BASF Aktiengesellschaft

BASF Aktiengesellschaft · D-6700 Ludwigshafen

BASF 6138 (96 tpi)

BASF 6128 (48 tpi)

MINI DISK DRIVE

TECHNICAL MANUAL

(preliminary)

Mannheim, July 1983
VID/WM

Rev. 0

Technical Guide Contents

1. Specifications

1.1 Basic specifications

		MDD 6128		MDD 6138	
		Single density	Double density	Single density	Double density
Storage capacity	Per diskette	250 KB	500 KB	500 KB	1 MB
	Per track	3.125 KB	6.25 KB	3.125 KB	6.25 KB
Transfer rate		125 KBit/s	250 KBit/s	125 KBit/s	250 KBit/s
Average latency time		100 ms		100 ms	
Access time					
Track-to-track positioning time		6 ms		3 ms	
Average access time		100 ms		100 ms	
Head loading time		25 ms		25 ms	
Head settling time		20 ms		20 ms	
Motor start time		800 ms		800 ms	

1.2 Physical specifications

	MDD 6128		MDD 6138	
	Single density	Double density	Single density	Double density
Innermost circumference recording density	2938 BPI	5876 BPI	2961 BPI	5922 BPI
Number of tracks	80 (Both sides)		160 (Both sides)	
Track density	48 TPI		96 TPI	
Track radius	Outer circumference 57.15 Inner circumference 34.4		Outer circumference 57.15 Inner circumference 34.13	
Modulation system	FM or MFM		FM or MFM	

1.3 Environmental conditions

Ambient temperature in operation	5° - 45°C
Ambient temperature in transportation	-40° - 62°C
Temperature in non-operation	-22° - 55°C
Relative humidity	20% - 80% RH
Max wet bulb temperature	29°C

1.4 Power supply

+5V ± 5% Ripple 50 mVp-p	TYP 0.5 A MAX 0.8A
+12V ± 5% *NOTE Ripple 100 mVp-p	TYP 0.5A MAX 0.8A

1.5 Dimensions

Width	150.0 mm	148.0 mm
Height	33.5 mm	42.0 mm
Depth	221.5 mm	220.0 mm
Weight (typ)	1.2 kg(typ)	

1.6 Reliability

M.T.B.F.	10000 P.O.H.
Unit life time	5 years
M.T.T.R.	30 minutes
Error rate	
Soft read error	10^{-9} bits
Hard read error	10^{-12} bits
Seek error	10^{-6} seeks

*NOTE: for 200 ms after MOTOR ON signal 1.2A (typ) max.1.7A
for 30 ms after HEADLOAD signal 1.2A (typ) max.1.7A

1.7 Vibration & impulse

Resistance against vibration in operation	Acceleration	1G
	Vibration sweep	5 - 100 Hz
	Vibration direction	X.Y.Z. directions
Resistance against vibration in transportation	Acceleration	3G
	Vibration sweep	5 - 100 Hz
	Vibration direction	X.Y.Z. directions
Resistance against impulse in transportation	To satisfy all specifications after being dropped from height of 100 cm in a packed condition.	

2. Interface

The MDD interface consists of two section.

1. Signal
2. Power supply

Each line is detailed below.

2.1 Signal interface

The daisy chain or radial chain is used for the signal interface of the select line, allowing connection to a maximum of 4 MDD's. In case of the daisy chain, only the last MDD is terminated. A resistor array close to the connector J2 is provided for this termination. In short, the termination is provided by the resistor array and select line.
(The terminator array is removable.)

The assignment of the interface connector and power connector is shown below.

Signal connector

Ground return	Signal pin	Signal name	Ground return	Signal pin	Signal name
1	2		19	20	STEP
3	4	HEAD LOAD	21	22	WRITE DATA
5	6	SELECT 4	23	24	WRITE GATE
7	8	INDEX	25	26	TRACK 00
9	10	SELECT 1	27	28	WRITE PROTECT
11	12	SELECT 2	29	30	READ DATA
13	14	SELECT 3	31	32	SIDE SELECT
15	16	MOTOR-ON	33	34	READY
17	18	DIRECTION-IN			

Power supply

Pin No.	Power name
1	+12V DC
2	+12V GND
3	+5V GND
4	+5V DC

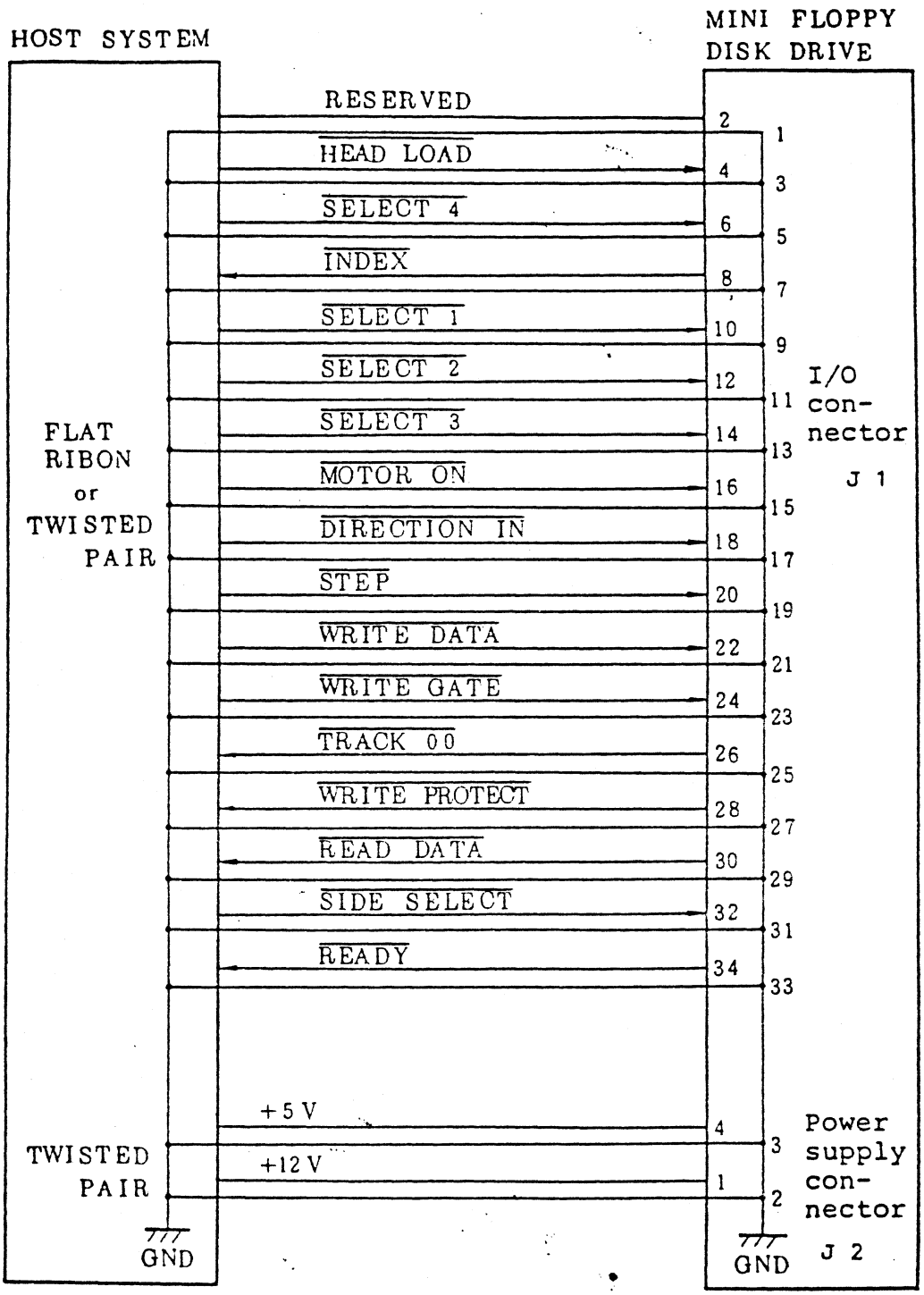


Fig. 2-1 Signal Interface

2.2 Input line

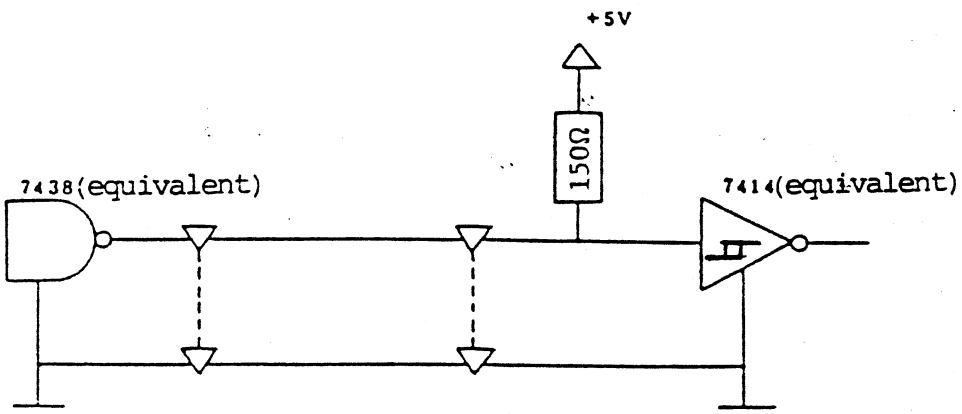


Fig. 2-2 Recommended I/O interface

Max cable length: 3m, Ribbon wire or twist pair wire
Signal interface specifications

Logical 0 = 0.0 - 0. 4 V (active)
Logical 1 = 2.5 - 5.25 V (inactive)

(1) SELECT 1-4

A maximum of 4 MDD's can be connected in the daisy chain mode. The jumper is used to switch each drive.
(All switches are set to select 1 at the factory.)

The select lines 1 - 4 are used to select the ranked MDD. Only the selected drive can send/receive signals.

(2) MOTOR-ON

This signal is a spindle motor-ON/OFF signal and the motor is turned ON at logical 0.

(3) DIRECTION-IN

The function of this signal is to determine the direction of the read/write head, and must be set at lease 1 μs earlier than the STEP pulse falling edge. The direction of the head carriage by the DIRECTION-IN signal is handled as follows.

Logical 1 = Inner direction from the disk center
Logical 0 = Central direction of the disk

(4) STEP

Sending the logical 0 pulse to this line causes the read/write head to move towards the direction determined by the DIRECTION-IN. In usual cases, this step speed is 6 ms/track (48 TPI Model) or 3 ms/track (96 TPI Model).

When the write gate signal is logical 0, the STEP signal is inhibited. For details, see the timing chart (Fig. 2-6).

(5) WRITE GATE

This is a signal to control the write data and read data. The write data are valid at logical 0, and the read data are valid at logical 1.

In case of a write-protected disk, the write is inhibited within the drive. Another function of the write gate is to internally operate the tunnel erase, which keeps operating for 972 μs after the write gate has been closed.

(6) WRITE DATA

This signal is used to write data into the disk. Power is supplied to the R/W head when logical 1 changes to logical 0, which causes a magnetic flux. This signal is valid when the WRITE GATE is logical 0.

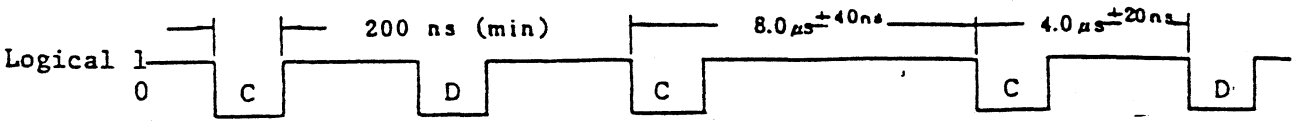


Fig. 2-3 WRITE DATA timing (FM)

(7) HEAD LOAD

When this signal becomes logical 0, the head is loaded and is released at logical 1. Depending on the jumper selection, both the HEAD LOAD and SELECT are available, or the head can be loaded by SELECT only. In every case, the head is loaded only when the READY signal is logical 0.

The function of this signal is to control the solenoid and the activity LED.

(8) SIDE SELECT

The function of this signal is to select the two R/W heads. Logical 0 selects one side head and logical 1 selects 0 side head. When one head is switched to the other head, the 200 μs wait time at the read time and 1200 μs wait time after the write time are required respectively.

