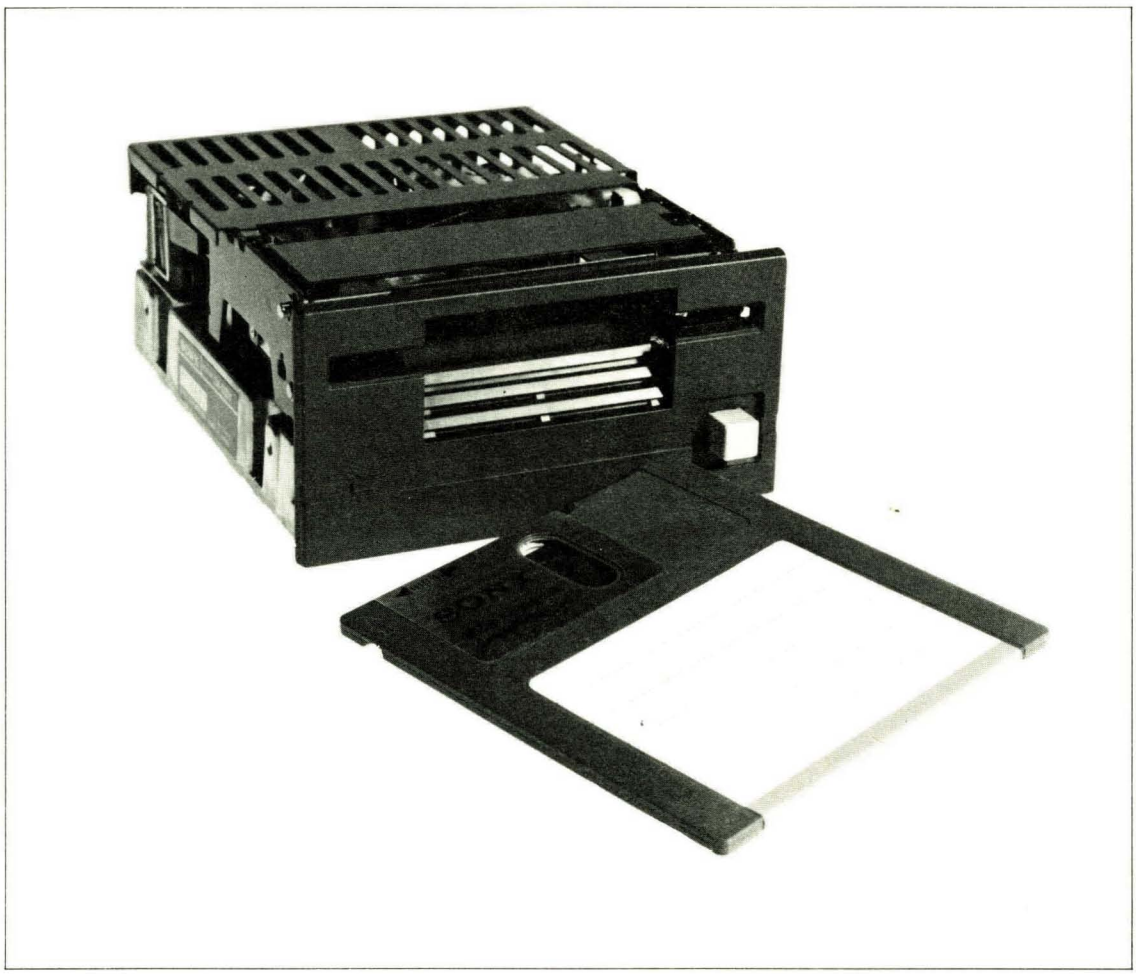
MICRO FLOPPYDISK™ DRIVE

MODEL OA-D30V

OEM MANUAL



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PROPRIETARY NOTICE

RECORD OF REVISIONS

REVISION	NOTES	
1	ORIGINAL ISSUE	October, 1981
2		March, 1982

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SECTION 1
INTRODUCTION

1-1. PURPOSE

This specification provides the information necessary to interface the OA-D30V **Micro Floppydisk** drive to floppy disk controllers, and provides the technical specifications for reference in OEM contracts.

1-2. GENERAL DESCRIPTION

The SONY **Micro Floppydisk** drive represents a technological break through offering extreme compactness, just 4.0" wide by 2.0" high by 5.1" deep, and lightweight, just 1.5 lbs., providing a versatile data storage component for the OEM Systems designer.

SONY's leadership in high-density recording techniques, perfected in video technology, enabled SONY engineers to develop the **Micro Floppydisk**, a new standard, just 3.5". Yet an unformatted, single side, double density capacity of 437.5 K bytes in 135 tracks per inch provides nearly double the capacity of conventional 5.25" disks.

This disk is unlike any you have handled before-it's floppy, but not too floppy. A rigid protective shell provides protection unique to the **Micro Floppydisk.** Plus a sliding disk guard to keep out dust, dirt, fingerprint and other foreign objects that might degrade performance plus a metal centering hub, allowing positioning to be accomplished with greater ease and more positive accuracy and over 30,000 interchanges with each diskette.

Driven by a SONY developed direct drive motor at a speed of 600 RPM, providing better signal to noise ratio while transferring data at a fast rate of 500 K bits per second in double density mode, twice as fast as conventional 5.25" drives. As drive motor is a brushless motor, it reduces mechanical and electrical noise and guarantees 10,000 Motor On Hour.

The SONY proprietary read/write and tunnel erase head developed using video techniques is positioned by a precision stepper motor assembly, providing fast access while maintaining positioning accuracy. And high coercivity media provides high data inergrity.

The OA-D30V **Micro Floppydisk** drive is interface compatible with conventional 8" floppy disk drives. Accordingly conventional FDC chips such as Western Digital FD1791, NEC μPD765 can be used.

Whether your application is small business systems, word processing, personal computers or any related, you will find the **Micro Floppydisk** drive offers a whole new range of possibilities.

The **Micro Floppydisk** drive offers the following features.

* 3.5" floppy disk media with disk guard
* Large capacity . . . . . 437.5 K bytes
* High track density . . . . . 135 TPI
* Long life brushless direct drive motor
* High transfer rate . . . . . 500 Kbps (MFM)

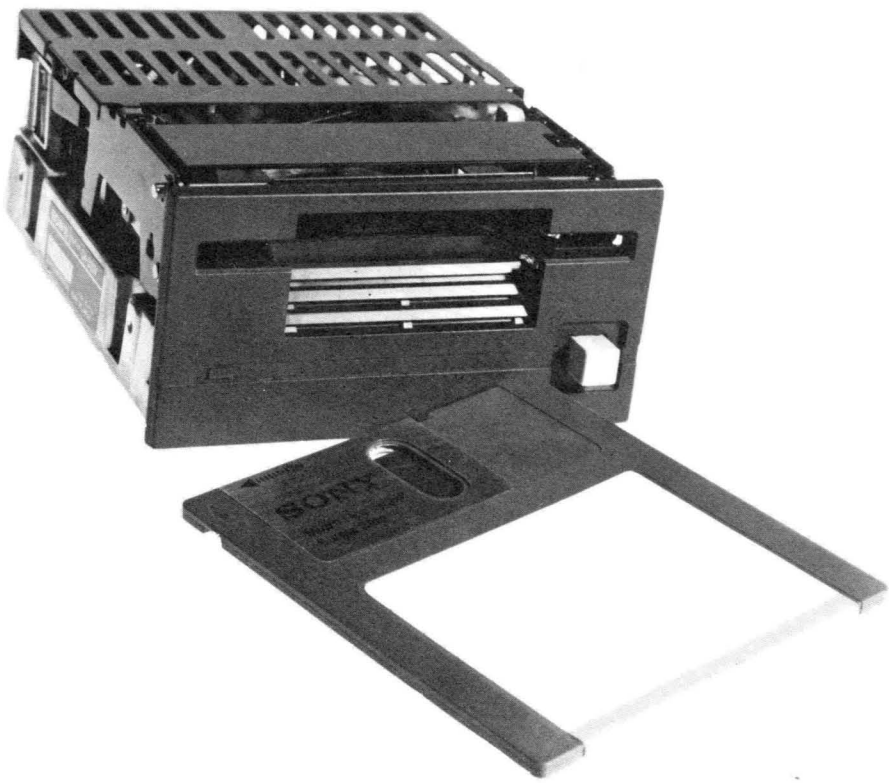


Figure 1-1. MICRO FLOPPYDISK DRIVE, MODEL OA-D30V

SECTION 2
FUNCTIONAL CHARACTERISTICS

2-1. GENERAL OPERATION

The relationship and interface signals for the internal functions of the OA-D30V are shown in Figure 2-1.

