FD1035

3.5" FLOPPY DISK DRIVE

PRODUCT DESCRIPTION

REV. ?

NEC Corporation

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Specifications remain subject to change to allow the introduction of design improvements.

Edition	Description
1	Prepared in March 1984
2	Prepared in July 1984

CONTENTS

1. GENERAL

The FD1035 micro-floppy disk drive is a double-sided micro-floppy disk drive with 135 tracks per inch (TPI).

The Micro-floppy disk (abbreviated as disk in this manual) used for the FD1035 is contained in a hard jacket with auto shutter.

The FD1035 micro-floppy disk drive has a total volume one fourth that of conventional 5-1/4" mini-floppy disk drives and weights only approximately 680 g, yet has a comparable storage capacity.

The drive uses a direct-driven spindle with a brushless DC motor, and by to the low power design it consumes only 4.5 watts of power.

The low noise design assures silent operations.

In this manual the FD1035 micro-floppy disk drive is abbreviated as FDD.

2. GENERAL SPECIFICATIONS

2.1 Drive specifications

No.	Item		Specification		Unit
1	Recording mode		MFM	FM	
2	Capacity	Unformatted	1	0.5	MB
		Formated	640	320	kB
3	Data transfer rate		250	125	k-bit/sec.
4	Maximum bit density		8717	4359	BPI
5	Tracks		160		
6	Average rotational speed		300		rpm
7	Seek time (Track-to-track)		3		ms
8	Seek settling time		15		ms
9	Head load time		35		ms
10	Track density		135		TPI
11	Start time		800		ms
12	Standard external dimensions (NOTE 1)	Width	41		mm
		Height	101.6		
		Depth	132		
13	Weight		680		gr
14	Operating environment conditions	Temperature	4 ∿ 46		°C
		Relative humidity	20 ∿ 80		%
		Maximum wet-bulb temperature	29.0 (no bedewing)		°C

No.	Item		Specification		Unit
15	Power supply requirement	Voltage (V)	Startup current (NOTE 1)	Steady-state current (NOTE2)	
		+12	540	160	mA
		+5	270	410	
16	Power dissipation (NOTE 2)		4.0		W
17	Heat output (NOTE 2)		3.4		kcal/h
18	Reliability	MTBF (NOTE 3)	12000 (Under standard use condition)		POH
		MTTR	0.5		h
		Device life	15000 POH or 5 years (Design life)		
		Retryable	10^{-9} (Not including 2 or less retry attemps)		Times/bit
		Unretryable error ratio	10^{-12}		Times/bit
		Seek error ratio	10^{-6}		Times/seek
19	Disk life	Pass count/ track	3.0×10^{6}		
20	Disk		Double sided 3.5" diskette specified by NEC		

21	Drive environment	Operating	Non-operating (Storage)	Transporting (Packing)	Unit
	Temperature	4 ∿ 46 (39 ∿ 115)	-20 ∿ 50 (-4 ∿ 122)	-40 ∿ 60 (-40 ∿ 140)	°C (°F)
	Relative humidity	20 ∿ 80	10 ∿ 90	5 ∿ 95	%RH
	Maximum wet-bulb temperature	29 (84)	40 (104)	45 (113)	°C (°F)
	Largest temperature grandient	15 (59)	36 (86)	30 (86)	°C/h (°F/h)

No.	Item		Specification		Unit
	Allowable vibration (Except at resonance point)	0.5 (Less than 100 Hz)	2 (Less than 100Hz)	2 (Less than 100 Hz)	G
	Allowable shock (Less than 10ms)	10	15	40	G

NOTE 1: Value at the time of spindle motor start-up.

NOTE 2: Average value of current consumption taken when FDD IS READY.

NOTE 3: Under standard use conditions

(1) Device service time (POH) : 8 h/day

(2) Actual head load time (R/W time) : 0.5h/day

(3) Head load count : 240 times/day

(4) Disk insertion/ ejection : 25 times/day

(5) Motor ON/OFF : 300 times/day

(6) Average use time per disk : 2h/day (4 disks/day.drive)

2.2 Drive structure

The major component of FDD have the following functions:

(1) Base

Constructs the frame.

(2) Spindle motor assembly

Drives the disk using a DC spindle motor. The disk is secured to the spindle with a magnet and is driven by a driving pin.

(3) Head carriage assembly

Contains a pair of magnetic heads facing across the medium. The R/W gap of the head on side one is dislocated 8 tracks inner than that of the head on side zero.

(4) Step motor

Moves the carriage assembly via the steel band.

(5) Head load assembly

Brings the magnetic head into contact with the disk in read/write operations.

(6) Index sensor

Optically senses the index point attached to the spindle motor.

(7) Track 00 sensor

Optically senses that the magnetic head is at track 00.

(8) Write protect sensor

Optically senses whether the write-protect hole in the disk is open or closed.

(9) Eject mechanism

Used for insertion and removal of disk and for automatic shutter control.

(10) P.W.B

Mounts the electric circuits that controls positioning of magnetic head, read/write operations, etc.

(11) Disply lamp

A LED is provided for display of the FDD status.

(12) Front panel

Dress panel installed on the Drive front.

2.3 Drive Operation

When a diskette is inserted into the FDD, the disk starts rotating and is chucked to the spindle. The FDD becomes ready when the spindle motor reaches the specified rotation speed after it was turned on. If the drive is selected, it transfers a READY signal to the controller. It takes approximately 800 ms for the spindle motor to become ready.

Then FDD moves the magnetic head to a target track for positioning according to the STEP pluse and DIRECTION SELECT signals sent from the controller.

FDD brings the magnetic head into contact with the disk by the MOTOR ON signal from the controller and selects the desired magnetic head by the SIDE SELECT signal. Now FDD is ready for read/write operations.

For a write operation, the FDD converts into a magnetized pattern the WRITE DATA signal which is the serial data sent from the controller and records on the disk.

For a read operation, FDD detects a magnetized pattern recorded on the disk, converts it into serial data, and sends to the controller as a READ DATA signal.

2.4 Disk Specifications

No.	Item		Specification
1	Media type		3.5" double sided medium specified by NEC
2	Product name		NEC micro floppy disk
3	Number of disks		1
4	Recording surfaces		2
5	Number of total tracks per disk		160
6	Disk cartridge size		90 × 94 mm
7	Operating environment conditions	Temperture	10 ∿ 60°C (50 to 140°F)
		Relative humidity	8 ∿ 80%
		Wet-bulb temperature	29°C Maximum (84°F)
		Temperature gradient	20°C/h Maximum (36°F/h)
		External Magnetic field	4000 A/m (50 oersted) or less
		Standing	Leave the disk at least 30 minutes in the device perating environment before use.

2.5 Disk Structure

The floppy disk is contained in a hard jacket withinside of which liner sheets are provided for disk surface protection. The disk uses a polyethylene terephthalate base coated with magnetic layers. The liner consists of unwoven cloth and protects the disk surfaces from scratch or dust. The hard jacket is made of ABS resin.

