

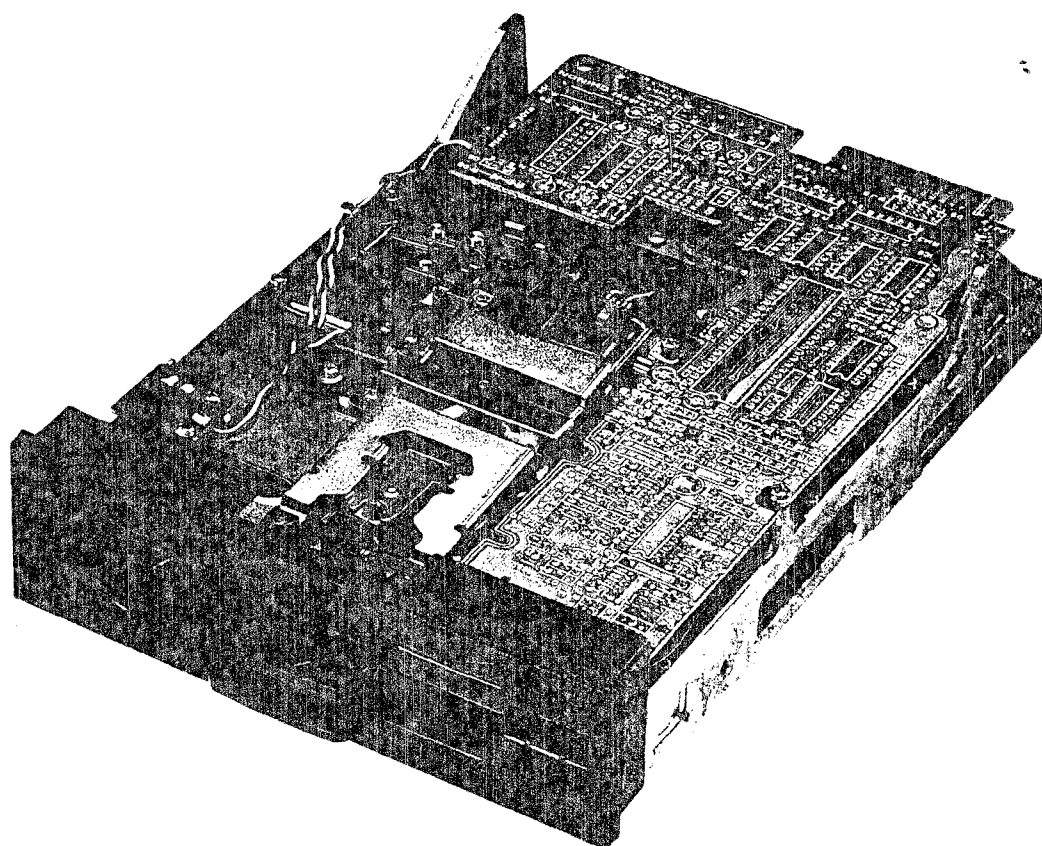
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**CHINON**

**5-1/4" FLOPPY DISK DRIVES**

**SPECIFICATIONS**

**MODEL: F-504 (96 TPI, DOUBLE SIDES)**



**CHINON INDUSTRIES, INC.**

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## GENERAL DESCRIPTION

The F-504 minifloppy disk drive has been designed as a system peripheral with the highest standards of design and construction. The drive however, must depend upon its host equipment to receive adequate power and environment in order to provide optimum performance along with compliance to applicable industry regulations. Special attention must be given to the areas of safety, power distribution, shielding, audible noise control, and temperature regulation of the device to ensure specified performance, and compliance with applicable regulations.

The F-504 minifloppy disk drive is a member of a family of low-cost, high-performance, highly reliable random access storage devices designed to meet the needs of the OEM market.

### 1. PURPOSE

This product specification applies to the double sided minifloppy disk drive, model F-504.

## 2. SPECIFICATIONS

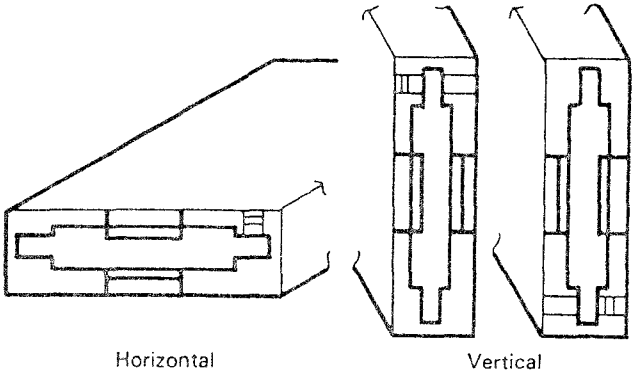
### 2-1. Specification (1)

Item			Specification	
			Double density	Single density
Storage capacity	Unformatted	Per disk	1 M bytes	500 K bytes
		Per track	6.25 K bytes	3.125 K bytes
	Formatted (Equivalent to IBM format)	Per disk	655.36 K bytes	327.68 K bytes
		Per track	4096 bytes	2048 bytes
Recording density			5922 BPI	2961 BPI
Rate of data transfer			250 K bits per second	125 K bits per second
Access time	Power-on to ready time		0.5 sec. or less	
	Single track seek time		3 ms per track	
	Average access time		100 ms	
	Settling time		20 ms	
	Average latency time		100 ms	
Rotation speed			300 rpm	
Long term speed variation			Less than +1.5%	
Instantaneous speed variation			Less than +1.5%	
Number of tracks			160	
Number of heads			2	
Radius of track	Outer		O side: 57.151 mm	I side: 55.034 mm
	Inner		36.249 mm	34.132 mm
Number of indexes			1	
Recording mode			MFM	FM
Track density			96 TPI	

## 2-2. Specification (2)

Item	Specification		
Physical dimensions	146 (W) × 41 (H) × 220 (D) mm		
Weight	Approx. 1.2 kg		
Power supply	DC +12 V ± 5%		
	DC +5 V ± 5%		
Power consumption	DC +12 V	Standby current	60 mA TYP. (Spindle moter stopped)
		Start current	900 mA Max. (0.5 sec or less)
		Operation current	250 mA TYP.
		Maximum operation current	600 mA
	DC +5V	Standby current	400 mA TYP.
		Operation Current	450 mA TYP.
Maximum operation current		600 mA	
Ripple voltage allowance	DC +12 V	Less than 200 mVp-p (including spike noise)	
	DC +5 V	Less than 100 mVp-p (including spike noise)	
Insulation	80 K $\Omega$ MIN at DC 50V (Between FG and SG)		
Cabinet specifications	Front panel	Material: ABS	Color: Black
	Front door	Material: ABS	Color: Black

