

CITIZEN

Model: X1DE-00R

3.5" Micro Floppy Disk Drive

Specification



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Table of Contents

TABLE OF CONTENTS	II
LIST OF FIGURES.....	III
LIST OF TABLES	III
ABBREVIATION/MNEMONICS	IV
NOTICES TO USERS	IV
1 INTRODUCTION	1
1.1 PURPOSE.....	1
1.2 GENERAL DESCRIPTION	1
1.3 SPECIFICATIONS SUMMARY	1
1.3.1 Performance Specifications.....	1
1.3.2 Functional Specifications.....	2
1.3.3 Physical Specifications.....	2
1.3.4 Reliability Specifications	2
2 ELECTRICAL INTERFACE	3
2.1 INTERFACE CONNECTION	3
2.2 INTERFACE CIRCUITS	3
2.3 INTERFACE SIGNALS.....	4
2.4 INPUT SIGNALS.....	4
2.4.1 Drive Select.....	4
2.4.2 Motor ON.....	4
2.4.3 Direction.....	4
2.4.4 Step.....	4
2.4.5 Write Data.....	5
2.4.6 Write Gate.....	5
2.4.7 Side 1 Select.....	6
2.4.8 Density Select.....	6
2.5 OUTPUT SIGNALS	6
2.5.1 Index.....	7
2.5.2 Track 00.....	7
2.5.3 Write Protect	7
2.5.4 Read Data	7
2.5.5 Disk Change.....	7
2.5.6 Ready.....	8
2.5.7 Media	8
2.6 INTERFACE TIMING.....	9
2.7 POWER INTERFACE	9
2.7.1 Power Supply Specifications	9

2.8	OTHER FUNCTIONAL CHARACTERISTICS.....	10
2.8.1	Automatic Motor ON/OFF.....	10
2.8.2	Stand-by.....	10
3	PHYSICAL INTERFACE.....	10
3.1	CABLE CONNECTIONS	10
3.2	CONNECTORS & CABLE	10
4	INSTALLATION	11
4.1	MECHANICAL DIMENSIONS	11
4.2	MOUNTING RECOMMENDATION	12
5	RECORDING FORMAT	13
5.1	RECOMMENDED FORMAT	13

List of Figures

FIGURE 1	INTERFACE CONNECTIONS	3
FIGURE 2	RECOMMENDED CIRCUIT	4
FIGURE 3	STEP PULSE TIMING	5
FIGURE 4	WRITE DATA TIMING (MFM)	5
FIGURE 5	WRITE GATE & WRITE DATA TIMING	6
FIGURE 6	MODE CHANGE (2.0/1.6MB).....	6
FIGURE 7	MODE CHANGE (1.6/1MB).....	6
FIGURE 8	INDEX SIGNAL TIMING	7
FIGURE 9	TRACK00 SIGNAL TIMING	7
FIGURE 10	READ DATA TIMING	7
FIGURE 11	DISK CHANGE TIMING	8
FIGURE 12	TIMING RELATIONSHIP FOR HOST/DRIVE INTERNAL SIGNAL.....	9
FIGURE 13	POWER CONSUMPTION DIAGRAM	9
FIGURE 14	TIMING OF SPINDLE MOTOR ROTATION	10
FIGURE 15	CONNECTIONS.....	10
FIGURE 16	CABLE DIMENSION	10
FIGURE 17	DIMENSIONS.....	12
FIGURE 18	MOUNTING DIRECTION.....	12
FIGURE 19	1.0MB IBM FORMAT	14
FIGURE 20	1.0MB ISO FORMAT	14
FIGURE 21	1.6MB IBM FORMAT	15
FIGURE 22	2.0MB IBM FORMAT	15

List of Tables

TABLE 1	PERFORMANCE SPECIFICATIONS.....	1
TABLE 2	FUNCTIONAL SPECIFICATIONS	2
TABLE 3	ENVIRONMENTAL LIMITS	2
TABLE 4	VIBRATION	2
TABLE 5	INPUT AND OUTPUT LEVEL.....	4
TABLE 6	POWER SUPPLY CURRENT.....	9
TABLE 7	1MB FORMAT	13
TABLE 8	1.6MB FORMAT	13
TABLE 9	2MB FORMAT	13

Abbreviation/Mnemonics

BPI	Bit per Inch
CRC	Cyclic Redundancy Check
DS	Drive Select
FDD	Floppy Disk Drive
FM	Frequency Modulation
MFM	Modified FM
MTBF	Mean Time Between Failures
MTTR	Mean Time to Repair
PCB	Printed Circuit Board
PM	Preventive Maintenance
P-P	Peak to Peak
R/W	Read and Write
TP	Test Point
TPI	Track per Inch

Notices to Users

Every effort had been made to ensure the information provide herein is correct. Please notify us in case of any error or inconsistency. Please send your comments with your name, mailing address, and phone number to:

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1 Introduction

1.1 Purpose

This material provides the information necessary to interface the X1 series micro floppy drive to floppy disk controller, and provides all the information usually needed to integrate the X1 series of disk drives into a computer system.

1.2 General Description

CITIZEN 3.5 inches micro floppy disk drives are designed for portable and desktop computers.

Key Features;

- ✓ 2/1.6/1MB
- ✓ Compact size 12.7mm high, 96mm wide, 130mm deep
- ✓ Single power operation..... 4.5V to 5.5V
- ✓ Light weight..... 158g
- ✓ 26 pins interface
- ✓ Low power consumption..... 1.1W (read), 0.015W (standby)
- ✓ High vibration resistance Operating: 0.5G, 5-500Hz
Standby: 4.5G, 5-500Hz

1.3 Specifications Summary

1.3.1 Performance Specifications

TABLE 1 PERFORMANCE SPECIFICATIONS

	1.0MB Mode	1.6MB Mode	2.0MB Mode
Capacity (Kbytes)			
Unformatted			
per disk	1000	1604	2000
per surface	500	802	1000
per track	6.25	10.025	12.5
Formatted per disk			
256B/sector	655.2 (16)	1025 (26)	1311 (32)
512B/sector	737.2 (9)	1183 (15)	1475 (18)
1024B/sector	819.2 (5)	1311 (8)	1638 (10)
Transfer Rate (K bits/sec)	250	500	500
Average latency (ms)	100	83	100
Access Time (ms)			
Track to track without settling	3	3	3
Average with settling	94	94	94
Settling time (ms)	15	15	15
Motor start time (sec)	0.5	0.5	0.5

1.3.2 Functional Specifications

TABLE 2 FUNCTIONAL SPECIFICATIONS

	1.0MB Mode	1.6MB Mode	2.0MB Mode
Rotational Speed (rpm)	300	360	300
Recording Density (BPI)	8717	14184	17434
Track Density (TPI)	135	135	135
Tracks	160	160	160
Encoding Method	MFM	MFM	MFM

1.3.3 Physical Specifications

Table 3 Environmental limits

	Operating	Shipping	Storage
Ambient Temperature	5°C to 55°C	-40°C to 60°C	-20°C to 50°C
Relative Humidity	20 to 80%	8 to 90%	8 to 80%
Maximum Wet Bulb	85°F (29.4°C)	No condensation	No condensation

DC Voltage Requirement +4.5V to +5.5V

DC Power Current

Motor start 510mA typ.
 Read 200mA typ.
 Write 200mA typ.
 Seek 500mA typ.
 Standby 3mA typ.

