

Specifications for MICRO FLOPPY DISK DRIVE SMD-280H(3m sec)

PRELIMINARY

暫 定

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EPSON

TABLE OF CONTENTS

	PAGE
General	1
Scope	2
General Features	2
General Specifications	
3.1 Performance Specifications	2
3.2 Physical Dimensions	3
3.3 Diskettes to be used	3
3.4 Reliability	3
3.5 Operating Conditions	3
3.6 Transportation and Storage Conditions	3
3.7 Power Supply	4
Safety Standards	5
Detailed Description of Functions	
4.1 Electronic Circuitry	5
4.2 Read/Write Heads	5
4.3 Head Positioning	7
4.4 Spindle Motor	7
4.5 Auto Injection and Auto Ejection (optional)	7
4.6 Sensors	8
4.7 In-Use LED	8
4.8 Power Save Function	8
Electrical Interfacing	
5.1 Input and Output Signal Specifications	9
5.2 Functions of Input Signals	10
5.3 Output Signals	13
Timing	15
Physical Interfacing	18
7.1 Power Connector	18
7.2 Signal Connector	18
7.3 Installation	18
7.4 Physical Dimensions and Mounting Holes	21

GENERAL

The EPSON SMD-280H(3msec) is a very low profile, high reliability 3.5 inch Micro Floppy disk drive. Together with its low power consumption feature, it is especially suitable for portable computer usages.

Standard profile Micro Floppy disk drives were actually compact compared with 5.25 inch drives but not compact enough to integrate into a hand held computers.

EPSON, the leader of double sided Micro Floppy disk drives has developed a compact, high density, and very low profile drive.

Some of key features are auto eject and inject functions which realize very easy and fool proof operation.

A storage capacity of 1 MB unformatted data is achieved using 135 TPI double sided technology.

1. Scope

This document describes the features, functions, installations and interfacing of the EPSON SMD-280H(3msec) micro floppy disk drive.

2. General Features

1. low profile of 28mm.
2. low power consumption of 1.6W
3. light weight of 460 g.
4. single power supply (5V)
5. fast track to track access of 3msec.
6. Options: Auto ejection
Auto injection

3. General Specifications

3.1 Performance Specifications

Capacity (MFM recording)

Unformatted

Per Disk	1000 kbytes
Per Surface	500 kbytes
Per Track	6.25 kbytes

Formatted (16 sectors/track)

Per Disk	656 kbytes
Per Surface	328 kbytes
Per Track	4.1 kbytes

Number of Tracks

Per Disk	160
Per Surface	80

Maximum Recording Density 8717 bits/inch

Track Density 135 tracks/inch

Transfer Rate 250 kbits/sec

Average Latency 100 msec

Access Time (Track to Track) 3 msec

Settling Time 15 msec

Motor Start Time 0.5 sec

Disk Rotation Speed 300 rpm

2 Physical Dimensions

- | | |
|-------------|--------------------------------|
| (1) Width: | 101.6 mm (4 in.) |
| (2) Depth: | 149.5 mm (5.88 in.) |
| (3) Height: | 28.0 mm (1.1 in.) |
| (4) Weight: | 460 g (1 lbs. without options) |

SEE Sec.7 (Fig.18 DIMENSIONS AND MOUNTING HOLE LOCATIONS)

3 Diskettes to be used

3.5 inch micro floppy diskettes prepared according to ANSI X3B8 draft. Double sided, 135 TPI, certified up to trk 79.

4 Reliability

MTBF	10,000 power on hours
Preventive Maintenance	not required
MTTR	30 min
Error Rates	
Soft Error Rate	1 per 10^9 bits or better
Hard Error Rate	1 per 10^{12} bits or better
Seek Error Rate	1 per 10^6 seeks or better
Media Life	3 million passes on a single track
Design Life	5 years

5 Operating Conditions

- | | |
|-----------------------------------|--|
| (1) Temperature: | 4 to 45°C (within the range specified for the diskette used) |
| (2) Humidity: | 20 to 80% R.H. (no condensation) |
| (3) Maximum wet-bulb temperature: | 29°C |
| (4) Vibration: | 5 to 500Hz, 0.6 G or less |
| (5) Impact: | 5G or less |

6 Transportation and Storage Conditions

- | | |
|------------------|---|
| (1) Temperature: | -40°C to 65°C (transportation)
-20°C to 65°C (storage) |
| (2) Humidity: | 95% R.H. or less |
| (3) Vibration: | 5Hz to 500Hz, 3 G or less |
| (4) Impact: | 50 G or less |

3.7 Power Supply

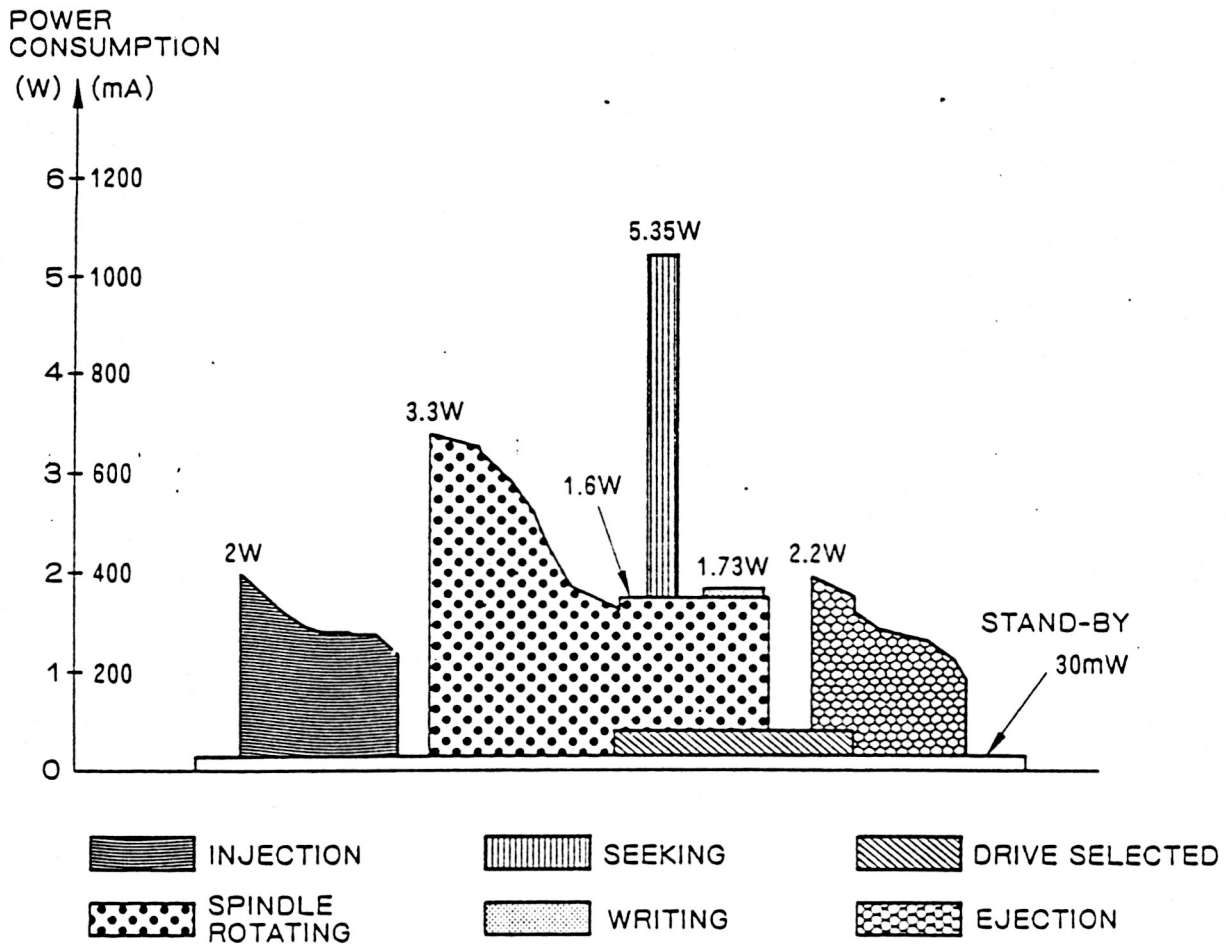
+5V (+10%, -5%)