### 2-3. Installation Conditions

Item				
Mounting position	 <p style="text-align: center;">Horizontal                      Vertical</p> <p style="text-align: center;">Keep the horizontal level to within 15 degrees with front panel raised.</p>			
Environment conditions	Temperature	During operation	5 ~ 45°C (disk section: 10 ~ 50°C)	
		During non-operation	0 ~ 50°C	
		During storage	-20 ~ 60°C	
		During Transit	-40 ~ 62°C	
	Humidity	During operation	20 ~ 80% RH Maximum wet bulb temperature 29°C	
During non-operation		5 ~ 90% RH No dew condensation		
During storage		8 ~ 90% RH No dew condensation		
Temperature change 15°C/H				
Vibration	During operation	Continuous vibration	Amplitude Less than 7 mm 5 ~ 25 Hz 3G 25 ~ 100 Hz	
		Single vibration	Less than 10G (10 ms)	
	During non-operation and storage (With protect sheet)	Continuous vibration	Amplitude Less than 7 mm 5 ~ 9 Hz 3G 9 ~ 100 Hz	
		Single vibration	Less than 30G (10 ms)	
Drop shock	Fall height in packing State: 70 cm (corner: one time, sides: three times, flat surfaces: six times)			

## 2-4. Reliability specifications

Item		Specification	
Drive	MTBF	10,000 POH	
	MTTR	0.5 H	
	Drive life	Five years	
Error rate	Software errors	$10^{-9}$ times/bit (with 2 times retry)	
	Hardware errors	$10^{-12}$ times/bit	
	Seek errors	$10^{-6}$ times/seek	
Life	Media	Number of identical track passes	$3.5 \times 10^6$ passes or more
		Number of seek passes	$10^7$ passes or more
		Number of mountings	$1 \times 10^4$ times
	Drive	Number of mountings of the media	$3 \times 10^4$ times or more
		Seek	$10^7$ seeks or more
		Head	10,000 H or more

\* Maintenance is not required under normal use conditions.

## 3. FEATURES

### 3-1. Drive configuration

The F-504 minifloppy disk drive consists of read/write and control logic, a drive mechanism, a read/write head and a track positioning mechanism.

Their functions are:

- Control signal interface
- Positioning of read/write head on tracks
- Data read/write
- Rotation of disk

### 3-2. Read/write and control logic

All necessary circuitries are on one printed circuit board (P.C.B.).

- Drive select logic
- Index/sector detection logic
- Positioning control circuit (drive stepping motor)
- Write protection logic
- Track 00 detection logic
- Drive motor control logic
- "Ready" logic
- Software interlock circuit
- Read circuit (with comparator)
- Write circuit

Connection with the host computer is to be made through 2 signal connections on the printed circuit board.

### **3-3. Spindle drive mechanism**

The spindle drive motor operates on 12V DC and turns the spindle directly at the speed of 300 rpm. The media is clamped on the spindle with a centering-cone operated by a clamp-lever.

### **3-4. Track positioning mechanism**

Positioning of head carriage is accomplished by the steel belt driven by a stepping motor. Thus, positioning of the R/W head is controlled by step pulses to the stepping motor.

### **3-5. Read/write head**

The R/W head of F-504 is a ceramic module single gap head. Track-to-track erasing is accomplished by the tunnel-erase portion of the head surface to insure interchangeability of the media. The R/W head is mounted on the head carriage and is driven by stepping motor through a steel belt on a guide rail. The disk media is loaded between the upper and lower heads then operated to transfer data. The surface of the R/W head is designed to minimize wear of the head and media and to carry out read/write operations efficiently.

### **3-6. Operation checking LED indicator**

In the following conditions, the operation checking LED indicator lights up.

- (1) When the DRIVE SELECT signal which has the same number of the turned ON short plug of DS0 – DS3 when MX short plug is OFF becomes low.
- (2) When the IN USE signal is low.

### **3-7. Power drift**

Voltage drift can occur during any sequence of operations. To avoid write errors during voltage drift, the DC control logic disables write operations.

### **3-8. Pop-up mechanism**

F-504 has a media pop-up mechanism for correct media insertion. When the media is inserted into the media slot, the pop-up spring is latched and the media is locked in a secure position. The media is loaded by closing the drive door. When the drive door is opened to unload the media, the pop-up latch mechanism is released and the media is ejected from the slot. If the media is not inserted properly, it is automatically ejected by the unlatched pop-up spring.

### **3-9 Front door mechanism**

The door opening and closing mechanism is of a one-touch design to enhance ease of operation during use.

By simply inserting the media and lightly pinching the door opening/closing lever, the media is loaded.

When removing the media, all you have to do is pinch the door opening/closing lever lightly in the same manner. The pop-up mechanism will then eject the media.