Mechanical Dimensions (inch)

Height 12.7mm
 Width 96mm
 Depth 130mm
 Weight 158g

Shock

Operating: 10Gs with duration of 11 milliseconds (no hard error)
 3Gs with duration of 11 milliseconds (no soft error)

Non-Operating 100Gs with duration of 11 milliseconds

TABLE 4 VIBRATION

	Frequency	Displacement	Acceleration
Operating	5-20Hz	0.01 inch	
	20-500Hz		² 0.5G
Non-operating	5-20Hz	0.12 inch	
	20-500Hz		4.5G

1.3.4 Reliability Specifications

MTBF 10,000 power on hours under typical usage

MTTR 30 minutes

Life 5 years

Error rates

Soft read errors 1 per 10⁹ bits read
 Hard read errors 1 per 10¹² bits read
 Seek errors 1 per 10⁶ seeks

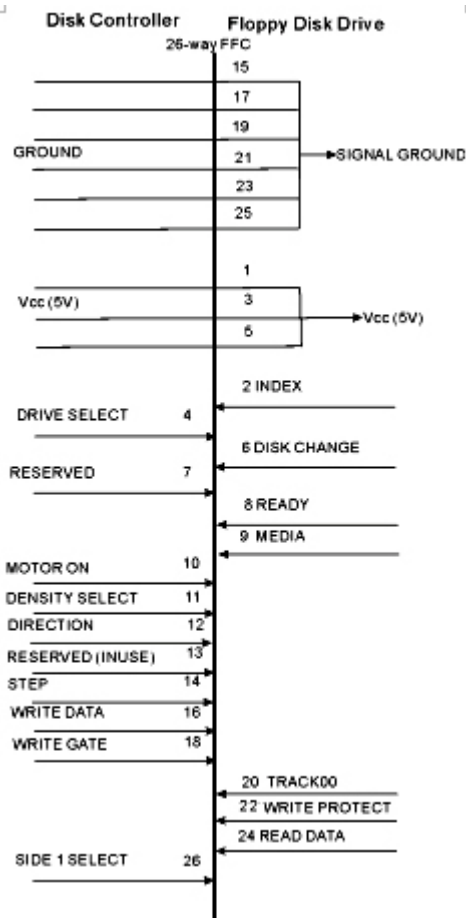
Media life

Passes per track 3.0x10⁶
 Insertions 30,000+ times

² Except resonant frequency

2 Electrical Interface

2.1 Interface Connection



Note:

Pin 11 should be open
when the drive is used

FIGURE 1 INTERFACE CONNECTIONS

2.2 Interface Circuits

The drive uses open drain as output line drivers, and CMOS as input line receivers. It is recommended that CMOS (SN74HC00 or equivalent) should be used as output drive of the controller side and SN74HC14 or equivalent as input receiver. Each input receiver is terminated in $1.0k\Omega \sim 10.0k\Omega$ to V_{CC} .

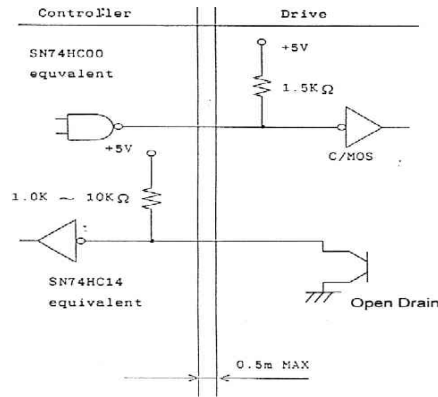


FIGURE 2 RECOMMENDED CIRCUIT

2.3 Interface Signals

Interface signals have following characteristics in case that DRIVE SELECT is low. (All signals are high impedance when Drive Select is high.)

TABLE 5 INPUT AND OUTPUT LEVEL

Input Signals	
HIGH	2.4 to V_{CC}
LOW	0 to 0.6 V
Input Impedance	1.5 k Ω terminated to V_{CC}
Output Signals	
HIGH	$V_{OH}=4.6V \sim V_{CC}$ ($I_{OH}=-2mA$)
LOW	$V_{OL}=0.4V$ max. ($I_{OL}=6mA$)

* $V_{CC}=5.0V$

2.4 Input Signals

The drive has the following input lines;

1. DRIVE SELECT
2. MOTOR ON
3. DIRECTION
4. STEP
5. WRITE DATA
6. WRITE GATE
7. SIDE1 SELECT
8. DENSITY SELECT

2.4.1 Drive Select

Input line is provided for Drive Select.

A "Low" level on input signal DRIVE SELECT enables the drive to operate.

2.4.2 Motor ON

The spindle motor starts when this signal becomes "Low".

2.4.3 Direction

This signal determines the direction of R/W heads movement by the following;

"High" level: Out (towards Track 00)

"Low" level: In (towards Track 79)

2.4.4 Step

This line causes the R/W Heads to move.

The period of a step pulse must be a minimum of 3ms.

An 18ms delay following the last STEP pulse is required before the read or write operation can be

initiated.

A 4ms delay following the last STEP pulse is required for the next STEP pulse when the DIRECTION is changed.

The following examples describe several cases that make STEP pulse valid or invalid;

1. STEP pulses towards the outside after the TRACK00 signal has been generated are invalid.
2. STEP pulses which intervals are less than 3ms may cause seek errors.
3. A step pulse should be generated at more than 4ms when DIRECTION signal had been reversed.