Operation: 0.32A

Maximum: 1.3 A

Permissible ripple: 100 mVpp (max)

FIG.1 POWER CONSUMPTION DIAGRAM
(Typical values for 3ms step rate mode)



3.8 Safety Standards

UL standard (to be approved)
CSA standard (to be approved)

4. Detailed Description of Functions

4.1 Electronic Circuitry

A custom made CMOS chip contains all the logic circuitry which reduces both number of components and power consumption. Analog circuitry is also integrated within a single chip operatable at 5V. All control and read/write circuitry are contained on a main board and spindle motor circuit is integrated with motor itself.

The control circuit consists of:

- (1) Read/write logic and amplifier
- (2) Stepper motor control circuit
- (3) Spindle motor control circuit
- (4) Side select circuit
- (5) Track 00 detector
- (6) Index detection circuit
- (7) Write protect sensor circuit
- (8) Cartridge-In sensor control circuit

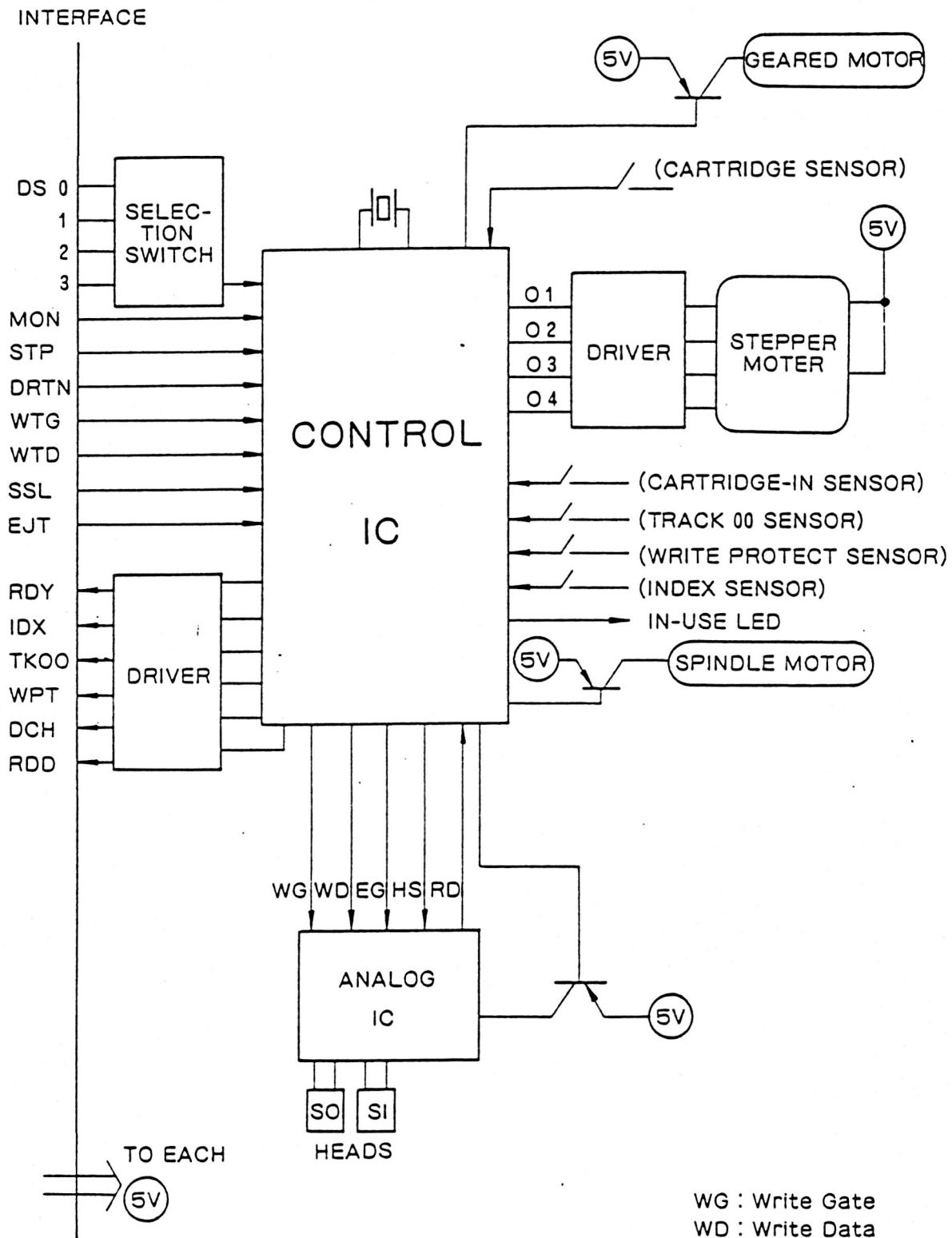
SEE Fig.2 CIRCUIT DIAGRAM

4.2 Read/Write Heads

The read/write heads are tunnel erase type manganese zinc ferrite heads.

The bulk type head reproduces a higher voltage signal, is less sensitive to external noises, and provides a very low profile.

FIG.2 CIRCUIT DIAGRAM
(Including Options)



WG : Write Gate
WD : Write Data
EG : Erase Gate
HS : Head Select
RD : Read Data

4.3 Head Positioning

We combined a 20 mm in diameter P.M.(Permanent Magnet) type stepper motor with a lead screw mechanism to realize a very low profile and fast access.

Quick access is attributed to the high torque/low inertia of the motor magnet.

One feature of this mechanism is that head carriage remains in the same position when stepper motor is not energized by use of a magnetic detent and lead screw mechanism; cutting off the power unless it is seeking.

This high performance motor together with the special magnet is proprietary to EPSON.

4.4 Spindle Motor

We use a very low profile Direct Drive motor.

4.5 Auto Injection and Auto Ejection (optional)

INJECTION

When disk is inserted about 75 mm into the drive, a cartridge sensor detects the presence of the disk and activates the geared motor, pulling in the cartridge with a lever to the proper position onto the chucking hub.

When the cartridge is seated properly, the cartridge-in sensor becomes active and the geared inject motor is turned off. Diskette can also be loaded manually when power is off.

EJECTION

An eject signal makes another half turn of the geared motor; ejecting the cartridge. This signal is gated with the drive select signal.

Removal of the disk from the drive is realized by two means.