The disk has a metal hub which is used to secure itself to the spindle. The hard jacket has a write-protect hole and automatic shutter.

The disk construction is shown in Figure 2.1.

Figure 2.1 shows the disk strucutre.

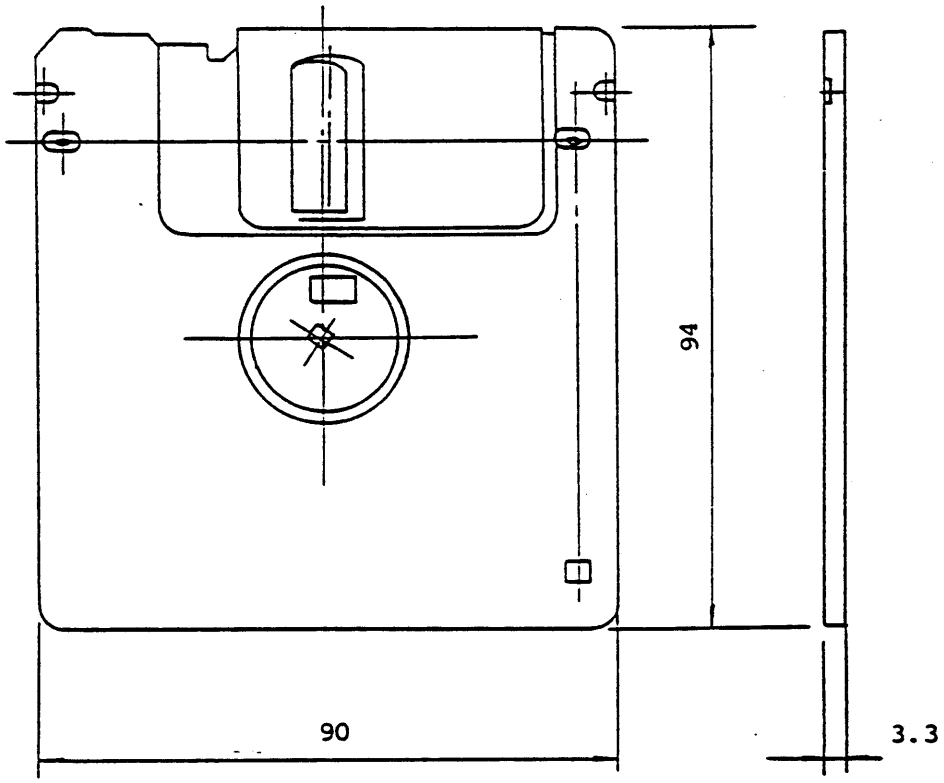


Fig. 2.1 Disk Structure

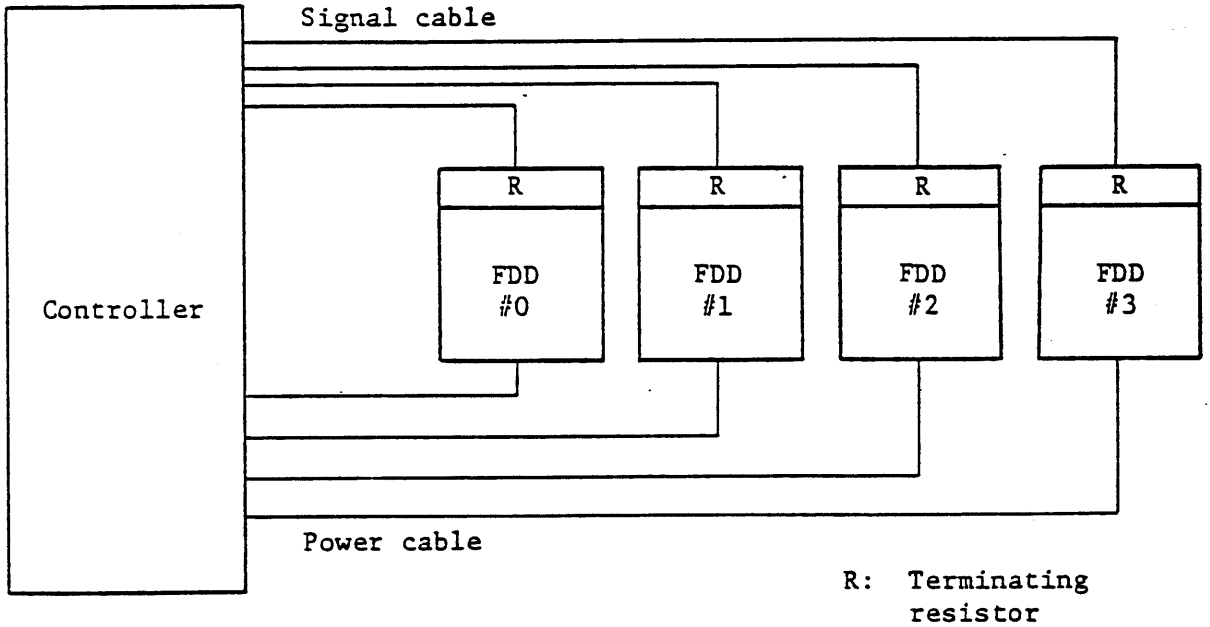
3. INTERFACE

3.1 General Description

FDD's may be attached to its controler in either parallel or daisy-chain configuration. The number of FDD's which can be attached to one controller depends on dividual system and controller. For daisy-chain attachment, each controller can control up to 4 FDD's.

Signal line termination resistors are provided on each FDD. The basic FDD attachment to the controller is shown in Figure 3.1.