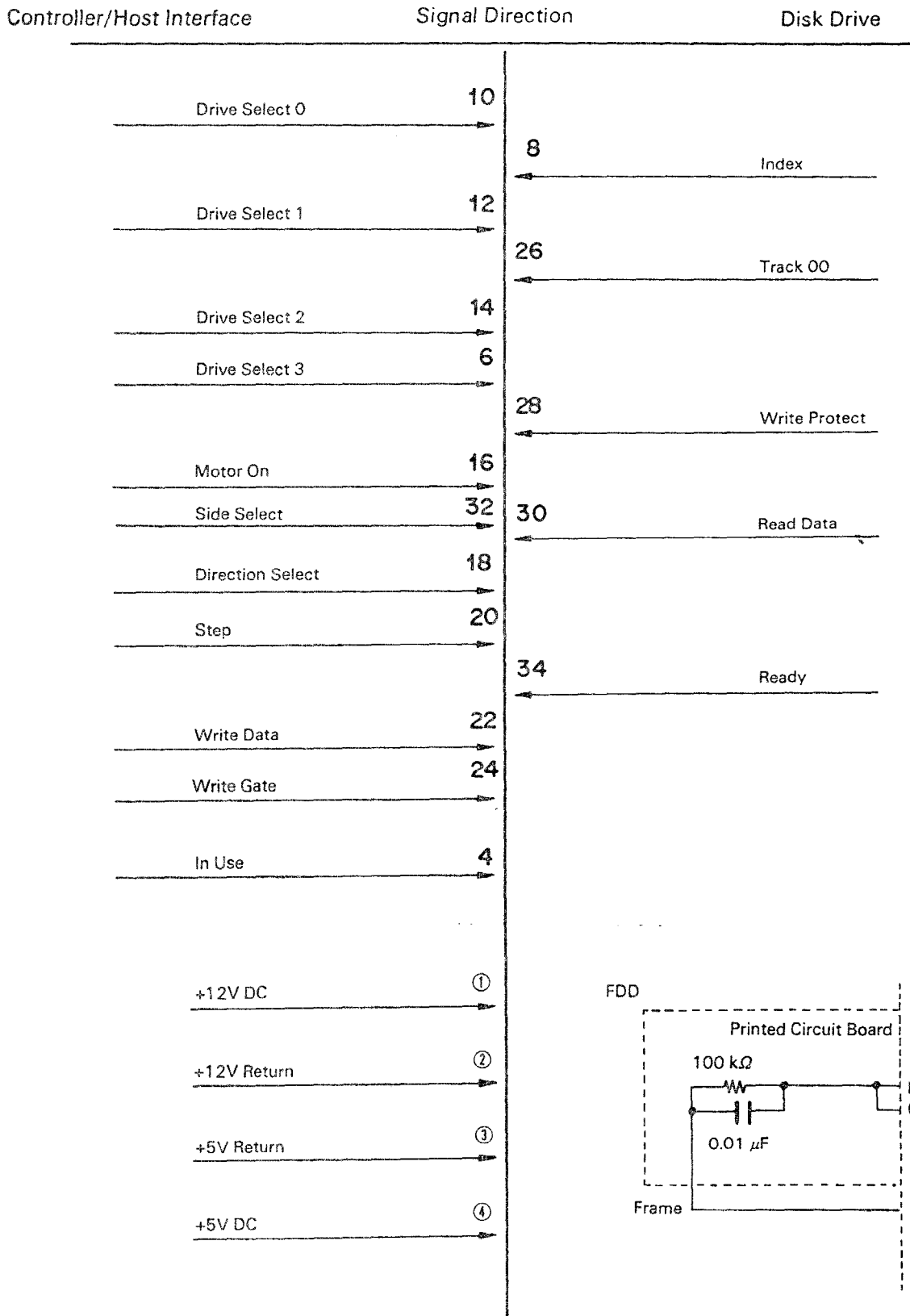
### **3-10. Consideration for saving energy**

If the step motor operation command is not executed during certain period of time, it will reduce power consumption of the stepping motor.



# 4. INTERFACE SIGNALS AND TIMING

## 4-1. Signals



Internal Connection Diagram of Frame Ground

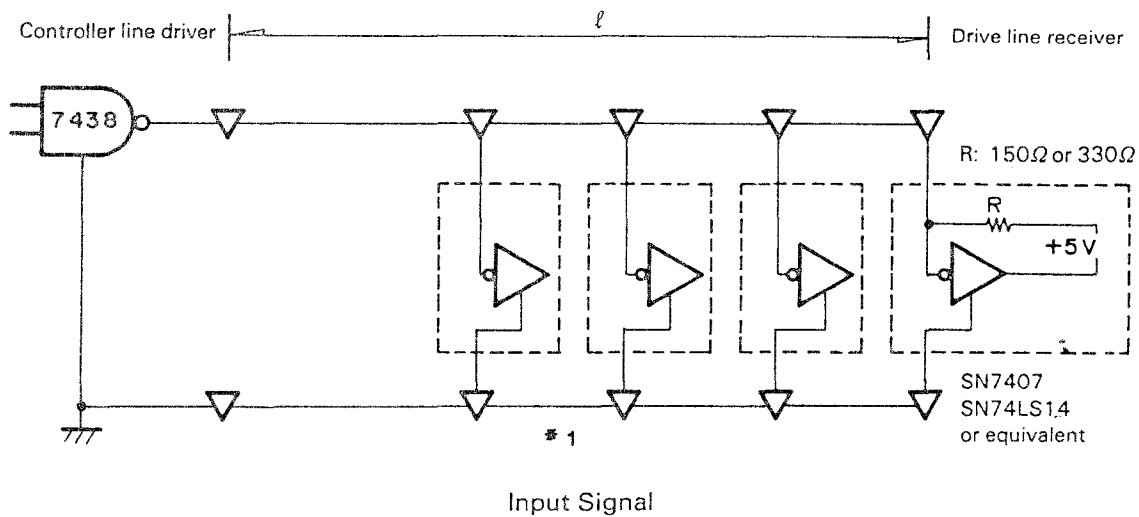
#### 4-2. Control/data lines

All lines are interfaced with TTL level signals.

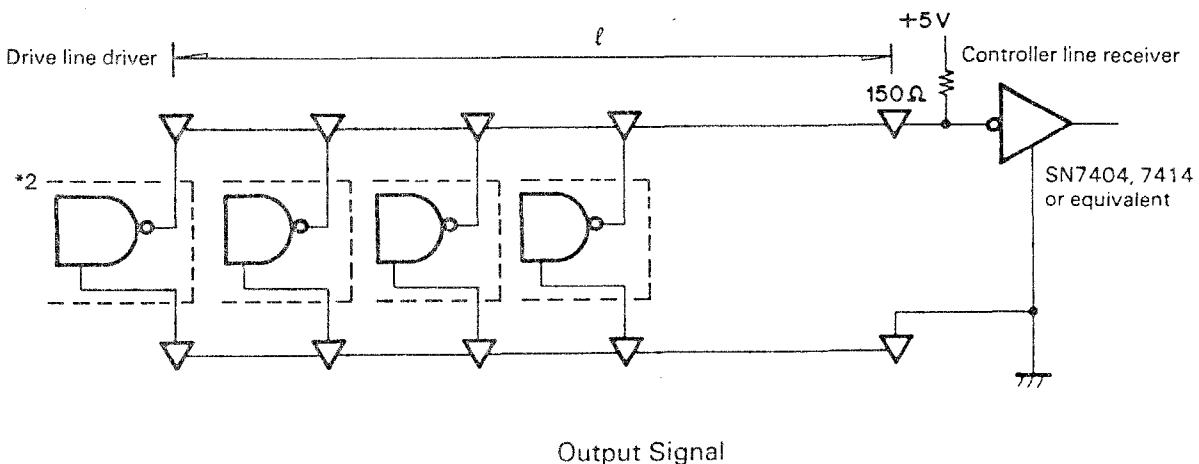
The logic level at the connector end of the drive is as specified below:

Logic Level	Low	High
Output level	0 – 0.4V	2.4 – 5.25V
Input level	0 – 0.4V	2.4 – 5.25V

##### ○ Input lines to Drives



##### ○ Output lines from Drives



Signal cables should be Flat-cable or Twisted-pair cable.