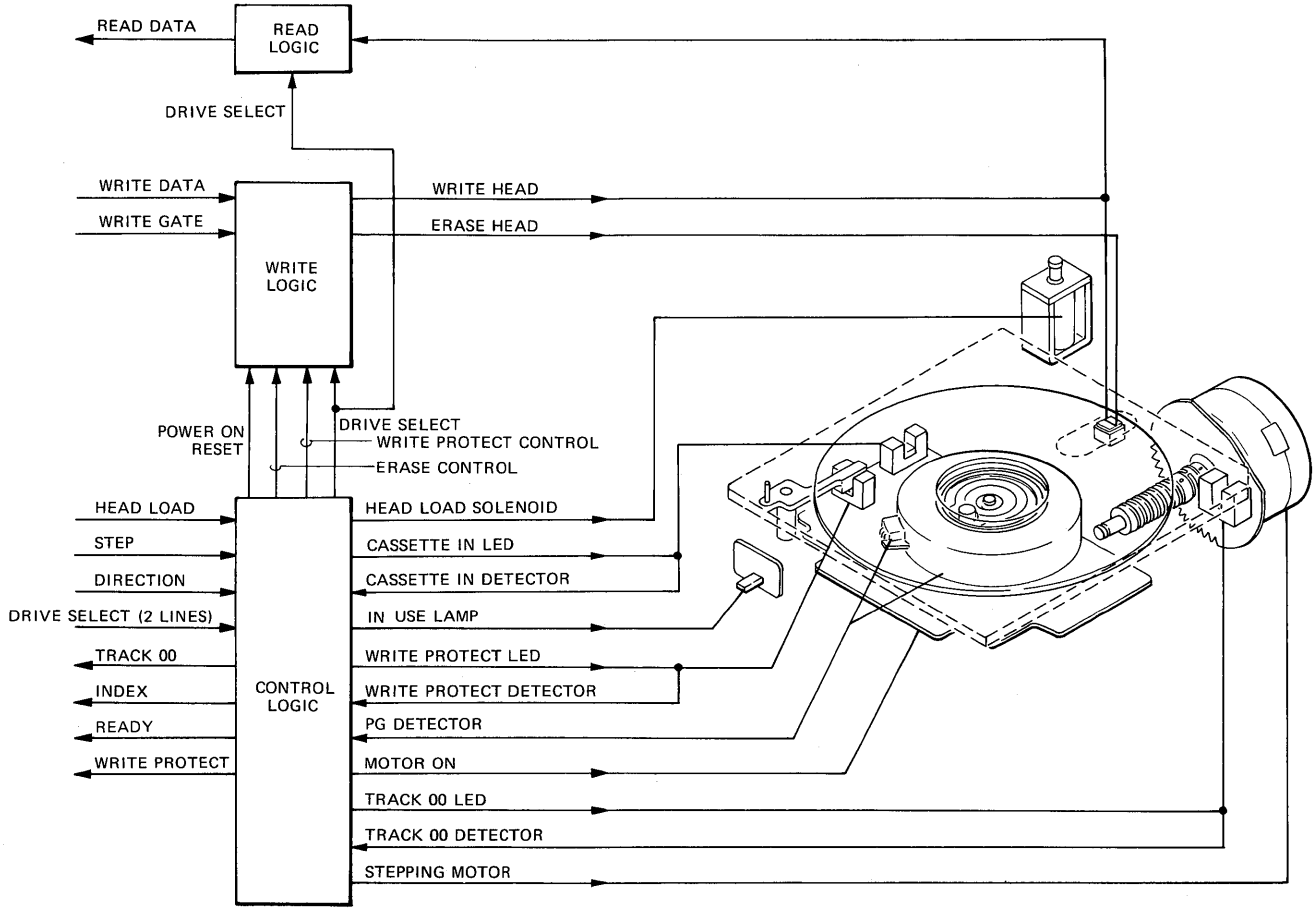


Figure 2-1. FUNCTIONAL DIAGRAM

2-2. READ/WRITE AND CONTROL ELECTRONICS

OA-D30V has following electronic components.

(1) Index Circuits
(2) Head Position Actuator Driver
(3) Head Load Actuator Driver
(4) Read/Write Amplifier and Transition Detector
(5) Write Protect
(6) Drive Ready Detector Circuit
(7) Drive Select Circuits
(8) In Use Lamp Circuits

2-3. DRIVE MECHANISM

The brushless direct drive motor rotates the spindle at 600 rpm. Owing to the long life brushless motor, the OA-D30V has no Motor On Control signal that conventional 5.25" drives have. And for low power consumption, the drive motor rotates only while **Micro Floppydisk** is inserted. There is no index hole in the **Micro Floppydisk**, because the OA-D30V positions the Disk precisely and Index Pulse is generated by photo sensor and hall element combination.

2-4. POSITIONING MECHANISM

In order to achieve high accuracy in track positioning, the head is positioned by a needle screw mechanism. And a stepping motor (Head Position Actuator) is controlled through the posicast control method to do the best performance. The stepping motor rotates the lead screw clockwise or counterclockwise in 45° increments. A 45° rotation of the lead screw moves the read/write head one track position. When +5 V and +12 V Power is on, the Head Positioning Actuator positions the read/write head at TRACK00. And if the head is positioned at TRACK69, STEP IN command is rejected.

2-5. DISK CHUCKING MECHANISM

A new medium utilizes a centering metal hub which maintains excellent Track positioning accuracy without causing eccentricity or chucking wear. (See Figure 2-2.)

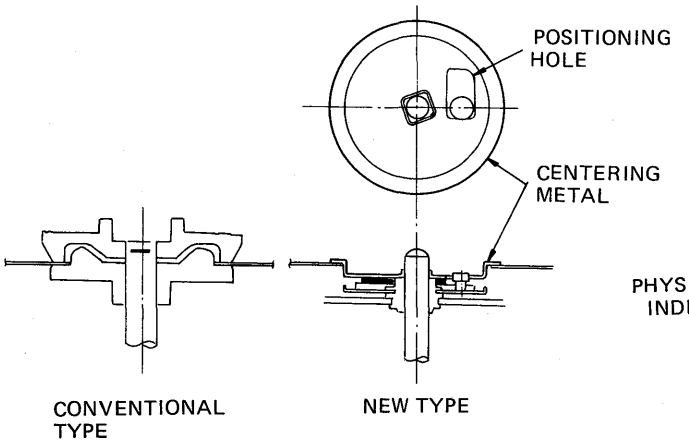


Figure 2-2. DISK CHUCKING MECHANISM

2-6. READ/WRITE HEAD

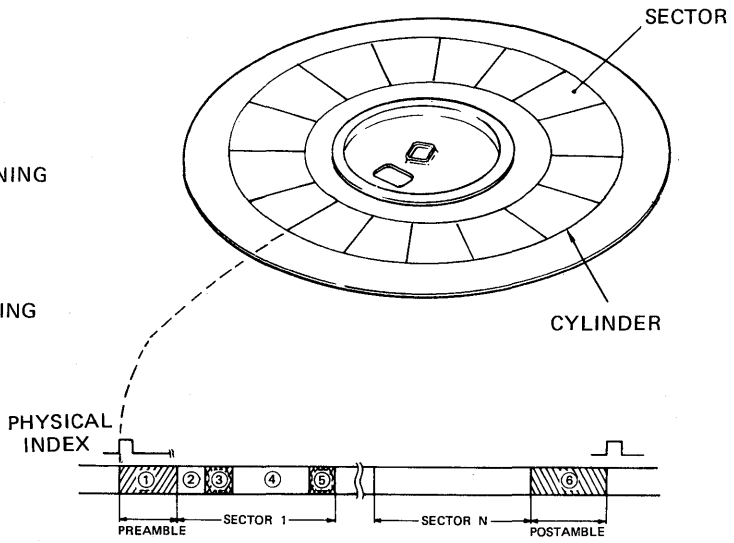
The OA-D30V head is a new type of single element ceramic read/write head with tunnel erase head to provide erased areas between data tracks. The head core is Mn-Zn single crystal ferrite. The data track width is 125 microns and guard band width is 63 microns.

2-7. RECORDING FORMAT

The format of the data recorded on the disk is totally a function of the host system, and can be designed around the users application to best take advantage of the total available bits that can be written on any one track. Figure 2-3 shows the concept of the track format. And Figure 2-4 and 2-5 shows the typically recommended format.

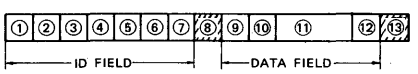
2-8. FLOPPY DISK CONTROLLER CHIPS

There are some LSI FLOPPY DISK CONTROLLER (FDC) Chips. Particularly NEC μPD765 (Intel 8272) and NEC μPD745 can format easily. The format of Figure 2-4 can be obtained by μPD765 and that of Figure 2-5 can be obtained by μPD745. SONY recommends μPD745 for more data capacity.



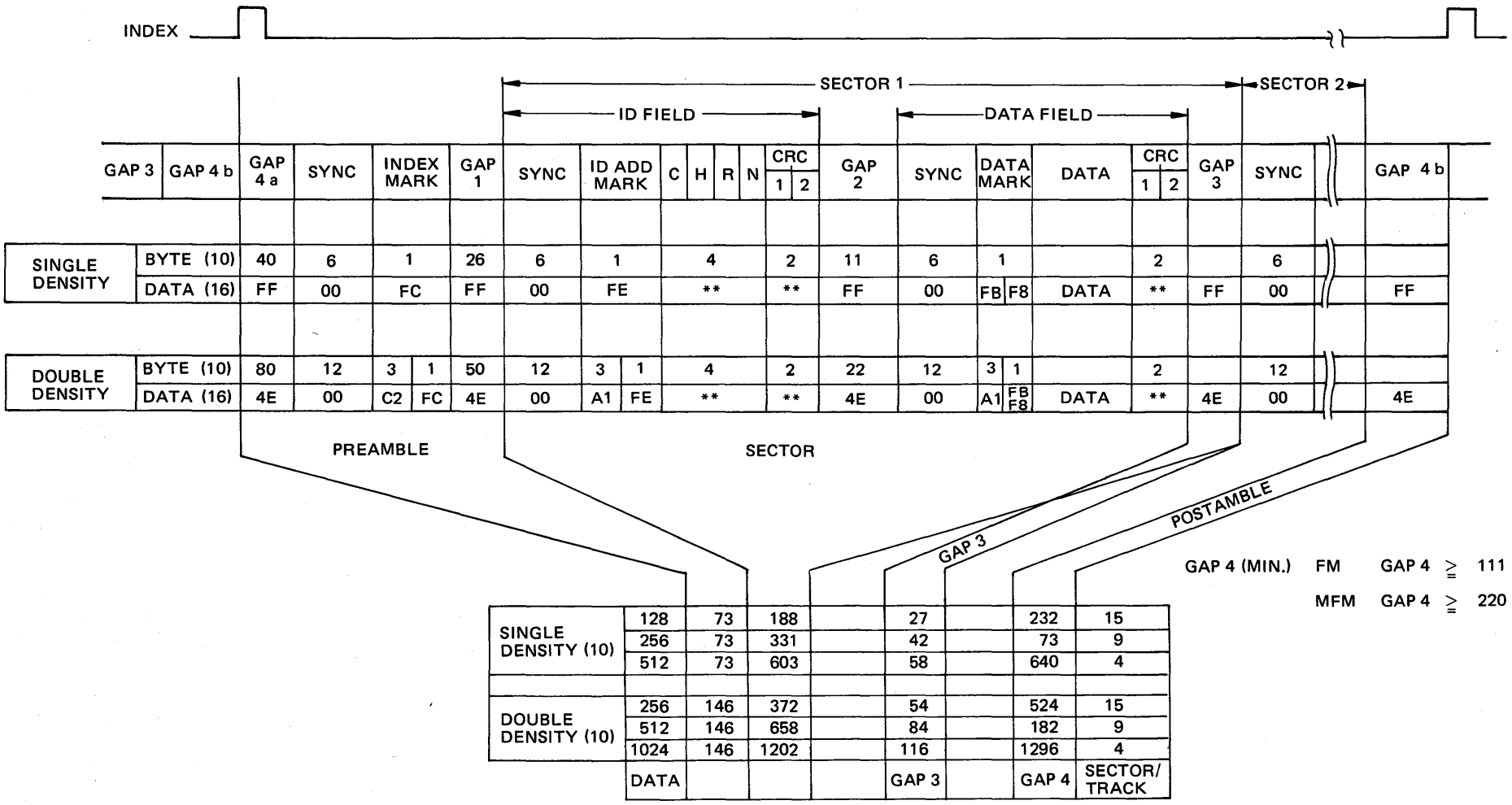
① GAP 1
② ID FIELD
③ GAP 2
④ DATA FIELD
⑤ GAP 3
⑥ GAP 4

SECTOR FORMAT



① SYNC
② ID ADDRESS MARK
③ CYLINDER NUMBER
④ HEAD NUMBER
⑤ RECORD NUMBER
⑥ RECORD LENGTH
⑦ CRC
⑧ GAP 2
⑨ SYNC
⑩ DATA ADDRESS MARK
⑪ DATA
⑫ CRC
⑬ GAP 3