1. Activating the disk eject interface signal.
2. When the power supply is off, push the eject button deeply.

These automatic functions are optional and system designer can choose both functions or only auto ejection.

Auto mechanisms are totally integrated in the main frame and no protrusion to the rear of the unit exists.

SEE Sec.6 (Fig.12 AUTO INJECT/EJECT)

4.6 Sensors

Track 00 sensor:
optical sensor

Cartridge-In Sensor:
mechanical micro switch

Write Protect Sensor:
mechanical micro switch

Index Sensor:
magnetic sensor

4.7 In-Use LED

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

4.8 Power Save Function

SMD-280H(3msec) is equipped with several electronic switches to cut off the power line when each component is not in operation.

During STAND-BY mode: (Motor On signal is HIGH or Cartridge is out)

Power supply to motors and analog IC is cut off.

Power is supplied only to control IC to receive the commands from the host.

Stepper motor is not energized when not seeking.

SEE Fig.1 POWER CONSUMPTION DIAGRAM

5. Electrical Interfacing

Up to four SMD-280H(3msec) units can be connected to a host system with the daisy chain configuration.

5.1 Input and Output Signal Specifications

OUTPUT LOGIC LEVELS

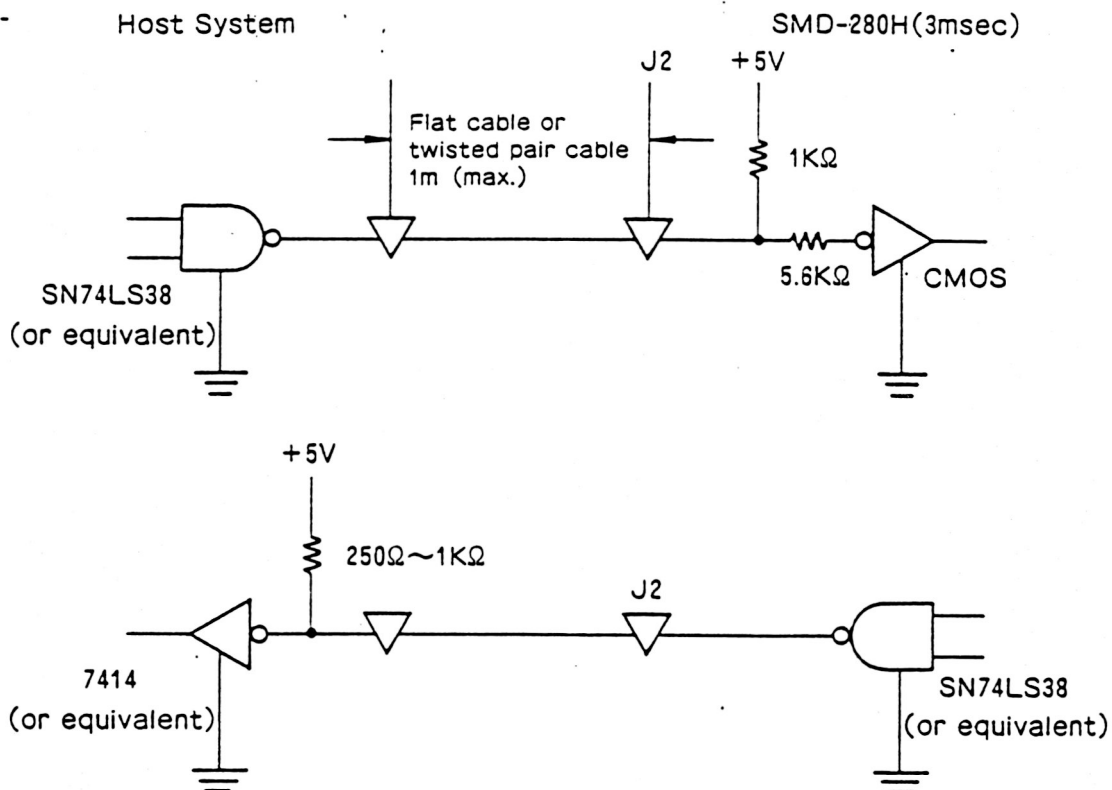
"Low" = True	Vin: 0 to 0.4V Iin: 20 mA (max)
"High" = False	Vin: 2.5 to 5.5V Iin: 0 mA (open)

INPUT LOGIC LEVELS

"Low" = True	Vin: 0 to 0.4V Iin: 6 mA(min)
"High" = False	Vin: 2.5 to 5.5V Iin: 0 mA (open)

To reduce the power consumption, SMD-280H(3msec) uses SN74LS38 instead of SN7438. So maximum driving current is 20mA. Conventional pull-up resistor of 150 Ω is too low for this drive. Please design your interface circuit that its pull-up resistors are more than 250 Ω . Signal interface cable has to be less than 1 m in length.

FIG.3 SIGNAL INTERFACE CIRCUITS



5.2 Functions of input signals

(1) Drive select 0 to 3 (DS0-DS3)

These signals select the drive address to be used. The address of each drive is determined by setting the short plug on the main PCB. This signal validates all the signals other than Motor On and Side Select.

(2) Motor On (MON)

The spindle motor starts rotating when the MON signal goes LOW when diskette is present. This signal is not gated with Drive Select signal. The diskette reaches normal rotation within 500 msec after MON signal goes active.

(3) Direction (DRTN)

The DRTN signal determines the direction of the stepper motor which positions the read/write heads when the Step signal is received. The heads move inward when the DRTN signal is LOW, and outward when HIGH.

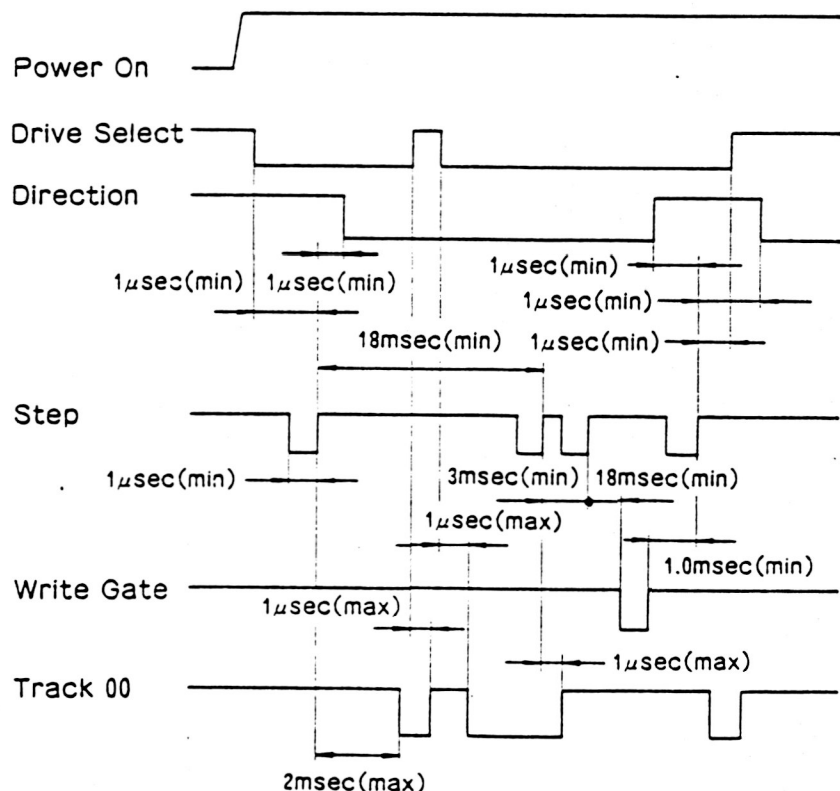
(4) Step (STP)

Pulse signal which moves the heads. One step is made in the direction determined by DRTN signal each time the STP signal goes HIGH. The period of STP pulses should be 3 msec or more.