(a) Parallel attachment



(b) Daisy Chain attachment

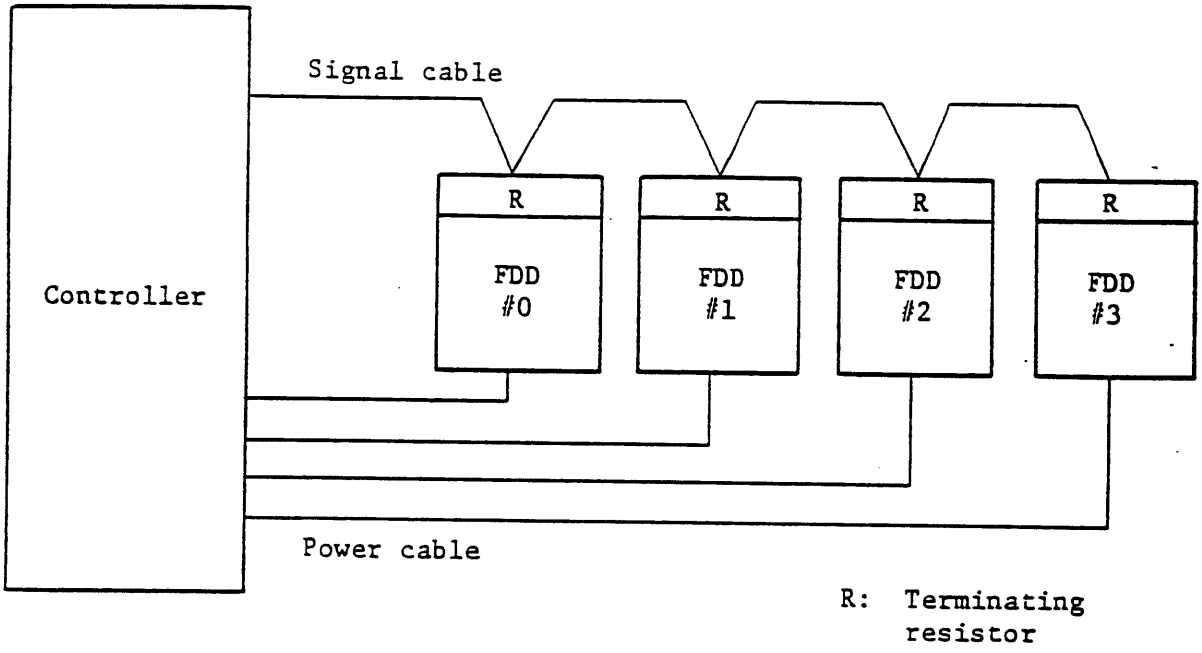


Fig. 3.1 Basic Connection Modes

3.2 Physical Specifications

The FDD is attached to its controller through a signal connector and a power connector. A faston terminal is provided for frame ground. The connector locations are shown in Figure 3.2.

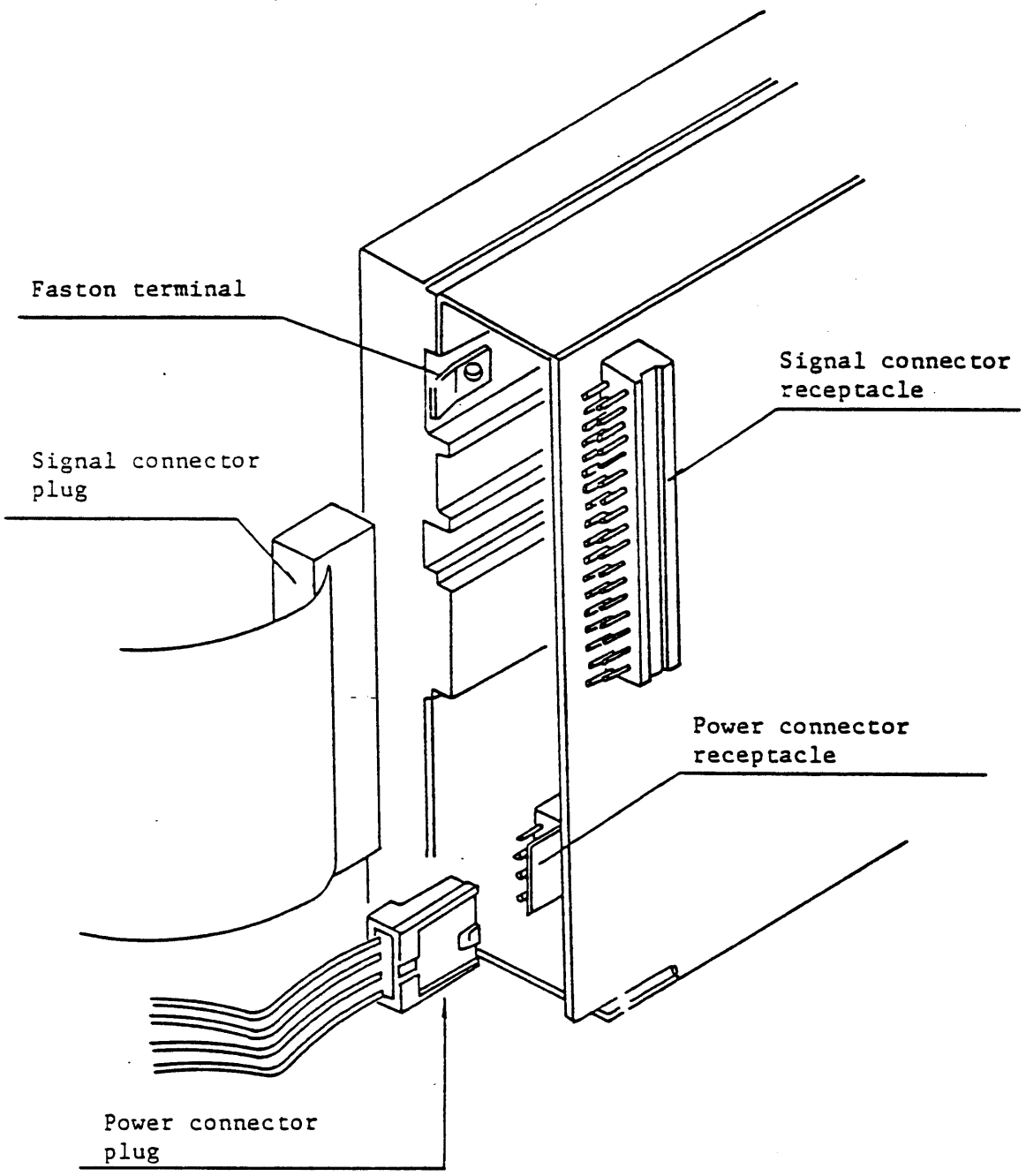
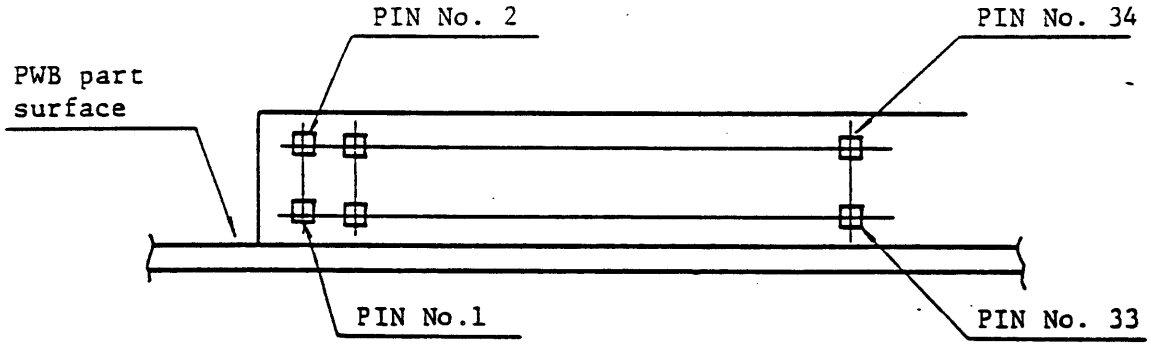


Fig. 3.2 Connector Locations

3.2.1 Signal Types and Pin Configuration

The following shows the signal connector pin configuration on the FD1030:



Signal name	I/O	Pin number	Pin number	Signal name
RESERVED	-	2	1	GND
(HEAD LOAD/IN USE)	Input signal	4	3	GND
DRIVE SELECT 3	Input signal	6	5	GND
INDEX	Output signal	8	7	GND
DRIVE SELECT 0	Input signal	10	9	GND
DRIVE SELECT 1	Input signal	12	11	GND
DRIVE SELECT 2	Input signal	14	13	GND
MOTOR ON	Input signal	16	15	GND
DIRECTION SELECT	Input signal	18	17	GND
STEP	Input signal	20	19	GND
WRITE DATA	Input signal	22	21	GND
WRITE GATE	Input signal	24	23	GND
TRACK 00	Output signal	26	25	GND
WRITE PROTECT	Output signal	28	27	GND
READ DATA	Output signal	30	29	GND
SIDE SELECT	Input signal	32	31	GND
READY	Output signal	34	33	GND

3.2.2 Power Connector and Pin Configuration

The following shows the power connector pin configuration:

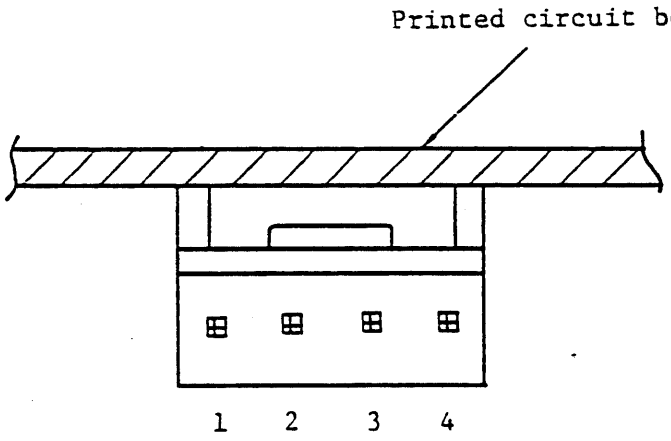


Fig. 3.3 Power Connector in Configuration

Table 3.1 Power Connector Pin Assignments

Pin number	Supply voltage
1	+5 V DC
2	GND
3	GND
4	+12 V DC

3.2.3 Connector Type

The following connector type are recommended for the signal and power connections for the FDD; equivalent connector types may also be used.

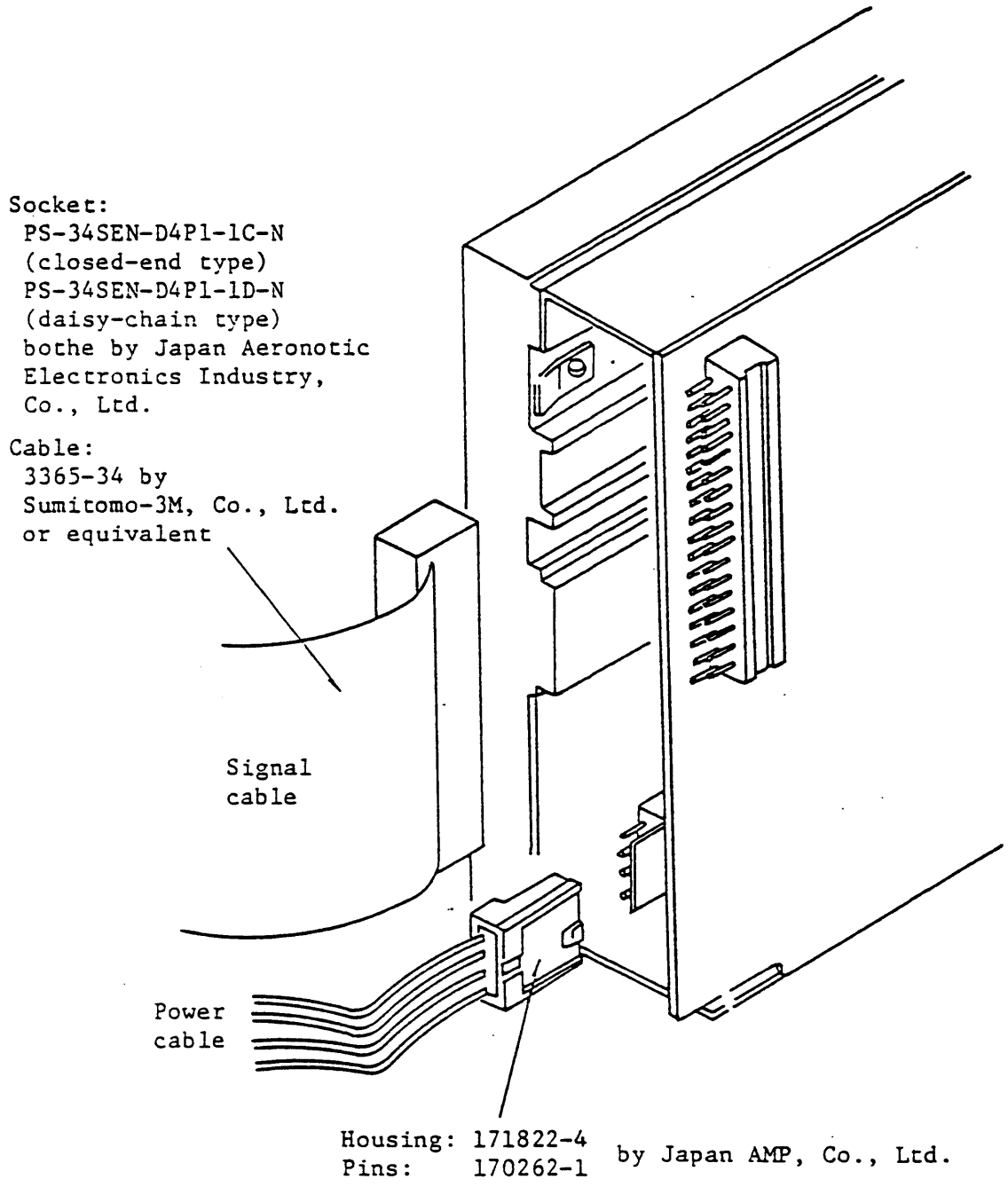


Fig. 3.4 Connector Locations and Recommended Models

3.3 Electrical Specifications

3.3.1 Signal Level

All the input/output signals are at TTL level with the following electrical specifications:

TRUE	= Logical "0" (LOW level)	0, to +0.4 V
FALSE	= Logical "1" (HIGH level)	+2.5 to +5.25 V

3.3.2 Driver/Receiver

The driver which outputs signals from PDD to the controller is an open collector output circuit capable of obtaining sink current of maximum 40 mA at LOW level. THe receiver which receives signals from the controller to FDD is a Schmitt trigger gate terminating with 1 k .