Figure 2-3. TRACK FORMAT



	SINGLE DENSITY		DOUBLE DENSITY	
	DATA	CLOCK	DATA	CLOCK
INDEX ADDRESS MARK	FC	D7	FC	01
ID ADDRESS MARK	FE	C7	FE	00
DATA ADDRESS MARK	FB	C7	FB	00
DELETED DATA ADDRESS MARK	F8	C7	F8	03
GAP	FF	FF	4E	10
SYNC	00	FF	00	FF

Figure 2-4. μPD765 IBM TYPE STANDARD FORMAT

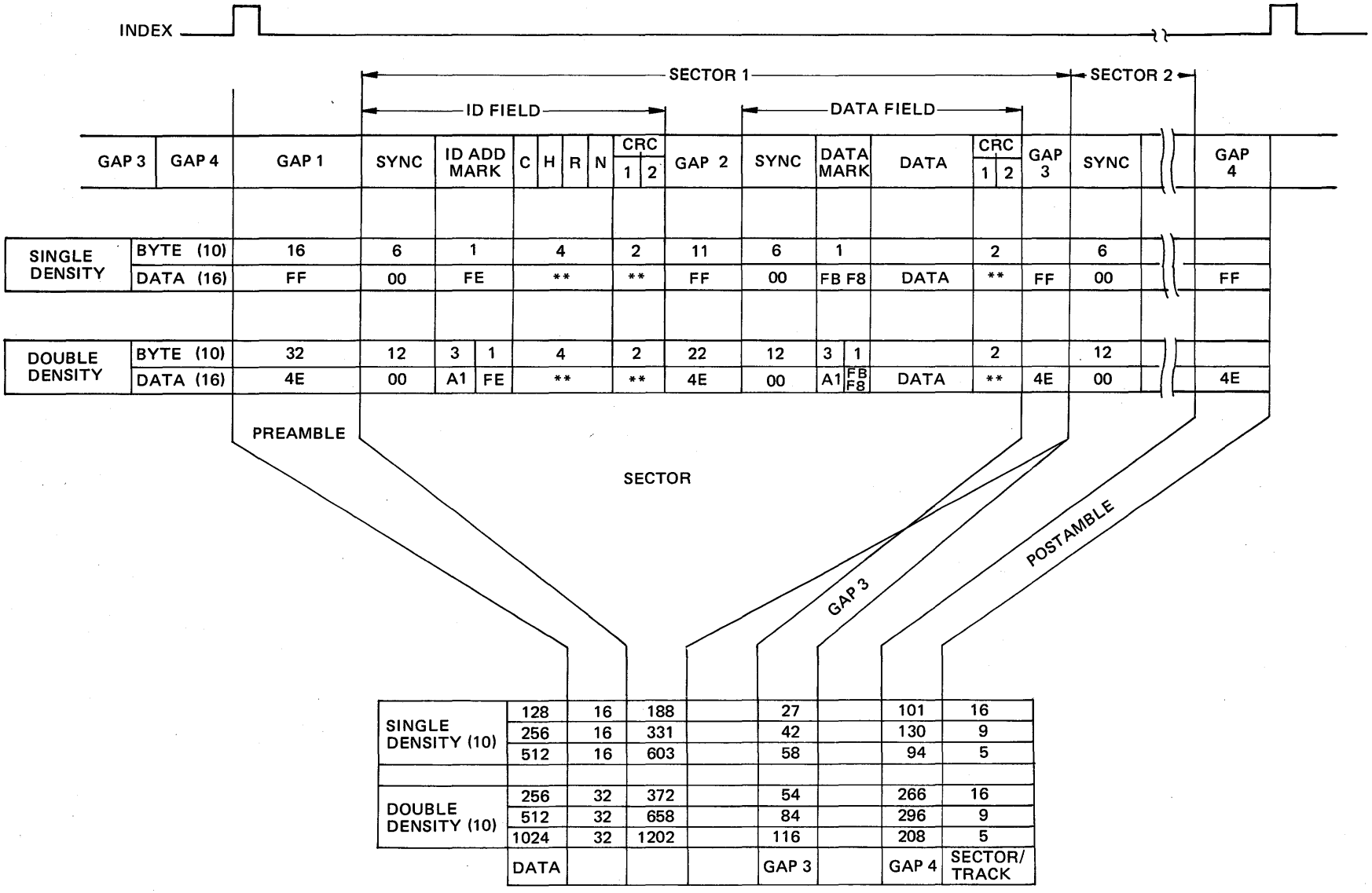


Figure 2-5. μPD745 SONY RECOMMENDING FORMAT
(ISO TYPE FORMAT)

SECTION 3
SPECIFICATIONS

3-1. DRIVE PERFORMANCE

Table 3-1 lists performance data for the SONY OA-D30V Micro Floppydisk drive.

TABLE 3-1. PERFORMANCE SPECIFICATIONS

Specification	Single Density	Double Density
CAPACITY		
Unformatted per disk	218.8 K bytes	437.5 K bytes
Formatted per disk	161.2 K bytes	322.5 K bytes
Burst TRANSFER RATE	250 K bits/sec.	500 K bits/sec.
ACCESS TIME		
Track to track	15 msec.	15 msec.
Average*	365 msec.	365 msec.
Settling Time	15 msec.	15 msec.
Head load time	60 msec.	60 msec.
Average latency	50 msec.	50 msec.
FUNCTIONAL		
Rotational speed	600 RPM	600 RPM
Recording density (inside track)	3805 BPI	7610 BPI
Track density	135 TPI	135 TPI
Cylinders	70	70
Tracks	70	70
R/W heads	1	1
Encoding method	FM	MFM
HEAT DISSIPATION		
Operating mode (Head Load)	7.5 W	7.5 W
Standby mode (Head Unload)	3.3 W	3.3 W

* Average access time = 1/3 x (Track Nos.) x (Track to track time) + (Settling Time)

3-2. DIMENSIONAL DATA

Table 3-2 lists the dimensional data for the **Micro Floppydisk** drive.

TABLE 3-2. DIMENSIONAL DATA

Physical Dimension	Value
Height	2.0 in. (51 mm)
Width	4.0 in. (102 mm)
Depth	5.1 in. (130 mm)
Weight	1.5 lbs (650 g)

3-3. DC POWER REQUIREMENTS

Table 3-3 lists the DC power requirements for the drive. The user need only supply DC power, no AC operating voltage is required.

TABLE 3-3. DC POWER REQUIREMENT

Voltage	Tolerance	Maximum Ripple	Current
+12.0 V DC	±5 %	0.1 Vp-p	0.4 A (typ.) 1.5 A (max.)
+ 5.0 V DC	±5 %	0.05 Vp-p	0.6 A (typ.) 0.8 A (max.)

3-4. ENVIRONMENTAL CONSIDERATIONS

3-4-1. Reliability and Maintainability

Preventive Maintenance (PM)	Not Required
Meantime between failures (MTBF)	8000 POH
Meantime to repair (MTTR)	30 min.
Component life	5 years
Media life	more than 1.0×10^6 passes/track
Diskette Interchange	30,000 times
Soft Read Error	1 per 10^9 bits read
Hard Read Error	1 per 10^{12} bits read
Seek Error	1 per 10^6 seeks

3-4-2. Environmental Limits

Temperature	Operating:	40° F to 115° F (5° C to 45° C)
	Non-Operating:	–40° F to 140° F (–40° C to 60° C) (When OA-D30V is set in a box, this temperature means the ambient temperature of OA-D30V in the box. And Temperature cycling shall not result in condensation.)
Humidity	Operating:	20 % to 80 % relative humidity, with a wet bulb temperature of 85° F (29° C) and no condensation.
	Non-Operating:	5 % to 95 % relative humidity and no condensation.
Vibration	Operating:	The unit shall perform all read/write operations (no seek) according to specifications, with continuous vibration of less than .5 G (±10 %), from 5 Hz to 100 Hz (along the x, y, z plane).
	Non-Operating:	The unit when packed for shipment shall withstand ±2.0 G from 5 Hz to 100 Hz along each of the three mutually perpendicular axes.
Shock	Non-Operating:	The unit when unpacked shall withstand 60 G.

SECTION 4
INTERFACE DESCRIPTION

4-1. HOST SYSTEM INTERFACE

The SONY OA-D30V drive is compatible with conventional floppy disk controllers. The interface consists of 13 signal lines for data, control and handshaking (see Figure 4-1).

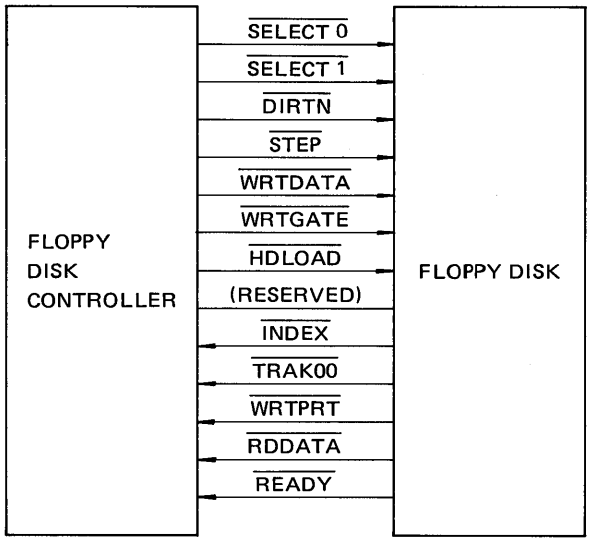


Figure 4-1. SIGNAL INTERFACE DIAGRAM

4-2. INTERFACE CHARACTERISTICS

4-2-1. Input Signal Requirements

The input signals to the drive unit have the following requirements at OA-D30V's input terminal:

Logical Zero	0.0 V to +0.8 V
Logical One	+2.0 V to +5.25 V
Input Impedance	1000 ohms

4-2-2. Output Signal Characteristics

The output signals from the drive unit have the following characteristics:

True = Logical Zero	0.0 V to +0.4 V
Output Current	40 mA (max.)
False = Logical One	+2.4 V to +5.25 V
Output Current	250 μA (max.)

4-3. SIGNAL INTERFACE

The drive has 13 interface signals (see Table 6-1 for pin assignments). Seven signals are input to the drive, and six are output. Recommended interface circuitry is shown in figure 4-2. The seven input signals are listed below, and are described in 4-3-1.

DRIVE INPUT	MNEMONIC
DRIVE SELECT 0	SELECT 0
DRIVE SELECT 1	SELECT 1
DIRECTION SELECT	DIRTN
STEP	STEP
HEAD LOAD	HDLOAD
WRITE DATA	WRTDATA
WRITE GATE	WRTGATE

The five output signals are listed below, and are described in 4-3-1.