The STP signal is ignored when the Write Gate (WTG) signal is LOW.

FIG.4 TRACK SEEK TIMING

(When head is on track 00)



(5) Write Gate (WTG)

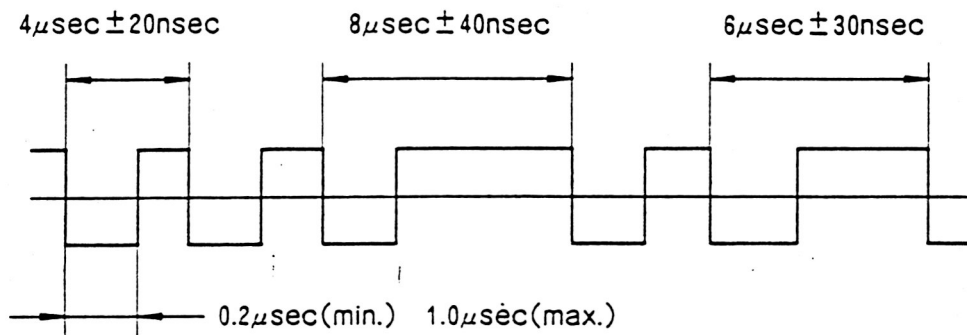
Write data is valid when the WTG signal is LOW. Writing to the write protected diskette is internally inhibited. Write protection is made when the write protect hole is open on the cartridge. The drive is equipped with protection circuit to reduce the possibility of the data damage which may occur during power on and off sequences. Erasing ends 1 msec after WTG goes HIGH.

(6) Write Data (WTD)

This signal represents data to be written on the diskette. The read/write head current is reversed when the this signal changes from HIGH to LOW.

This signal is valid when the WTG signal is LOW.

FIG.5 WRITE DATA TIMING



(7) Side Select (SSL)

This signal selects the read/write head to be used.

LOW : side 1 (upper head)
HIGH : side 0 (lower head)

Side Select changing within 1 msec after WTG become inactive is internally delayed.

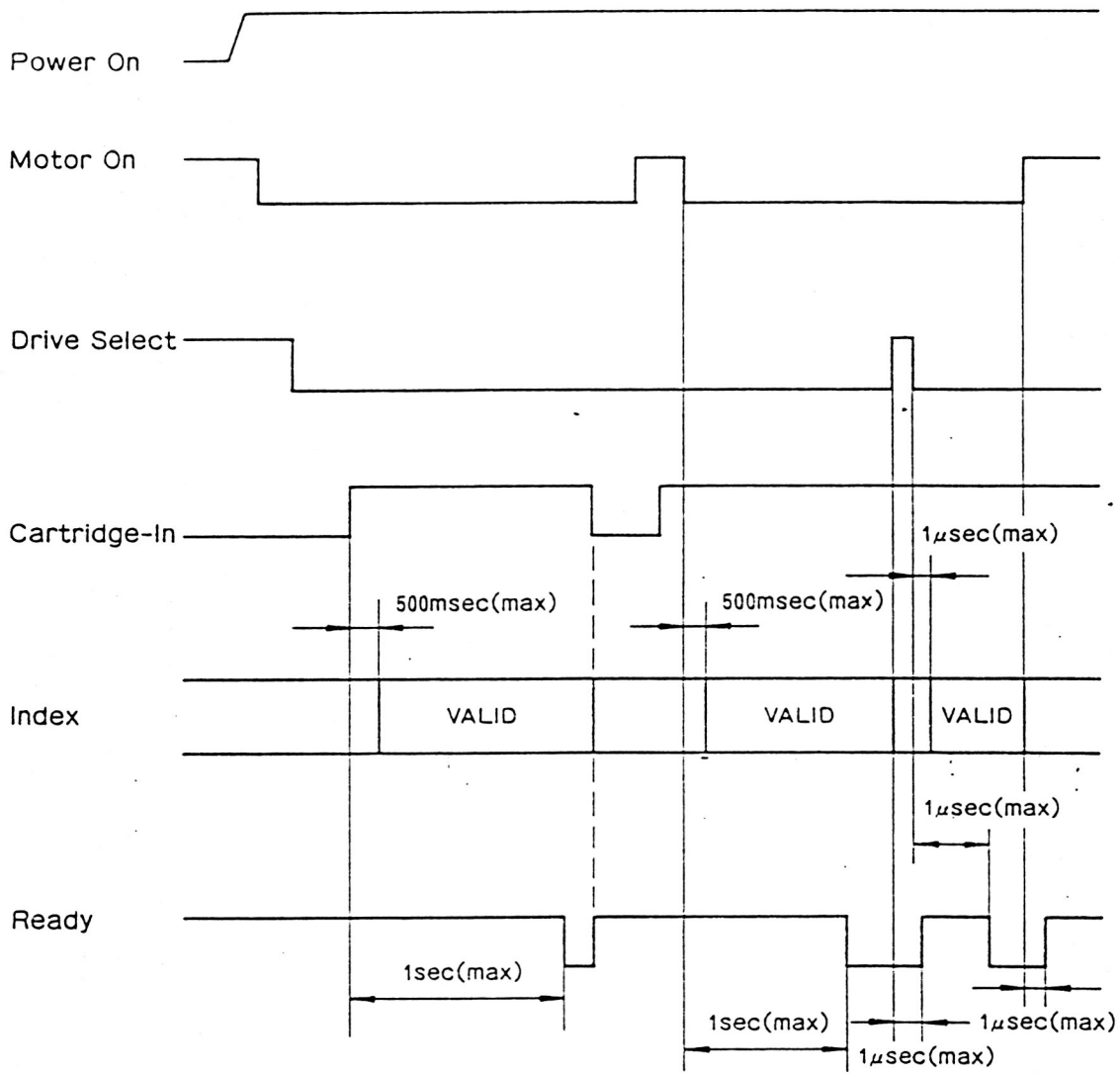
(8) Eject (EJT) (option)

The falling edge of Eject signal triggers the auto ejection of the diskette.

The signal is gated with Drive Select signal.

SEE Sec.6 (Fig.12) FOR TIMING

FIG.6 READY SIGNAL TIMING



Cartridge-In*: "HIGH" when cartridge is inserted into the drive.
 "LOW" when cartridge is removed from the drive.

5.3 Output Signals

(1) Ready (RDY)

The RDY signal goes LOW when diskette is inserted and is rotating normally which is within 1 sec after MON goes active. The SMD-280H(3msec) has a detection circuit which uses the Index signal to determine whether a diskette is loaded and properly rotating.