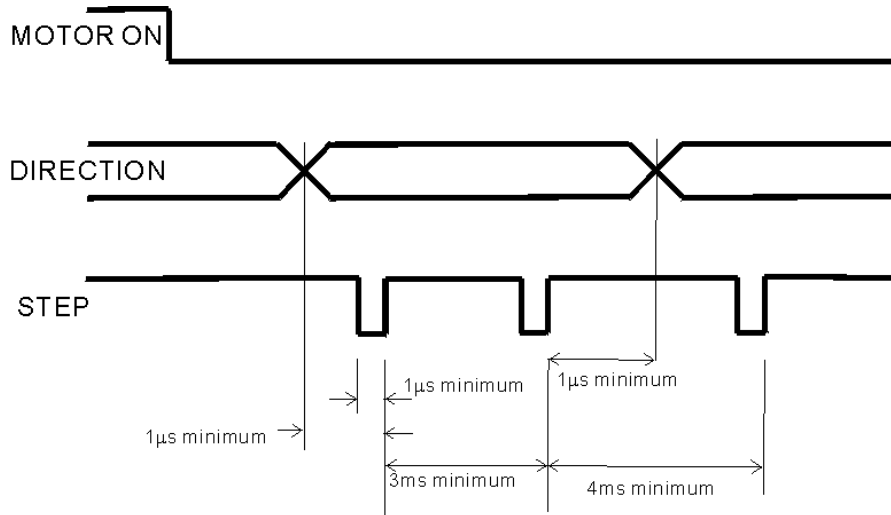


FIGURE 3 STEP PULSE TIMING

In consideration of a delay of a STEP pulse in a drive, the DIRECTION is latched at the trailing edge of the STEP pulse.

2.4.5 Write Data

This line provides data to be written on the disk.

Each transition from “High” to “Low” changes the polarity of the R/W Head Current and causes a data bit to be written on the disk.

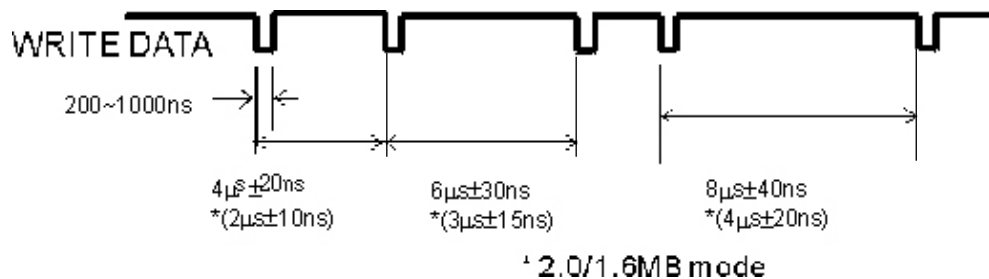


FIGURE 4 WRITE DATA TIMING (MFM)

When the power is turned on or when the source voltage is suddenly dropped lower than 3.5V & returned to normal voltage, the write data signal is invalid for 10ms after the source voltage returns to a normal level.

2.4.6 Write Gate

A “Low” level on this line enables writing.

When the READ DATA or STEP lines are activated, the signal on this line must be “High”. The change of DRIVE SELECT, start of reading, Drive Select off, Motor Off and STEP must be delayed by 1.2ms (0.59ms for 2/1.6MB mode) after WRITE GATE become “High”, because the erase head is operating at this time. When the above is not observed, data errors may occur.

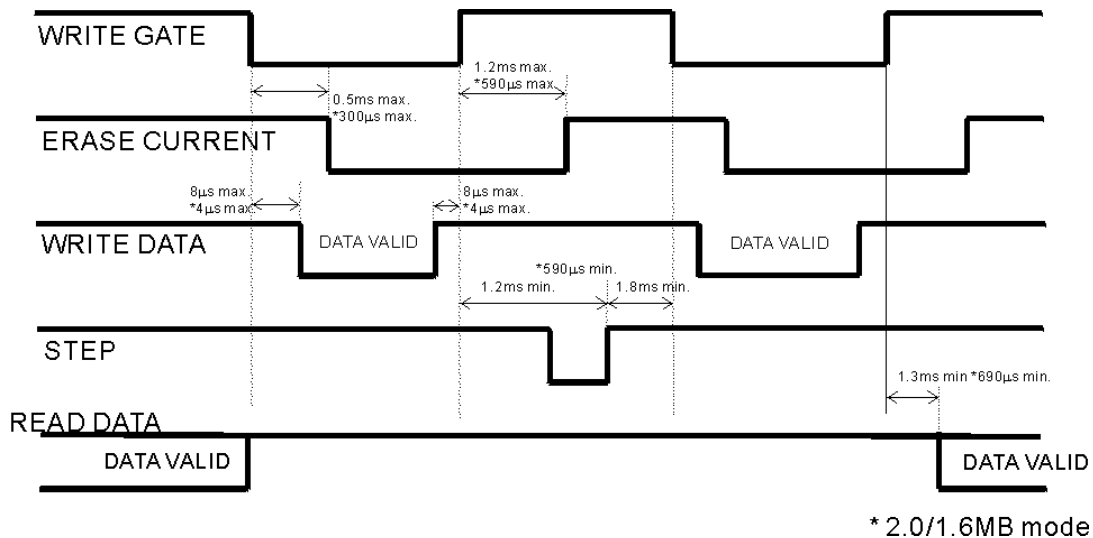


FIGURE 5 WRITE GATE & WRITE DATA TIMING

2.4.7 Side 1 Select

“Low” level on this line selects Side 1 and “High” selects Side 0.
When the WRITE GATE is “Low”, change of side is invalid.

2.4.8 Density Select

This signal changes density mode. (High: 2MB, Low: 1.6MB mode)

READY signal is not changed even the motor speed is changed by this signal.

READ/WRITE is not valid for 0.5sec from mode change. Details refer to Figure 6 & 7.

Note: Normal Density (1.0MB) and High Density (2.0/1.6MB) is switched by media sensor.

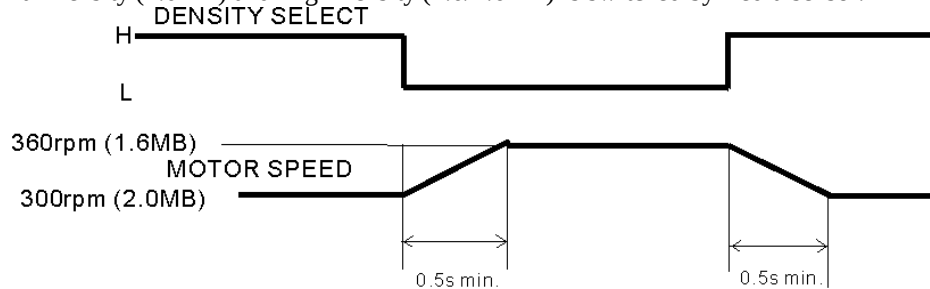


FIGURE 6 MODE CHANGE (2.0/1.6MB)

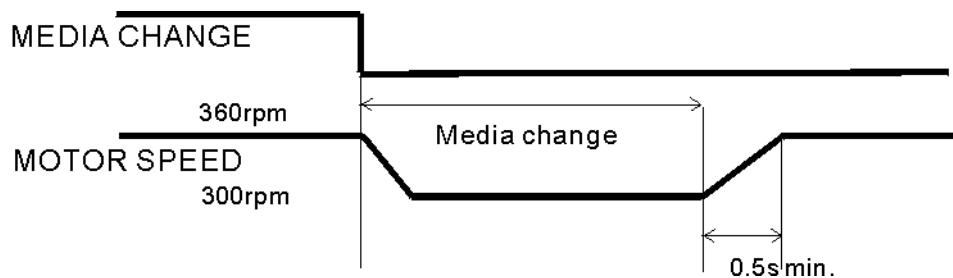


FIGURE 7 MODE CHANGE (1.6/1MB)

2.5 Output Signals

Output signals are as follows. All output signals are gated by DRIVE SELECT signal.