DRIVE OUTPUT	MNEMONIC
INDEX	INDEX
TRACK00	TRK00
WRITE PROTECT	WRTPRT
READY	READY
READ DATA	RDDATA

4-3-1. Input Signal Descriptions

4-3-1-1. Drive Select 0, 1 – Logical 0 on this line selects the designated drive for operation.

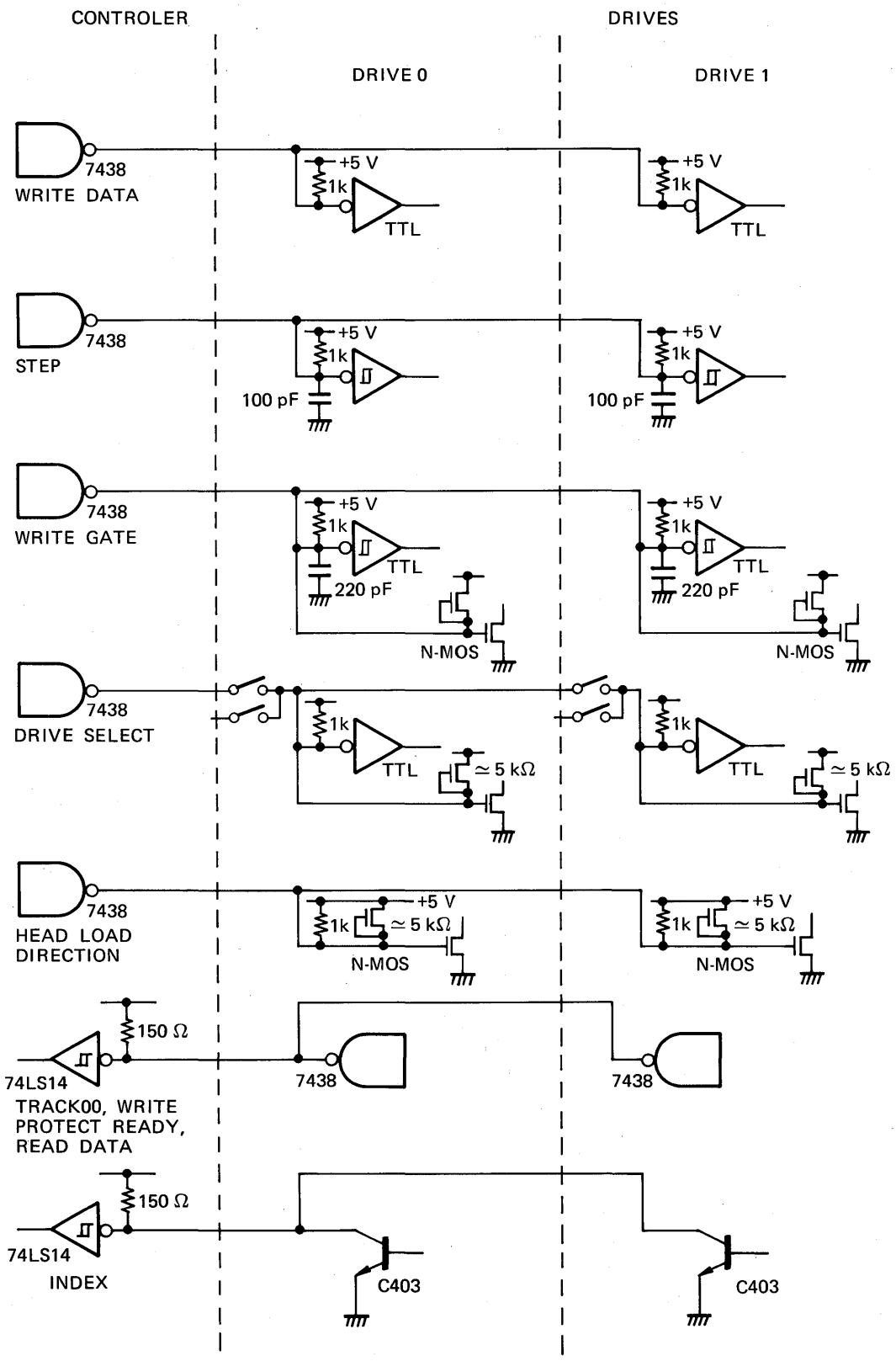


Figure 4-2. INTERFACE CIRCUITRY

4-3-1-2. Direction Select (DIRTN) – This line defines the direction of head movement when the step line is activated. Logical one on this line defines the direction as "out", and when the step line is activated the head will move to the outside of the disk. Logical zero on this line defines the direction as "in", and when the step line is activated the head will move to the center of the disk.

4-3-1-3. Step – This line causes the read/write head to move in the direction defined by the DIRTN line. The transition from logical one to logical zero initiates the stepping motion.

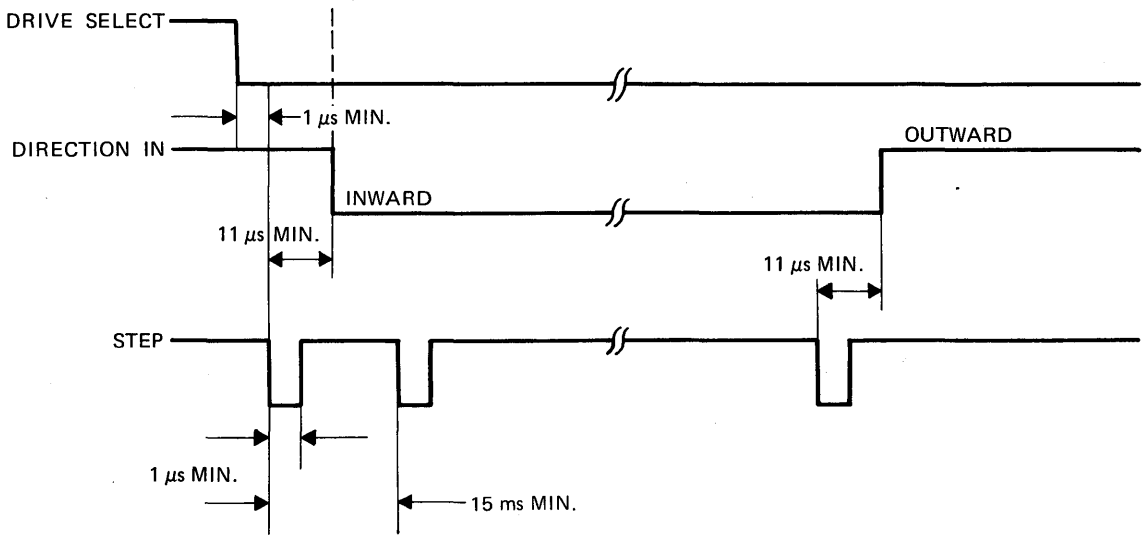


Figure 4-3. TRACK ACCESS TIMING

4-3-1-4. Head Load (HDLOAD) – This line causes the read/write head to contact the disk surface. If the drive is not selected this line is disabled. When a disk is inserted into the drive, the head is momentarily loaded to properly seat the disk on the spindle.

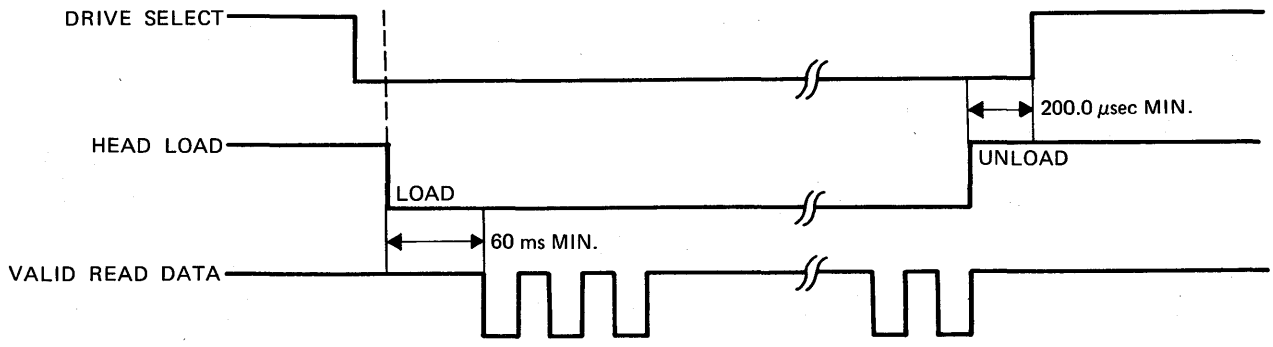


Figure 4-4. HEAD LOAD AND UNLOAD TIMING

4-3-1-5. Write Data (WRTDATA) – This line is used for data that is to be written on the disk. A transition from logical one to logical zero changes the polarity of read/write head current and causes a data bit to be written on the disk. This data line is active when the WRTGATE and READY signals are logical zero, and the WRTPRT signal is logical one.

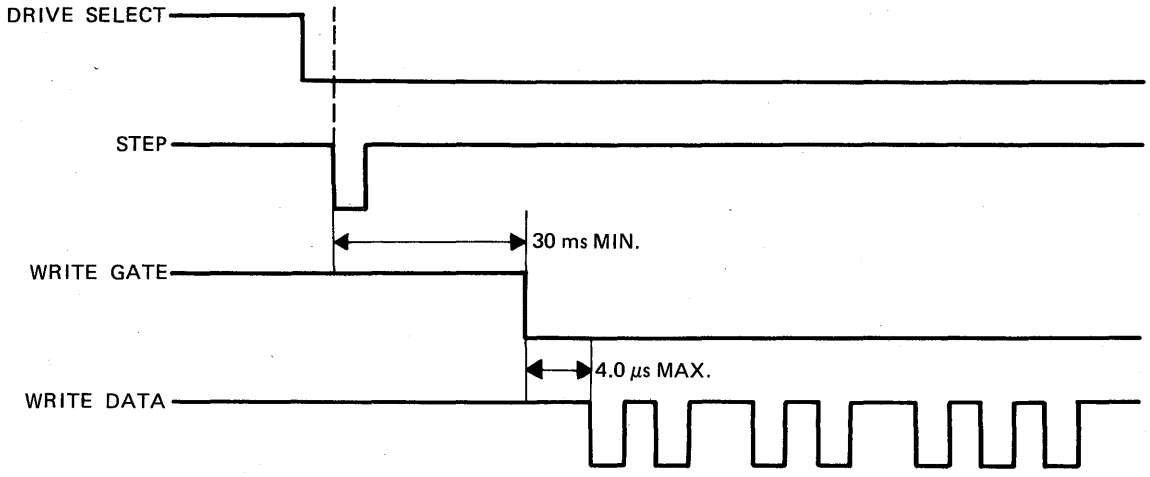


Figure 4-5. WRITE INITIATE TIMING

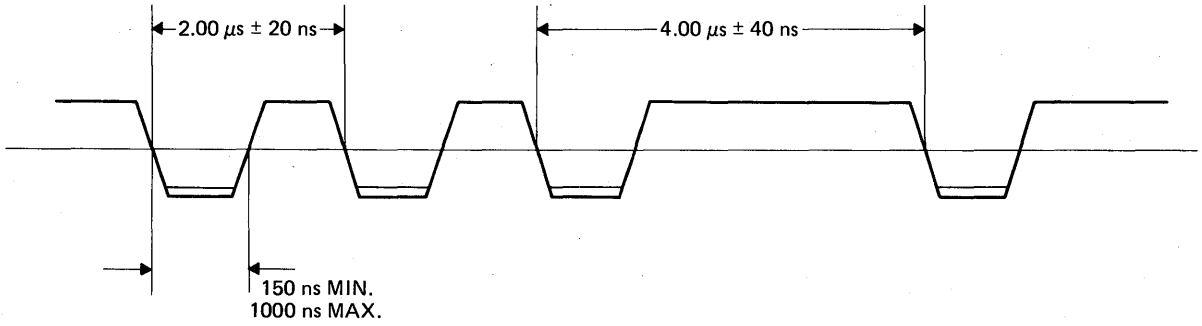


Figure 4-6. WRITE DATA TIMING

4-3-1-6. Write Gate (WRTGATE) – This line defines an operation as read or write. Logical zero on this line enables data to be written on the disk; logical one indentifies a read operation. And this line controls the tunnel erase head.