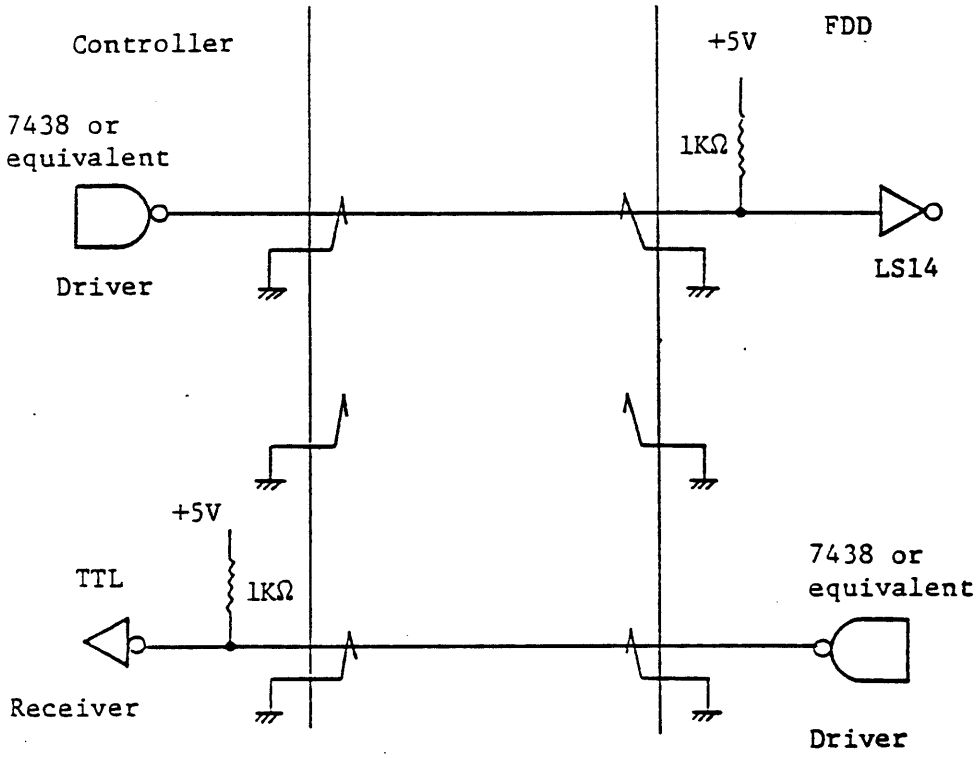


Fig. 3.5 Driver/Receiver Circuit Example

3.4 Input Signals

3.4.1 DRIVE SELECT 0 to 3 (DS0 to 3)

DRIVE SELECT 0 to 3 are signals for selecting a specified FDD. Setting one of DS0 to DS3 to LOW level selects the corresponding FDD, which makes effective the input/output lines.

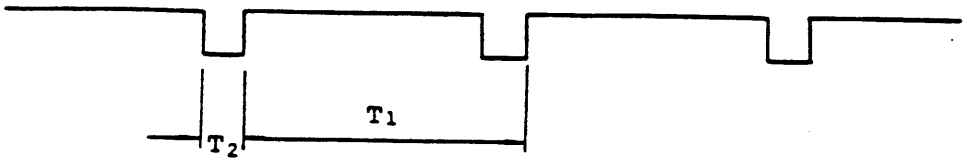
FDD is specified by shorting one of the DX selection plugs 0 to 3 on the PWB.

3.4.2 HEAD LOAD (HDL) (Option Signal)

When FDD is ready (see Section 3.5.3), setting this signal to LOW level causes the magnetic head to touch the disk surface. However, in this device, it is common to make the magnetic head touch the media surface by motor on signal.

3.4.3 STEP (STP)

Pulse signal which moves the magnetic head in the direction specified by the direction select signal. The head begins moving at the rising from LOW to HIGH level of this signal. The magnetic head moves over as many cylinders as the number of input pulses. Figure 3.6 shows the pulse timing conditions.



T_1: 3 ms min.

T_2: 0.8 μs~2 ms

Fig. 3.6 STEP Pulse Specification

3.4.4 DIRECTION SELECT (DIR)

Signal instructing the direction of magnetic head movement. The HIGH level indicates the direction toward the outer tracks and the LOW level indicates toward the inner tracks.

This signal must be switched definitely 0.8 μs before the trailing edge (positive going) of the STEP signal.

3.4.5 SIDE SELECT (SSL)

Signal selecting one of the heads used for write or read. The HIGH level selects the magnetic head on the side "0" of the disk and the LOW level selects the side "1".

This signal must be switched 100 μs before start of the read/ write operation.

3.4.6 WRITE GATE (WGT)

This signal writes data when at LOW level and reads data when at HIGH level. Do not turn off the HEAD LOAD signal, switch the SIDE SELECT signal, or start positioning, for 1 ms after this signal has gone to HIGH level.

3.4.7 WRITE DATA (WDT)

Pulse signal that supplies data to be written to the disk. Every time the signal changes from HIGH to LOW level, the write current in the magnetic head changes direction, which changes the direction of magnetization on the disk.

Figure 3.7 shows the WRITE DATA specification.

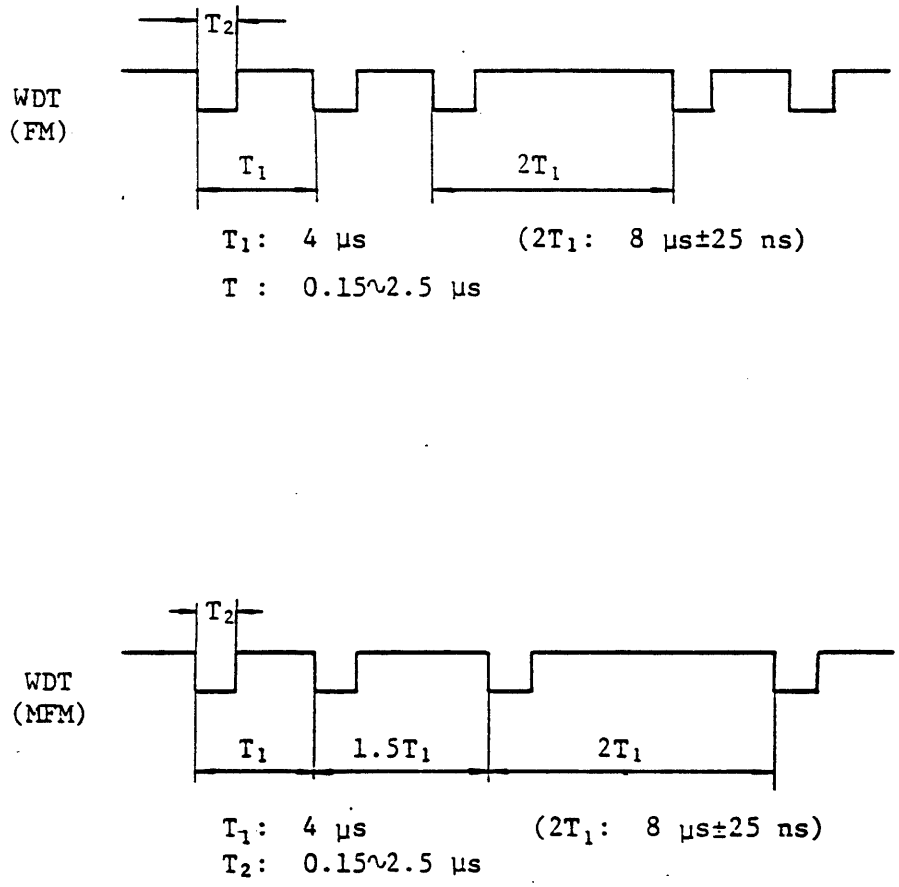


Fig. 3.7 WRITE DATA Pulse Specification

3.4.8 MOTOR ON (MON)

Setting this signal to LOW turns the spindle motor.

