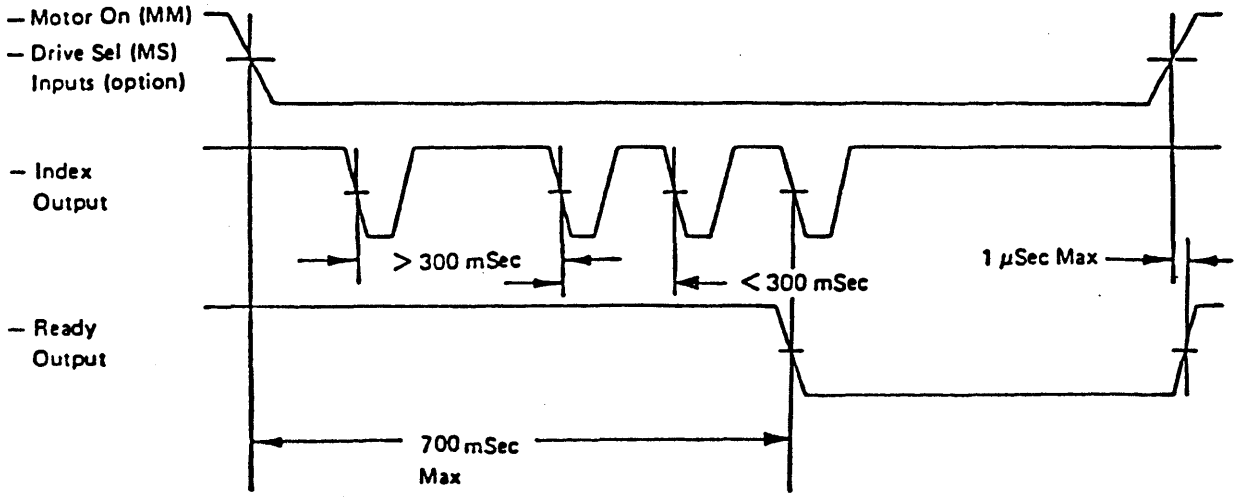


Figure 3-8 Basic Ready Timing

FM Encoding

FM (Frequency Modulation) encoding is shown in Figure 4-1. It is the simplest form of encoding, and may be decoded by use of inexpensive one-shot multivibrators. It can do this because each data pulse is between two clock pulses, thereby rigidly defining the "read window" very precisely.

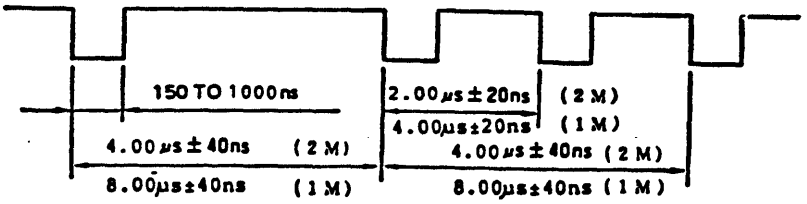
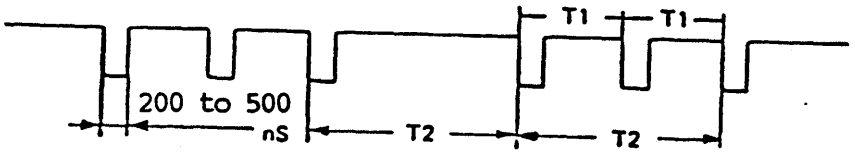


Figure 3-9 FM Write Encoding



2M: T_1=2μs±800ns(Jitter due to rotation variation excluded)

T_2=4μs±1.6us(")

1M: T_1=4μs±800ns(")

T_2=8μs±1600ns(")

Figure 3-10 FM Read Timing

3.1.3.7 In use LED

A red LED on the front bezel lights when Drive Select (DS) signal is active.

3.1.3.8 Motor on

This interface line starts the spindle motor when it goes to logical "0". See Section 3.1.5.2 for related options.

The motor-on line goes logical "1" to stop the motor and keep it off while the drive is out of operation, thus reducing system heat generation.

3.1.3.9 High density select

This interface line selects whether read/write operations are set for high density or normal density media Logical "0" corresponds to high density, and logical "1" corresponds to normal density. When this line is switched, write operations always begin after the read/write head moves to track 00. The erase power delay of a few hundred micro-seconds, which is generated within the drive, is necessary for switching when the head is moved to track 00 or when the power is turn on.

3.1.4 Output signal lines

The MF355B has five standard output signal lines.

3.1.4.1 Index

This interface line is normally logical "1" but sends a logical "0" output pulse 2.0 msec wide each time the disk makes one revolution (200 ms period).

This signal signifies the start of a track on the rotating disk. The index signal timing is shown in Figure 3-7.

3.1.4.2 Track 00

When this interface line is at logical "0", it indicates that a read/write head of the selected drive is positioned on track 00. If the output of the selected drive is at logical "1", it indicates that the read/write head is positioned on a track other than track 00. See Figure 3-11.

3.1.4.3 Ready

This interface line is set to logical "1" when the spindle motor is stopped or no disk is mounted onto the drive. After mounting a disk and the state of the index pulse effect when sensor is properly detected and the DC power (+5V,+12V) is supplied, this interface line is set to logical "0" (Ready) when three or more index pulses are detected. See Figure 3-8.
This signal shows the state that the disk is rotating and it can be read/written. The STANDARD READY signal is set within 700 ms maximum after the motor is started by a MOTOR ON or other signal and is reset under the following conditions.

(a) Spindle motor off

(b) Disk ejection

3.1.4.4 Read Data

This interface line transmits the data that is detected by the read/write head on the disk.