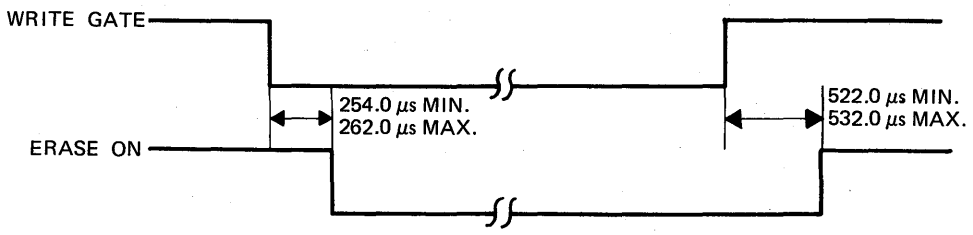


Figure 4-7. ERASE ON AND OFF TIMING

4-3-2. Output Signal Descriptions

4-3-2-1. Index – This line is used to indicate a reference position on a track. The line is usually a logical one; it becomes logical zero when the drive senses the index mark (see Figure 4-8). The trailing edge of the signal should be used to determine position. This line becomes logical one when the drive is not selected.

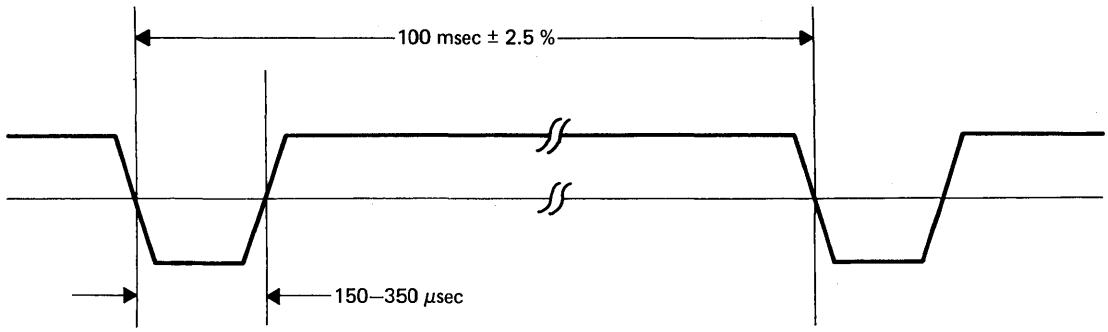


Figure 4-8. INDEX MARK TIMING

4-3-2-2. Track00 (TRK00) – This line indicates that read/write head located at track00 (the outermost track). Logical zero on this line indicates the head is located at track00. Logical one indicates the read/write head is not at track00. When drive power is turned on the read/write head positions itself at track00. When the drive is not selected this line is logical one. (See Figure 4-9 and 4-10.)

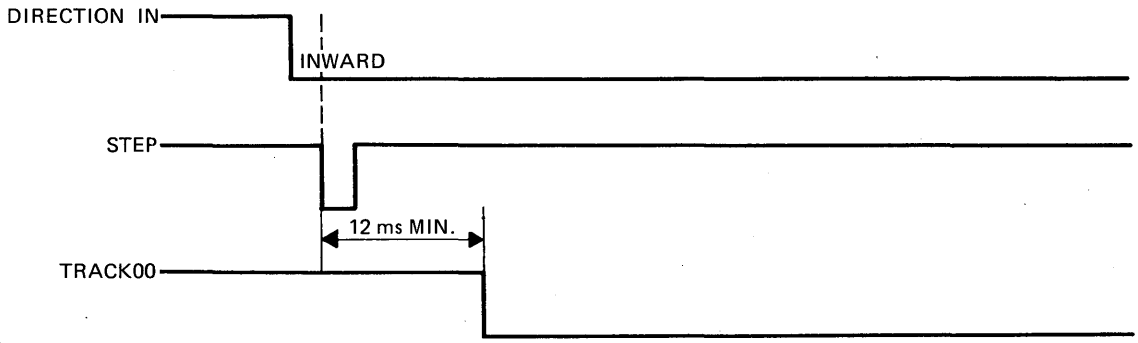


Figure 4-9. TRACK00 TIMING WHEN STEP IN

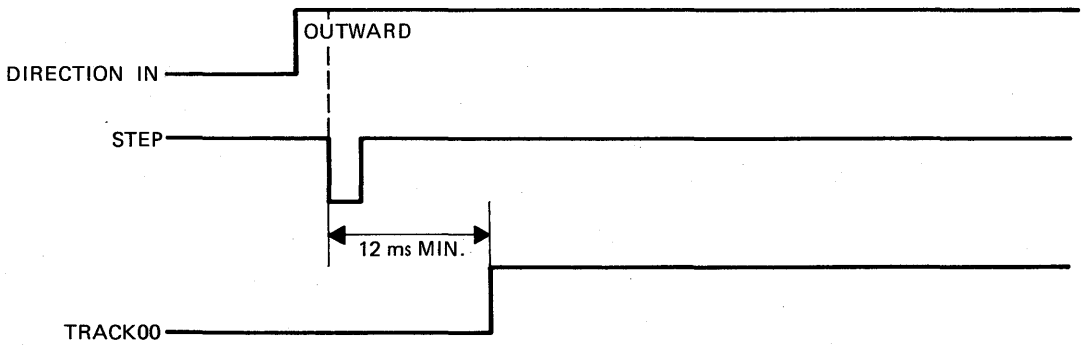


Figure 4-10. TRACK00 TIMING WHEN STEP OUT

4-3-2-3. Write Protect (WRTPRT) – This line indicates a disk is write protected. Logical zero on this line indicates a write protected disk is inserted in the drive. Logical one on this line indicates data may be written on the disk. If no disk is inserted in the drive logical zero appears on this line. If the drive is not selected this line is logical one.

4-3-2-4. Ready

This line is logical zero when

a) disk is inserted
and
b) motor is rotating
and
c) drive unit is selected.

At all other times this line is logical one.

4-3-2-5. Read Data (RDDATA)

This line provides unseparated data (data and clock combined). The line is normally logical one, and becomes logical zero when data is read.

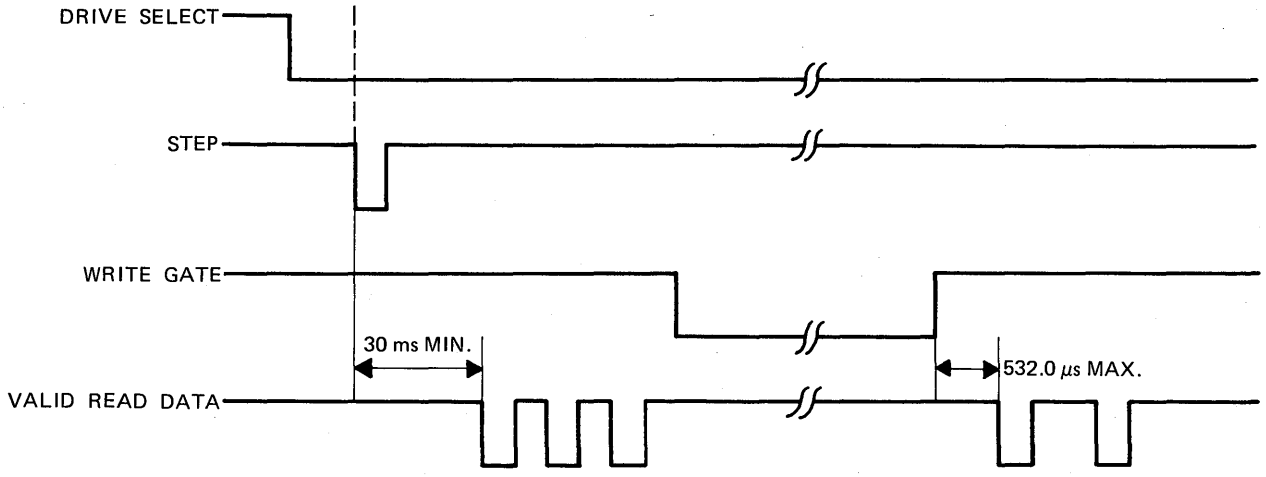


Figure 4-11. READ INITIATE TIMING

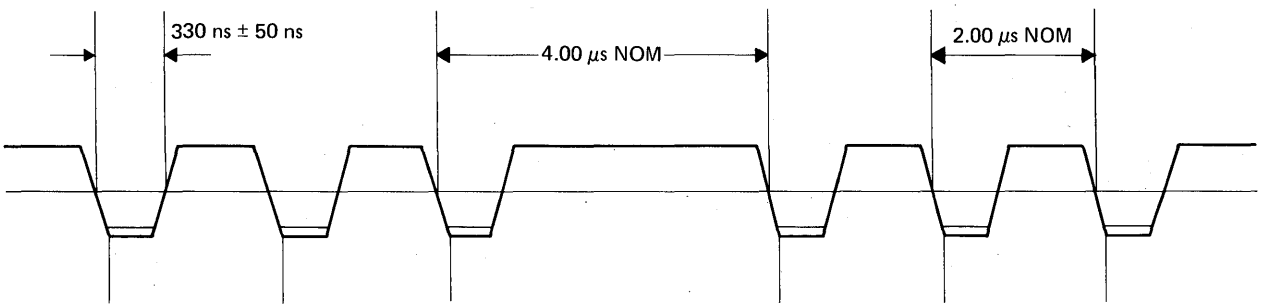


Figure 4-12. READ DATA TIMING

4-4. INTERFACE TIMING

Figure 4-13 shows the timing relationship for host/drive interface signals.