SEE Fig.6 READY TIMING

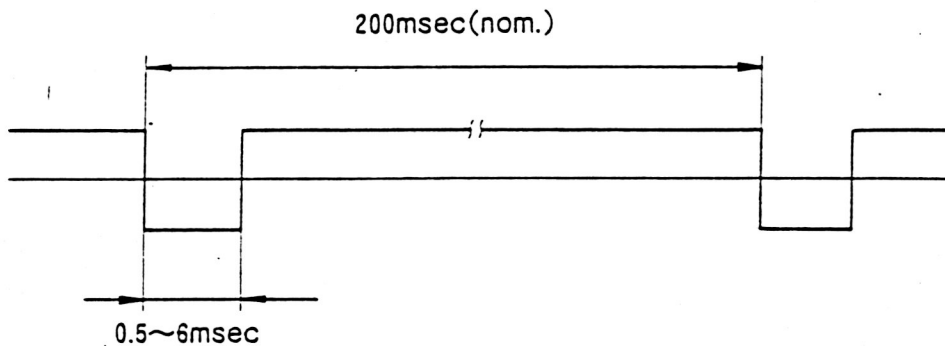
(2) Track 00 (TK00)

The TK00 signal goes LOW when the read/write head is positioned on track 00, the outermost track of the diskette.

(3) Index (IDX)

One LOW pulse is generated per revolution of the spindle. The falling edge of this pulse indicates the beginning of the track.

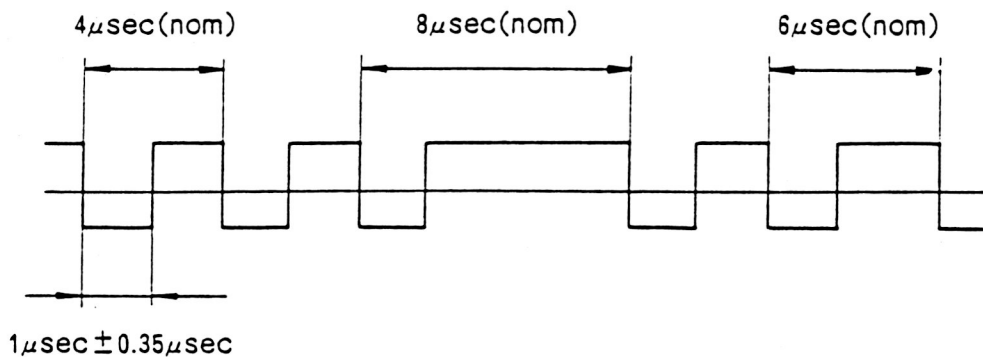
FIG.7 INDEX PULSE TIMING



(4) Read Data (RDD)

The RDD signal outputs the series of data pulses read by the head. This signal is normally HIGH, and goes LOW whenever a magnetic reversal exists on the diskette.

FIG.8 READ DATA TIMING



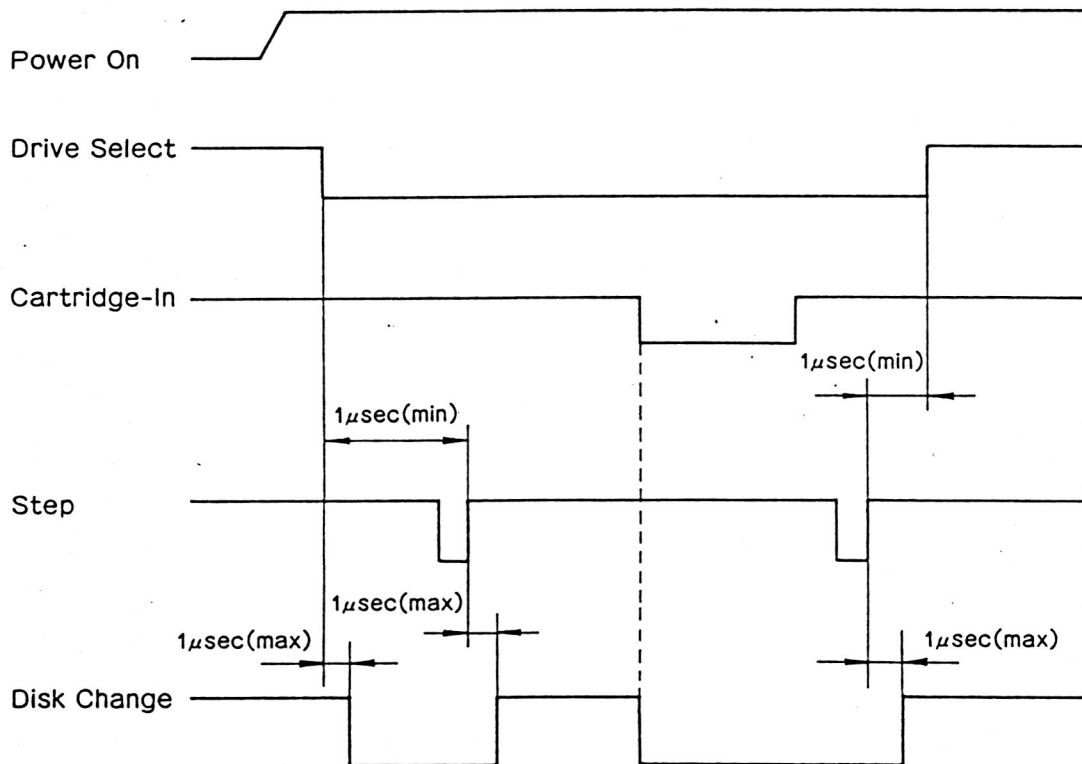
(5) Write Protect (WPT)

The WPT signal goes LOW when the diskette inserted is write-protected.
Writing on write protected diskette is internally inhibited.

(6) Disk Change (DCH)

The purpose of this signal (LOW active) is to tell the host system that the diskette has once been removed from the drive.

This signal goes LOW each time power is turned on; reset by Step pulse.