The read data line is normally logical "1" but it sends a logical "0" (negative-going) output pulse during a read operation. See Figure 3-10 for allowable limits on timing variations with the usual disk and bit shifts.

3.1.4.5 Write Protect

This interface signal notifies the host system of the insertion of a disk without a write protect notch into the drive. The signal goes to logical "0" when a write-protected disk (See Figure 3-12) is inserted into the drive. When the signal is at logical "0", writing on the disk is inhibited even if the write gate line becomes active.

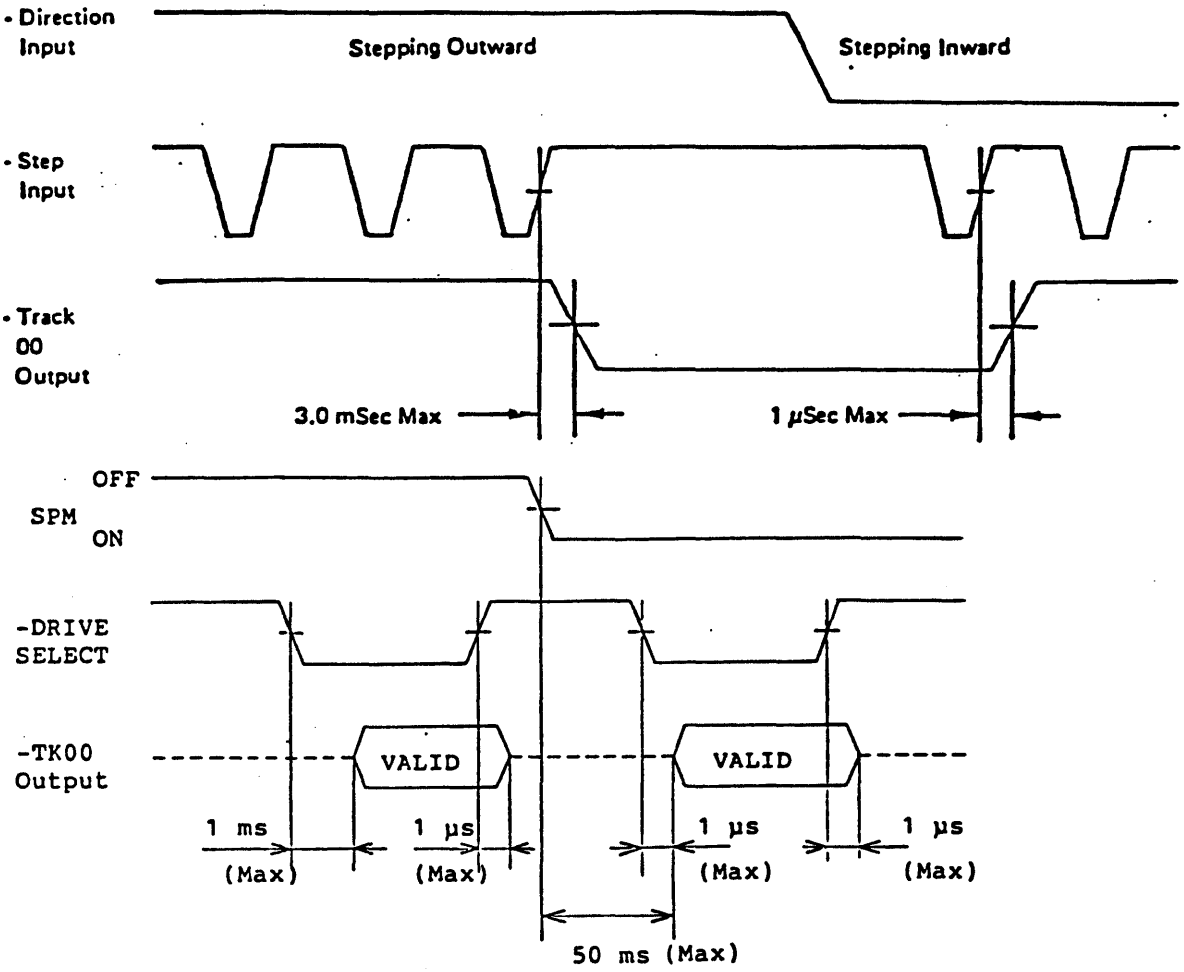


Figure 3-11 Track 00 Timing

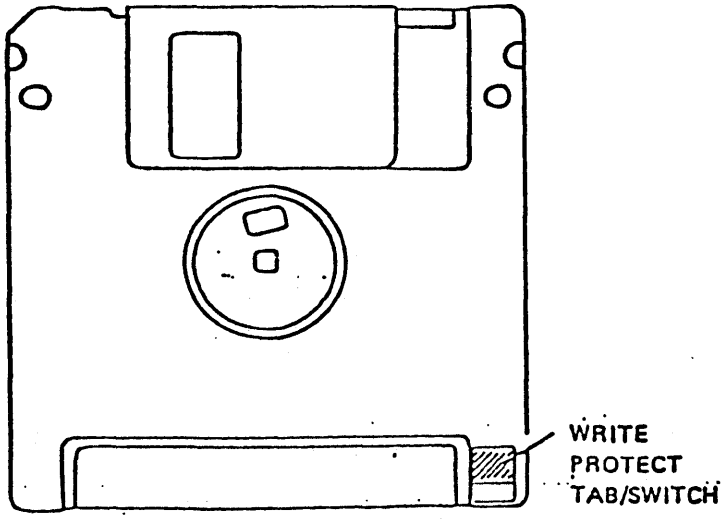


Figure 3-12 Write Protect on Disk

3.1.5 Short plug and jumper wire

The short plug and jumper wire determine the condition to select a drive, condition to start the spindle motor.