1. INDEX
2. TRACK00
3. WRITE PROTECT
4. READ DATA
5. DISK CHANGE
6. READY
7. MEDIA

2.5.1 Index

This line is used for indicating the reference position of a track.
The leading edge of an INDEX pulse should be used when an INDEX signal is needed.

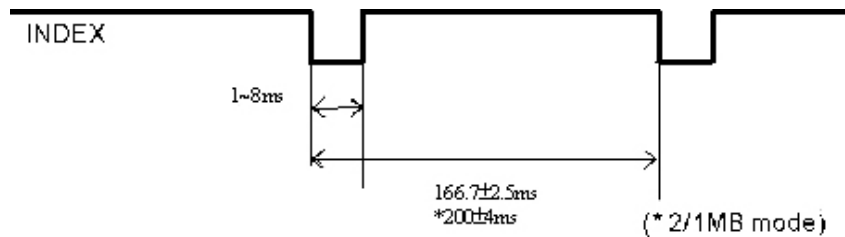


FIGURE 8 INDEX SIGNAL TIMING

2.5.2 Track 00

This signal becomes “Low” when the R/W heads are positioned at track00. Figure 9 shows the timing for the last STEP pulse and the TRACK00 signal.

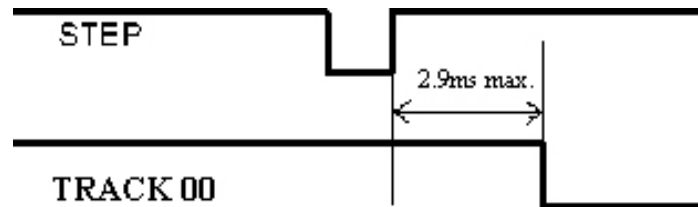


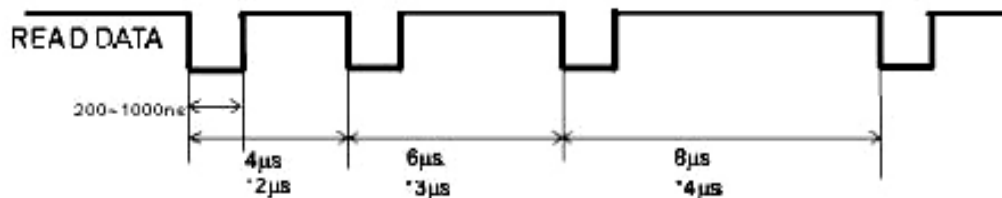
FIGURE 9 TRACK 00 SIGNAL TIMING

2.5.3 Write Protect

A “Low” level on this line indicates that a write protect disk is inserted, or the V_{CC} is below the level of write protect.

2.5.4 Read Data

This line provides “raw data”. (Clock and data information not separated) Details refer to below figure.



*: 2/1.6 MB mode

Figure 10 Read Data Timing

NOTE:

- ◇ Figures indicate the nominal positions.
- ◇ The accuracy of READ DATA to reference position is $\pm 0.7\mu s$ ($\pm 0.35\mu s$ for 1.6/2.0MB mode)

2.5.5 Disk Change

When one of the following conditions is satisfied, the signal becomes low.

1. Power is turned on.
2. Disk is ejected.

When the following condition is satisfied, this signal becomes high.

1. STEP signal is received while disk is loaded.

Following figure shows the DISK CHANGE timing.

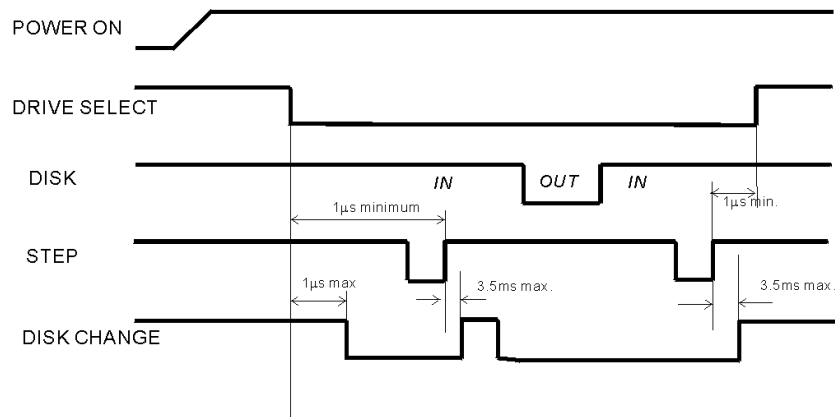


FIGURE 11 DISK CHANGE TIMING

2.5.6 Ready

A “Low” level on this line indicates that the drive is ready.

The signal becomes “Low” when all of the following conditions are satisfied.

1. Drive is selected.
2. Cartridge is correctly loaded.
3. Two continuous INDEX pulses which cycle meets the specification are generated.

The READY signal becomes “High” when one of the following conditions is satisfied.

1. Drive is not selected.
2. Disk is rejected.
3. Spindle motor stops.
4. INDEX signals are generated with shorter interval than specification for five times.
5. INDEX intervals become longer than specification.

The READY signal becomes “Low” at a maximum of 1sec after the spindle motor starts to run.

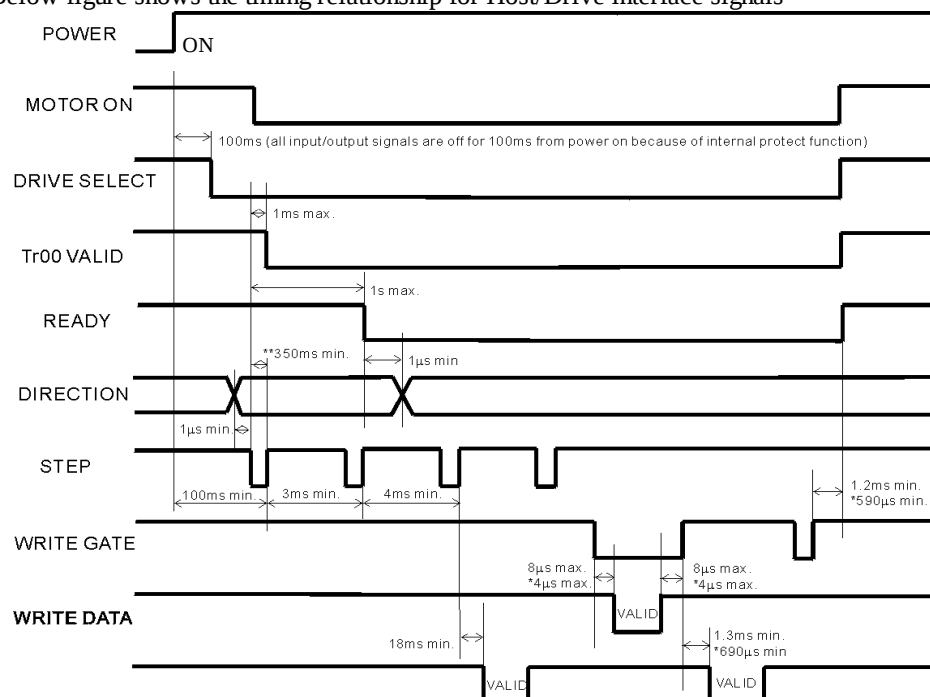
2.5.7 Media

This signal is changed by Media Type as follows;