Setting this signal to LOW makes the magnetic head touch the disk.

3.5 Output Signals

3.5.1 INDEX (IDX)

Signal for indicating the origin on the disk. This is output once every revolution. Figure 3.8 shows the output pulse specification.

The reading edge of the pulse is used as a reference.

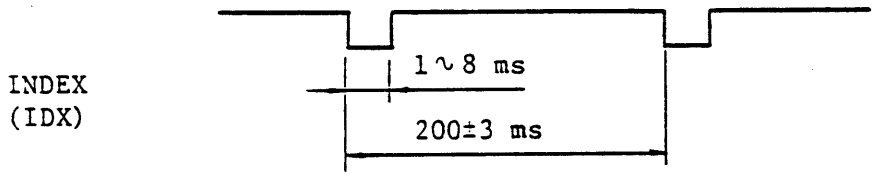


Fig. 3.8 INDEX Pulse Specification

3.5.2 TRACK 00 (TK0)

When at LOW level, this signal indicates that the heads are on track "00".

This signal is generated by the signal from the track 00 sensor and the (excitation) phase of the step motor.

3.5.3 READY (RDY)

Signal indicating that FDD is ready to operate. This signal goes to LOW level, when the FDD is selected, if the following conditions are satisfied:

(i) DC power is supplied.

(ii) A disk is mounted.

(iii) The rotational speed of the floppy disk has reached 90% of the specification.

3.5.4 READ DATA (RDT)

Data read from a disk which is shaped into a pulse string.

Figure 3.9 shows the READ DATA signal obtained when normally recorded information is read.

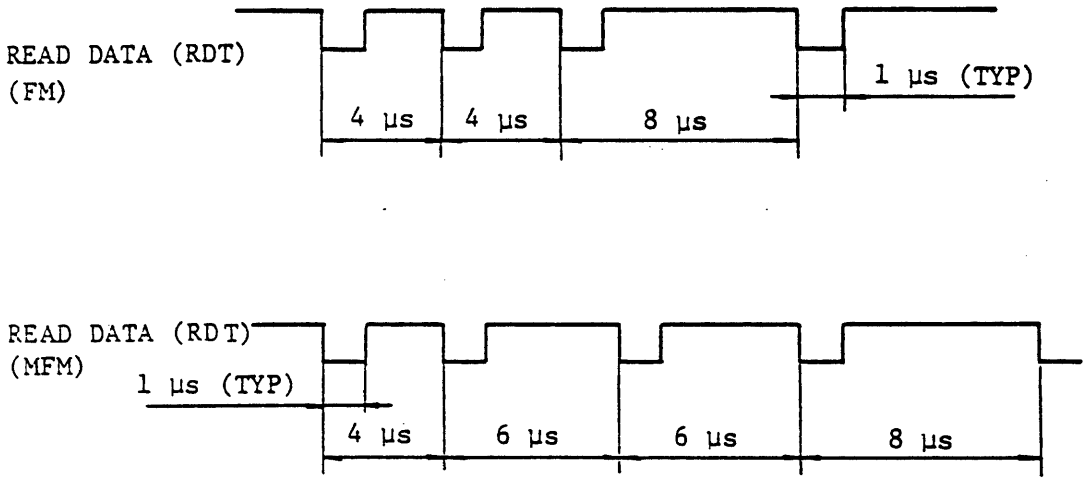


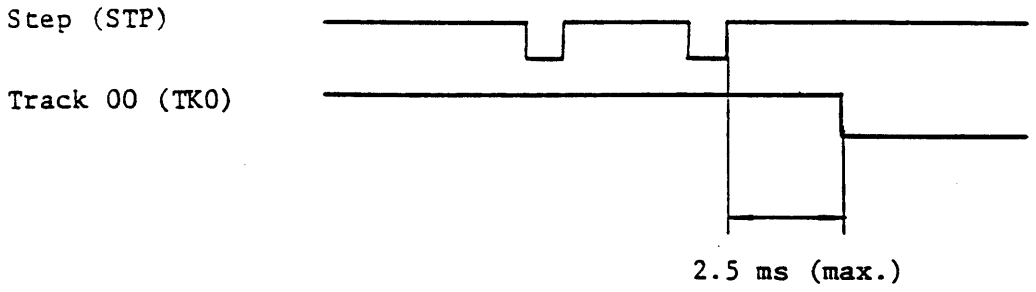
Fig. 3.9 READ DATA Signal Specification

3.5.5 WRITE PROTECT (PRT)

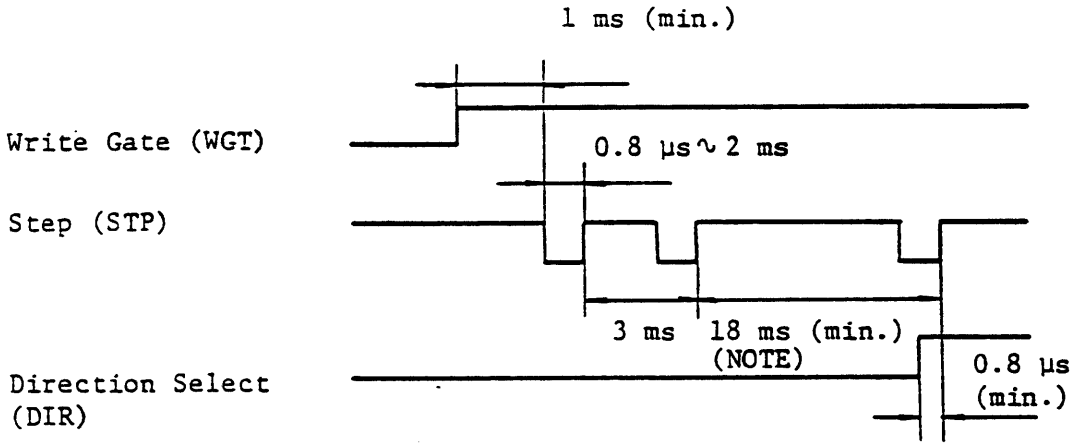
If a disk with its WRITE PROTECT hole uncovered is inserted into the drive, the PRT line goes low, which places the FDD in the WRITE PROTECT state.