$\ell = 3$  meters max

\*1: Each control line (Drive select 0 – 3) is connected to the specific disk drive.

\*2: Read Data..... SN7438 equivalent

Index  
Ready  
Track 00  
W.P. } ... SN74LS09 equivalent + 2SC2458 equivalent

### 4-3. Input signals

NAME	DESCRIPTION
Drive Select 0 – Drive Select 3	These input lines are used to activate the drive, only one of four lines should be "Low" to select the drive. When one of the four lines is selected by the selecting jumper-pin "DSn" and becomes "LOW", the LED of front panel will indicate that the drive has been selected.
Motor ON	"Low" is active and starts the drive motor. This signal is not gated with "Drive select" signal.
Direction Select	A "High" on this line will cause a step pulse to be applied to move the head carriage towards the outer rim of the media. A "Low" on this line will cause a step pulse to be applied to move the head carriage towards the inner rim of the media.
Step	Step is a negative logic pulse and used with direction to cause head carriage movement. For this pulse signal, "logic 0" is true. Each pulse (transition from "0" to "1") on this line causes the head carriage to be moved in the direction determined by the direction select line.
Write Gate	Activation of "Low" on the Write gate signal enables the write drive and initiates recording of the contents of the Write Data lines onto the media. When the media is protected from "Write", this prevents writing onto the disk. This signal is gated with the Drive Select line.
Write Data	Data to be recorded on the media is supplied by a modulated negative logic pulse. Each timepulse transition from "1" to "0" occurs, the signal reverses the current and records the data bits onto the media. This operation can be accomplished when the Write Gate signal is "Low".
In Use	This signal controls the LED on front panel to indicate "in operation".
Side Select	When this signal is "High", side 0 magnetic head is selected. When this signal is "Low", side 1 magnetic head is selected.

### 4-4 Output signals

NAME	DESCRIPTION
Index	Index, which occurs once per revolution, indicates the physical beginning of the sectors by detecting the index/sector holes in the media. If the media is not inserted, the signal is maintained at "Low". Index occurs every 2 – 5 m seconds width pulse per revolution.
Ready	A "Low" on this line indicates that the disk is up-to-speed and the drive is on. This line is gated with Drive Select.
Track 00	When the head is positioned on track 00, a "Low" on this line is output. This line is gated with Drive Select.
Read Data	This signal represents the "raw data" (combined clock and data bits) read from the media. The signal is a negative logic pulse output. This line is gated with Drive Select.
Write Protect	This line indicates "Low" when media with write protection is inserted into the slot. This line is gated with Drive Select.

## 5. CABLE CONNECTION AND PIN ASSIGNMENT

### 5-1. Connector

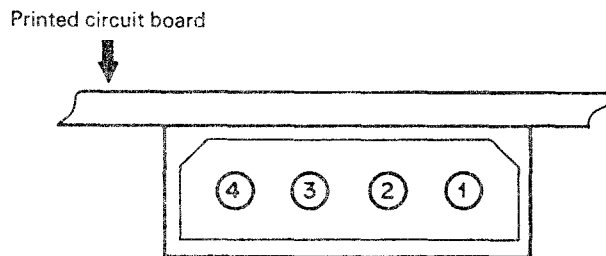
Recommended part numbers for the mating connectors are specified below, but equivalent parts may be used.

DC Cable Connection Connector mounted on PCB DC cable side housing contact cable	Parts No. AMP-172349-1 AMP-1-480424-0 AMP-60619-1 Standard AWG 18 (3m max.)
Signal Cable Connection Connector mounted on PCB Signal cable side connector (through-end) cable	34 pin board-edge connector as illustrated. FCN-767J034-AU/6 CN630-7672-T617 Flat-cable or twisted-pair cable
Frame Ground Drive side      Fasten type	AMP-61761-2

### 5-2. Pin assignment

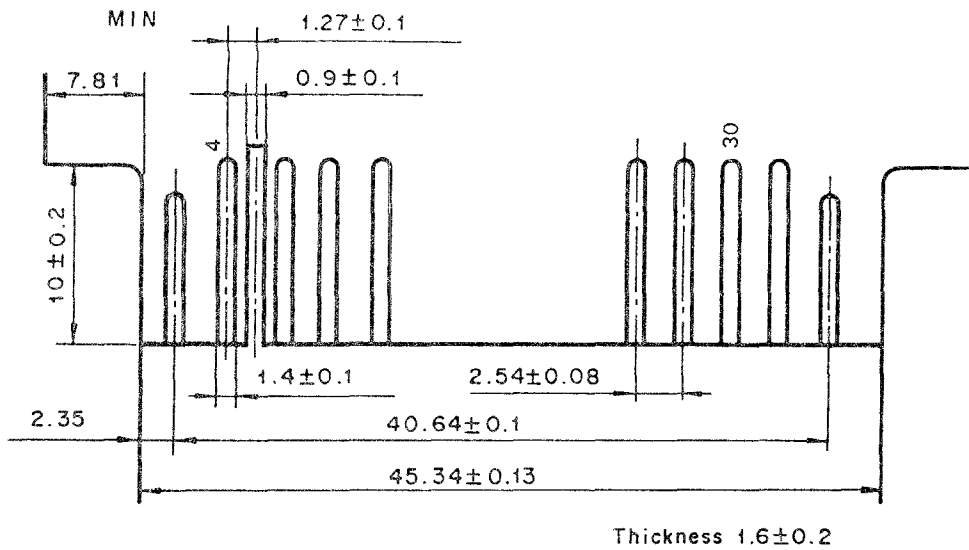
#### A. DC Power connector

Pin No.	Signal Name	Pin No.	Signal Name
1	+12V DC	3	+5V Return
2	+12V Return	4	+5V DC



4 Pin connector

B. Interface connector



Dimension of card-edge connector

Pin No.	Signal name	Pin No.	Signal Name
1	E (*1)	2	Open
3	E	4	In Use
5	E	6	Drive Select 3
7	E	8	Index
9	E	10	Drive Select 0
11	E	12	Drive Select 1
13	E	14	Drive Select 2
15	E	16	Motor On
17	E	18	Direction Select
19	E	20	Step
21	E	22	Write Data
23	E	24	Write Gate
25	E	26	Track 00
27	E	28	Write Protect
29	E	30	Read Data
31	E	32	Side Select
33	E	34	Ready