1.6MB/2.0MB Media (HD Media):	LOW
1.0MB Media (DD Media):	HIGH

2.6 Interface Timing

Below figure shows the timing relationship for Host/Drive interface signals



**: This is our recommended value to keep power consumption small.

(*: 2.0/1.6MB mode)

FIGURE 12 TIMING RELATIONSHIP FOR HOST/DRIVE INTERNAL SIGNAL

2.7 Power Interface

2.7.1 Power Supply Specifications

Power supply and current are shown in below Figure and Table.

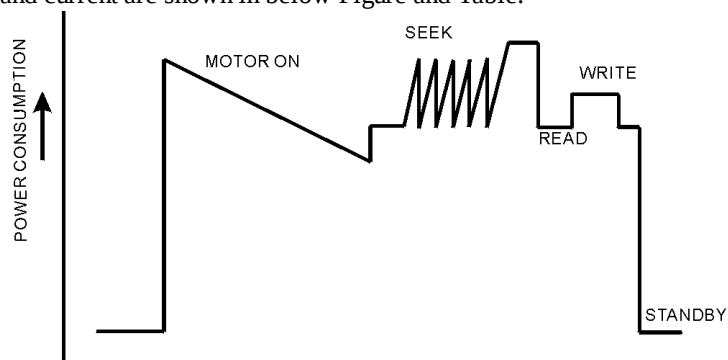


FIGURE 13 POWER CONSUMPTION DIAGRAM

TABLE 6 POWER SUPPLY CURRENT

MODE					
	SPINDLE MOTOR ON	SEEK (PEAK)	READ	WRITE	STANDBY
TIME (MS)	20MS	15MS	-	-	-
PEAK TYPICAL V _{CC} =5V	510mA	500mA	200mA	200mA	3.0mA

2.8 Other Functional Characteristics

2.8.1 Automatic Motor ON/OFF

The spindle motor starts when both of the following conditions are satisfied.

1. The cartridge is correctly loaded.
2. The MOTOR ON signal is "Low".

The spindle motor stops when either of the above is not satisfied.

Figure 14 shows the timing of the spindle motor rotation.

2.8.2 Stand-by

When the MOTOR ON signal becomes "High", the power consumption is very low in the standby mode.

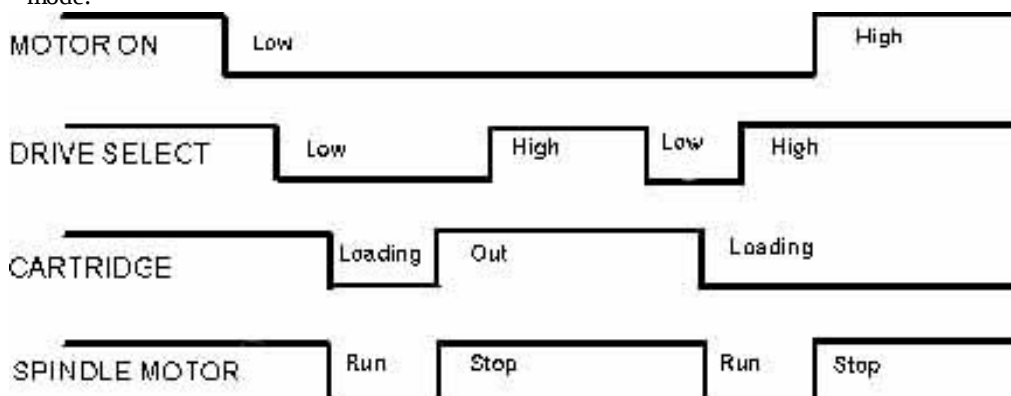


Figure 14 Timing of Spindle Motor Rotation

3 Physical Interface

3.1 Cable Connections

The electrical interface between this series and the host system via only one connector.

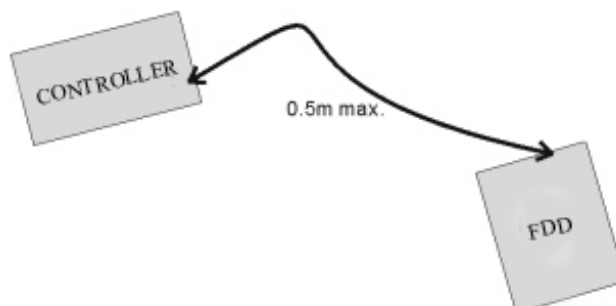


FIGURE 15 CONNECTIONS

3.2 Connectors & Cable

26-pin type connector is located on the drive as in Figure 16.

Connector: IMSA-9610S-26DY900 (IRISO) or equivalent

Cable: SMCD-26×L1-BD×L2(BL)-P1.0-S4-M (UL2896, Sumitomo)

L1: Insulation length

L2: Supporting Tape (8,10,15, and 20mm)

Cable thickness A: 280~350μm (FFC)

300~350μm (FPC)