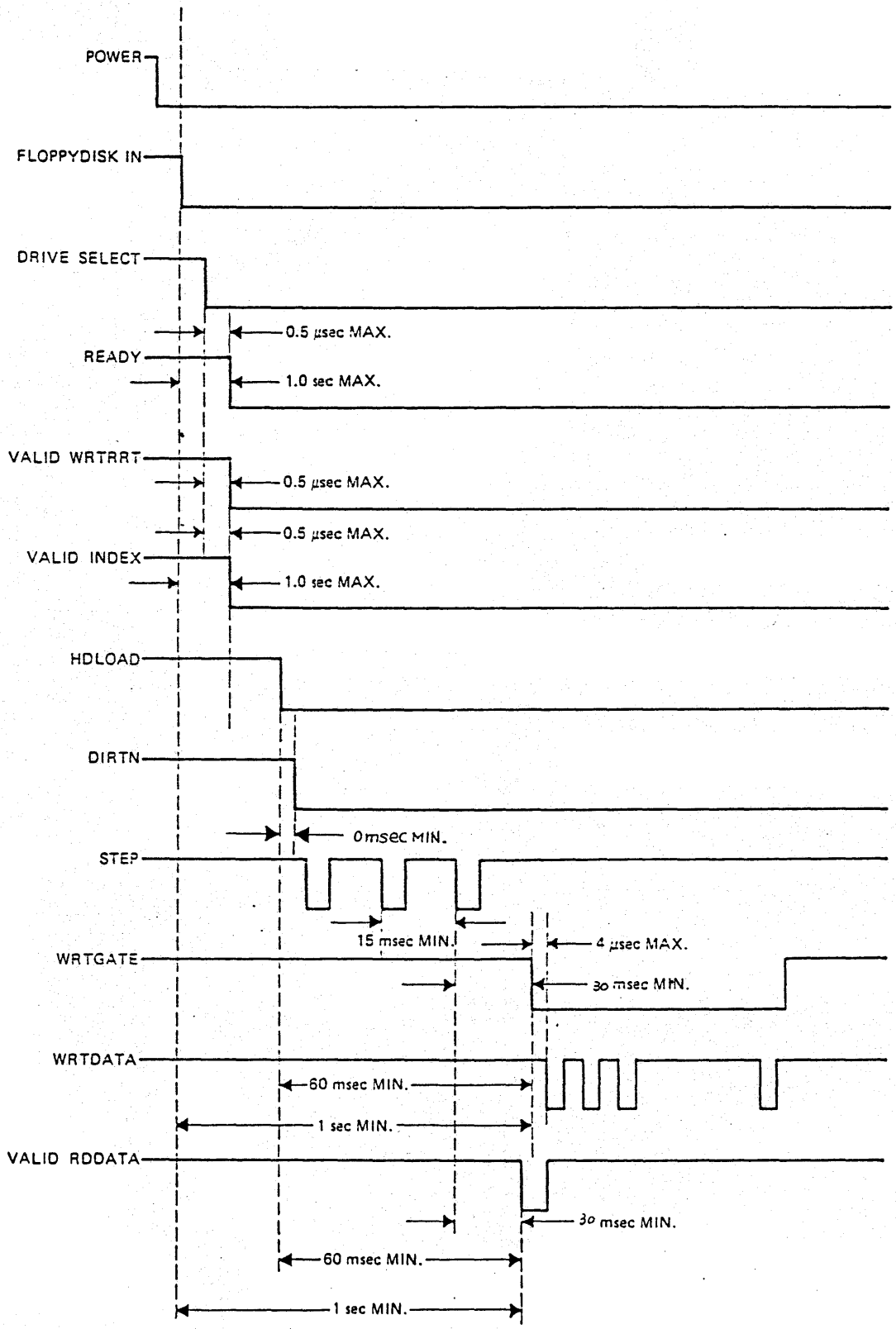


Figure 4-13. HOST SIGNAL INTERFACE TIMING DIAGRAM

SECTION 5
CONTROLS AND INDICATORS

5-1. OPERATOR CONTROLS AND INDICATORS

5-1-1. Front Panel Controls

The disk eject button (see Figure 5-1) is used to remove a disk from the unit. Depression of the disk eject button causes the disk in the unit to be ejected. With no disk in the unit, the motor stops rotating.

5-1-2. Front Panel Indicators

The activity light (see Figure 5-1) indicates that a disk is in the unit and head is loaded.

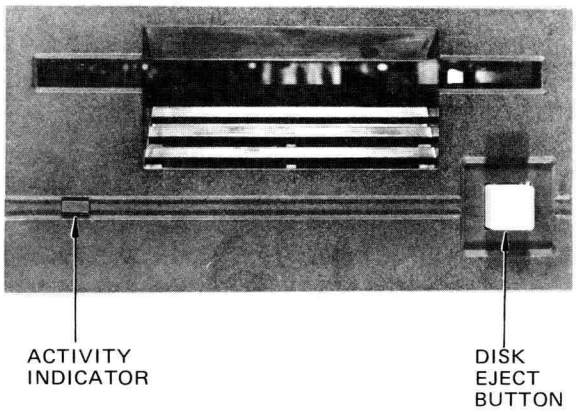


Figure 5-1. CONTROLS AND INDICATORS

5-1-3. Rear Panel Controls

Drive Select switch SW1, located on the rear panel, is used to designate drive 1 and drive 2 in a daisy chain application. The **Micro Floppydisk** drive is shipped from the factory designated as drive 1. To designate a drive as unit 2 (see Figure 5-2) close arm 2 of Drive Select switch SW1, and open arm 1.

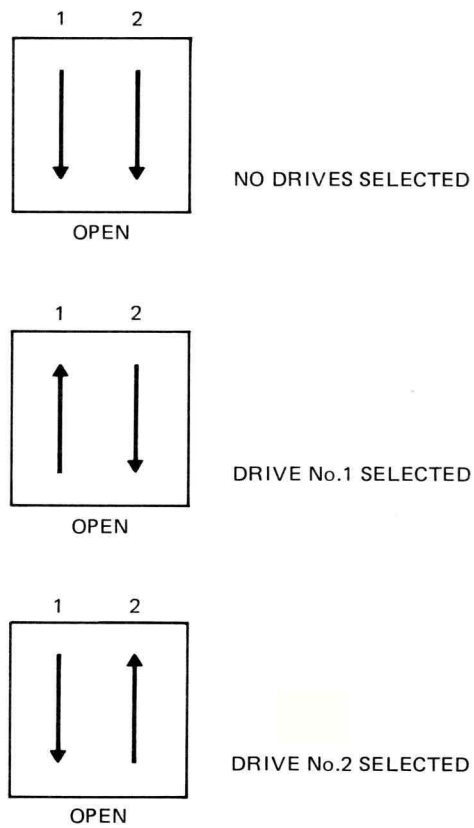


Figure 5-2. REAR PANEL CONTROLS

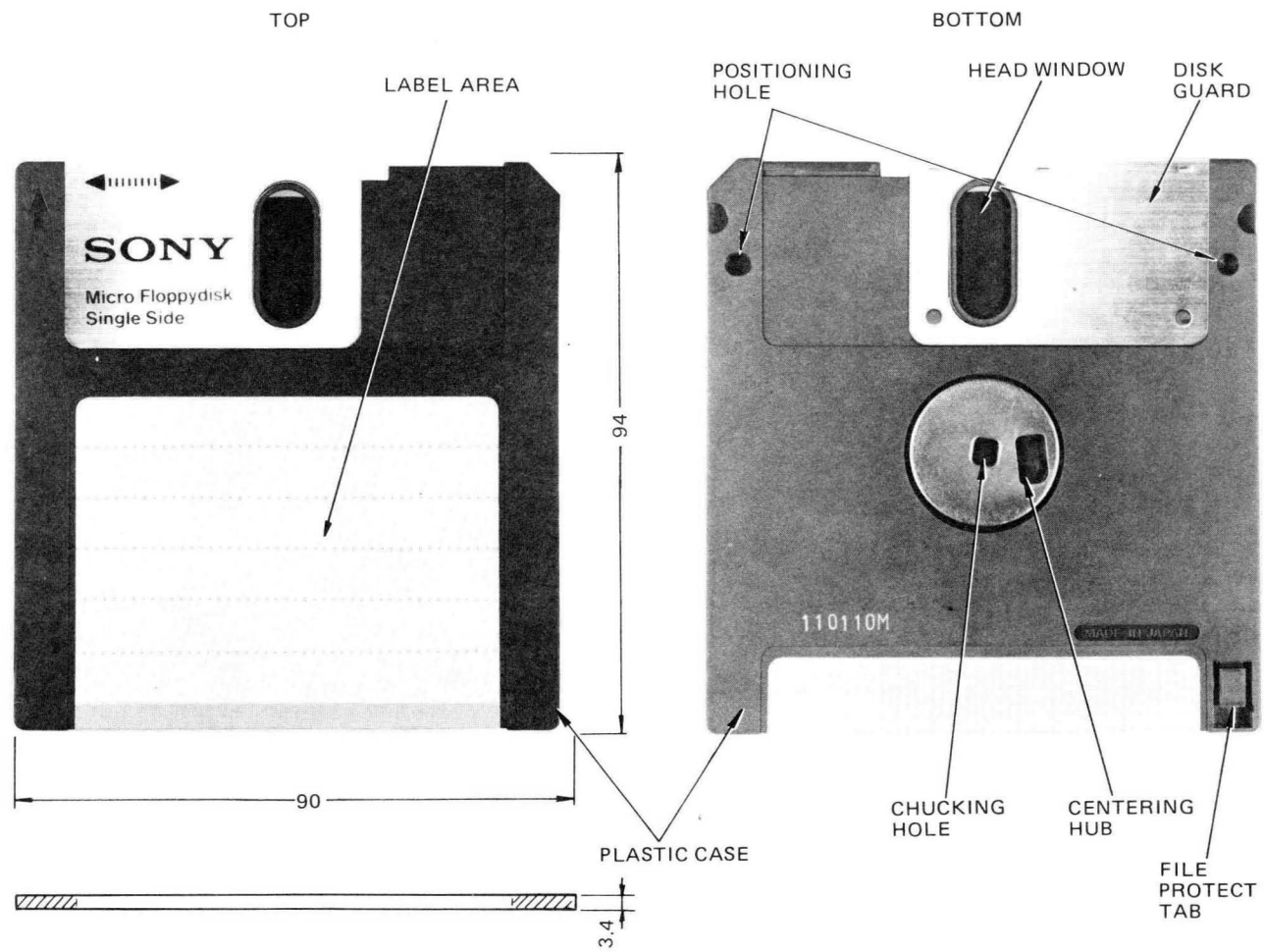
SECTION 6
OPERATION

6-1. DISK DESCRIPTION

The **Micro Floppydisk** (OM-D30V) is enclosed in a rigid plastic shell for extra protection and reduced disk-to-case friction (see Figure 6-1). A metal centering hub ensures rapid and accurate positioning when the disk is inserted in the drive. SONY's exclusive disk guard protects the recording surface from foreign object contamination. The guard prevents dust, dirt and fingerprints from degrading the integrity of the stored data.