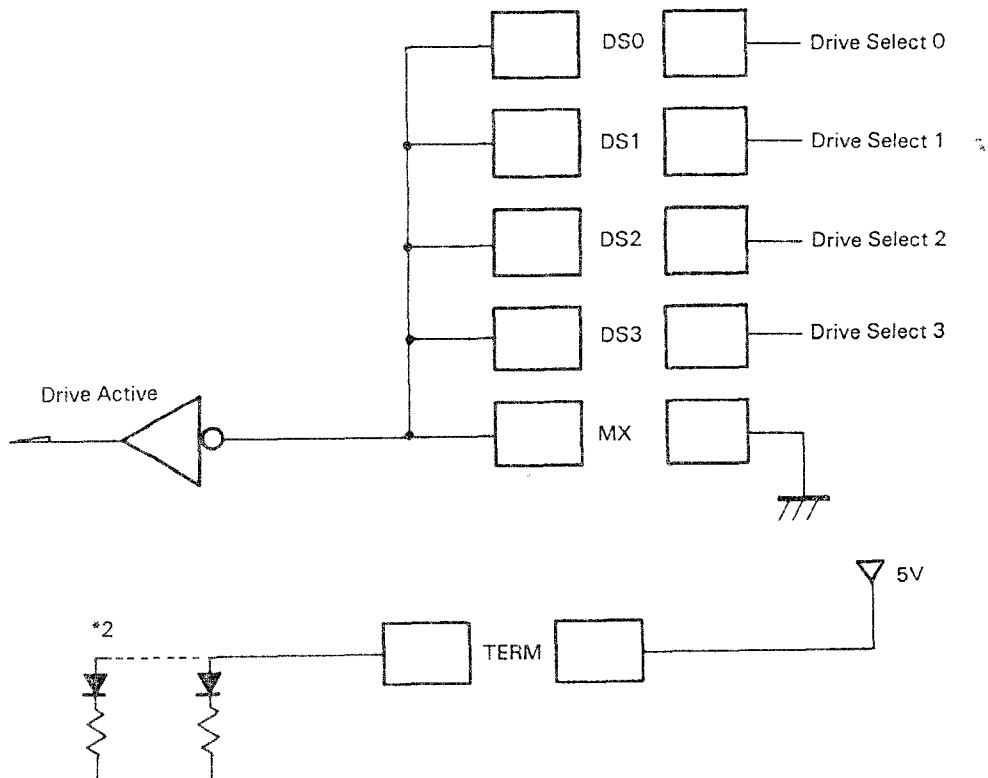
\*1 "E" signifies "signal ground".

## 6. DRIVE SELECTOR JUMPER

The drive can be set for any drive number by selecting the jumper pin as below.

Function	Set	Open
Activation of drive with Drive Select 0 signal	DS0	DS1, 2, 3 & MX
with Drive Select 1 signal	DS1	DS0, 2, 3 & MX
with Drive Select 2 signal	DS2	DS0, 1, 3 & MX
with Drive Select 3 signal	DS3	DS0, 1, 2 & MX
Activation of drive with any Drive Select signal	MX	DS0, 1, 2 & 3

Short plug function\*1

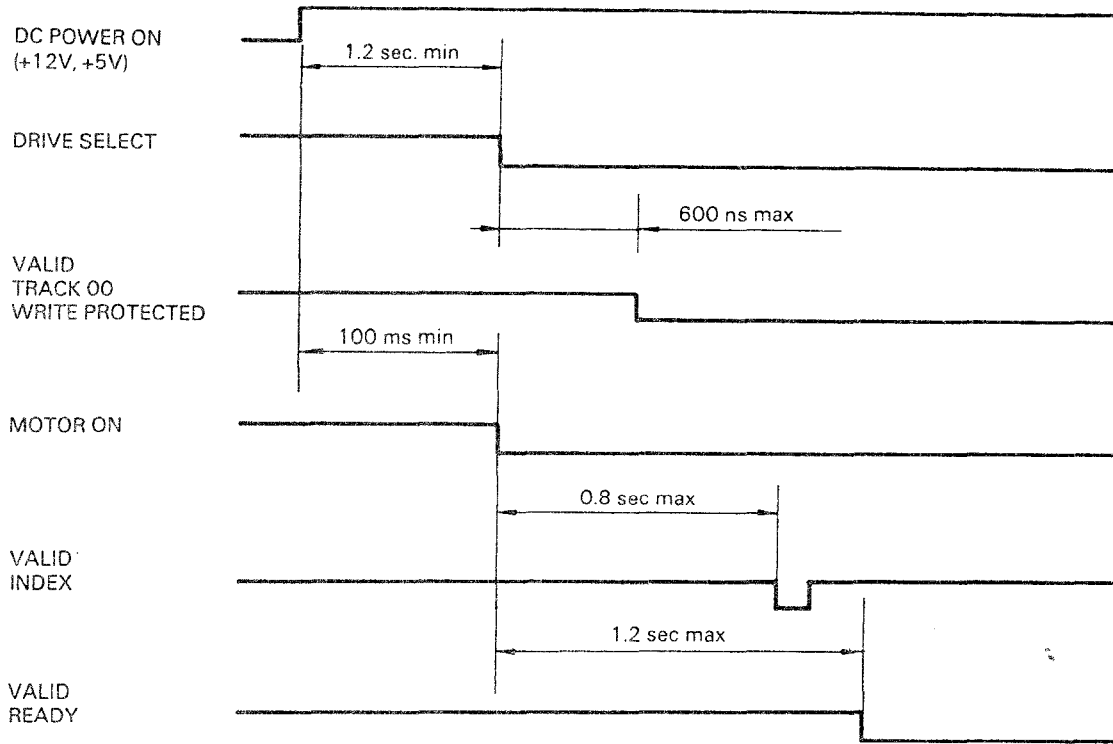


\*1: This short plugs are attached to DS0 and TERM 2.