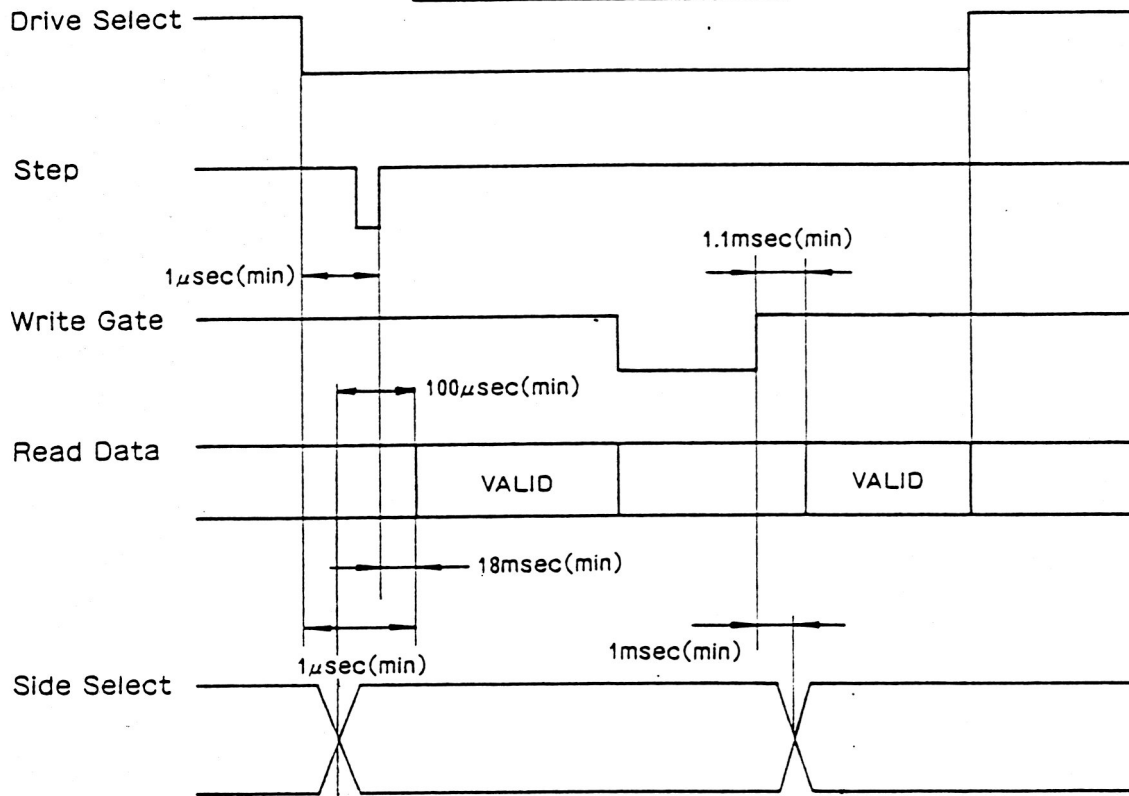
FIG.9 DISK CHANGE SIGNAL TIMING

Cartridge-In*: "HIGH" when cartridge is inserted into the drive.
"LOW" when cartridge is removed from the drive.