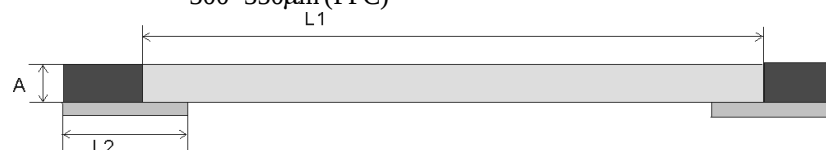


FIGURE 16 CABLE DIMENSION

4 Installation

4.1 Mechanical Dimensions

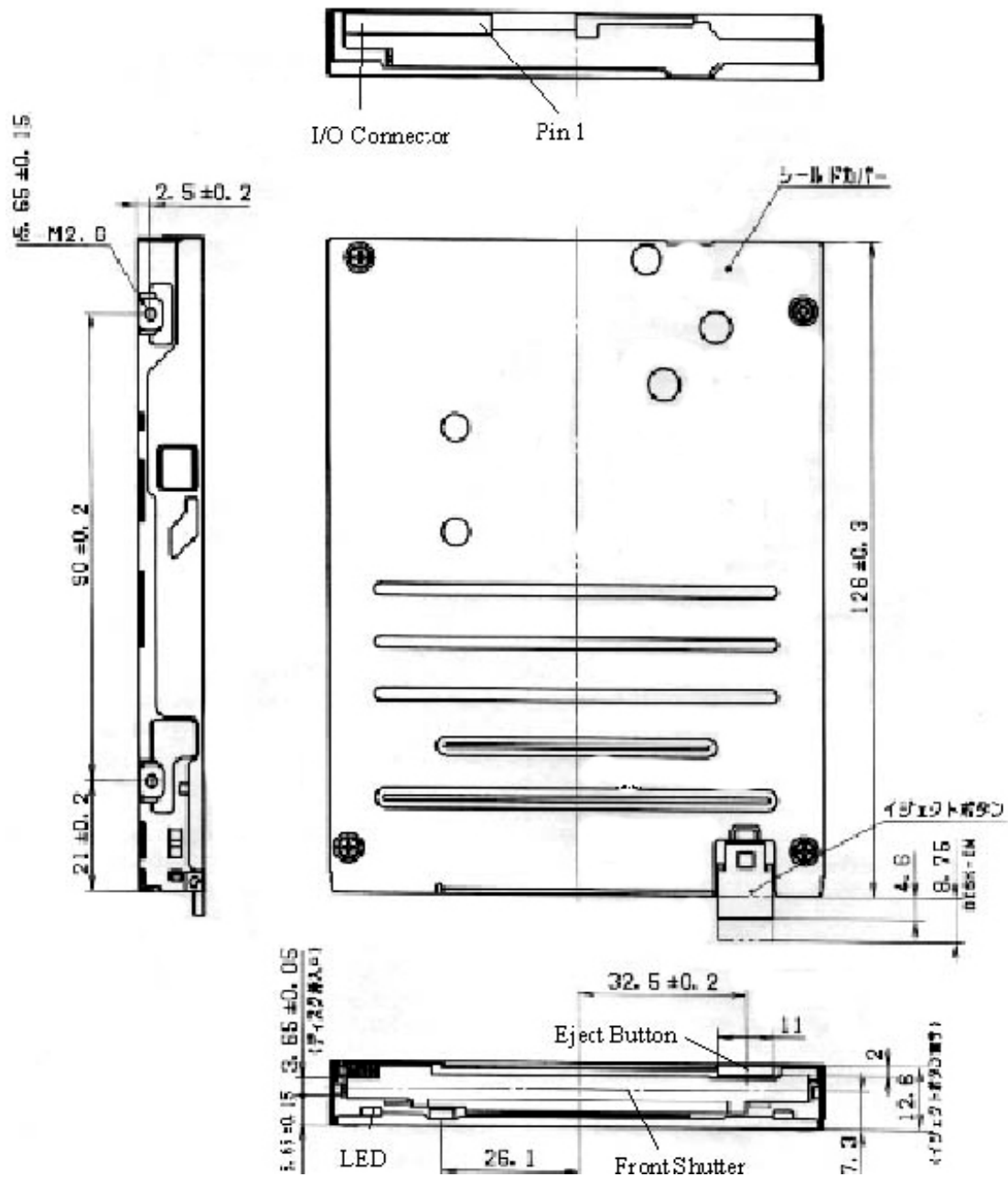
The dimensions are as follows:

Width: $96 \pm 0.2 \text{ mm}$

Depth: $130 \pm 0.4 \text{ mm}$ (With Front panel); $126 \pm 0.4 \text{ mm}$ (Without Front panel)

Height: $12.7 \pm 0.2 \text{ mm}$

Two mounting holes are provided on each side for mounting. No hole is provided on bottom side.



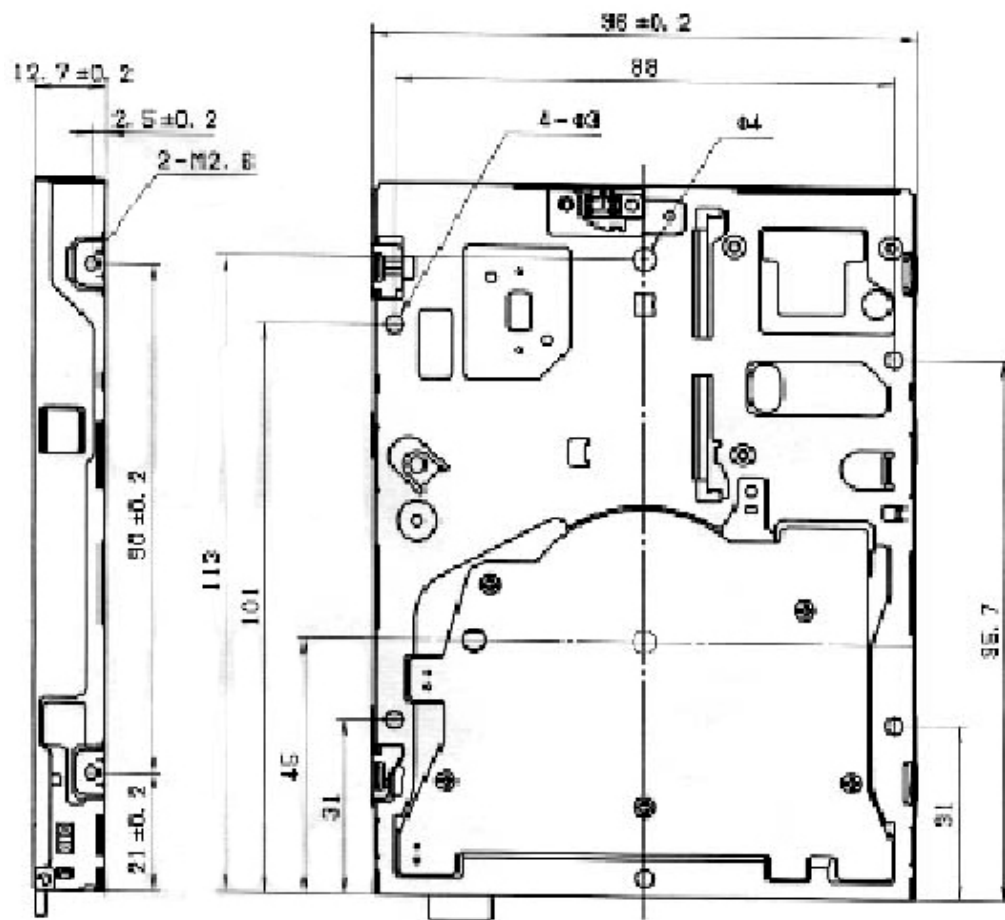


FIGURE 17 DIMENSIONS

4.2 Mounting Recommendation

The drive can be mounted in three directions as shown in the diagram.