2.3 Output line

Five output lines are provided, the interface of which is shown in 2.1.

Logical 0 = 0.0 - 0.4V (active)
Logical 1 = 2.5 - 5.25V (inactive)

(1) READY

This signal is issued when the disk is inserted at the POWER-ON time, and is logical 0 at the normal select time. It is logical 1 in other cases.

(2) TRACK 00

This signal becomes logical 0 when the read/write head is positioned at track 00, and is used to detect the head carriage position after POWER-ON.

(3) INDEX

The MDD carries the index detection feature, and issues the detection signal when the index hole comes out.

Usually this signal is logical 1, and becomes logical 0 when the index hole comes out (4 ms).

On the soft sector disk, a signal at one hole indicates the start of the track. When the disk is not inserted, the index signal remains at logical 0. Fig. 2.4 indicates the index timing.

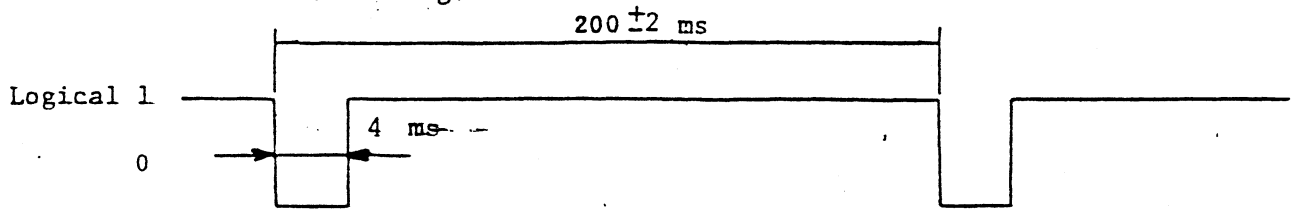


Fig. 2-4 Index timing

(4) READ DATA

The function of this signal is to output the raw data read by the read circuit of the MDD. Usually this signal is logical 1 and becomes logical 0 when the magnetic inversion exists on the disk.

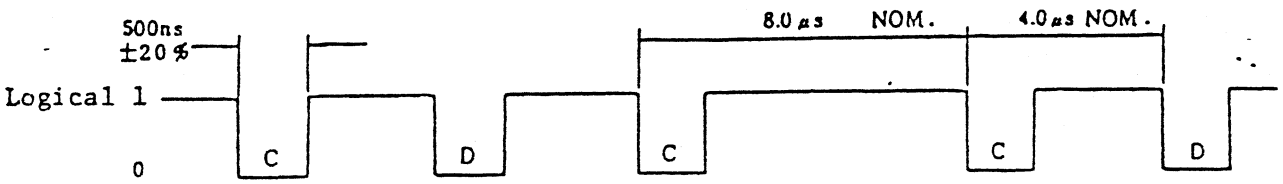


Fig. 2-5 READ DATA (FM)

(5) WRITE PROTECT

The function of this signal is to notify the host system that a write-protected disk has been inserted.

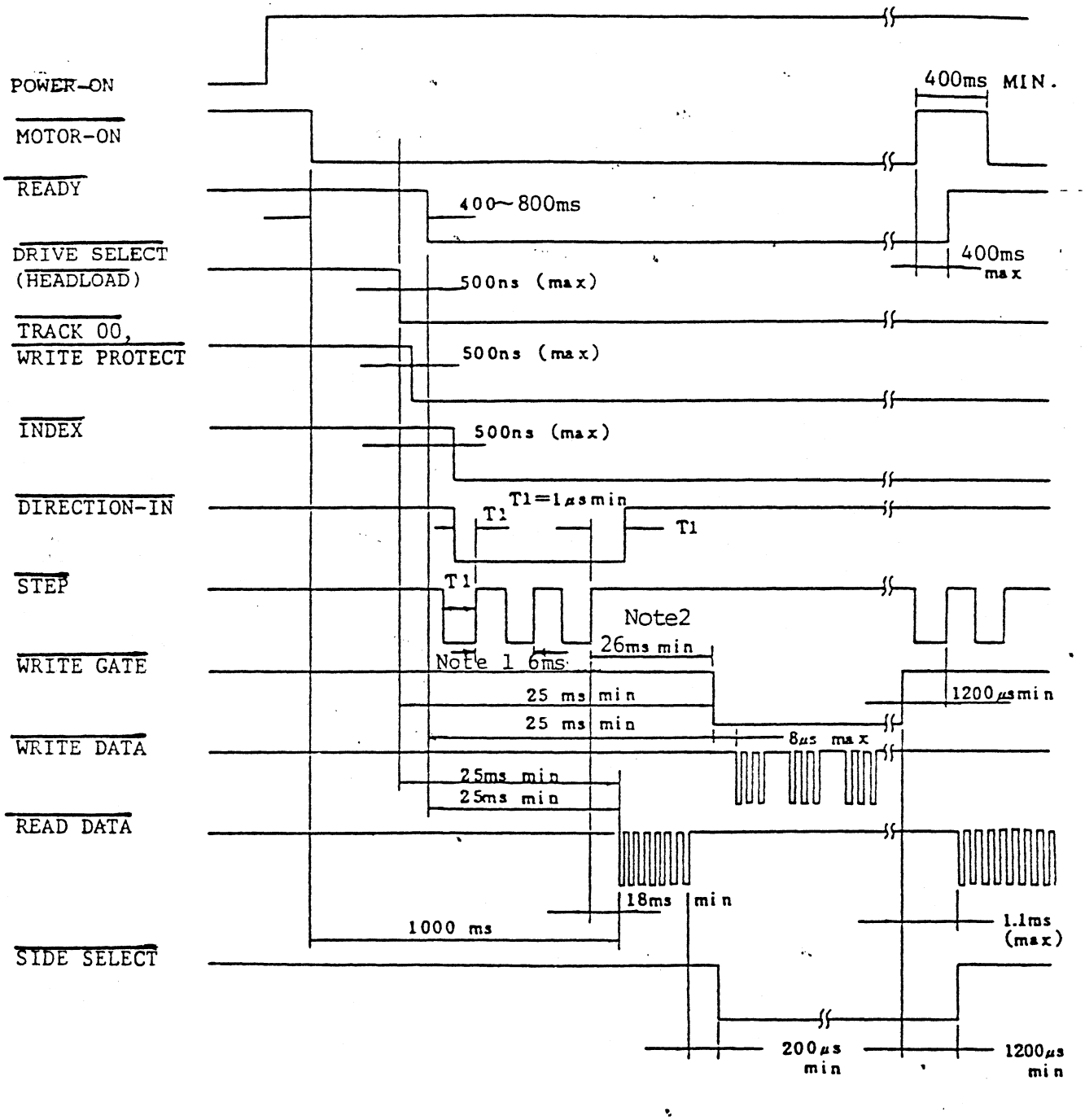
When the protected disk is inserted, the signal becomes logical 0, and the write into the disk is inhibited in the MDD. For write protect, the disk write prevention notch can be covered by an opaque label.

2.4 Jumper pin

As aforementioned, selecting the jumper pin located on the PCB permits a desired function to be used.

The head load and the activity LED can be controlled by jumper pins.

See Fig. 2-7 Block diagram.



Note 1: In 96 TPI Model, the period is 3 ms. (min)

Note 2: In 96 TPI Model, the period is 23 ms. (min)

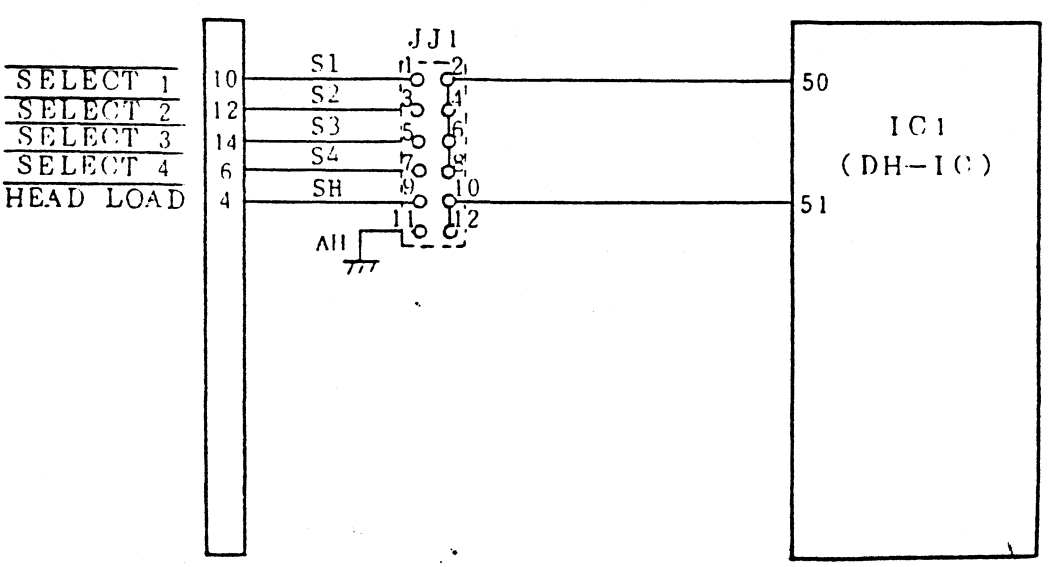
Fig. 2-6 Timing chart

Fig. 2-7 Jumper pin assignment

Function	Content	JJ1					
		S1	S2	S3	S4	SH	AH
	Jumper mode at factory before shipment.	o	x	x	x	o	x
Drive select	Drive select 1	o	x	x	x		
	" 2	x	o	x	x		
	" 3	x	x	o	x		
	" 4	x	x	x	o		
Head load selection	Head loading takes place under head loading signal.					o	x
	Head loading takes place by ready mode automatically.					x	o