6. Timing

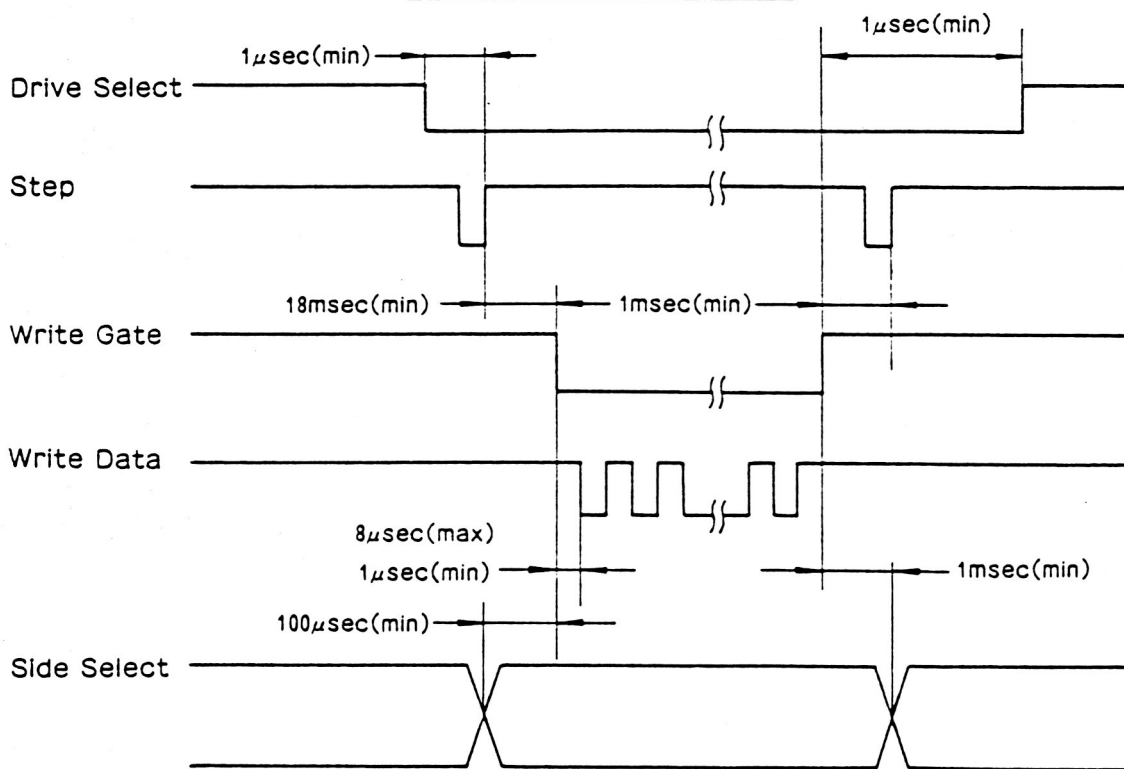
(1) Read Start Timing

FIG.10 READ START TIMING

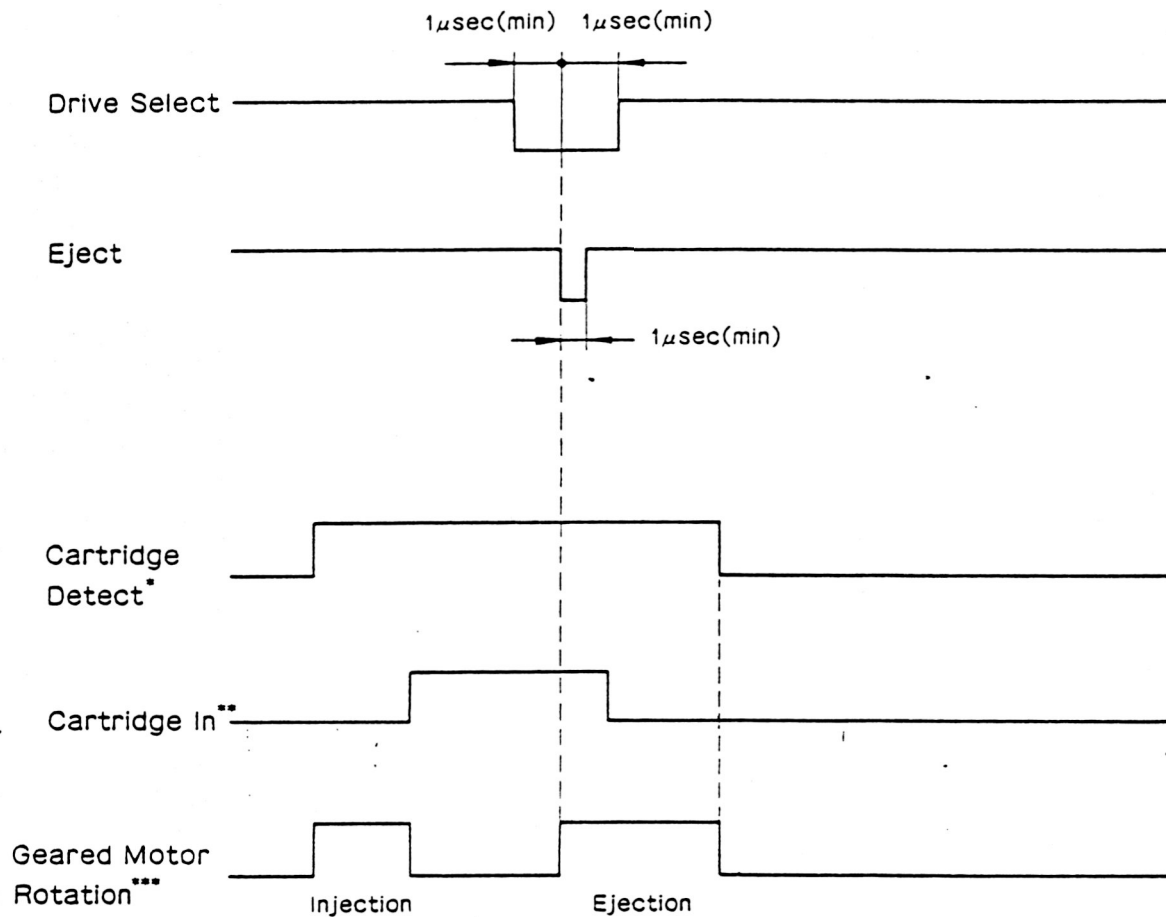


(2) Write Start Timing

FIG.11 WRITE START TIMING



(3) Auto eject and Inject Timing

FIG.12 AUTO INJECT/EJECT

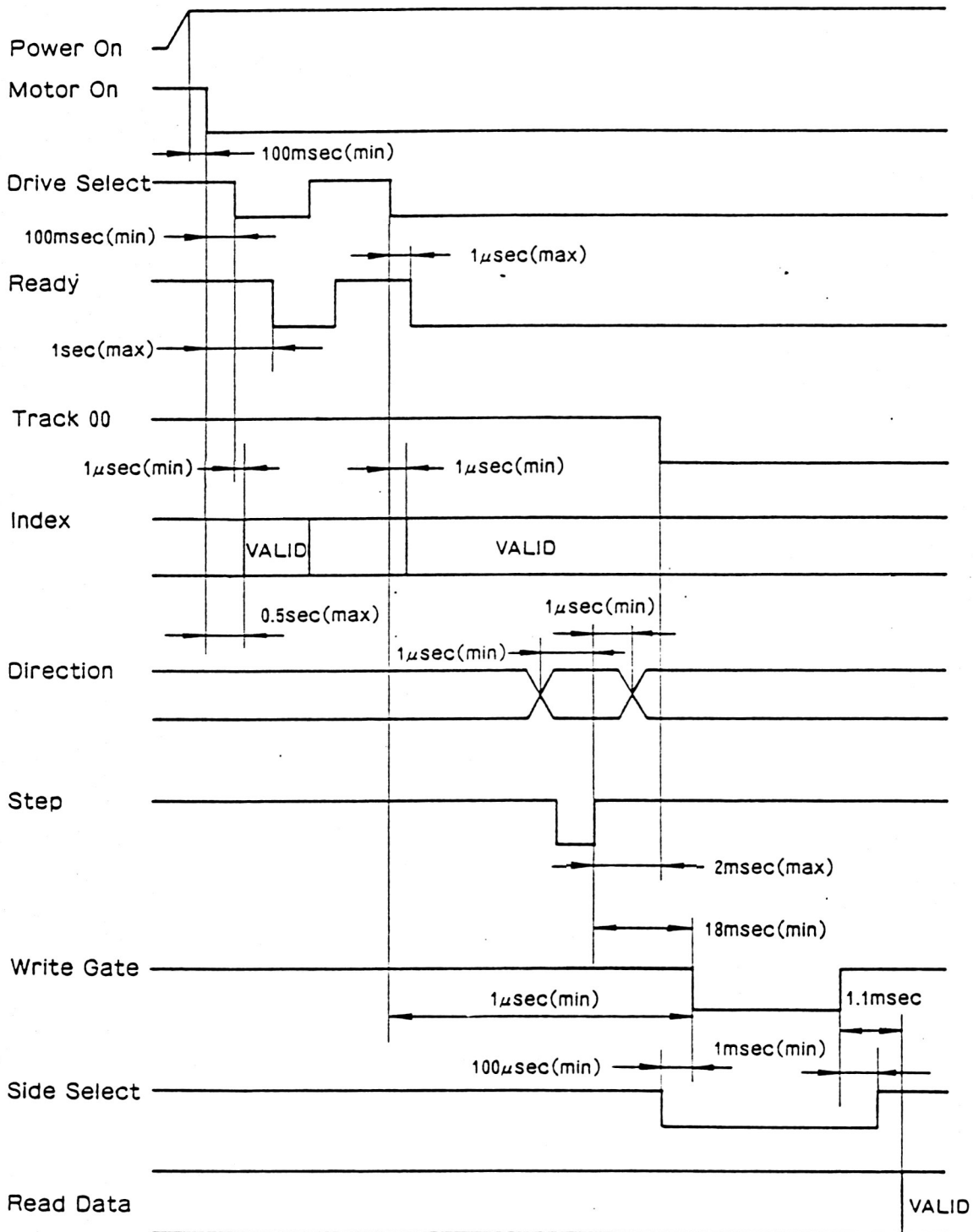
Cartridge Detect* "HIGH" when cartridge is inserted more than about 75mm into the drive.
 "LOW" when cartridge is removed from the drive perfectly.

Cartridge In** "HIGH" when cartridge is inserted into the drive.
 "LOW" when cartridge is removed from the drive.

Geared Motor Rotation*** "HIGH" when the geared motor is rotating, "Injection" is inject action
 and "Ejection" is eject action.
 "LOW" when the geared motor is not rotating.

(4) Control Data Timing

The following charts show signal timings.

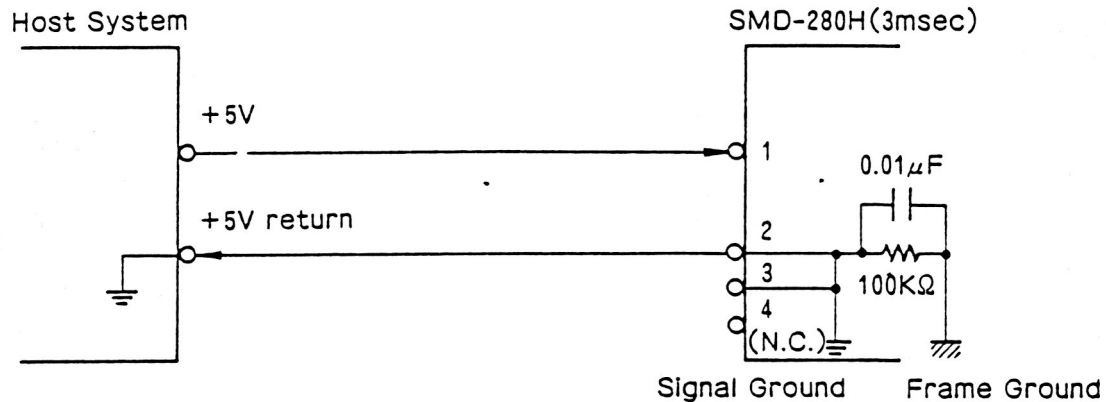
FIG.13 CONTROL DATA TIMING

7. Physical Interfacing

7.1 Power Connector

DC power supply connector J1 is installed on the main PC board.
Suggested mating connector is AMP P/N 171822-4(housing) and 170262-1(pin).

FIG.14 POWER CONNECTOR



7.2 Signal Connector

Up to four SMD-280H(3msec) Micro Floppy disk drives can be connected in a daisy chain configuration. The power supply interface requires +5V only.

The following connector parts are suggested to be provided by the customer.