6-1-1. Disk Preparation and Write Protection

The **Micro Floppydisk** is write unprotected as shipped from the manufacturer. To prepare the disk for file protected operation break off file protect tab.



ALL DIMENSIONS IN MM.

Figure 6-1. STORAGE MEDIA

6-2. OPERATION

6-2-1. Disk Eject Mechanism

SONY's fail-safe eject mechanism prevents damage to disk or drive by ejecting the **Micro Floppydisk** in the event it is improperly inserted. The disk will also be ejected if the disk guard is in the closed position.

6-2-2. Disk Insertion

Do not force disk. Slide guard so disk surface is exposed through head window. With metal centering hub down, insert guard end into disk drive. When disk is in drive the motor will rotate; motor rotation stops only when disk is removed from the drive. The **Micro Floppydisk** drive is now ready for operation.

6-2-3. Disk Removal

Depress disk eject button to remove disk. When disk is extracted be sure to close guard to exclude foreign contaminants. Do not depress disk eject button if activity light is illuminated.

6-3. DISK PRECAUTIONS

The following precautions will assure full disk life and maximum data integrity:

a) Do not store disk with guard open
b) When handling disk do not touch exposed disk surface
c) Keep disks away from magnetic materials
d) Do not expose disks to excessive heat or direct sunlight
e) Never attempt to clean disk surface. This may result in damage to disk or drive head.

6-4. DISK ENVIRONMENTAL LIMITS

Operating:	Temperature	50 ~ 140°F	(10 ~ 60°C)
	Humidity	8 ~ 80 % RH	
Storing:	Temperature	50 ~ 140°F	(10 ~ 60°C)
	Humidity	8 ~ 80 % RH	
Transporting:	Temperature	–40 ~ 140°F	(–40 ~ 60°C)
	Humidity	8 ~ 80 % RH	

(Maximum wet bulb temperature $\leq$ 85°F (29.4°C))

SECTION 7
ELECTRICAL CONNECTORS

7-1. POWER CONNECTOR

7-1-1. Frame Ground

The drive unit should be frame grounded to the host system. A frame ground screw for this purpose is provided on the back of the unit.

7-1-2. DC Power Connector (J2)

DC power connector (J2) is a 4-pin male plug which is located at the rear of the drive unit. This connector should be used to satisfy the power requirements of the unit.

7-1-3. DC Power Cable Fabrication

The DC power from the host system should be delivered to the drive unit over a cable with the following recommended parts:

Receptacle (4-pin)	AMP 171822-4
Contact	AMP 170262-1
Wire	AWG 20 (or equivalent)

Table 7-1 is a list of pin assignments for connector J2. Figure 7-1 illustrates power interconnection.

TABLE 7-1. DC POWER CONNECTOR PIN ASSIGNMENTS

Pin No.	Description
1	+5 V DC
2	GND (+5 V Return)
3	GND (+12 V Return)
4	+12 V DC

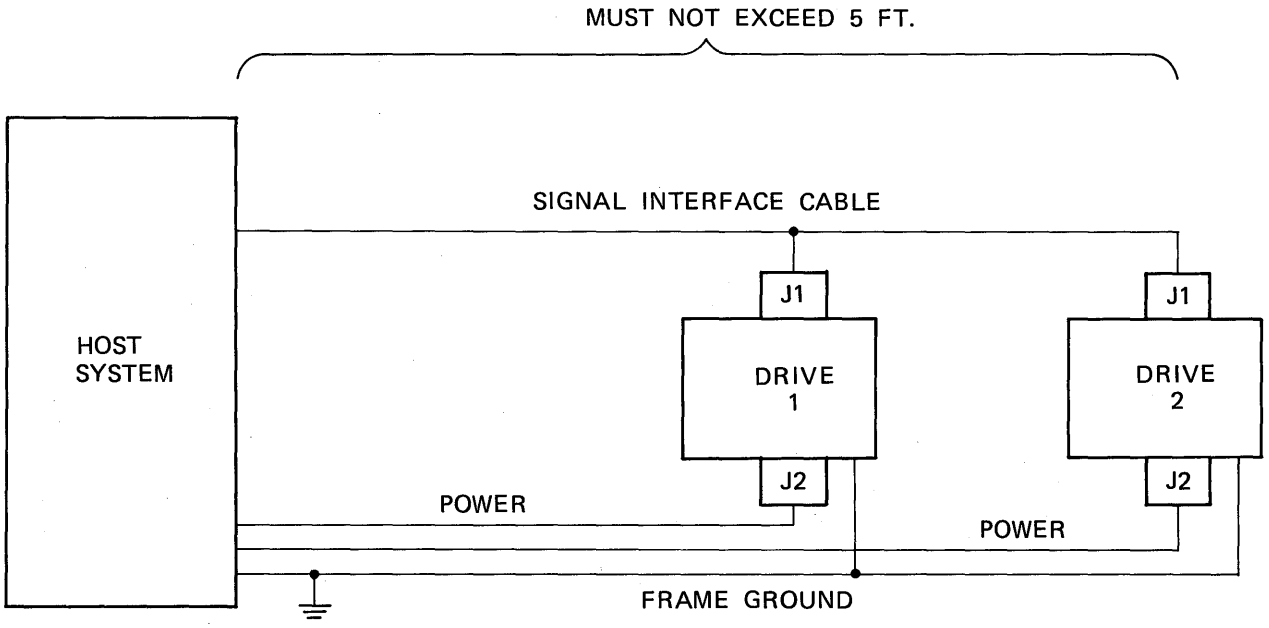


Figure 7-1. PHYSICAL INTERCONNECTION FOR DAISY CHAIN APPLICATION

7-2. SIGNAL INTERFACE CONNECTOR

7-2-1. Signal Interface Connector (J1)

Signal interface connector (J1) is a 26-pin male plug located at the rear of the unit. This connector should be used to interface drive logic with the host system. When mating a receptacle with connector J2, the polarizing key should be placed upwards. Figure 7-2 shows J1 connector dimensions.

7-2-2. Signal Interface Cable Fabrication

The drive unit signal interface cable must not exceed 5 feet in length. A 26-pin receptacle is required to mate with signal connector J2. The following parts are recommended for host system to drive unit signal cable fabrication:

Receptacle (26-pin) (JAE PS-26SE0-D4P1-1C)

Receptacle (26-pin) for "daisy chain" application. (JAE PS-26SE0-D4P1-1D)

Cable 3M 3365/26

Table 7-2 is a list of pin assignments for signal interface connector J2. Figure 7-1 illustrates signal interface connection. (If you need more detail, please contact with your Sony Office Products dealer.)

TABLE 7-2. SIGNAL INTERFACE CONNECTOR PIN ASSIGNMENTS

Pin No.	Description
1	RETURN
2	SELECT 0
3	RETURN
4	SELECT 1
5	RETURN
6	DIRTN
7	RETURN
8	STEP
9	RETURN
10	WRTDATA
11	RETURN
12	WRTGATE
13	RETURN
14	HDLOAD
15	RETURN
16	(RESERVED)
17	RETURN
18	INDEX
19	RETURN
20	TRK00
21	RETURN
22	WRTPRT
23	RETURN
24	RDDATA
25	RETURN
26	READY

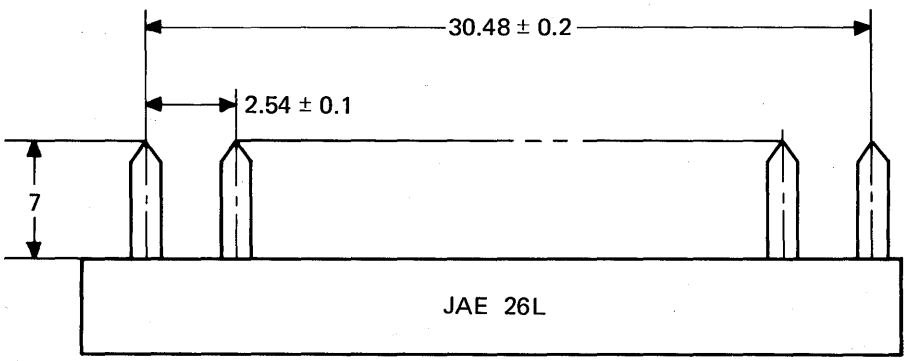


Figure 7-2. J1 CONNECTOR DIMENSIONS

SECTION 8
MOUNTING AND INSTALLATION

8-1. ORIENTATION

The drive may be mounted in either a horizontal or vertical position. (See Figure 8-1.) In the horizontal position the drive must be positioned with the printed circuit board on bottom. No other restrictions concerning orientation exist.