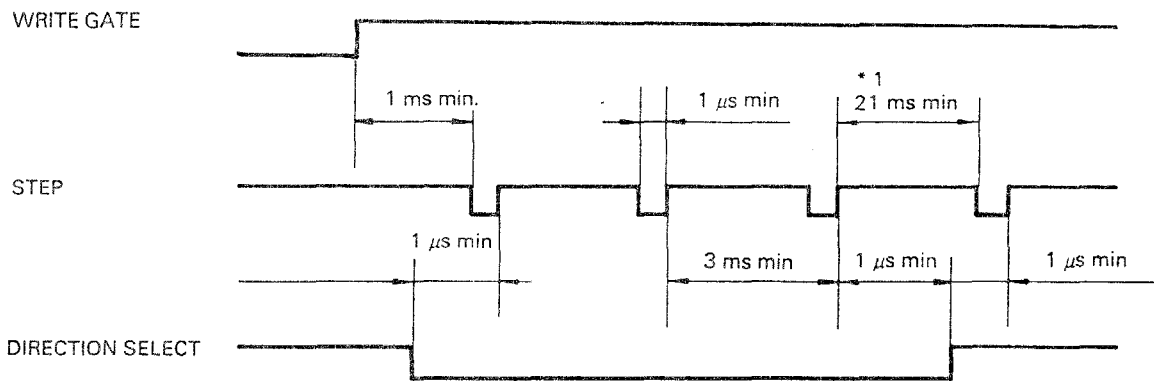
\*2: A switching diode is built in the terminator and when the short plug is set to the TERM position, terminator becomes valid. When the short plug is removed, the terminator becomes invalid.

## 7. SIGNAL TIMING

### 7-1. Initialize sequence

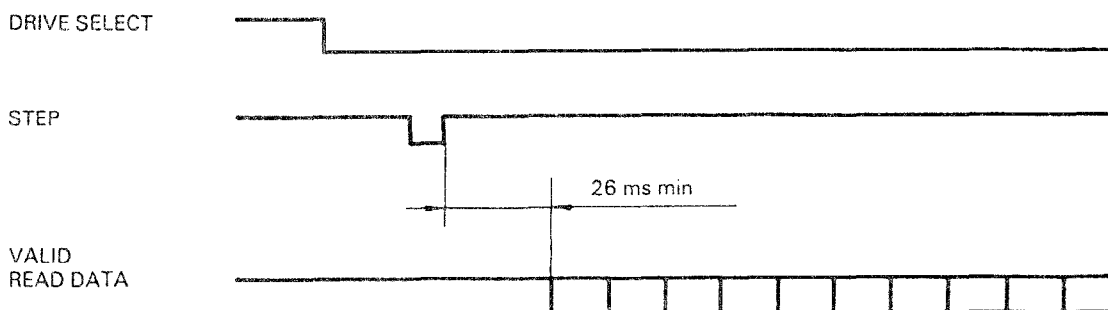


### 7-2. Access timing

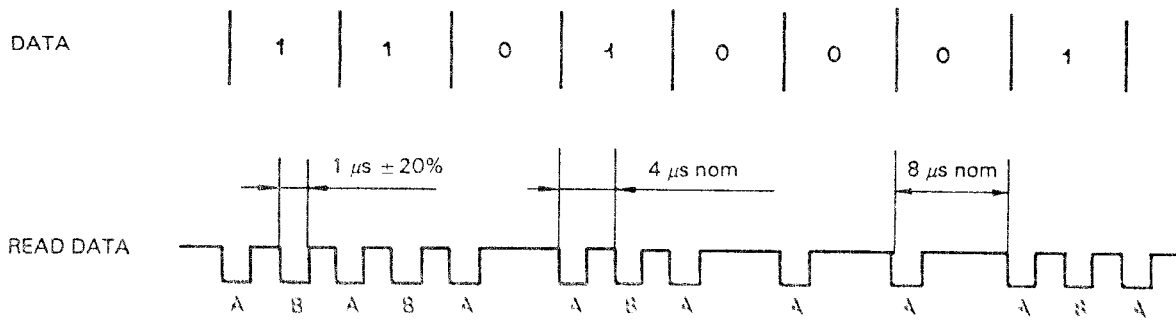


\*1 : 3 msec. min. if the Direction Select signal is not changed

### 7-3. Read timing



### 7-4. Read data timing

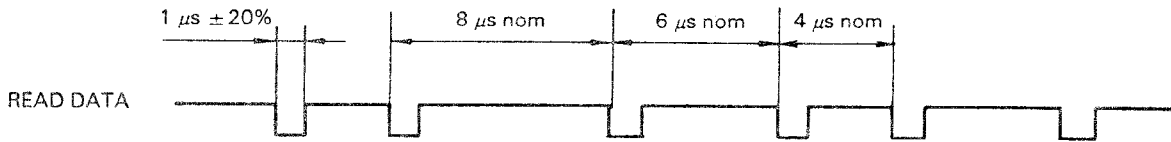


A = leading edge of pulse is  $\pm 800$  nsec from base position (Clock)

B = leading edge of pulse is  $\pm 400$  nsec from base position (Data)

Except jitter due to rotation fluctuation

(FOR FM)

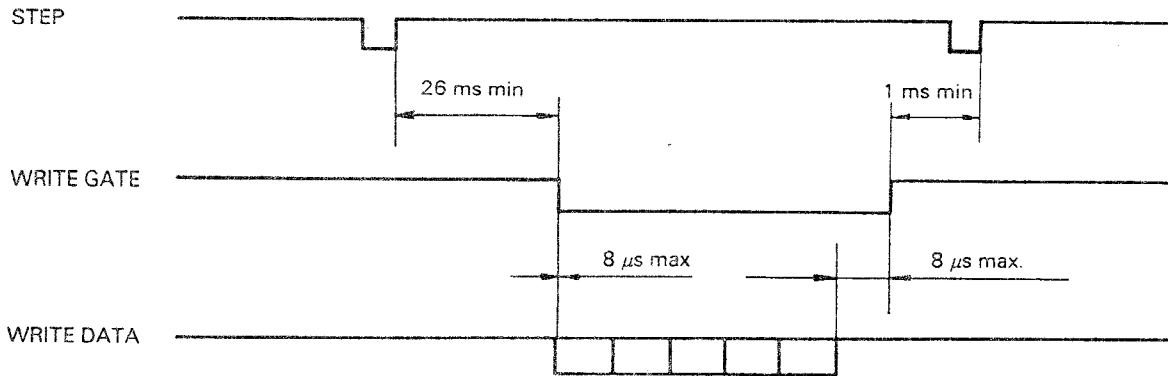


Leading edge of pulse is  $\pm 800$  nsec from base position

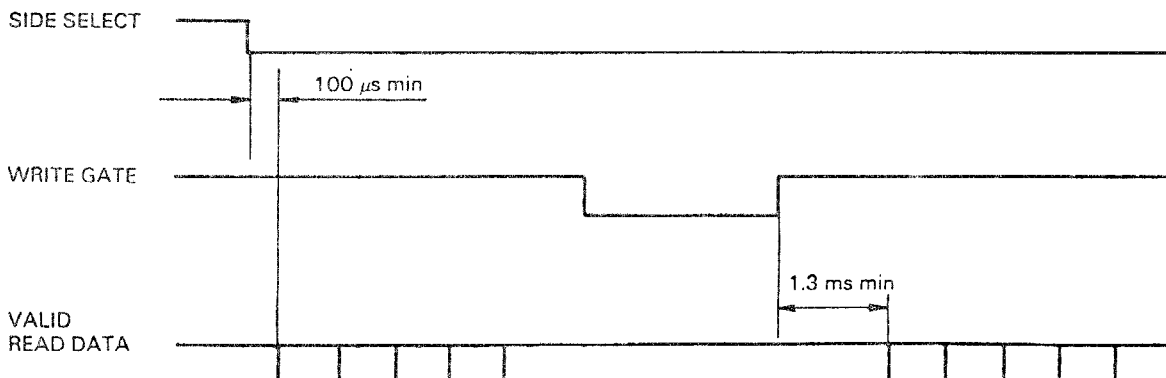
Except jitter due to rotation fluctuation