3.1.5.1 Drive select condition selecting DS0-3

When two or more drives are connected with a system and one of DS0-3 is short-circuited, the only drive of logical "0" for the corresponding DRIVE SELECT line is selected and an input/output signal can be sent/received.
For example, a drive on which DS0 is short-circuited is selected when the DRIVE SELECT 0 line is set to logical "0".

3.1.5.2 Motor control conditions MM, MS

The spindle motor on condition can be selected as shown below by combining the open and short state of MM and MS.

Jumper		Note	Remarks
MM	MS		
Short	Open	1)	State when shipped out of the plant
Open	Short	2)	

1) The spindle motor on/off is controlled by the MOTOR ON signal.

2) The spindle motor on/off is controlled by the drive select condition selected by a signal of DRIVE SELECT 0-3.

3.1.5.3 Ready output conditions DC,SR

The following ready conditions can be selected by combining the optional DC and SR jumper wire settings.

Jumper		Note	Remarks
DC	SR		
Open	Short	1)	State when shipped out of the plant
Short	Open	DISK CHANGE	Reset by step pulse

1) Standard Ready

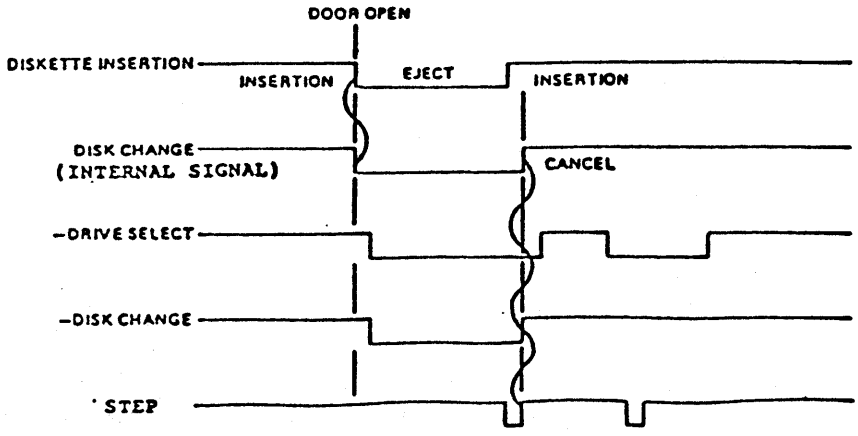
This signal shows the states that the disk is rotating and it can be read/written. The STANDARD READY signal is set within 700 ms maximum after the motor is started by MOTOR ON or other signal and is reset under the following conditions.

(a) Spindle motor off

(b) Disk ejection

2) DISK CHANGE

This signal shows that the power on is turned on or the disk is ejected from the system.
This signal is reset by the trailing edge of first DRIVE SELECT signal after mounting a disk to the system, and the signal is not changed by the DRIVE SELECT signals that are generated after that.
This signal takes the logical product with the DRIVE SELECT signal.



3.1.5.4 Panel indicator LED lighting condition IS,IU

JW	JW	LED lighting condition
IS	[IU]	Lights up by the IN USE signal.
[IS]	IU	Lights up by the DRIVE SELECT signal.

Note: The option name enclosed in a square shows an insertion of jumper line, and the name not enclosed shows that it is open. (JW=Jumper Wire)

Function	Name	Contents	Setting when shipped from the factory
Selection of drive select	[DS0]	Drive select 0	DS0 [o o]
	DS1	Drive select 1	DS1 o o
	DS2	Drive select 2	DS2 o o
	DS3	Drive select F3	DS3 o o
Selection of the MOTOR-ON conditions	[MM] MS	Motor is started by the MOTOR-ON Signal	MM o—o
	MM [MS]	Motor is started by the DRIVE SELECT Signal	MS o o
Selection of send signals from interface (connectorP1)	[SR] DC	Sends a STANDARD READY signal on pin No.34.	SR o—o
	SR [DC]	Sends a DISK CHANGE signal on pin No.34.	DC o o
Frame ground	[FG]	Frame ground and signal ground are shorted.	FG 0—0
	FG	Frame ground and signal ground are opened.	

Note: [ ] means the plug position when shipped from factory, and 0—0 for Jumper wire shorting.