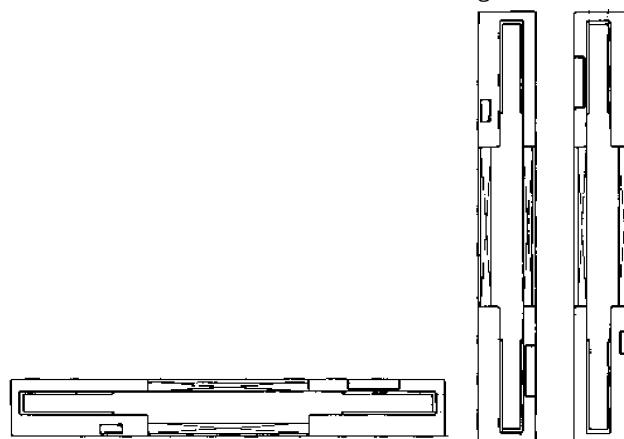


FIGURE 18 MOUNTING DIRECTION

The drive should not be mounted at an angle exceed 15°.

5 Recording Format

5.1 Recommended Format

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

The following tables and figures shows the typical record formats.

TABLE 7 RECOMMENDED 1MB FORMAT

FM/MFM	IBM FORMAT	ISO FORMAT
128/256 BYTES/SECTOR	15 SECTORS (FM)	16 SECTORS
	16 SECTORS (MFM)	
256/512 BYTES/SECTOR	9 SECTORS	9 SECTORS
512/1024 BYTES/SECTOR	4 SECTORS	5 SECTORS