Jumper selection table

Arrangement of Jumper



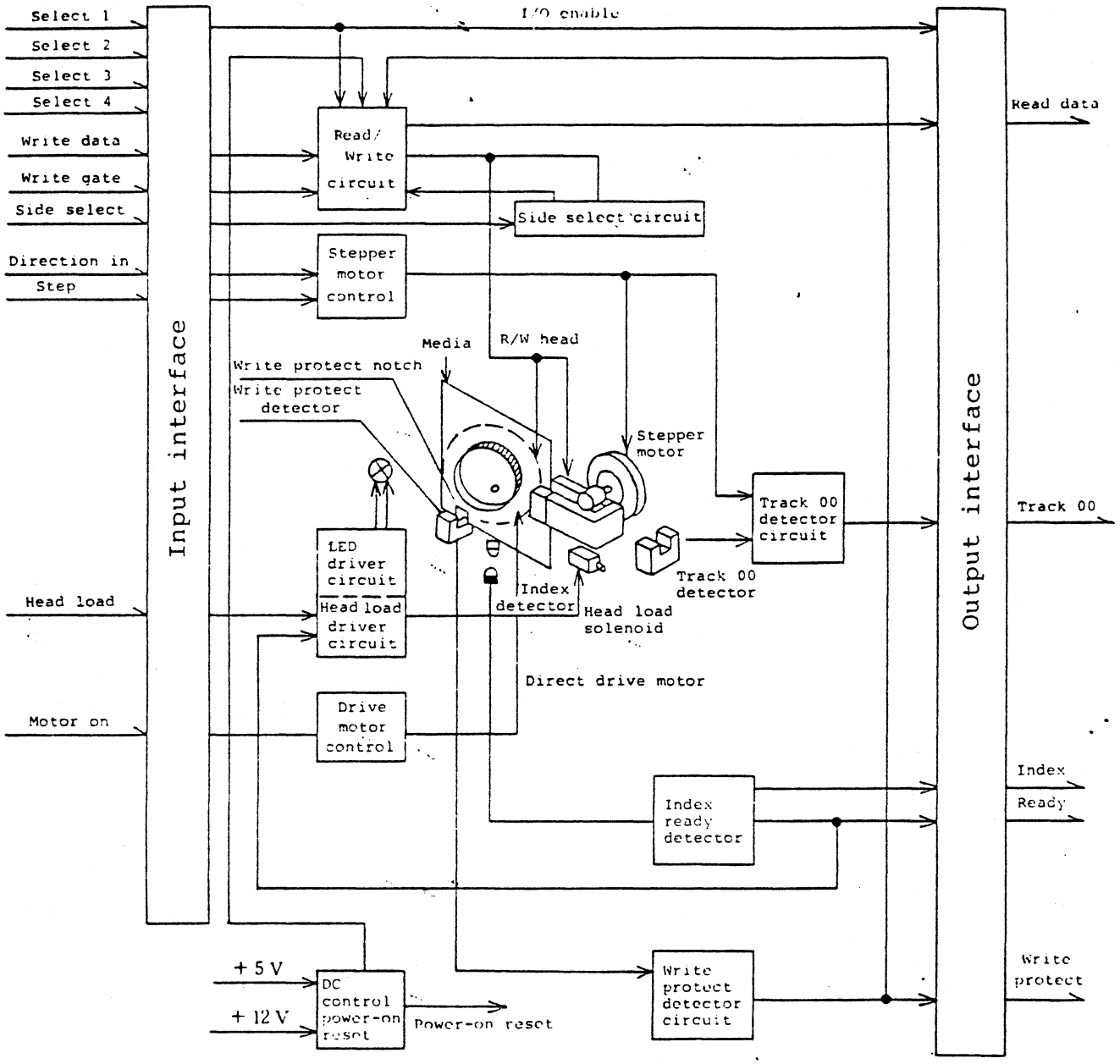
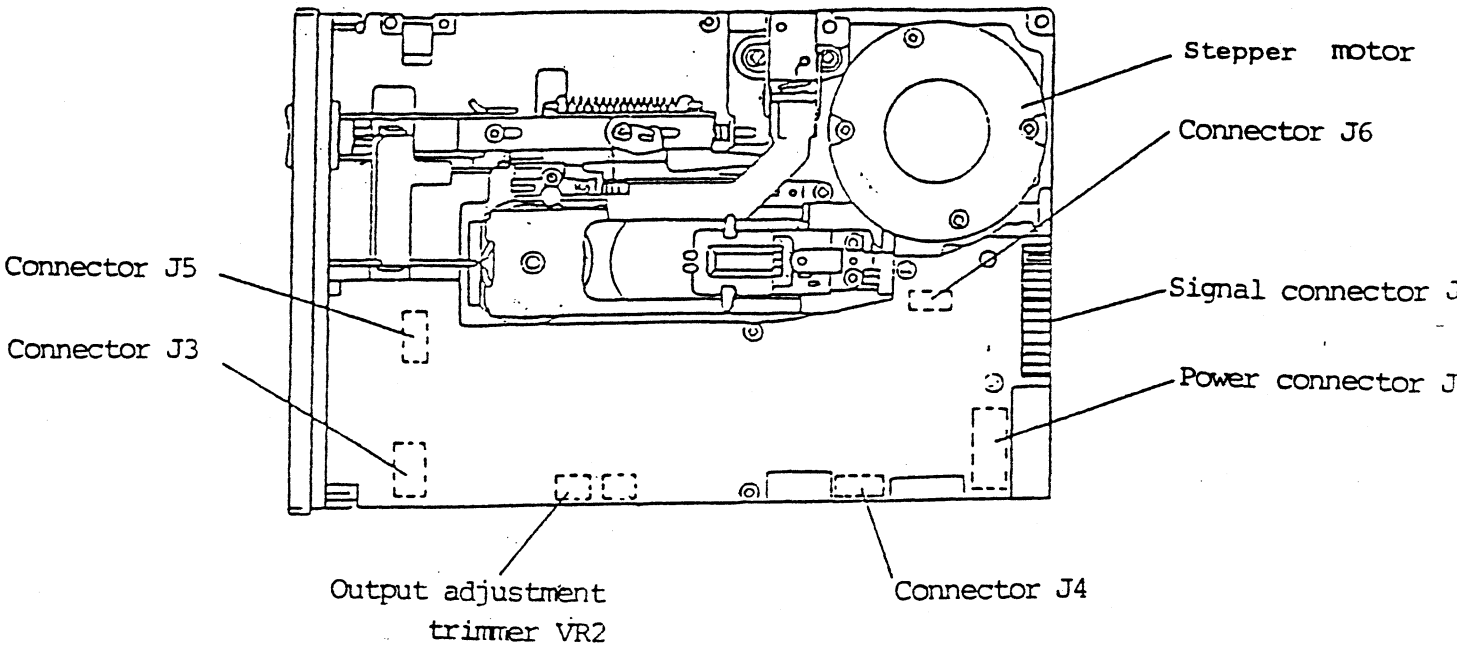
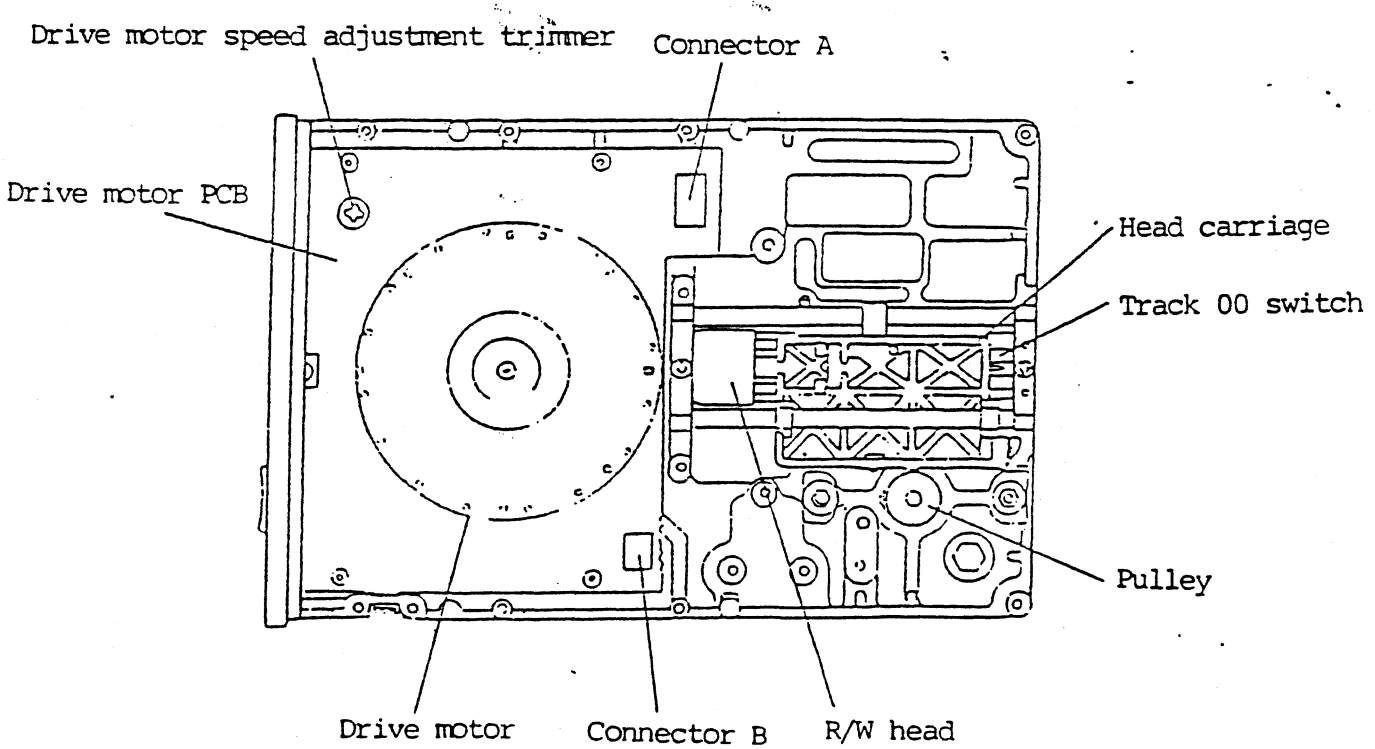


Fig. 3-1 Function block diagram


Stepper motor
Connector J6
Connector J5
Signal connector J
Connector J3
Power connector J
Output adjustment trimmer VR2
Connector J4


Drive motor speed adjustment trimmer
Connector A
Drive motor PCB
Head carriage
Track 00 switch
Pulley
Drive motor
Connector B
R/W head

3.1 Drive feature

The spindle of this drive is directly driven by the DC motor at a fixed speed of 300 rpm (200 ms/revolution). The drive motor starts and stops by the MOTOR-ON signal.

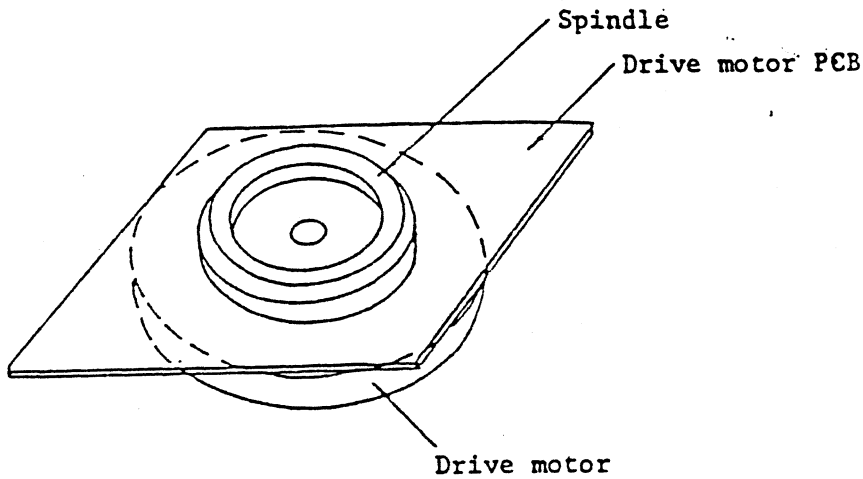


Fig. 3-2 Drive feature

3.2 Spindle feature

This feature consists of the following parts.

Spindle
Center cone
Main arm
Latch
Clamp lever
Button

Inserting a mini-disk and pressing the button for loading the disk cause the clamp lever to lower the main arm and the center cone to enter the hole of the disk. The center cone catches the inside diameter of the disk and sets it to the correct position. In order to discharge the disk, pressing the button once again causes the latch to be released, the main arm to be raised by a spring, the center cone to be raised, the disk to be released from the spindle, and the media to be ejected.

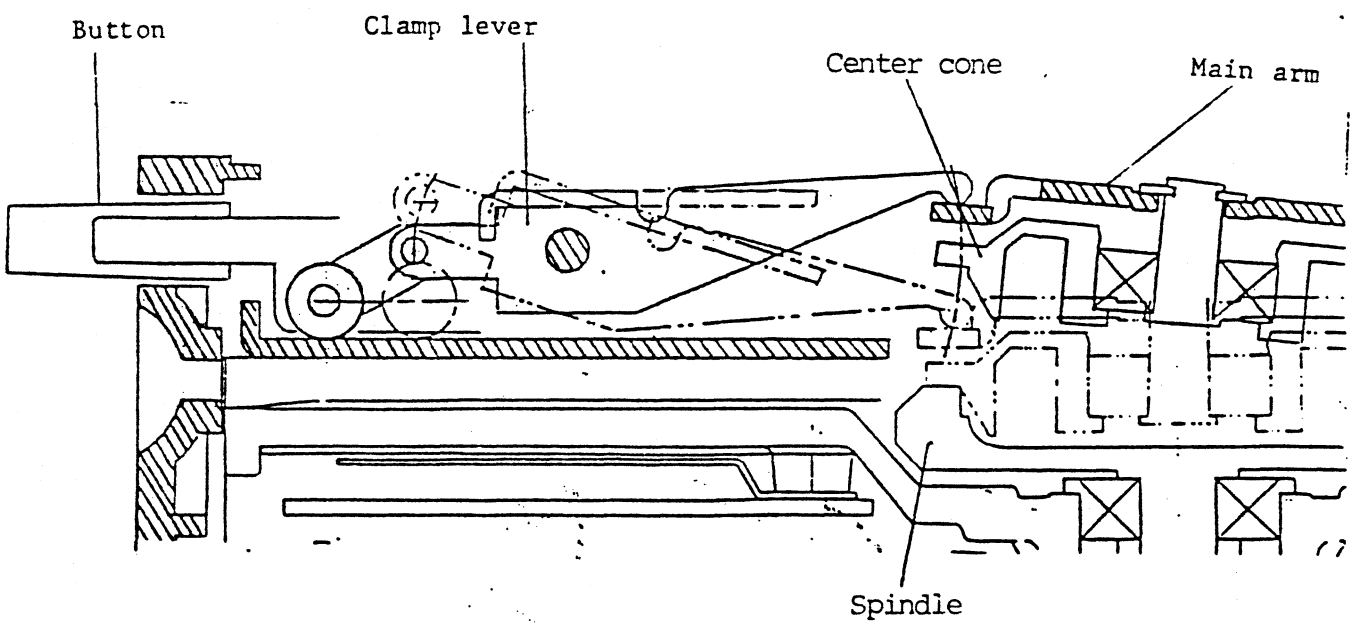


Fig. 3-3 Spindle feature

3.3 Positioning feature

The positioning feature consists of the following parts.