JAE PS-34SE0-D4Pl-1C(closed type)
or
PS-34SE0-D4Pl-1D(for daisy chain connection)

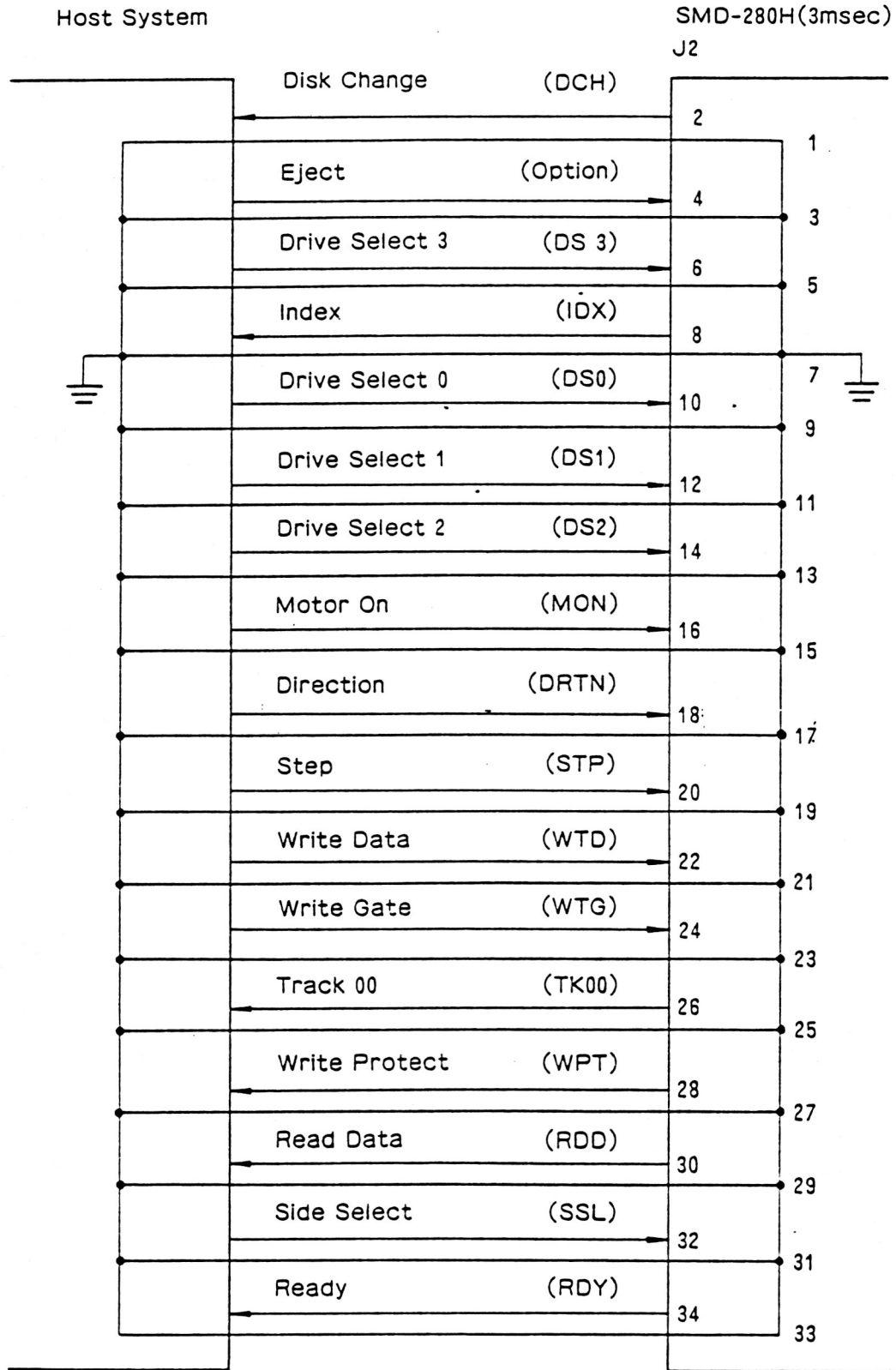
SEE Fig.15 and Fig.16

7.3 Installation

Three orientations.

SEE Fig.17

FIG.15 SIGNAL LINE



**FIG.16 CONNECTOR LOCATIONS
(REAR VIEW)**

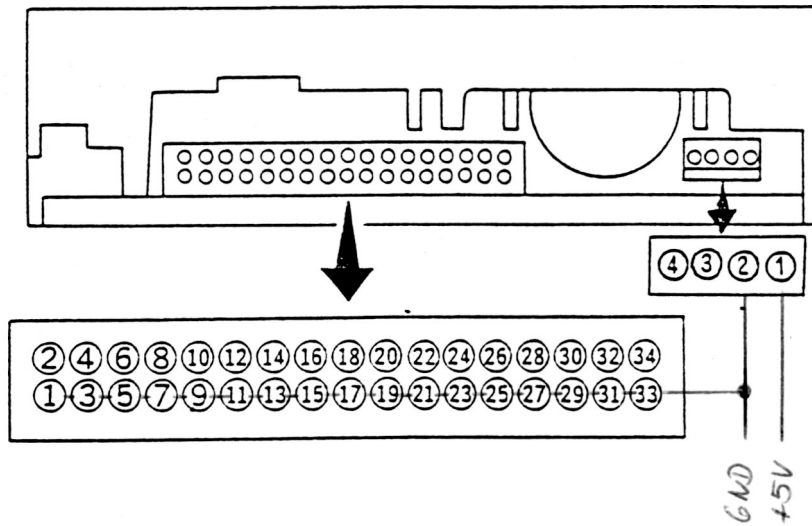
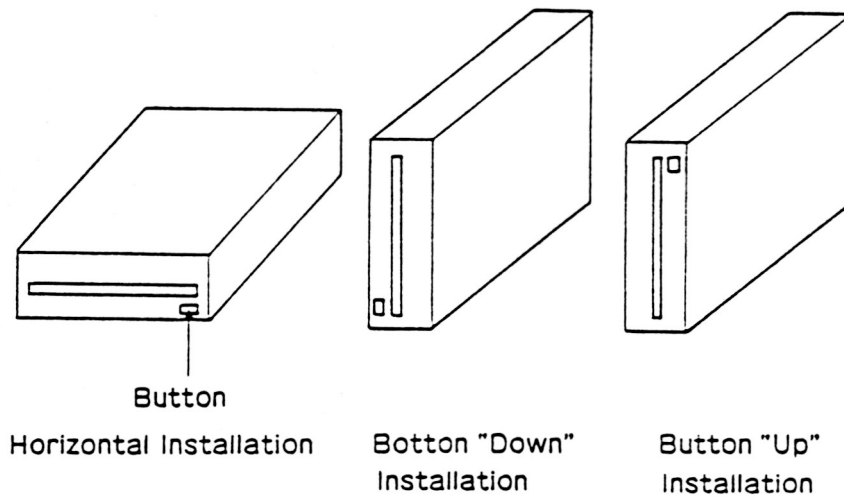


FIG.17 INSTALLATION



7.4 Physical Dimensions and Mounting Holes

FIG.18 DIMENSIONS AND MOUNTING HOLE LOCATIONS
(BOTTOM VIEW)