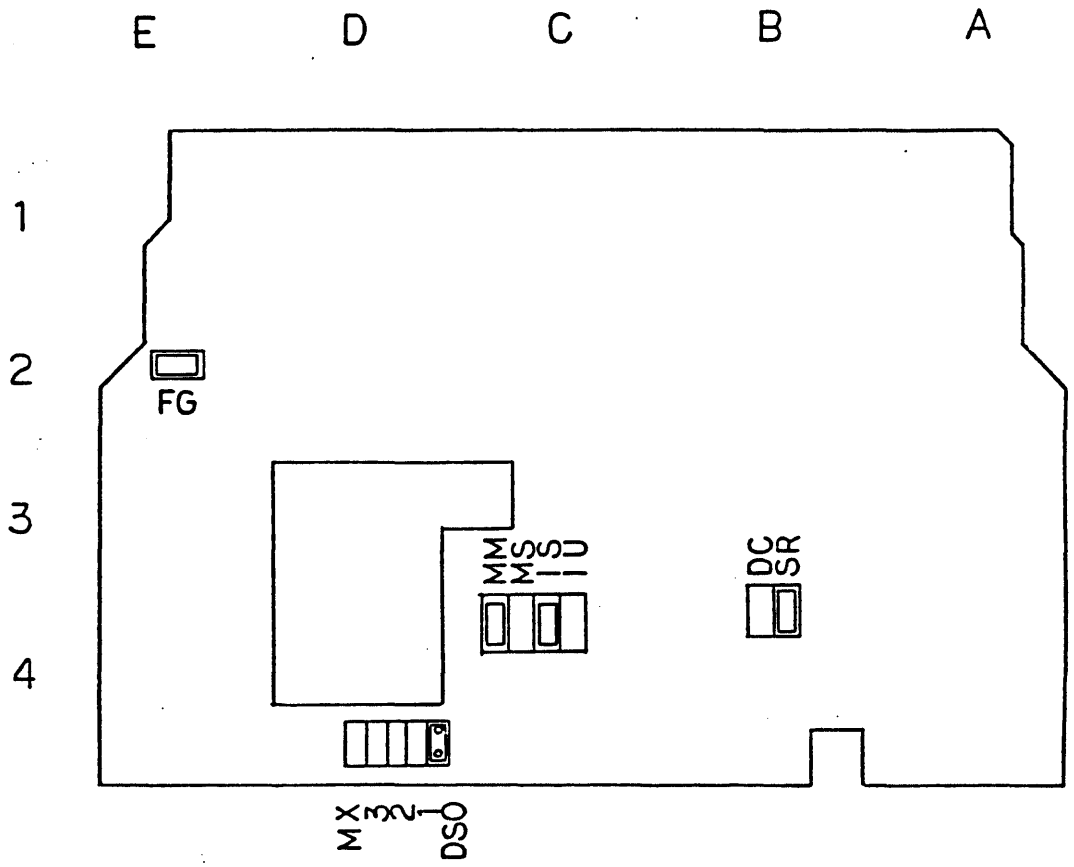


Figure 4-5 Printed-Circuit Board Trace Location

4. FUNCTIONAL OPERATION

4.1 Power On Sequencing *

No read/write operatin is permitted during the period before control signals are stablized after turning on the DC power. The ready state is established within maximum 700 ms after inputing the MOTOR ON signal.

The read/write head may be positioned on an incorrect track after switching the DC power on, so before starting a read/write operation, perform a step out operation until a track 00 signal is detected, thus correctly positioning the head at a known track.

4.2 Positioning Operation

The seek operation which moves the read/write head to the desired track selects a direction first, inward or outward, with the polarity of the direction select signal, and moves the head with the step signal. If access to a track two or more tracks away is required, step pulses are continuously sent until the head moves to the desired track.

Head movement occurs with the trailing (low to high) edge of the step pulse.

* When the DC power is applied to the drive, the step motor rotates to the exact phase.

4.3 Read Operation

Two modes of encoding, FM, or MFM are used for the data stored on media. FM is used for single-density recording, and MFM for double-density recording.

A comparison of the FM and MFM encoding modes is shown in Fig. 4-1. See chapter 3 for operational timing methods and timing requirements.

4.4 Write Operation

Write data can be encoded by either FM, or MFM. The MF355B has good contact stability of the read/write head on the medium and employs a high-performance read/write head, so minimum precompensation is necessary for correcting the bit shift effect when writing data in the MFM mode (double density). Specifically, precompensation of 125 nsec or smaller can be used on tracks 43 and above,and none should be used on lower numbered tracks.

The required timing for write data and operation timing is described in Chapter 3.

4.5 Ready Signal Output Operation

Refer to Fig. 4-2 for the timing of STANDARD READY signal.