Stepper motor
Pulley
Steel belt
Carriage assembly
Guide bar

The revolution by 1.8° Note per step of the stepper motor is converted into rectilinear motion by the pulley steel belt feature directly connected to the motor axis and conveyed to the carriage assembly. The carriage assembly consists of the carriage, side 0 R/W head and side 1 R/W head, and loads and unloads the head by the head load feature.

Note: The stepper motor in 48 TPI rotates for 3.6 degrees per step.

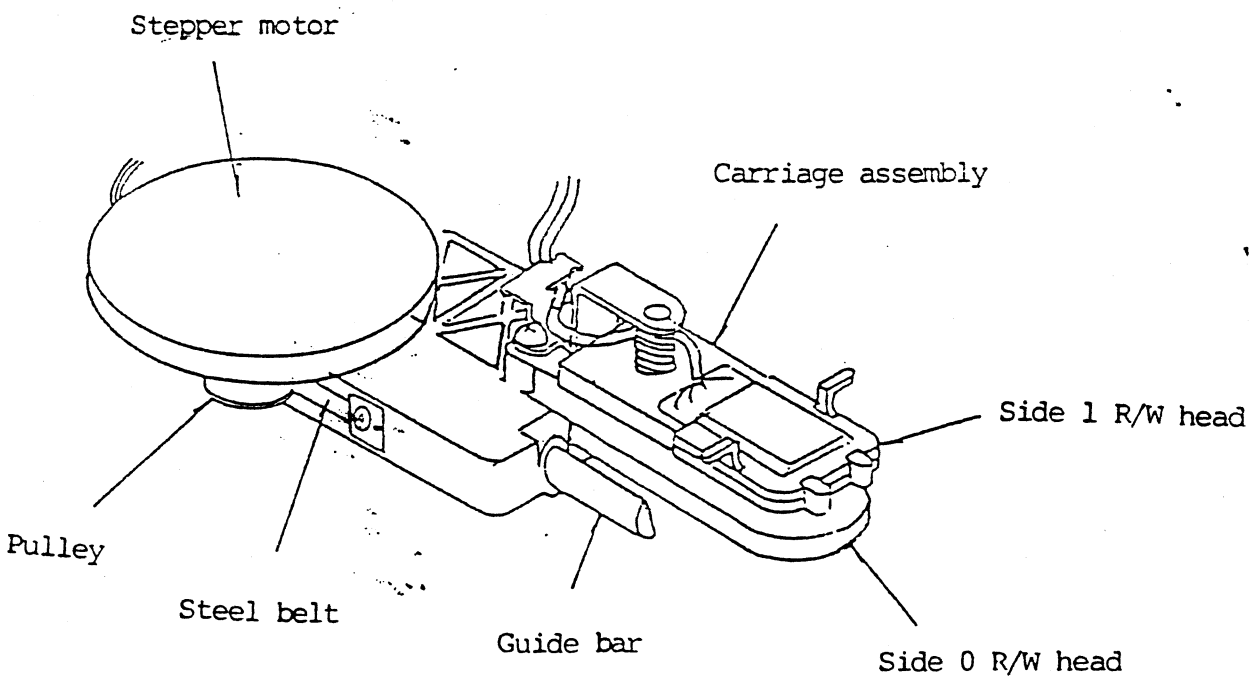


Fig. 3-4 Positioning feature

3.4 Head load and interlock feature

This feature consists of the following parts.

Solenoid
Head load arm
Stabilizer pad
Head load arm bracket
Interlock arm
Latch
Latch spring

The solenoid is excited by the HEAD LOAD signal, the head load arm is pressed down and the stabilizer pad presses the disk to prevent the disk from vibrating. Also, the signal causes the side 1 R/W head to be depressed to the disk. Moreover, since the interlock arm presses the latch spring, the latch does not move and the disk cannot be discharged. By turning off the signal, the stabilizer pad and the side 1 R/W head move from the disk, thus lowering the interlock arm and moving the latch. In this state, the disk can be discharged.

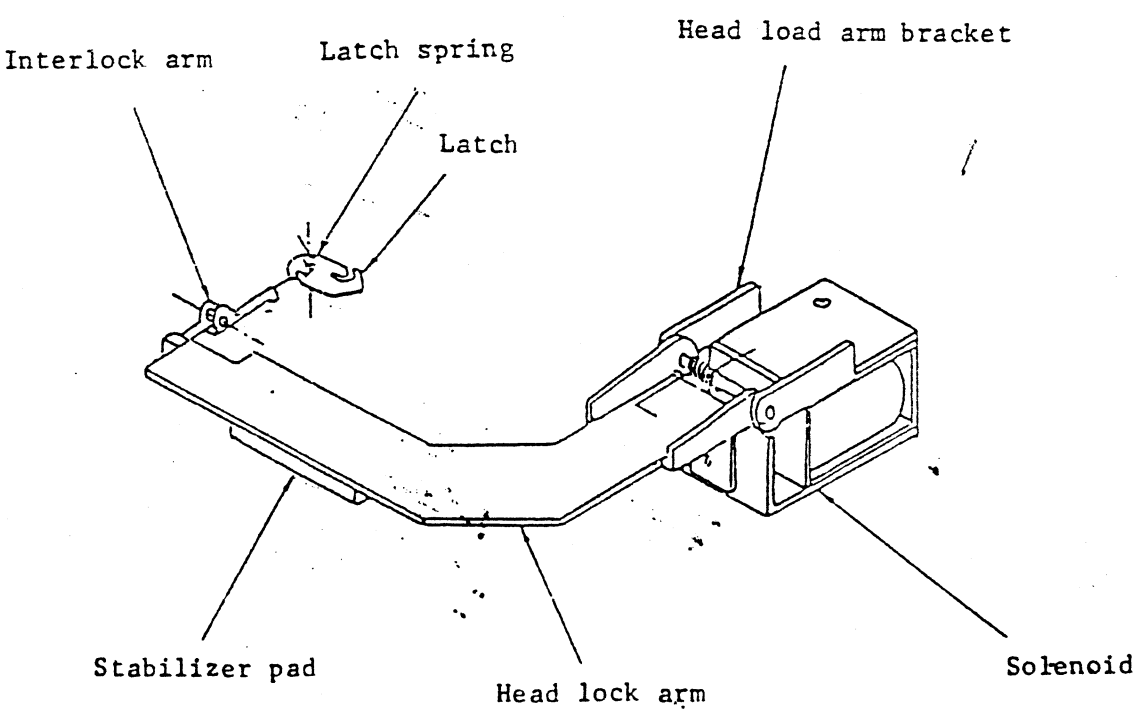


Fig. 3.5 Head load interlock feature

3.5 Circuit

This MDD uses LSIs for the major circuits, thus deleting the number of circuit parts 1/4 times as many as the conventional products. It increases the reliability of the products and miniaturizes the PCB space, thereby realizing a 33.5 mm very thin drive.

These LSIs consist of custom AH-IC (analog hybrid IC) and DH-IC (digital hybrid IC), each of which accommodates the following circuit features. (See Fig. 3-35 "Circuit Block Diagram".)

- AH-IC (analog system)
  - DC control circuit
  - Erase amplifier circuit
  - Read amplifier circuit
  - Write circuit
  - Others
- DH-IC (digital system)
  - Stepper motor control circuit
  - Index ready circuit
  - Write protect circuit
  - Head load solenoid control circuit
  - Others

Major circuits are described on the following pages 22 to 42.

3.5.1 Stepper motor control

The stepper motor is a 4-phase DC motor and the circuit built in the IC1 controls the motor.

The step signal rotates the motor for 3.6 and 1.8 degrees in the 48 TPI and 96 TPI Models respectively. The rotation of the stepper motor is converted to linear motion of the read/write head. The DIRECTION-IN signal regulates the direction of the head towards the inner direction at the low level and towards outer direction (towards track 00) at the high level.

Fig. 3-9 shows the 4-phase status transfer.
The signal timing condition is as follows.

Step signal time interval: 48 TPI: 6 msec, 96 TPI: 3 msec
The DIRECTION-IN signal is required to be determined over 1 μs prior to the STEP signal termination (step start point.)

When the WRITE GATE signal is low during write operation, the STEP signal is invalid.

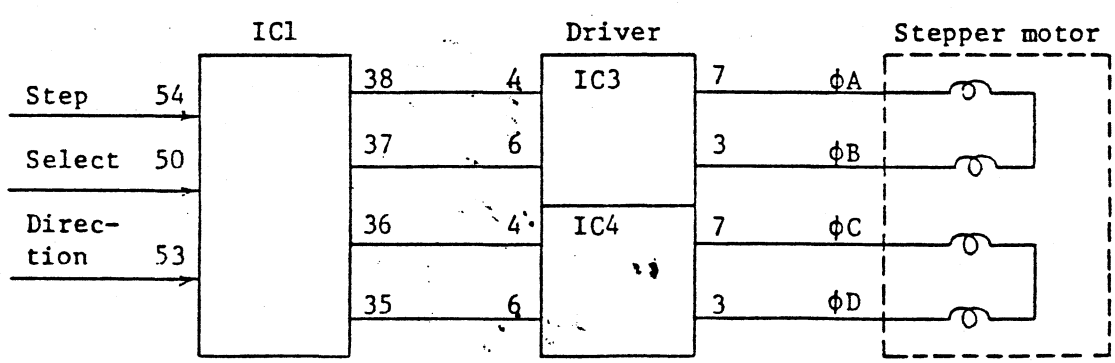


Fig. 3-6 Stepper motor control circuit

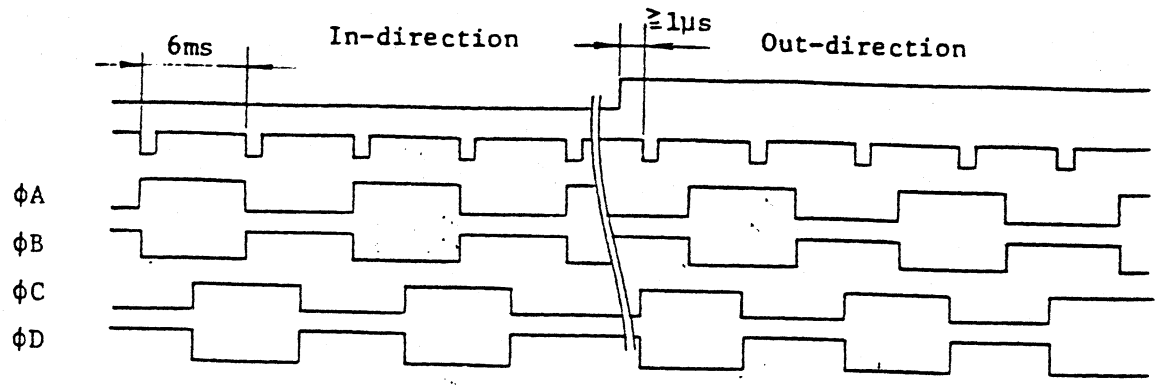


Fig. 3-7 Stepper motor timing (48 TPI)