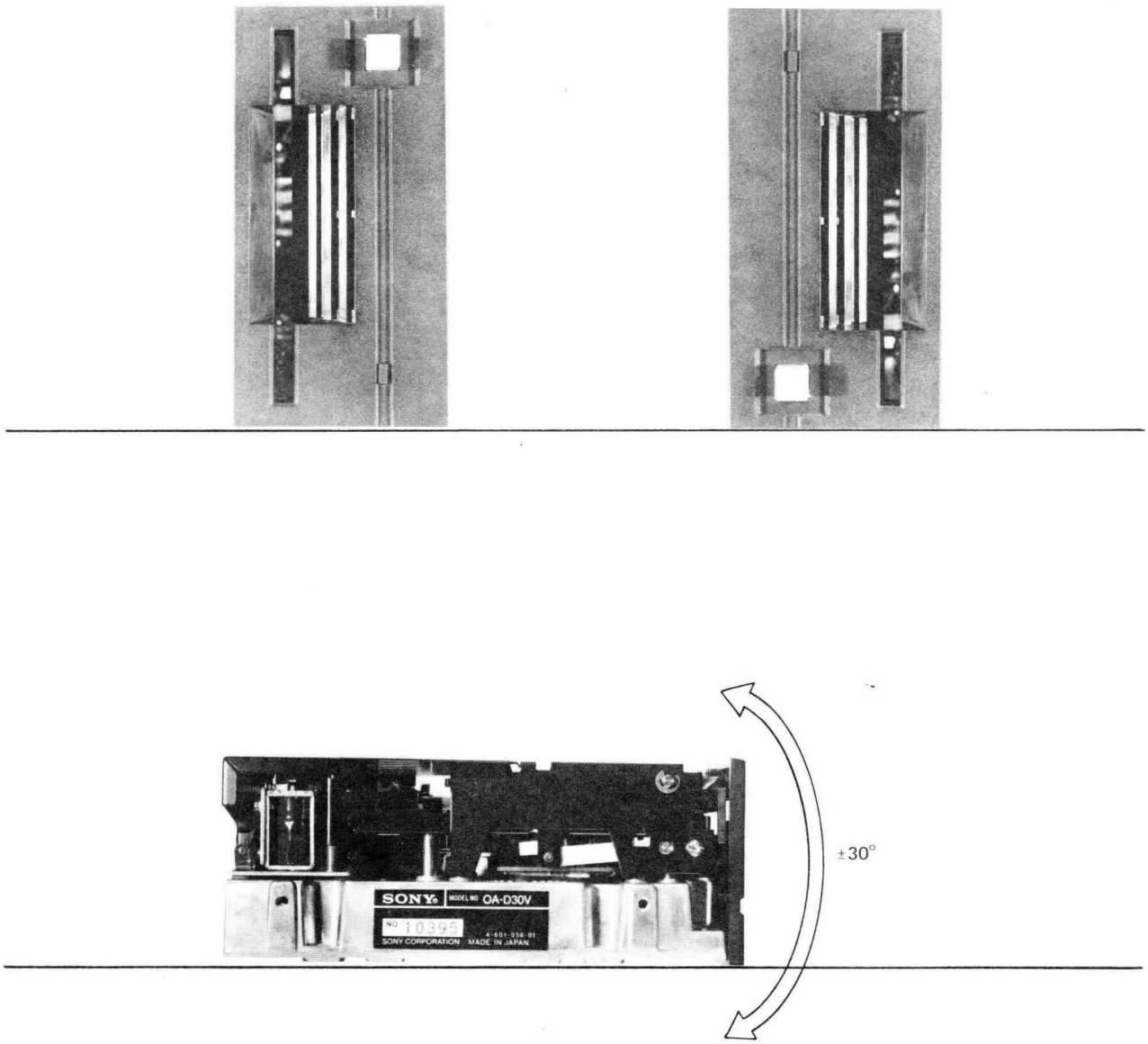


Figure 8-1. PERMITTED DRIVE ORIENTATION

8-2. INSTALLATION

The drive is designed for installation in an area 4.0 in. wide by 2.0 in. high by 5.1 in. deep. See Figure 8-2 for dimensional data. Eight mounting holes are provided on the unit to facilitate installation (see Figure 8-2.) The unit has two mounting holes on each side, and four mounting holes on bottom.

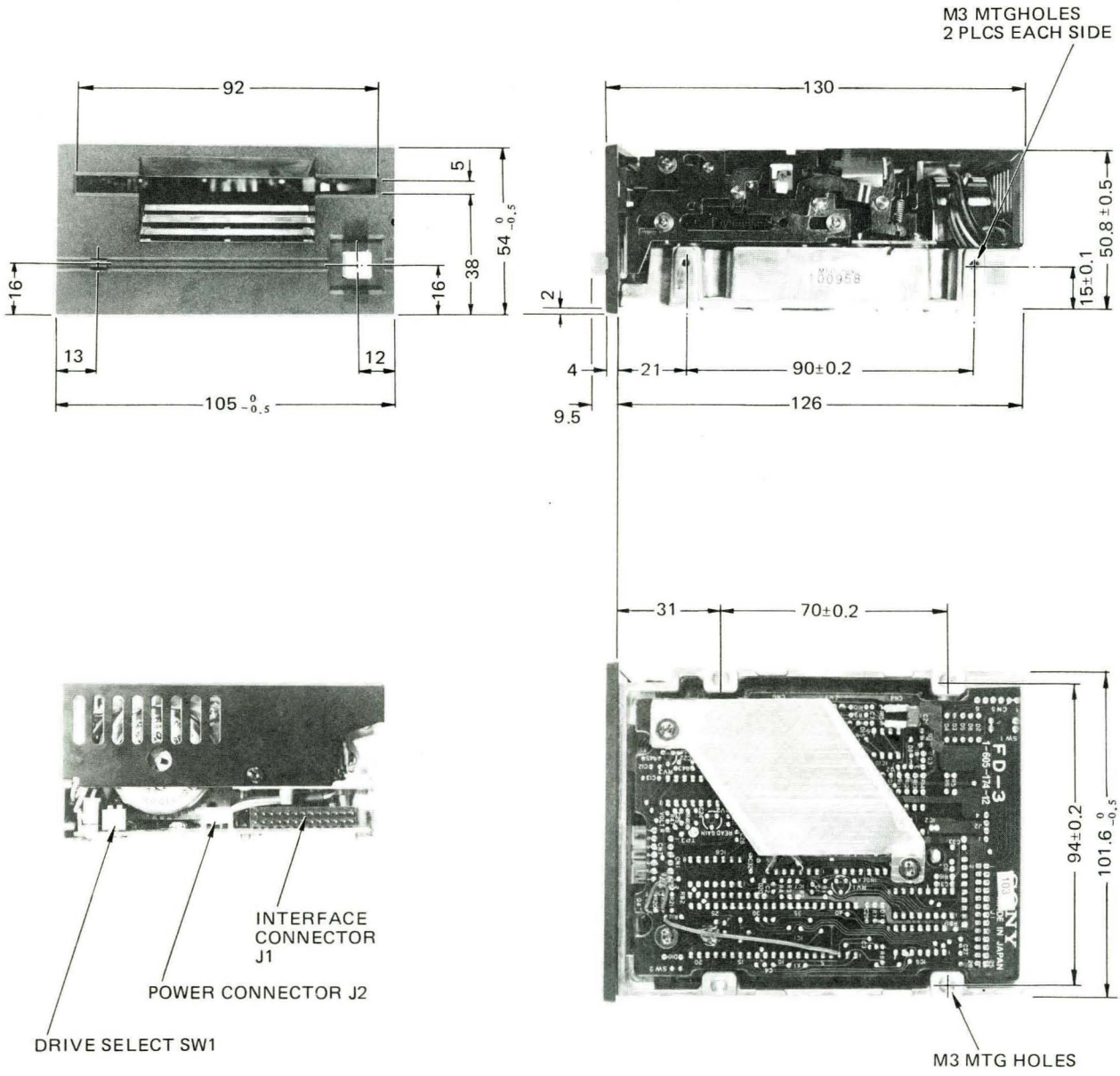


Figure 8-2. DRIVE DIMENSIONAL DATA

8-3. PCB COMPONENT LOCATIONS

Figure 8-3 shows the location of components on the PCB.

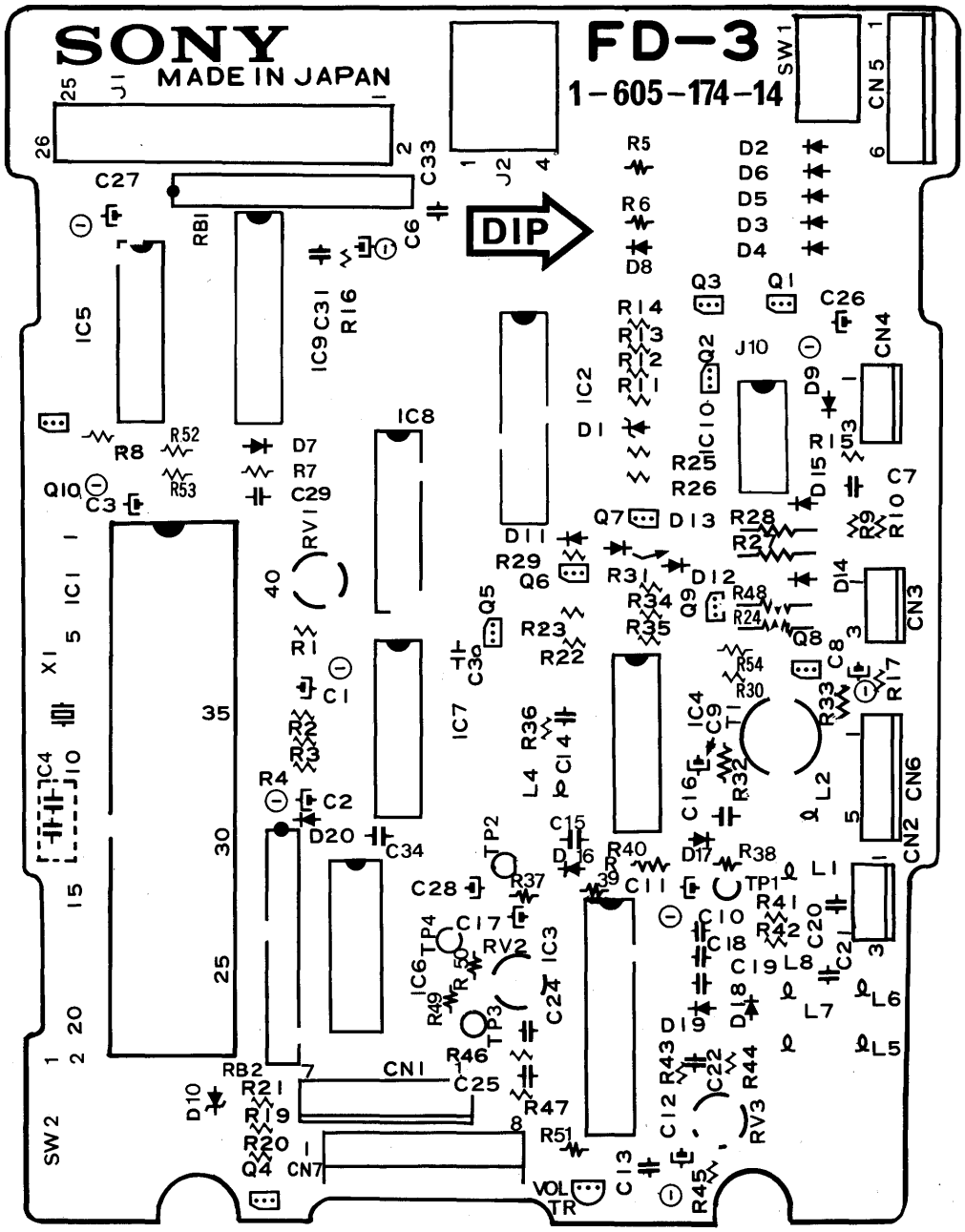


Figure 8-3. PCB COMPONENT LOCATIONS

SECTION 9
ERROR DETECTION AND CORRECTION

9-1. 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 (10) attempts have been made, a read operation should be attempted on another track to determine if the media or the drive is failing. If the error still persists, the disk should be considered defective and discarded.

9-2. READ ERROR

Most errors that occur will be "soft" errors; that is, by performing an error recovery procedure the data will be recovered.

Soft errors are usually caused by:

1. Airborne contaminants that pass between the read/write head and the disk. These contaminants will generally be removed by the cartridge self-cleaning wiper.
2. Random electrical noise which usually lasts for a few μ sec.
3. 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 procedures are recommended to recover from the above mentioned soft errors:

1. Reread the track ten (10) times or until such time as the data is recovered.
2. If data is not recovered after using step 1, access the head to the adjacent track in the same direction previously moved, then return to the desired track.
3. Repeat step 1.
4. If data is not recovered, the error is not recoverable.

Sony Corporation

9-975-100-01

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82D0503-2

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