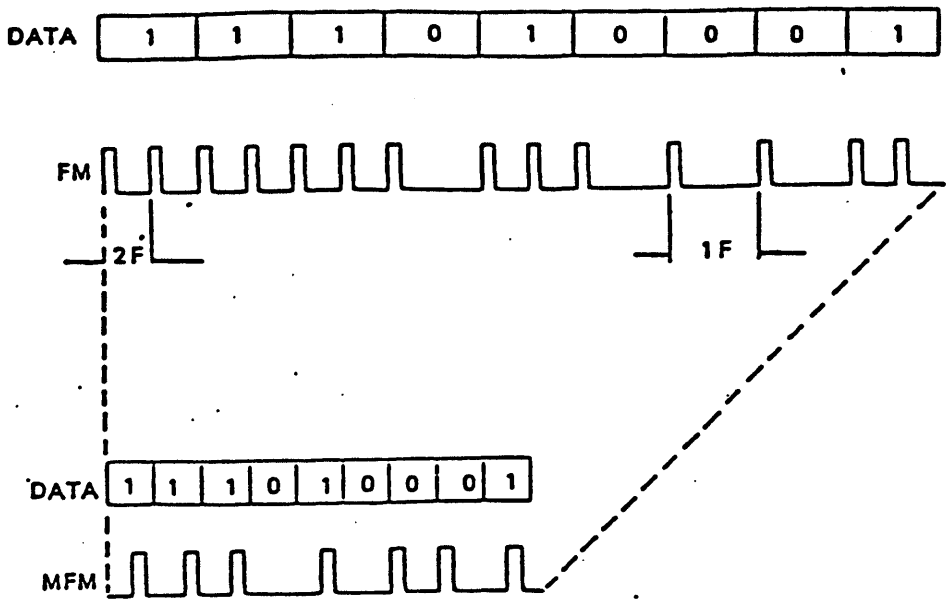


Figure 4-1 Comparison of FM and MFM encoding

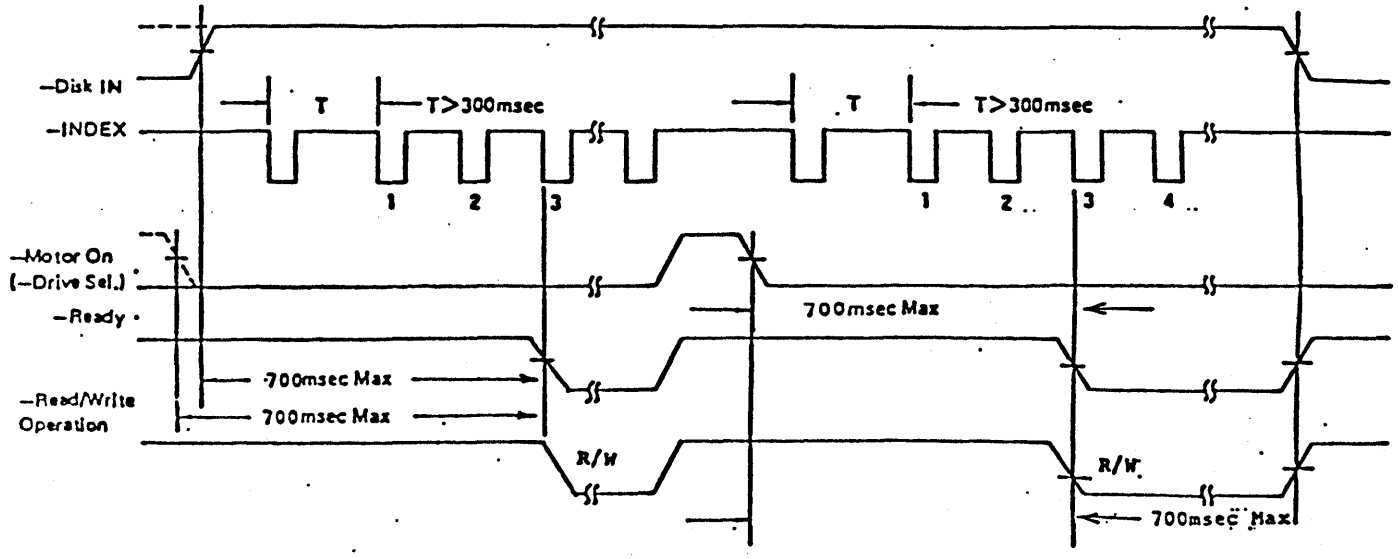
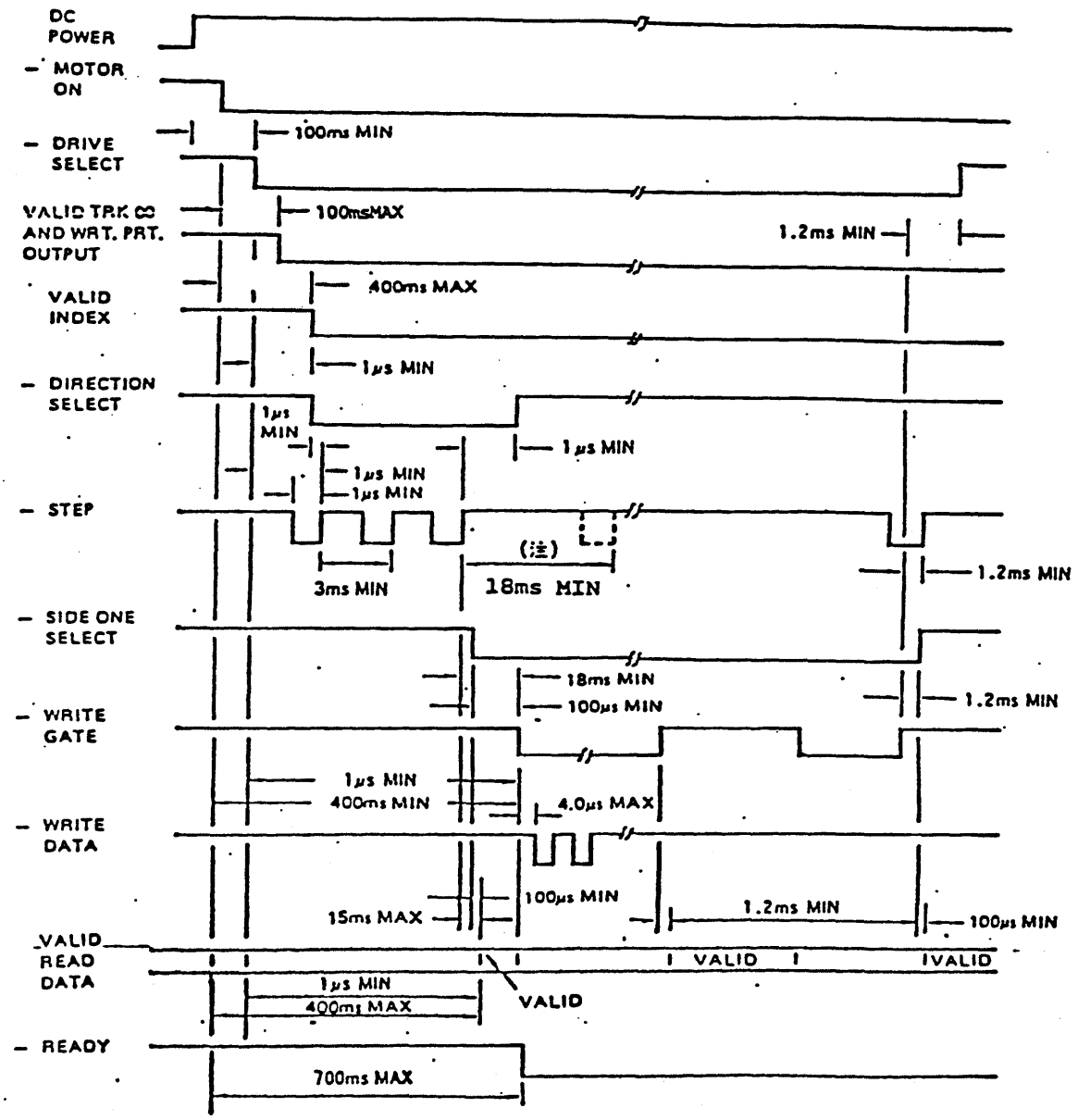


Figure 4-2 The Timing of STANDARD READY signal



NOTE: When reversing direction, issue a next step pulse after more than 18 ms from the step pulse before inversion.