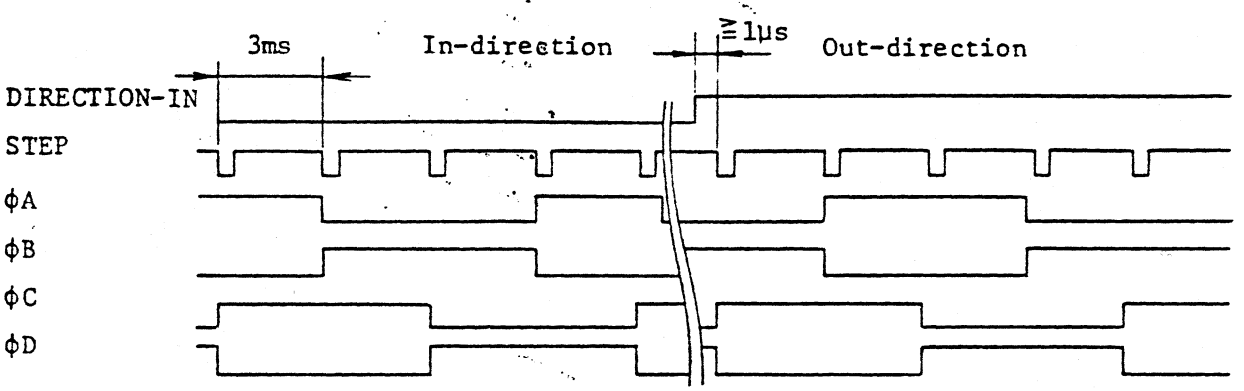


Fig. 3-8 Stepper motor timing (96 TPI)

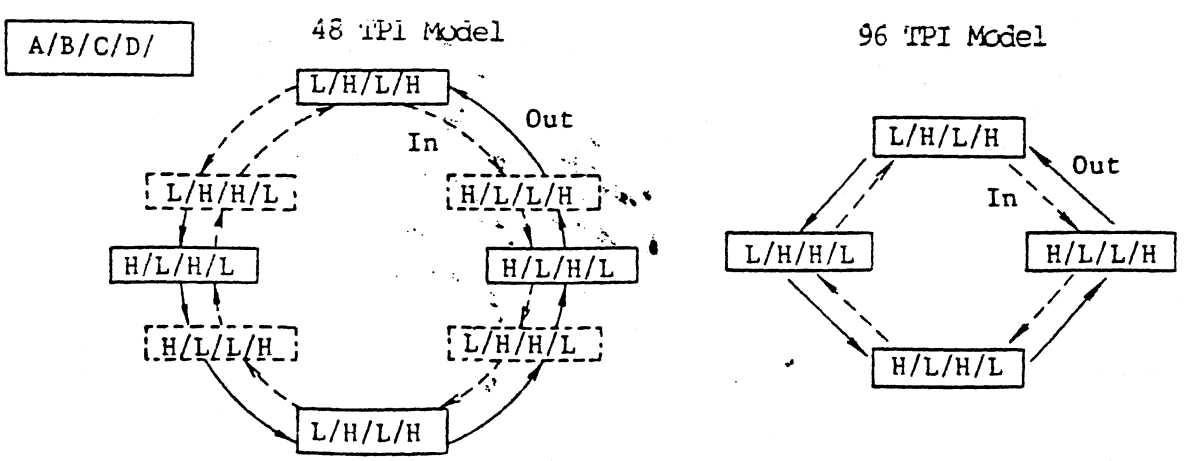


Fig. 3-9 Stepper motor alternative transfer chart

3.5.2 Drive motor control

The drive motor is a DC brushless DD motor and is controlled by the PCB of the DD motor itself. The motor is started and stopped by the MOTOR-ON signal. The motor reaches the optimum speed in0.8safter the motor has started. The speed is adjusted to 300 rpm by the potentiometer located on the DD motor PCB.

3.5.3 Head load circuit

The head load feature is operated by the solenoid. When it is drawn, transistor Tl is turned ON by one shot of 36 ms to supply sufficient start current.

There are two methods to load the head, both of these can be selected by the jumper connection. One method, named SH (select head load), is that the head load solenoid is drawn when the drive has been selected and the head load signal becomes low. Another method, named AH (automatic head load), is that the head load solenoid is drawn when the drive is selected.

In both methods the inserted disk should be properly rotating.

3.5.4 Motion check LED

The motion of the drive is indicated with a green and red lights.

i) Green light

Green light indicates that a disk is inserted in the drive and the control is in the ready condition. In this state, the disk can be discharged from the drive. It disappears when the following red light appears.

ii) Red light

Red light indicates that a disk is inserted in the drive and the read/write head has been loaded to the disk. In this state, the disk cannot be discharged. It disappears when the preceding green light appears.

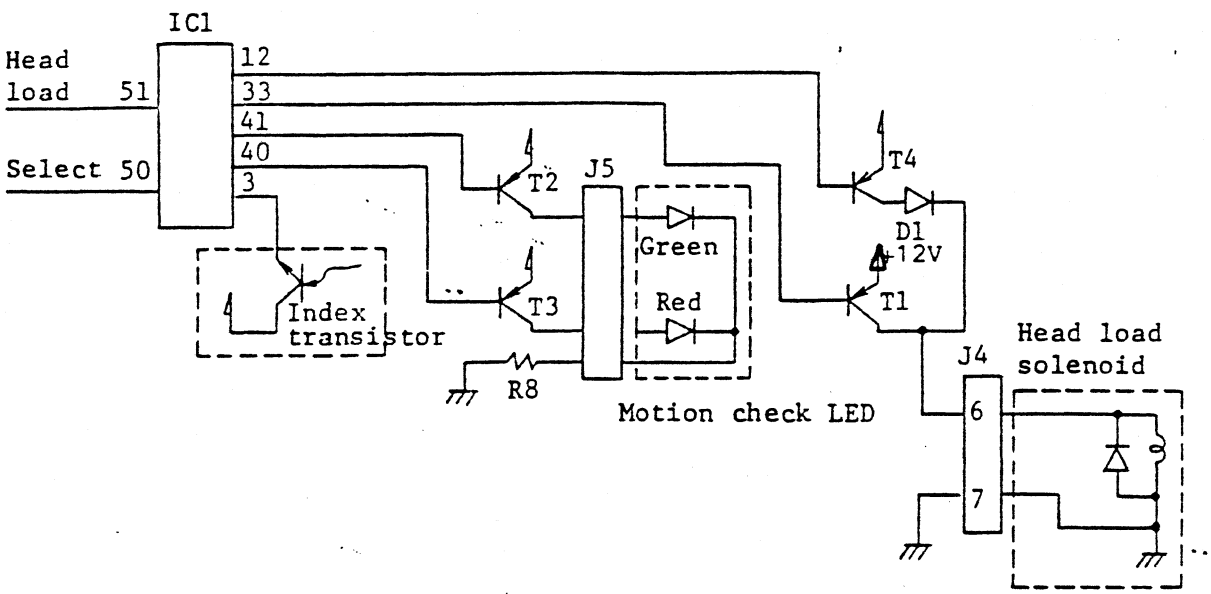


Fig. 3-10 Head load solenoid and operation confirmation LED drive circuit

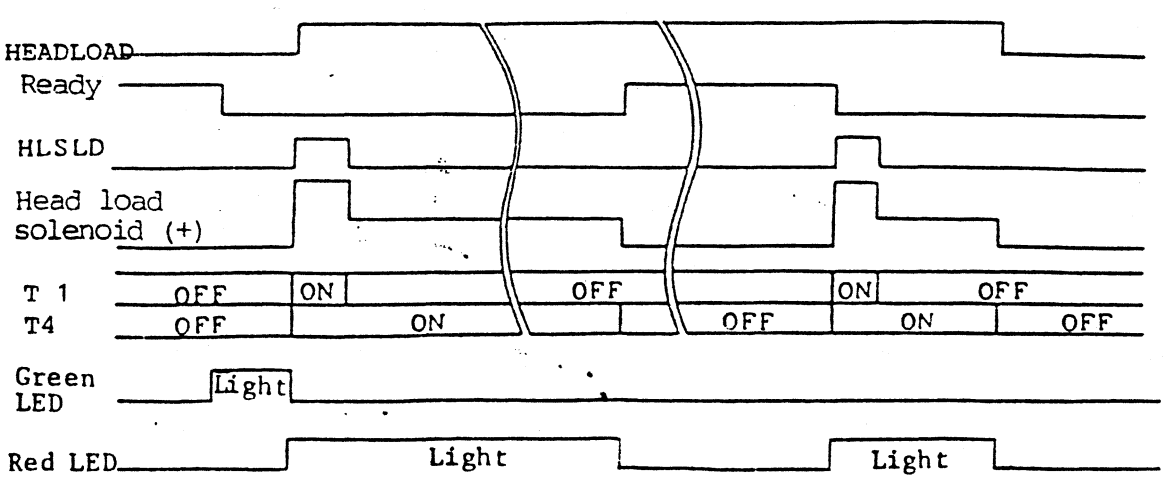


Fig. 3-11 Head load timing and motion check LEDs

3.5.5 Track 00 detector

The TRACK 00 signal is provided for correcting the head position when the track position of the read/write head is unknown. Moving the head to Track 00 causes the TRACK 00 signal to be low. The Track 00 detector consists of a photo switch comparator and peripheral circuit. The Track 00 switch is closed by the head carriage by shutting the photo switch light. The Track 00 signal is output when the output level of Track 00 photo switch is same to the output level of phase A and phase C of the stepper motor. The stepper motor phase status repeats 4 tracks.