3.6 Interface Signal Timing

3.6.1 Step and Track 00

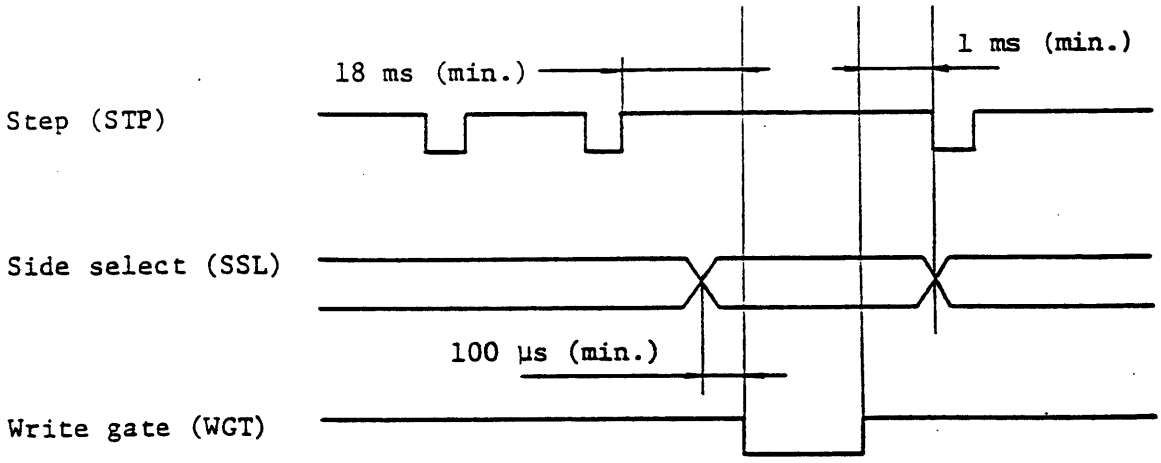


3.6.2 Access Timing

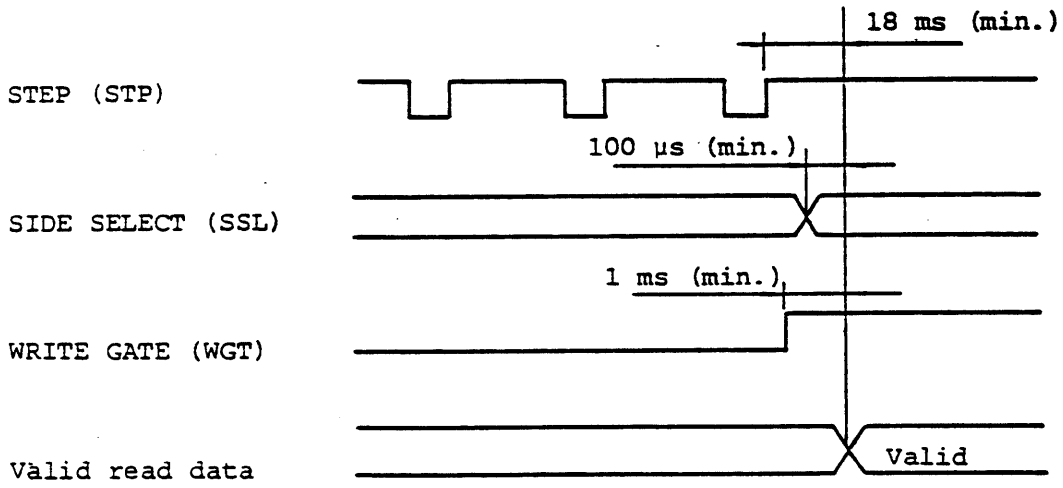


(NOTE) An interval of at least 18 ms is required between step pulses when the direction changes.

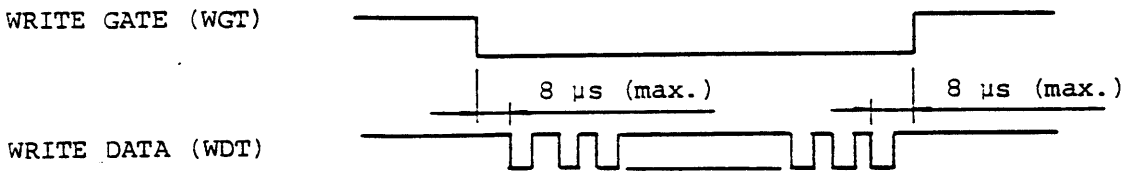
3.6.3 Write Timing



3.6.4 Read Timing



3.6.5 Write Data Timing



3.6.6 DRIVE SELECT and Output Signal Timing

The drive control and status signals are become valid 500 mS after that the DRIVE SELECT line is selected.

Only the MOTOR ON signal is independent of the DRIVE SELECT signal.

3.7 Power Interface

3.7.1 Input Power Specifications

Table 3.2 lists the DC power specifications for FDD.

A sequence for each DC power is not needed.

Table 3.2 Input Power Specifications

Item		+12 V power	+5 V power
Voltage		+12 V ±5%	+5 V ±5%
Current	Startup	540 mA	270 mA
	Steady-state	160 mA	410 mA
Ripple voltage (NOTE 1)		200 mVp-p or less	100 mVp-p or less

NOTE 1: This includes the spike voltage.

4. OPERATING PROCEDURES

The basic operating procedures for FDD include the power on/off, disk setting and removal.

4.1 Setting A Floppy Disk

(1) Turn on DC power.

(2) Insert the diskette slowly into the slot until the Eject button pops out.

4.2 Removing the Floppy Disk

(1) Make sure the write/read operation of FDD has finished.

(2) To eject the diskette from the drive, just press the Eject button.