(FOR MFM)

### 7-5. Write timing

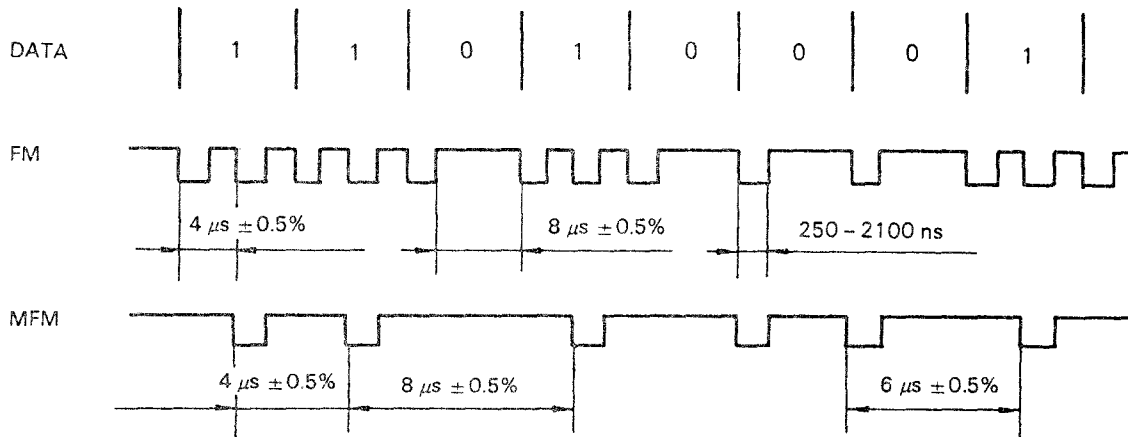


### 7-6. Read after write timing

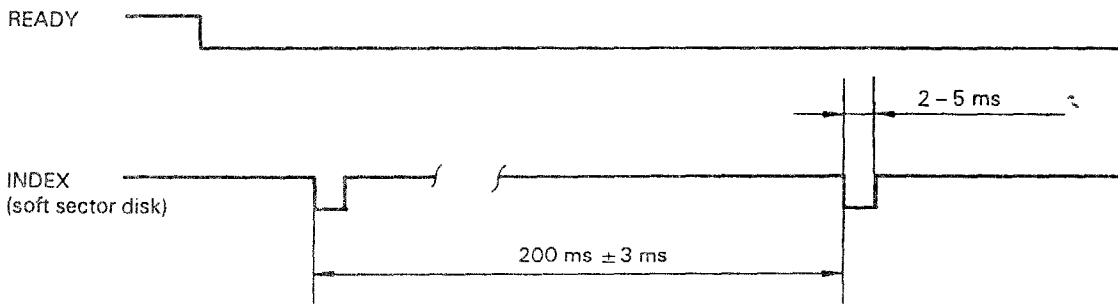




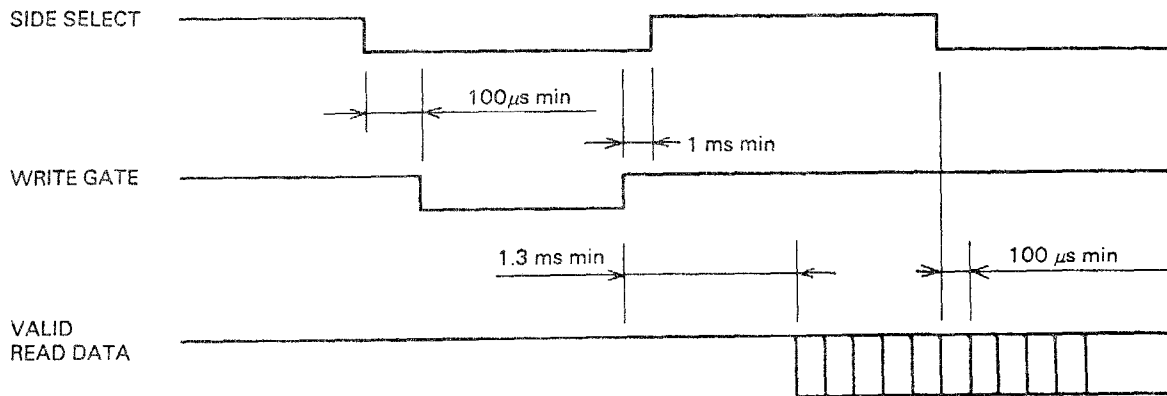
### 7-7. Write data timing



### 7-8. Index timing



### 7-9. Side select timing



## 8. ALIGNMENT

When CE diskette (DYMEK501-1) is moved from track 0 to track 16 and from track 39 to track 16, each cat's eye lobe ratio will be 84% or more.

## 9. AZIMUTH

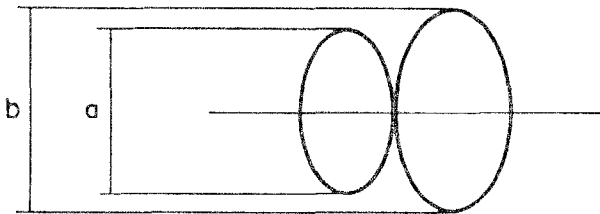
When CE diskette (DYMEK501-1) is used, the azimuth of track 34 will be within  $\pm 12$ .

## 10. MODULATION

Modulation, after writing the 2F pattern onto track 39 and tracks using Hitachi Maxell or Fuji work media, taken in and out 5 times can be considered as follows:

The ratio of maximum value to minimum value of the read level will be 75% or more in terms of the lowest value.