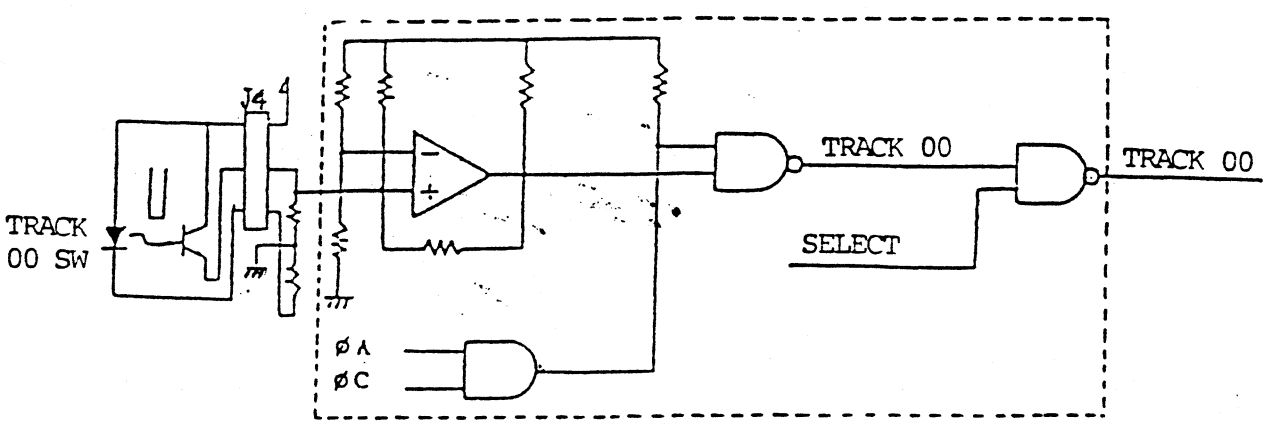


Fig. 3-12 TRACK 00 Detector circuit

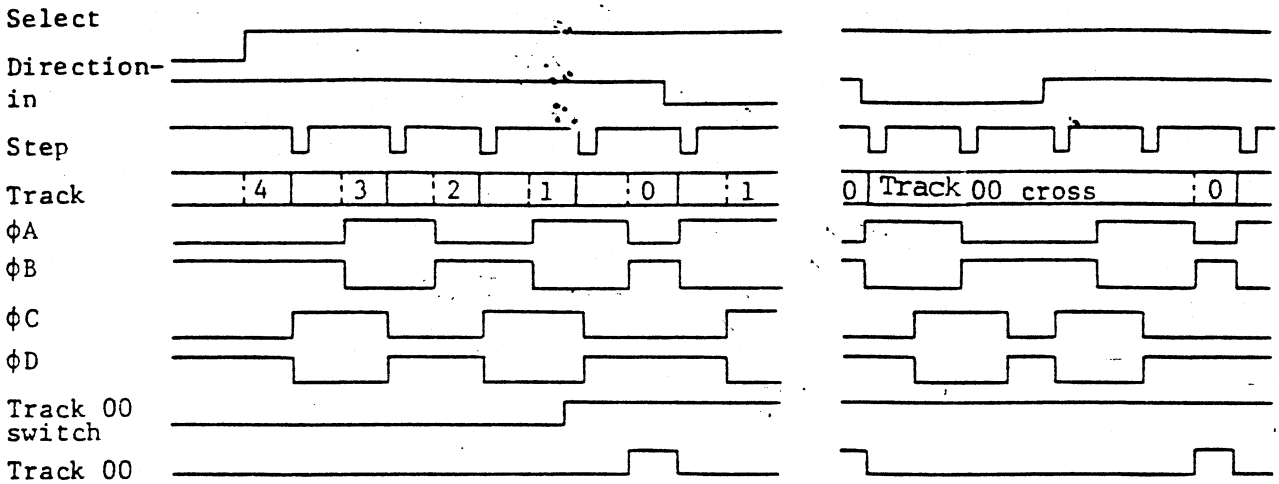


Fig. 3-13 Track 00 timing MDD 6128 48 tpi

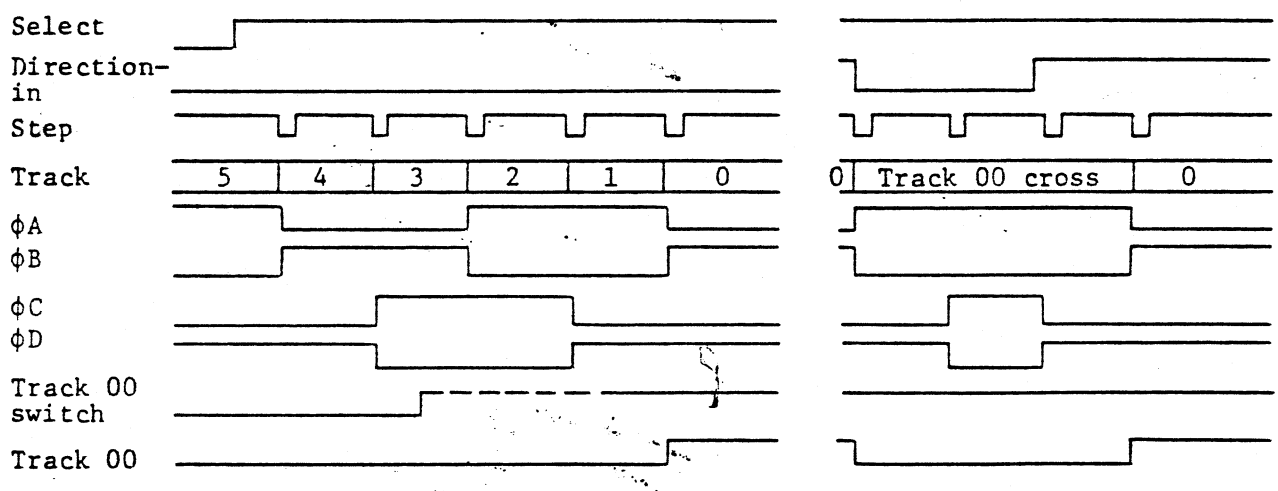


Fig. 3-14 Track 00 timing MDD 6138 96 tpi

3.5.6 Write protect detector

The write protect detector consists of an LED, photo transistor. For write protect, the disk write protection notch can be covered by an opaque cover.

Inserting a disk with the covered notch causes the notch open signal to become low and the write inhibit signal to become high, because the light from the LED does not reach the photo transistor. In this case, if the select signal becomes high, the WRITE PROTECT signal becomes low. The host system is notified of the write protect status.

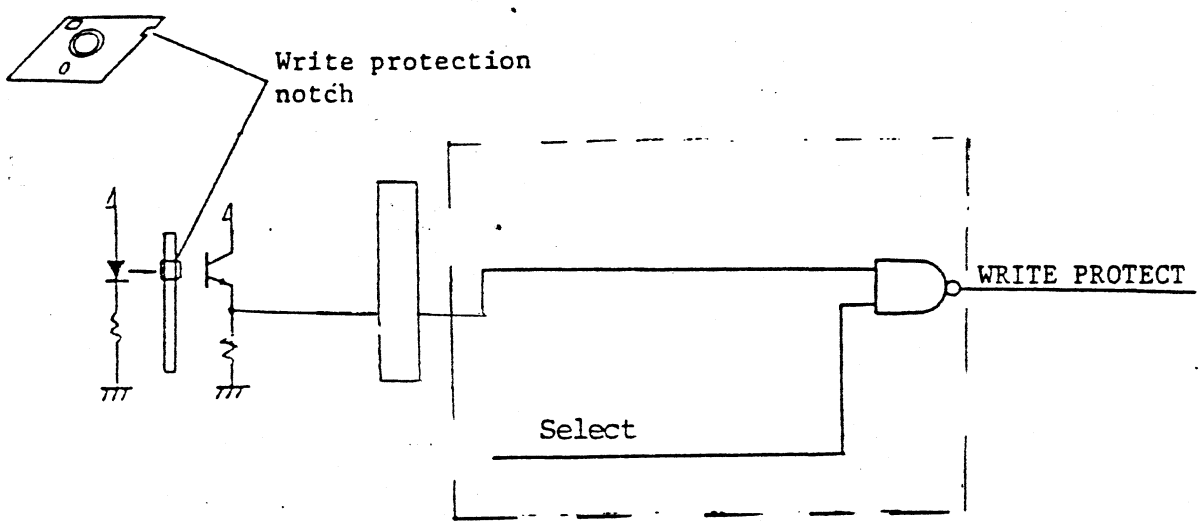


Fig. 3-15 Write protect detection circuit

3.5.7 INDEX/READY DETECTOR

3.5.7.1 INDEX DETECTOR

The index detector consists of an LED, photo transistor and comparator, like the write protect detector.

When the index hole is positioned between the LED and photo transistor, the LED light reaches the photo transistor, and a positive pulse of 2.5 ms - 5 ms is generated in the comparator output. This pulse enter to the counter, and as a 4 ms pulse, is conveyed to the host system as a negative pulse when the select signal is active.

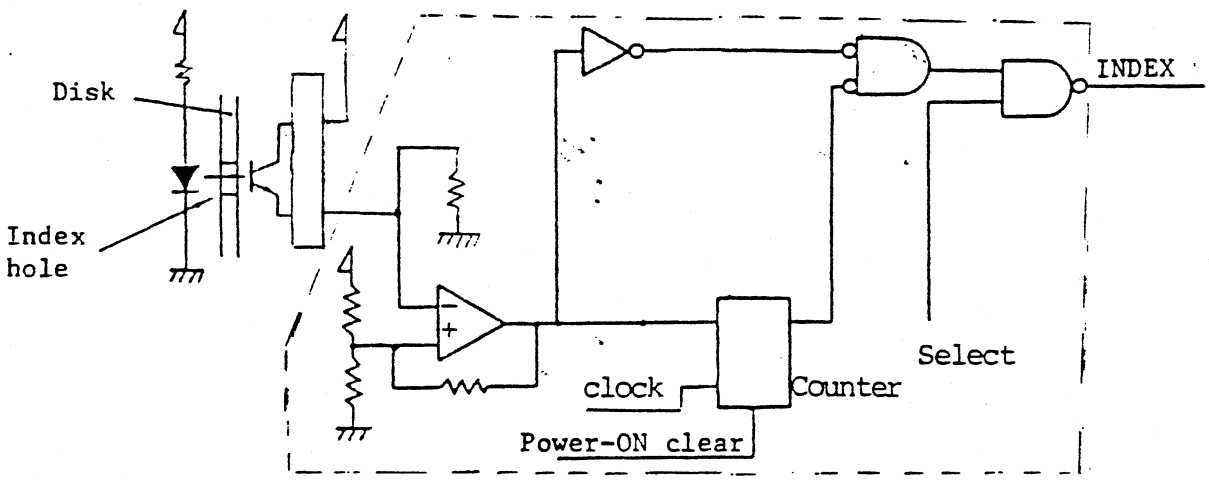


Fig. 3-16 Index detection circuit

3.5.7.2 Ready detector

The ready detector is provided for monitoring the disk speed by the index pulse and built in the IC1.

When the index pulse time interval is over 300 ms, the IC1 READY (61-pin) output is high. When it is below 300 ms, the READY output becomes low (active).

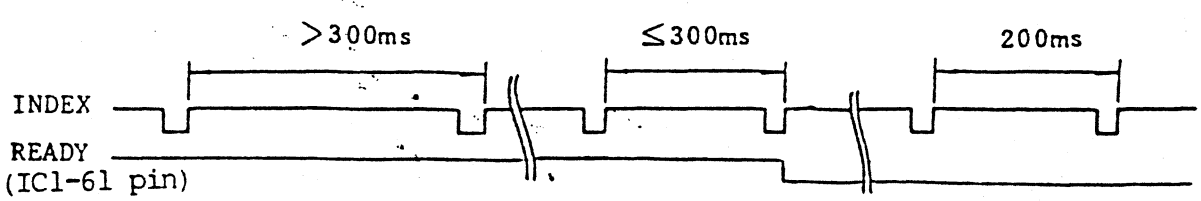


Fig. 3-17 Ready timing

3.5.8 Read/write circuit

3.5.8.1 Read/write head

The read/write head is a tunnel erase type ceramic head. The head consists of the two read/write coils, one erase coil and three coils. The erase coil is excited in the write mode, and a noise prevention area is formed at both sides of a track recorded by the read/write coil. The two read/write coils are rolled on one core chip and center-tapped. The read/write head connection is illustrated in Fig. 3-19. At the write operation time each bit of write data is alternatively distributed by each coil of the D-FF, and magnetic flux inversion is generated. Writing data on the old data causes the old data to be replaced by the new data.

At the read time the output voltage is inducted when the read/write head gap passes the magnetic flux inversion section. This voltage is sent to the read circuit. The specifications are shown below.

Magnetic inversion density	5922 FCI (inner track)			
	FCI: Flux Changes/Inch			
Read/write frequency (at the head)	FM record	62.5 KHz	125 KHz	
	MFM record	62.5 KHz	83.3 KHz	
		125 KHz		
Magnetic inversion time	FM record	4 μs	8 μs	
	MFM record	4 μs	6 μs	8 μs

	48 T.P.I.	96 T.P.I.
Track interval (A)	0.529 mm 0.0208 inch	0.265 mm 0.0104 inch

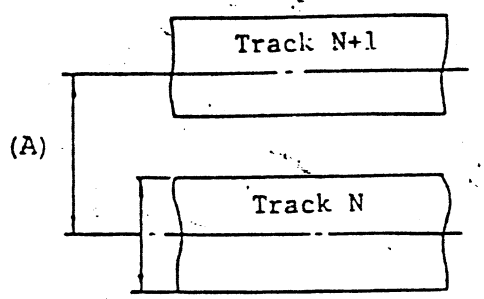


Fig. 3-18 Track dimension

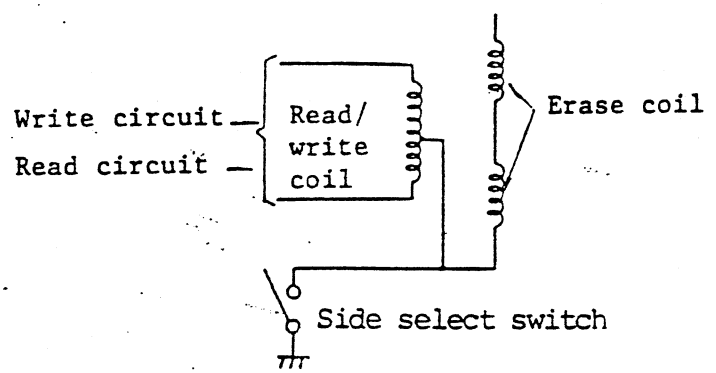


Fig. 3-19 Read/write head connection diagram

3.5.8.2 Write circuit

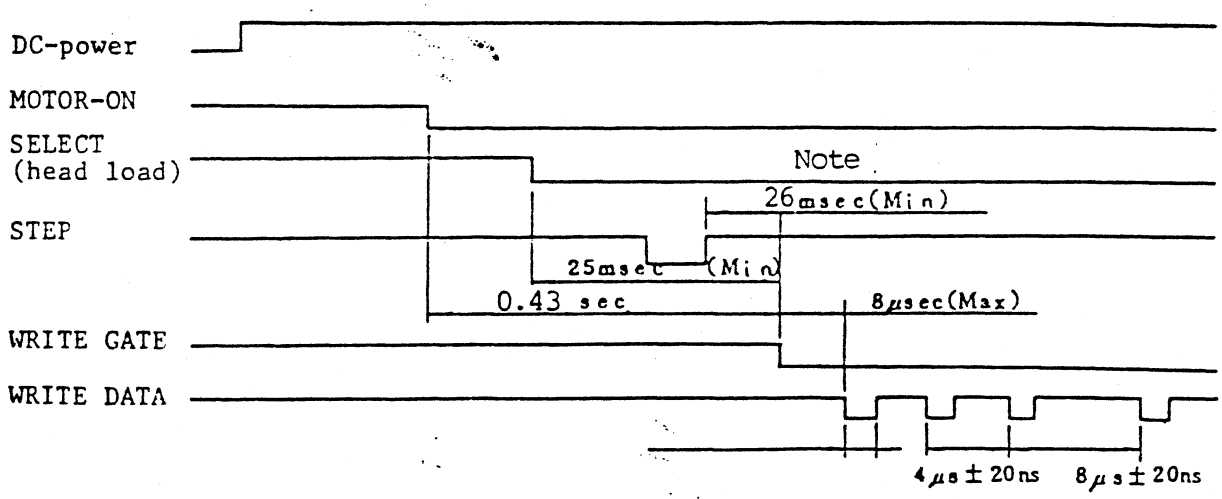
The write circuit converts the serial data passed from the host system into the magnetic pattern on the disk. Fig. 3-20 shows the write timing.