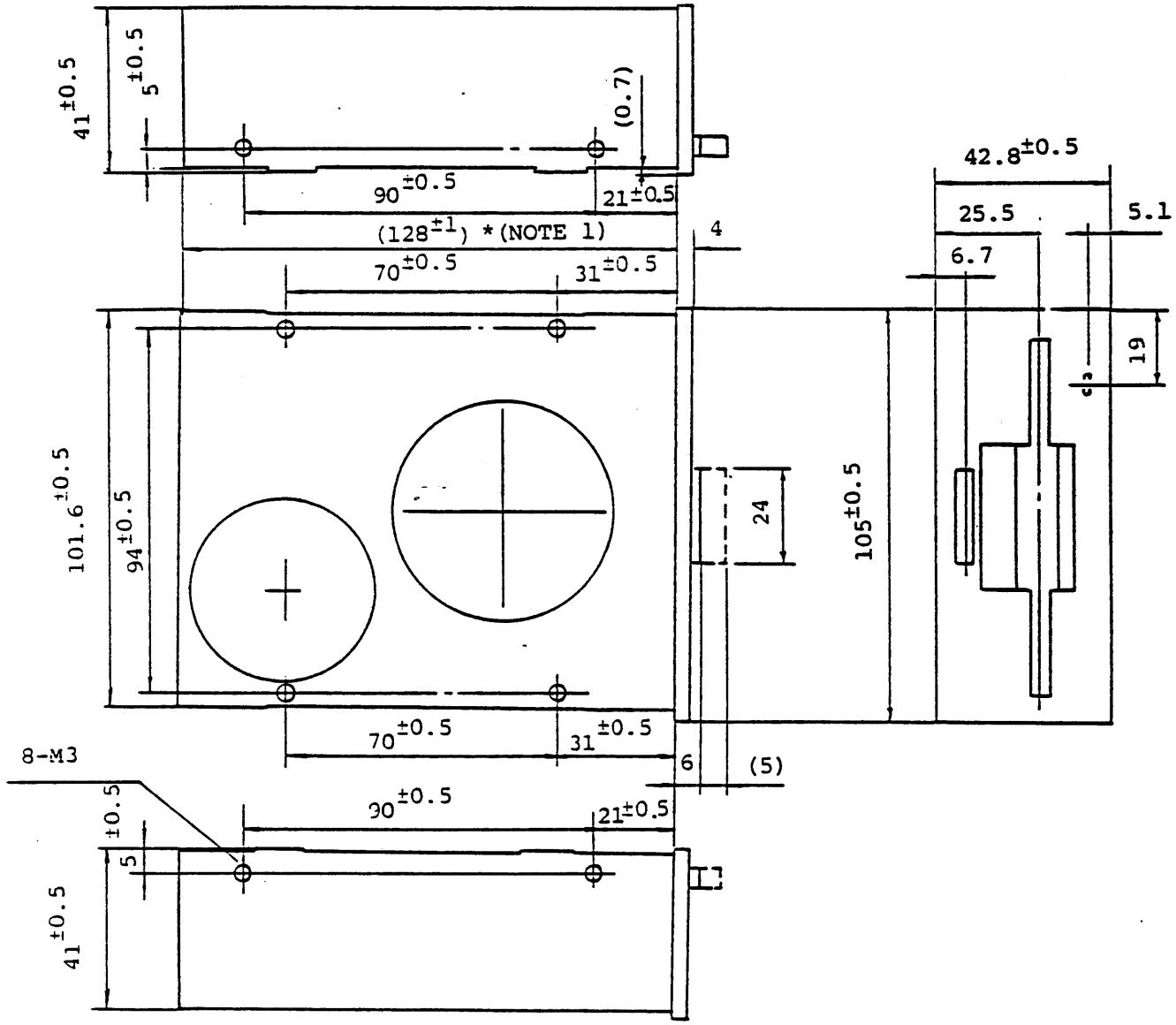
4.3 Display Lamp

The Display lamp indicates the FDD status. It comes on while heads are loaded.

5. EXTERNAL SHAPE AND INSTALLATION

5.1 External Shape and Fitting Hole Positions

Figure 5.1 shows the external shape and fitting hole positions.



NOTE 1: The faston terminal and cable are excluded from the size $128^{\pm 1}$.

Fig. 5.1 External Shape and Fitting Hole Positions

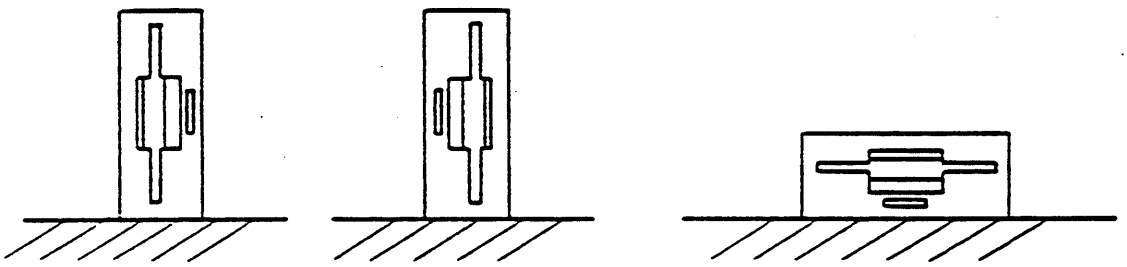
5.2 Installation

FDD may be installed in the following manners:

(a) Vertical

(b) Vertical

(c) Horizontal

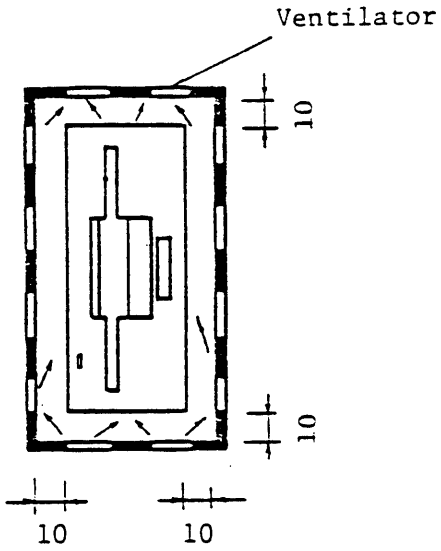


(a) (b) (c)

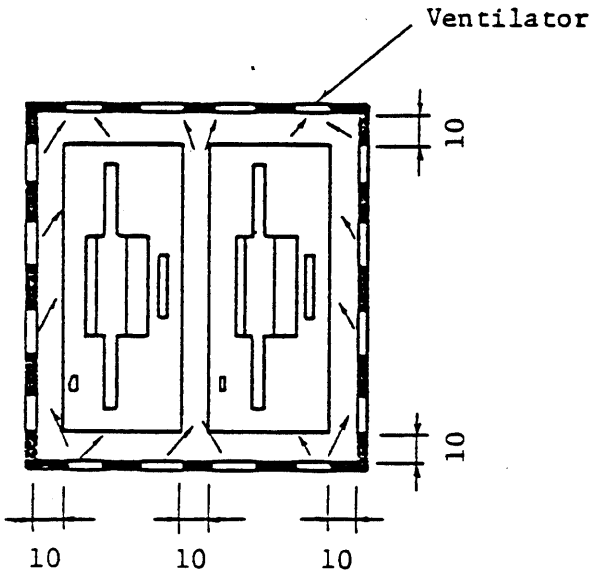
Consider the location of FDD in the system, so that it may be protected against the noise from CRT, power supply, etc., especially when installing it inside CRT.

5.3 Recommended Air Flow

(1) Installing one FDD



(2) Installing two FDDs



NOTE: Appropriate cooling is required if the ambient temperature around FDD rises considerably.

6. PACKING AND TRANSPORTATION

(1) For external packing, either use the packing material used in the carrying in of FDD of make sure no direct shock will be transmitted to FDD.

(2) Insert for packing the protective sheet used in the carrying in.

(3) Make sure that FDD will sustain no excessive shock during transportation.