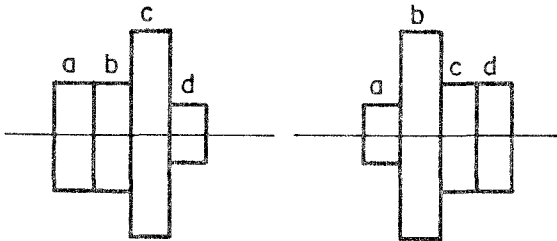
Cat's eye lobe ratio



$$\frac{a}{b} \times 100 \cong 84 \quad a < b$$

$$\frac{b}{a} \times 100 \cong 84 \quad a > b$$

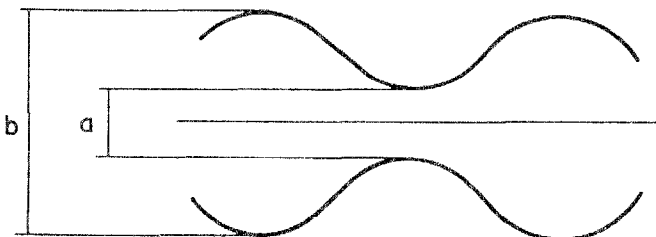
Azimuth



$$a \cong b$$

$$c \cong d$$

Modulation



$$\frac{a}{b} \times 100 \cong 84$$

## 11. STEPPING MOTOR

- a. Step angle 1.8°
- b. Operating voltage DC 12V
- c. Phase current MAX 280 mA

## 12 SPINDLE MOTOR (DD motor)

- a. Rated motor speed 300 rpm
- b. Stall current 0.85A
- c. Drift (at 300 rpm in rated spindle speed)
  - Initial  $\pm 1.5\%$
  - Long term  $\pm 1.5\%$
- d. Life 10,000 hours min.

## 13. HEAD

- a. Asymmetry  
If the time is measured between the point of plus maximum value and that of minus maximum value, and the time between the point of its minus maximum value and the point of next plus maximum value, then:  
Longest time – minimum time = 400 nsec (1F)

- b. Overwrite

When the 2F signal has been recorded on the 1F signal recorded at the specified signal current, the ratio of the 2F signal to the 1F signal will be 26 dB or more.

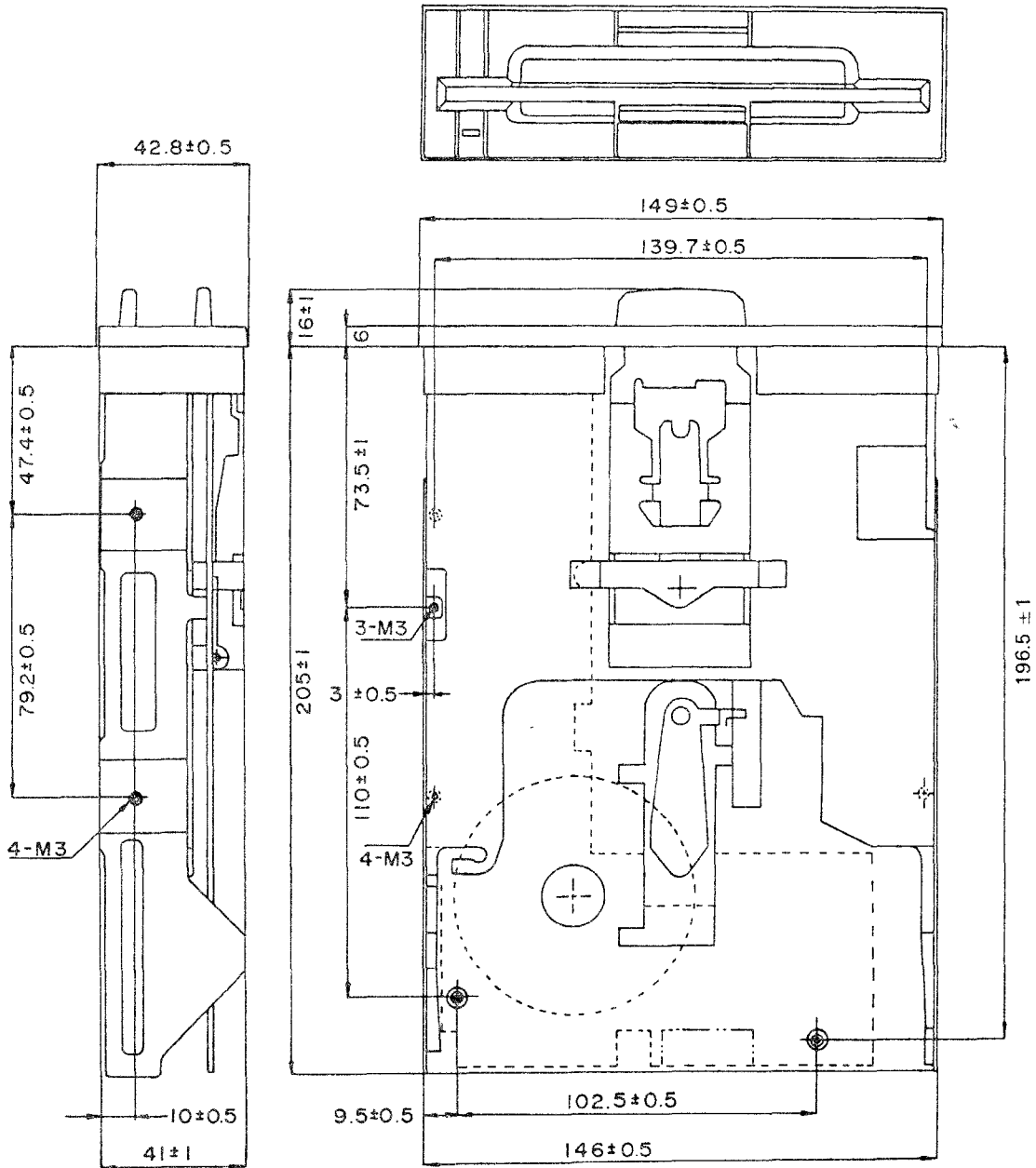
- c. Resolution

$$\frac{E_{\text{out}}}{E_{\text{out}}} \frac{2F}{1F} \cong 0.55 \text{ (79 Track)}$$

$$\frac{E_{\text{out}}}{E_{\text{out}}} \frac{2F}{1F} \cong 0.95 \text{ (0 Track)}$$

- d. Write current 7.0 mA
- e. Read voltage 2.5 mV more at 2F (39 Track)  
13.0 mV or less at 1F (0 Track)
- f. Erase current 40 mA
- g. Life 16,000 hours min.

# 14. DIMENSIONS



[MEMO]