Fig. 3-21 shows a simplified circuit block. Loading the head and making the WRITE GATE signal become low causes the drive to enter into the writable status.

Sending data from the host system in this state causes the write flip-flop to alternately turn ON.
Hence, the write current Iω, Iω' determined by R3 is supplied to the read/write coils ω_1, ω_2 alternately. The inversion magnetic field corresponding to the data is stored in the disk.

When the erase enable signal is low, erase amplifier turns ON, and current I_E is supplied to the erase coil. The current I_E value is determined by resistance R4. The erase enable signal becomes low after the write gate signal has become low and a fixed delay time has elapsed. The reason is that the tunnel erase gap is positioned by being preceded by the read/write gap.
Fig. 3-23 shows the erase ready circuit.

The write current and erase current are cut by the DC control circuit if an electrical trouble occurs.



Note: It is 23 Ms (Min) in the 96 TPI Model.

Fig. 3-20 Write start timing

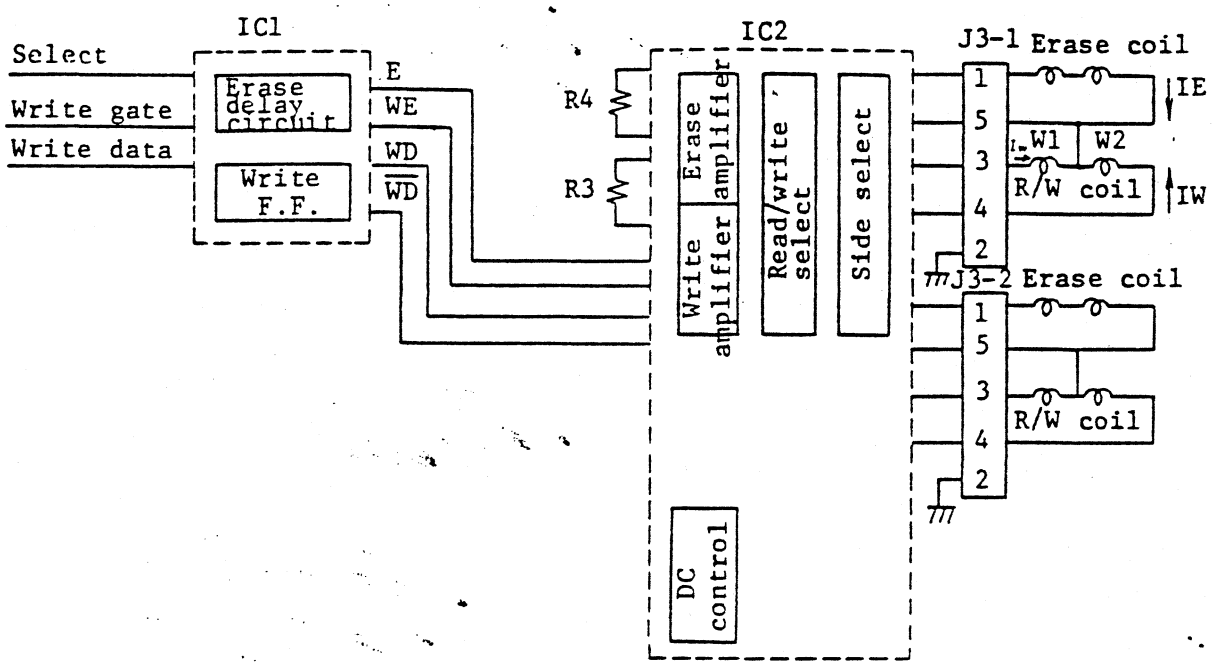


Fig. 3-21 Write circuit block diagram

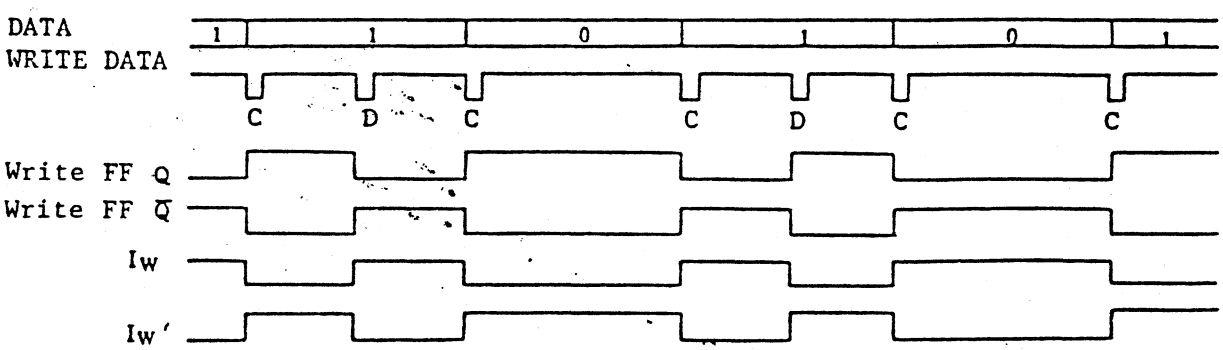


Fig. 3-22 Write timing

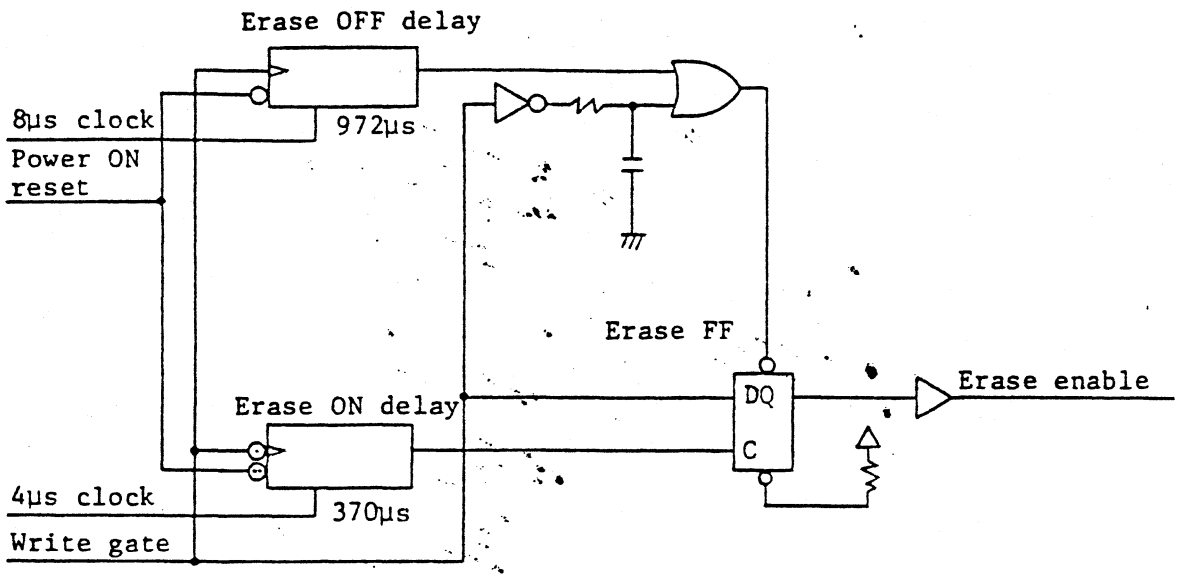


Fig. 3-23 Erase delay circuit (equivalent)

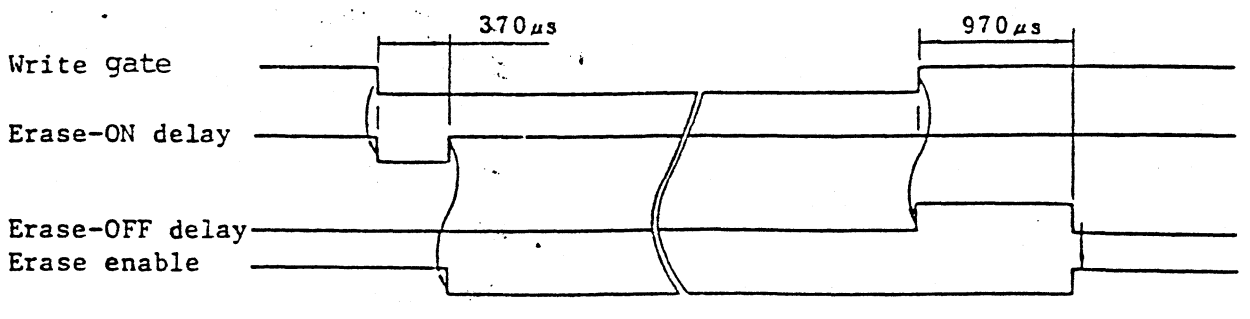


Fig. 3-24 Erase delay timing

3.5.8.3 Read circuit

Data stored in the disk are regenerated by the read circuit. Fig. 3-31 shows the read timing.

Fig. 3-25 shows the read circuit. Loading the head and making the WRITE GATE signal become high causes the drive to enter into readable status. The read circuit consists of an IC floppy amplifier and required parts.