TABLE 8 RECOMMENDED 1.6MB FORMAT

FM/MFM	IBM FORMAT
128/256 BYTES/SECTOR	26 SECTORS
256/512 BYTES/SECTOR	15 SECTORS
512/1024 BYTES/SECTOR	8 SECTORS

TABLE 9 RECOMMENDED 2MB FORMAT

FM/MFM	IBM FORMAT
128/256 BYTES/SECTOR	32 SECTORS
256/512 BYTES/SECTOR	18 SECTORS
512/1024 BYTES/SECTOR	10 SECTORS

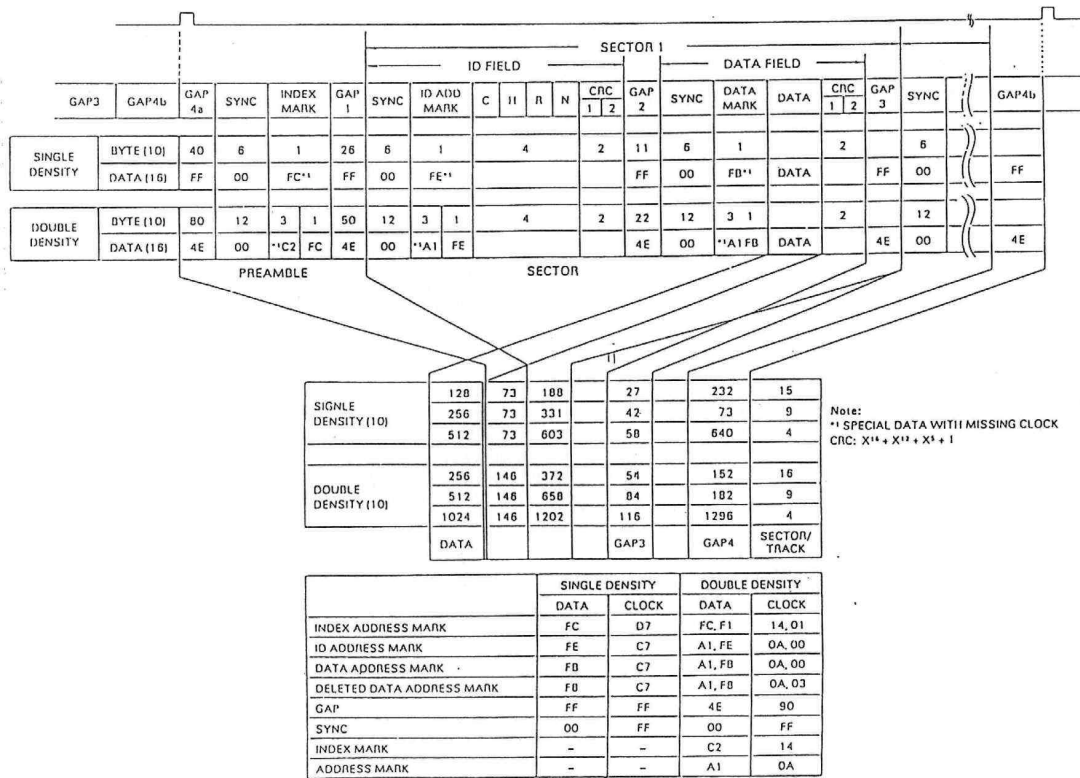


FIGURE 19 1.0MB IBM FORMAT

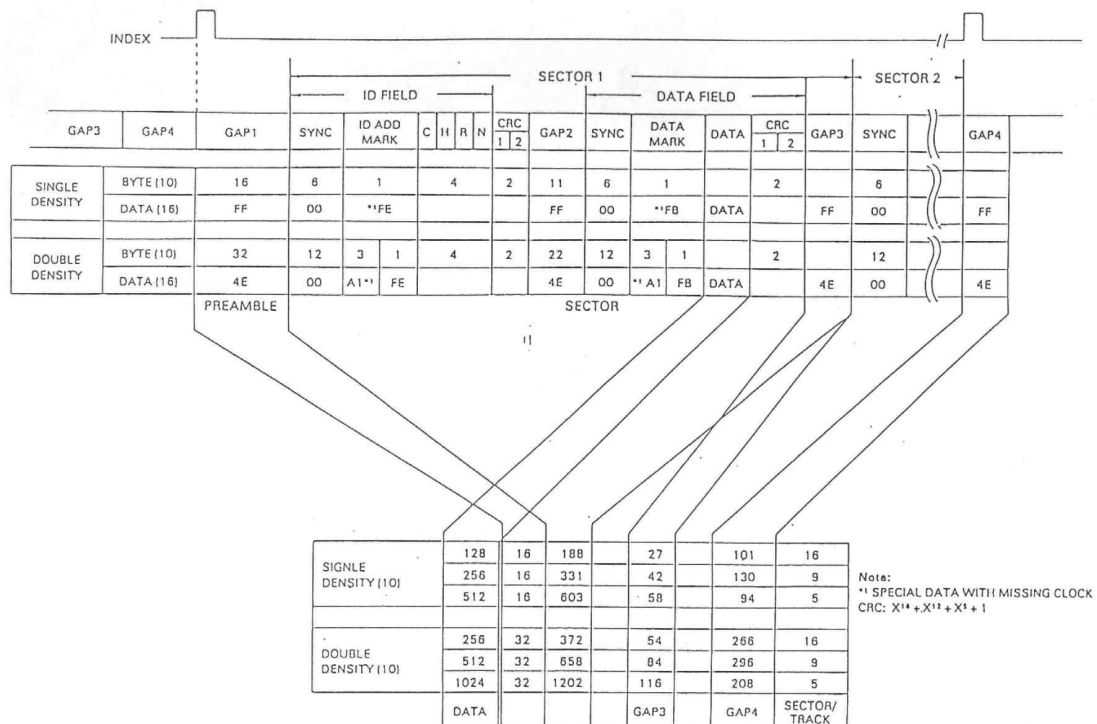


FIGURE 20 1.0MB ISO FORMAT

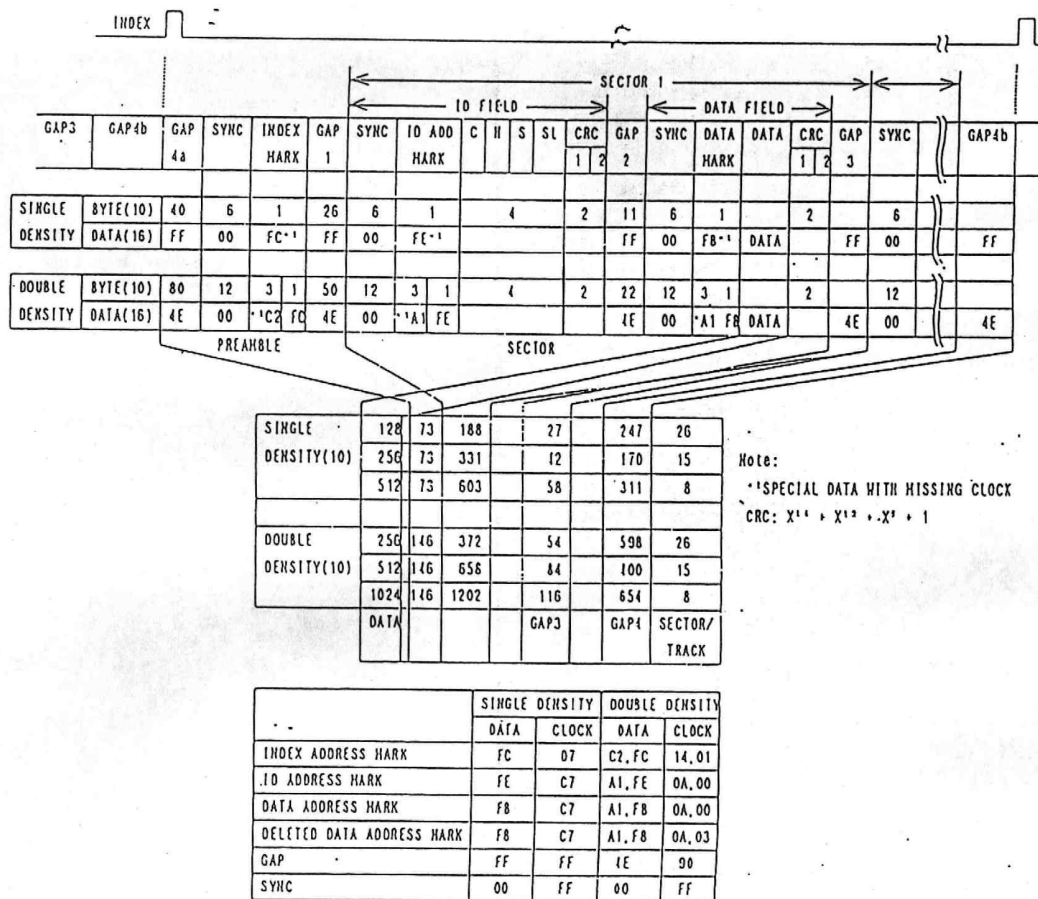


FIGURE 21 1.6MB IBM FORMAT

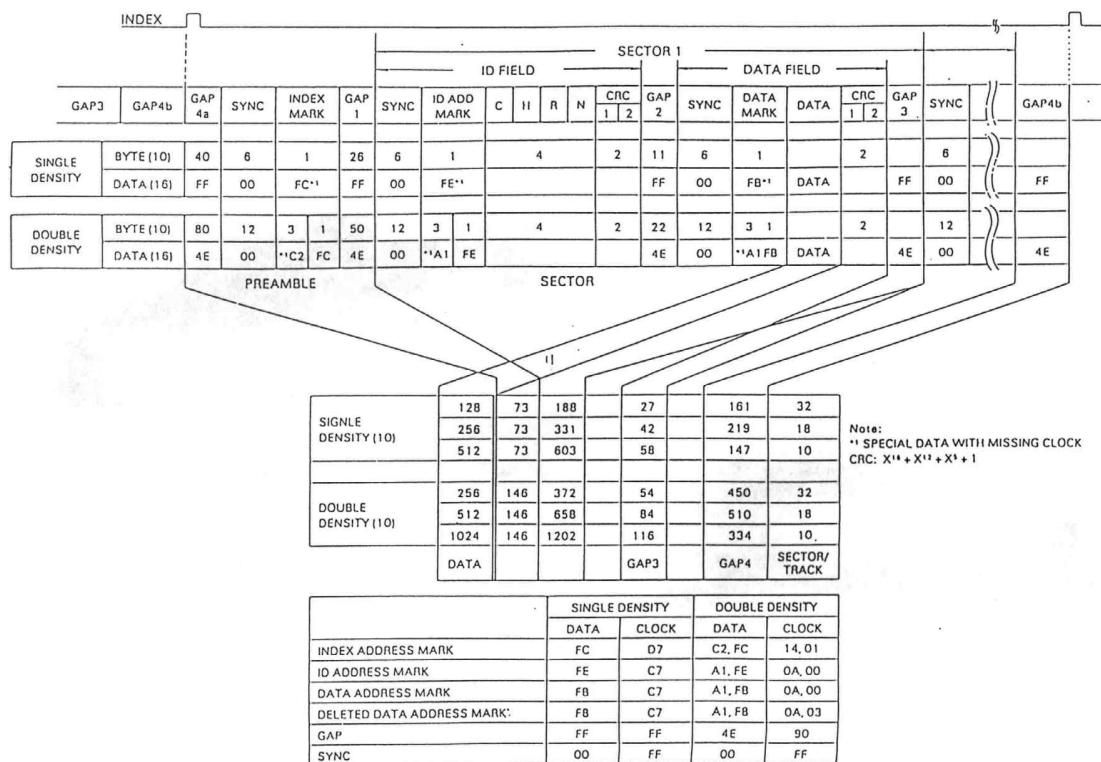


FIGURE 22 2.0MB IBM FORMAT