Figure 4-3 Control and Data Timing

5. CONNECTOR & CABLE

Electronic interfaces between the MF355B and the host system are accomplished with three connectors. Connector P1 is for the signal interfaces, connector P2 for the DC power supplies, and connector P5 for frame grounding. The connectors used for the MF355B and recommended mating connectors are described below.

5.1 Signal Connectors (J1/P1)

P1 is a 34-pin (2 rows of 17 pins) of pin header type. The substrate side connectors are given even numbers (2,4-34) and the other side odd numbers (1,3-33).

The P1 pin location is shown in Table 9.

Table 10 shows recommended J1 connectors that mate with P1.

AMP P/N	JAE P/N
3-171451-4	PS-34PA-D4LT1-PN1

Table 5-1 Connectors (P1) Drive side

AMP P/N	JAE P/N
172534-5	PS-34SEN-D4P1-1D PS-34SEN-D4P1-1C PS-34SA-D4LT-1

Table 5-2 Connectors (J1) for Flat cable

(Contact the connector manufactures for details on the crimping tools and others.)

5.2 DC Power Connectors (J2/P2)

P2 is the DC power supply connector. A 4-pin connector is mounted at the rear part of printed-circuit board for the purpose.

Table 5-2 and 5-3 show the connector at the drive side and connector side, respectively.

AMP P/N
171826-4

Table 5-3 DC power supply connector (P2) (Drive side)

AMP P/N
171822-4

Table 5-4 DC power supply connector (J2) (Cable side)

5.3 Frame Ground Connectors (J5/P5) (option)

Fast-on pin (P5), drive side	Crimped pin (J5), cable side
AMP P/N 61761-2	AMP P/N 60972-2

Table 5-5 Frame Ground connctor

5.4 Interface Connector Physical Location

Figure 5-1 shows the physical locations of the interface connectors used for the MF355B.

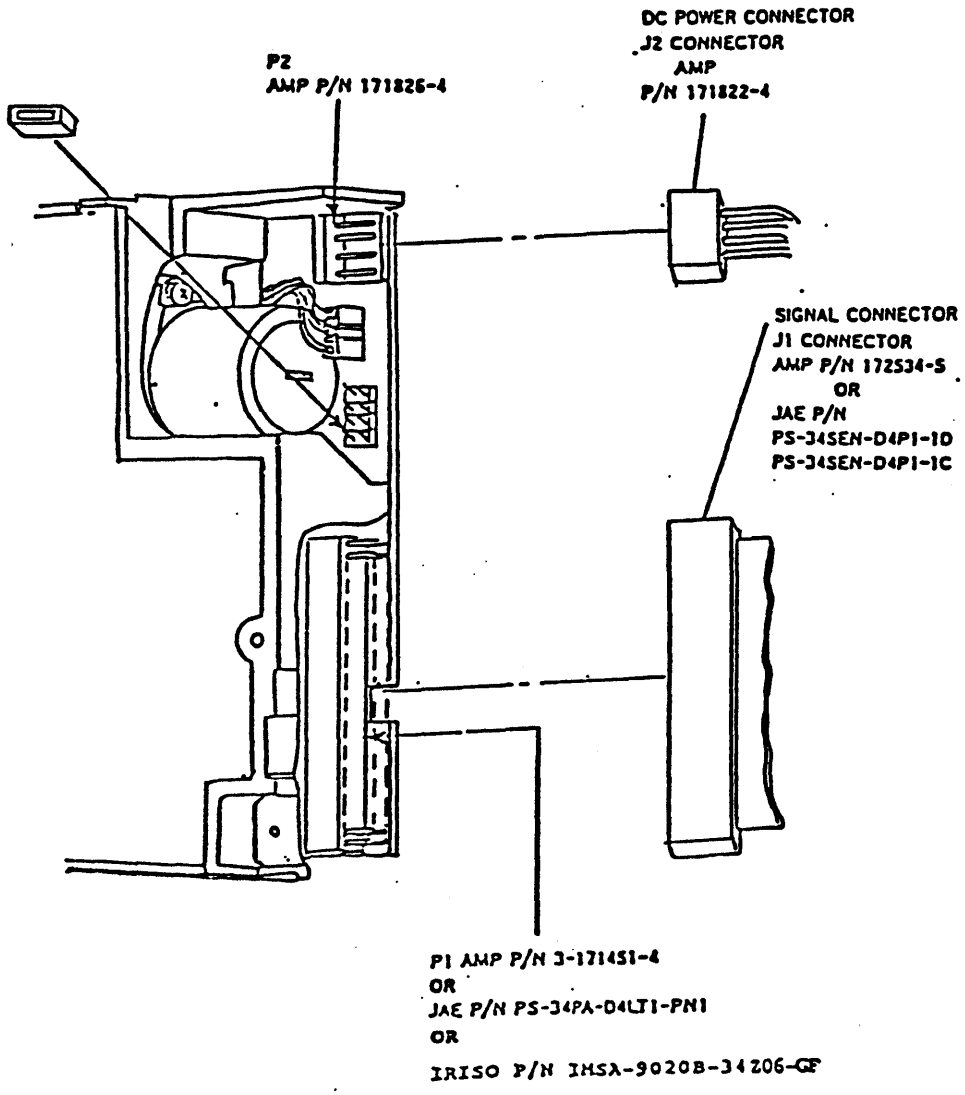


Figure 5-1 Connector Location Diagram (Rear View)

6. PHYSICAL SPECIFICATIONS

6.1 Installation Directions

Install the MF355B Disk Drive in the directions shown in Figure 6-1.

Slant mounting should be within 10 degrees of perpendicular.

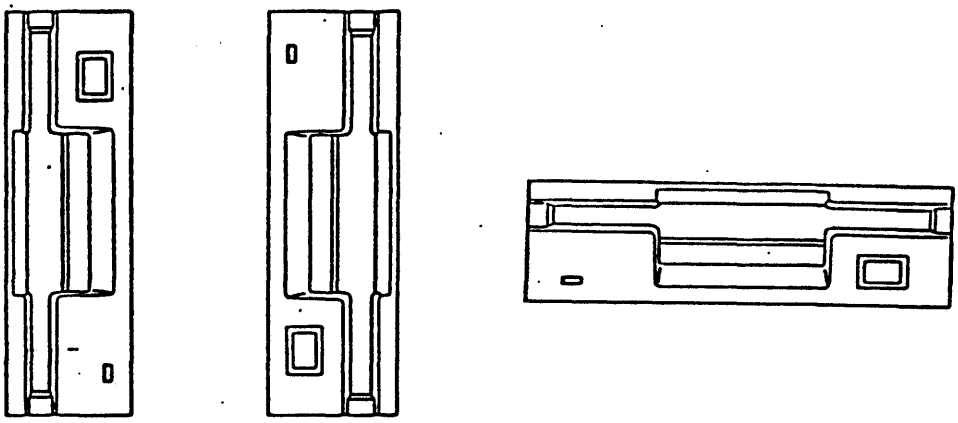


Figure 6-1 Disk Drive Installation Directions

6.2 Drive dimensions

See Fig. 6-2.

Select the mounting hole dimensions shown in Table 5-6.

Allowance ±0.5

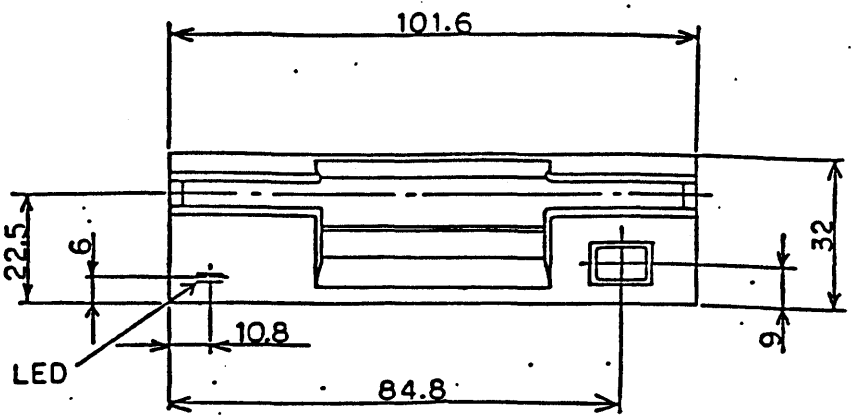
	A	B	C	D	E	F	
(1)	6.35	5.1	99.1	88.9	14.2	69.9	M3x0.5x4DP
(2)	6	35	55	90	35	55	or
(3)	5	21	60	94	31	70	UNC6-32x0.15DP

Table 5-6 Mounting holes

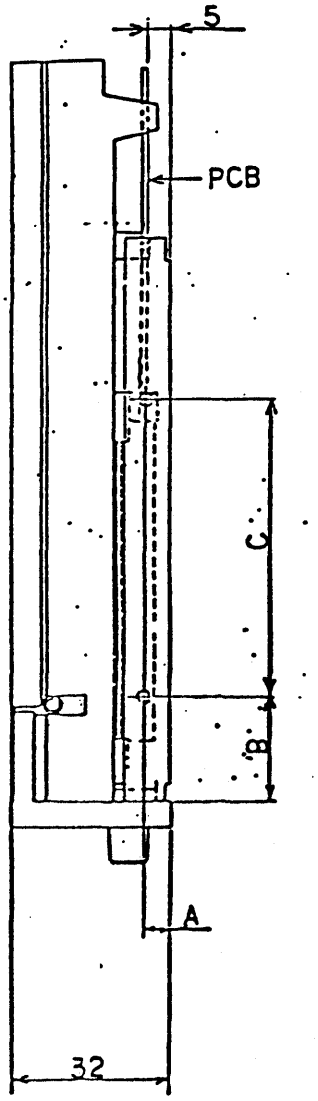
Standard type is (1) or (2)

UGD-0489A

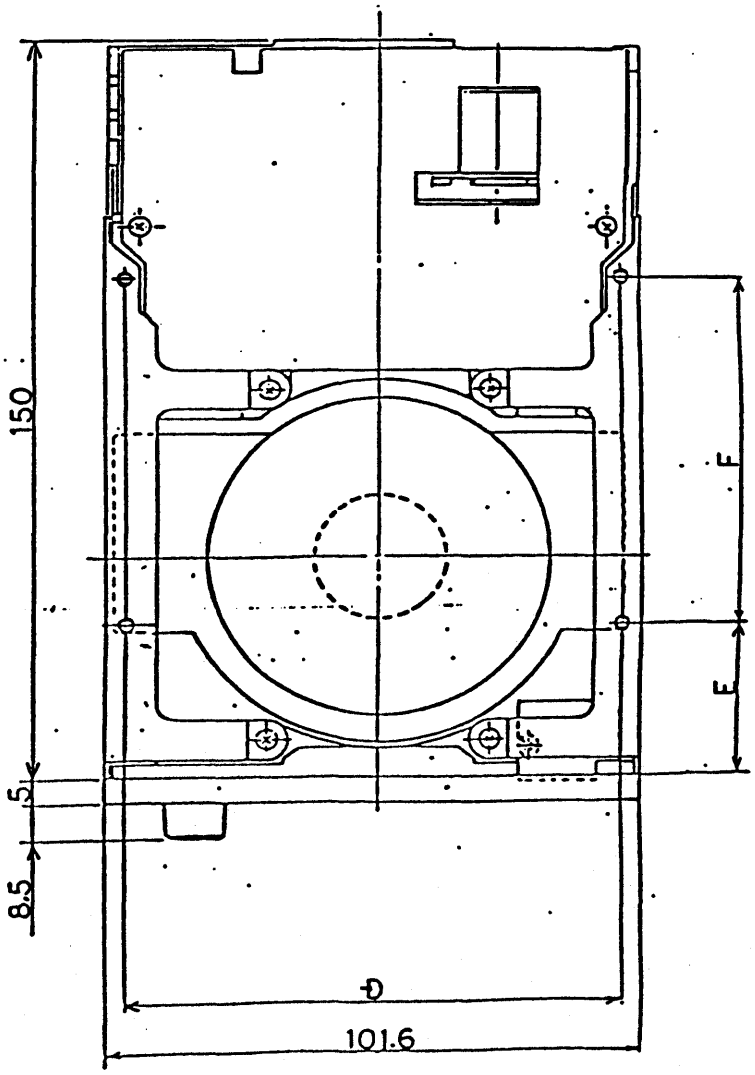
Allowance ±0.5



FRONT VIEW (WITH FRONT PANEL)



SIDE VIEW



BOTTOM VIEW

Figure 6-2 Dimensions of MF355B (mm)

7. ERROR DETECTION AND CORRECTION

The following describes the methods of troubleshooting and recovery that are applicable to data errors.

7.1 Write errors

If an error occurs during a write operation, it can be detected by performing a read operation on the disk immediately following the write operation. This is generally called a write check, which is an effective means of preventing write errors. It is recommended, therefore, that a write check be made without fail.

If a write error occurs, repeat the write operation and conduct a write check. If data cannot be correctly written even after the write operation is repeated about ten times, perform a read operation on another track to determine whether the data can be read correctly. If so,9 specific track of the disk is detective. If data cannot be correctly read on the other track, the drive is assumed to have some trouble. If the diskette is defective, replace it.

7.2 Read errors

Most data errors that occur are soft errors. If a read error occurs, repeat the read operation to re-cover the data.

The followings are possible main causes of soft errors:

* Dust is caught between the read/write head and disk causing temporary fault in head contact. Such dust is generally removed by the self-cleaning wiper of the jacket, and the data is recovered by the next re-read operation. If read/write is continued for a long time in a very dusty environment, however, hard errors can result from a damaged disk surface.

* Random electrical noise ranging in time from a few microseconds to a few milliseconds can also cause read errors. Spike noise generated by a switching regulator, particularly one that has short switching intervals, deteriorates the signal-to-noise ratio, and increases the number of re-read operations for data recovery. It is necessary, therefore, to make an adequate check on the noise levels of the DC power supplies to the drive and frame grounding.

* Written data or disk may have so small a defect as cannot be detected by a data check during write operation.

* Fingerprints or other foreign matter on a written diskette can also cause a temporary error. If foreign matter is left on a written disk for a long time, it can adhere to the disk, possibly causing a hard error.

It is recommended that the following read operations be performed to correct these soft errors:

* Step 1: Repeat the read operation about ten times, or until the data is recovered.

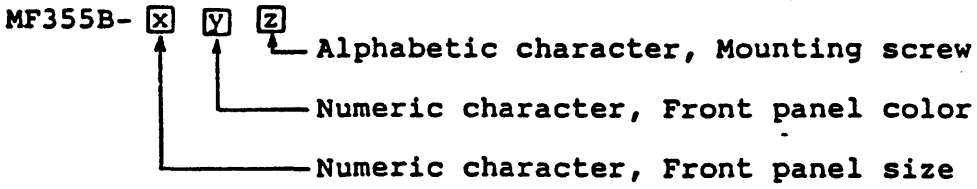
* Step 2: If the data cannot be recovered by Step 1, move the head to another track, The opposite direction of the previous track position before the designated track, and then return the head to the original position.

* Step 3: Repeat an operation similar to Step 1.

* Step 4: If the data cannot be recovered, assume the error is a hard error.

8. TYPE REFERENCES TO BE STATED WHEN ORDERING

8.1 Table Listing Changes in Type Reference Designations (indicated by three alphabetic characters in the secondary name chart.)



x Front panel size

x	Dimensions
1	32.0x101.6x5.0

y Front panel color

y	Panel color	Button color
0		
1		
2	Black	Black

z Mounting screw

z	Mounting screw specifications
U	Unified screw No.6-32 UNC x 0.15 DP
M	Metric screw M3x0.5 Screw Depth 4

Note: MF355B-12U is the standard model No.
Check catalog befor ordering other models.

Specifications subject to change without notice.