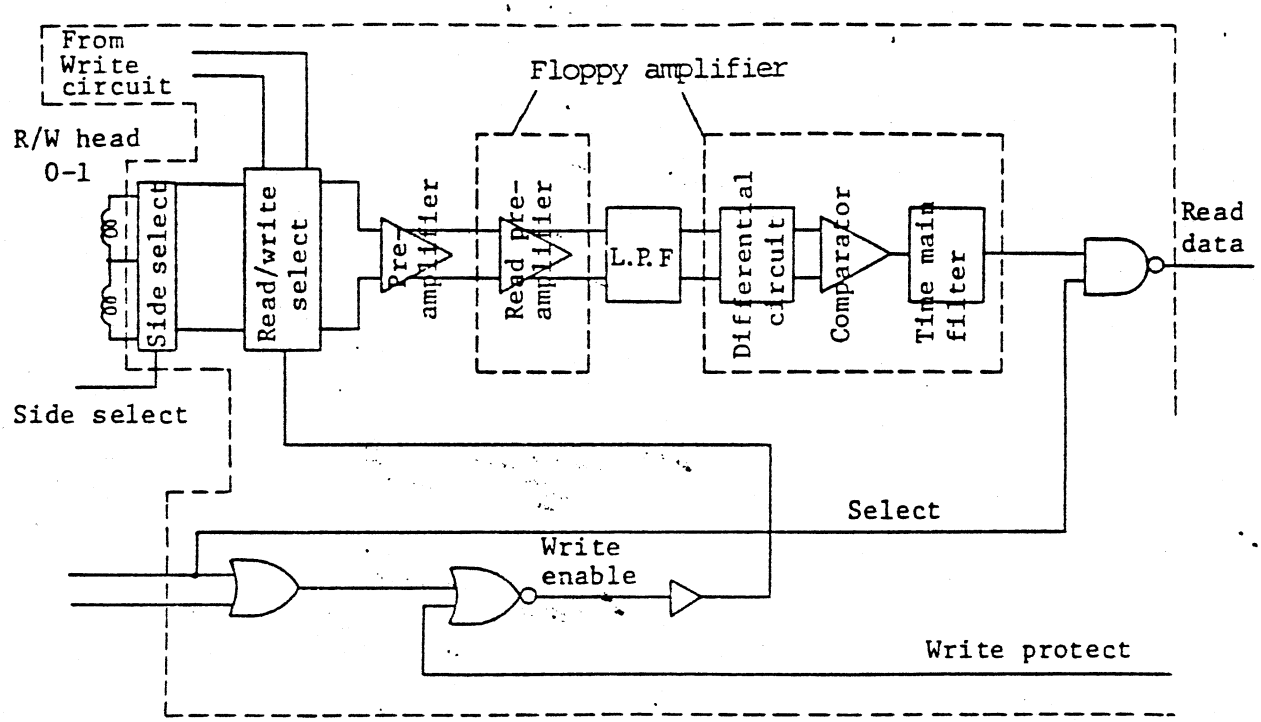
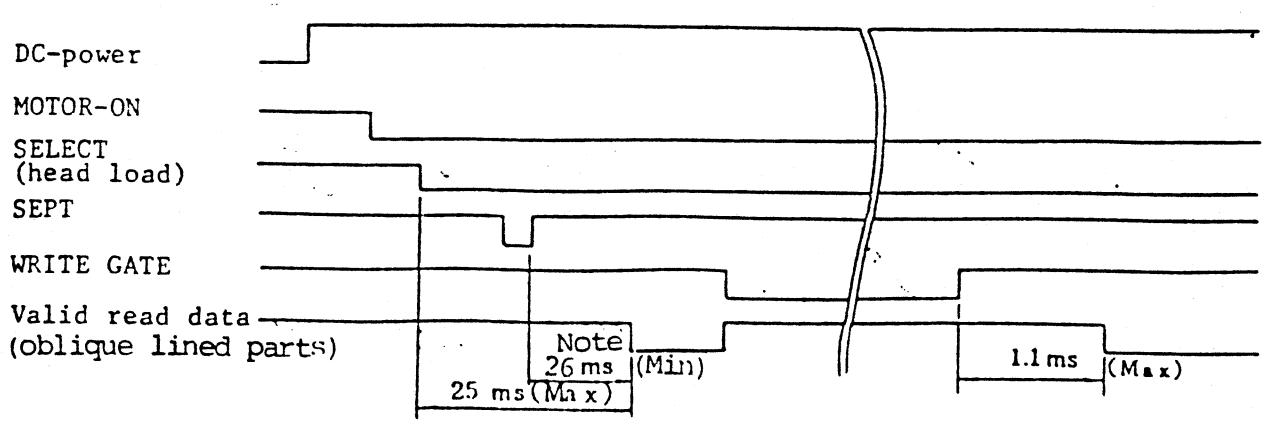


Fig. 3-25 Read circuit



Note: It is 23 ms (Min) in the 96 TPI Model,

Fig. 3-26 Read start timing

3.5.8.4 Read/write select

The read/write select circuit consists of diode switches. The input side of the switch is connected to the coil of the read/write head, and the output side to the read amplifier.

When the drive is in the write mode, a write enable signal is low and diodes D9 and D10 are turned OFF. Meanwhile, in the read mode, the write enable signal is high, diodes D10 and D9 are turned ON, and the read/write head and the read amplifier are connected.

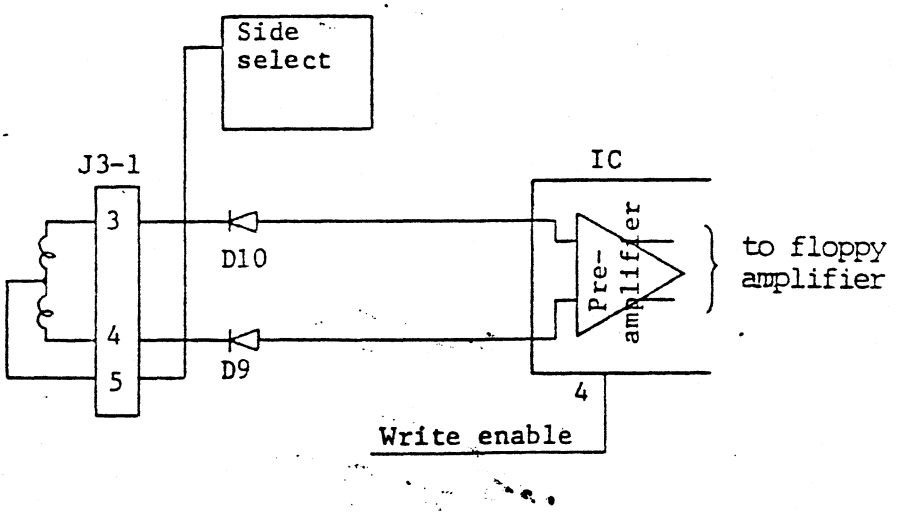


Fig. 3-27 Read/write select circuit

3.5.8.5 Read amplifier circuit and filter network

A read signal is amplified by the pre-amplifier and the floppy amplifier. The read signal amplified by both amplifiers drives the next filter network. The filter network is a low-pass filter.

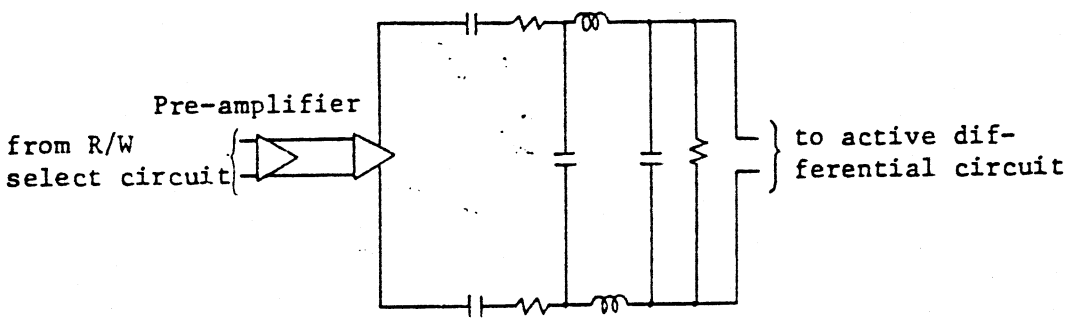


Fig. 3-28 Read circuit and filter network

3.5.8.6 Active differential circuit and comparator

Both circuits are part of the floppy amplifier. Fig. 3-29 shows the outline. The active differential circuit is a differential amplifier, the emitter of which is coupled by the capacitor. The current passing through the capacitor becomes the differentiation of the input voltage. In short, the current passing to the collector resistance is the differentiated input voltage. Hence, the output voltage Vo of the differential amplifier is also the differentiated input voltage.

$$Ic = C \frac{dVin}{dt}$$

$$Vo = 2RIc = 2RC \frac{dVin}{dt}$$

The output voltage Vo is inputted into the connector which detects the zero-cross. As a result, the peak of the voltage inputted into the differential circuit is detected. Fig. 3-31 shows the timing of the differential circuit and comparator.

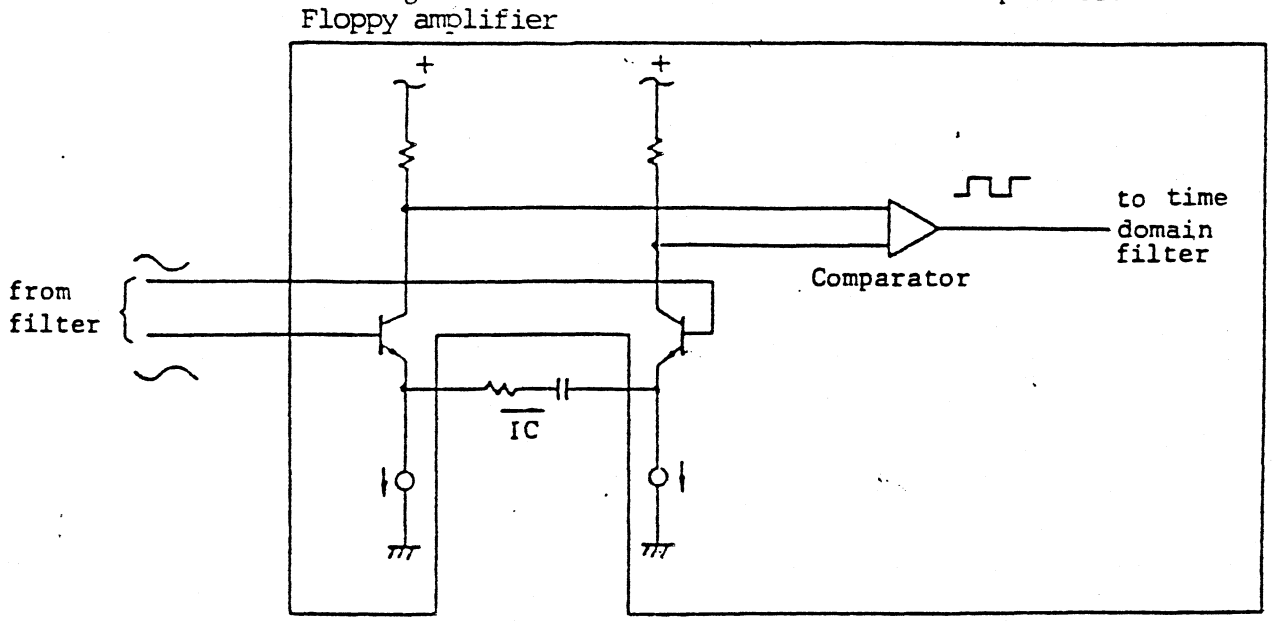


Fig. 3-29 Active differential circuit and comparator

3.5.8.7 Time domain filter and crossover detector

Both circuits are part of the floppy amplifier. The timing filter removes an erroneous crossover of the comparator caused by shouldering of the differentiated read signal. When a high resolution head is used, shouldering sometimes occurs in the outer circumference of the drive.

The time domain filter consists of a pulse generator, time domain one shot and time domain flip-flop. The pulse generator generates a short pulse to trigger the time domain one shot at every input transfer. The time domain one shot pulse width is determined by the external resistor and capacitor value.

The MDD are set to 2.2 μs. The information passed from the comparator is delayed by 2.2 μs by the time domain one shot and loaded on the time domain flip-flop. Even if the timed flip-flop is clocked by an erroneous crossover, the time domain flip-flop output does not change, because the erroneous cross-over time is shorter than 2.2 μs.

The crossover detector is triggered at the every time domain flip-flop transfer. The pulse width of the crossover detector is determined by the resistor and capacitor value, and is set to 500 nsec.

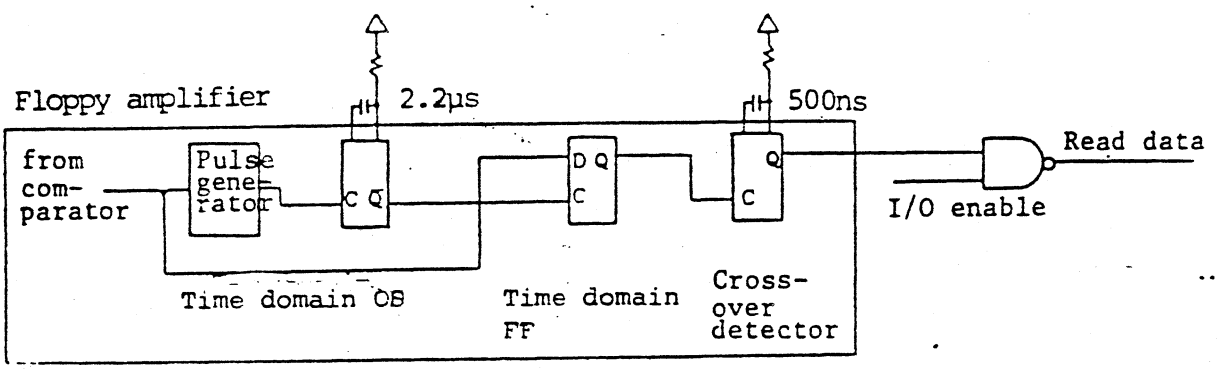


Fig. 3-30 Timed main filter and crossover detector

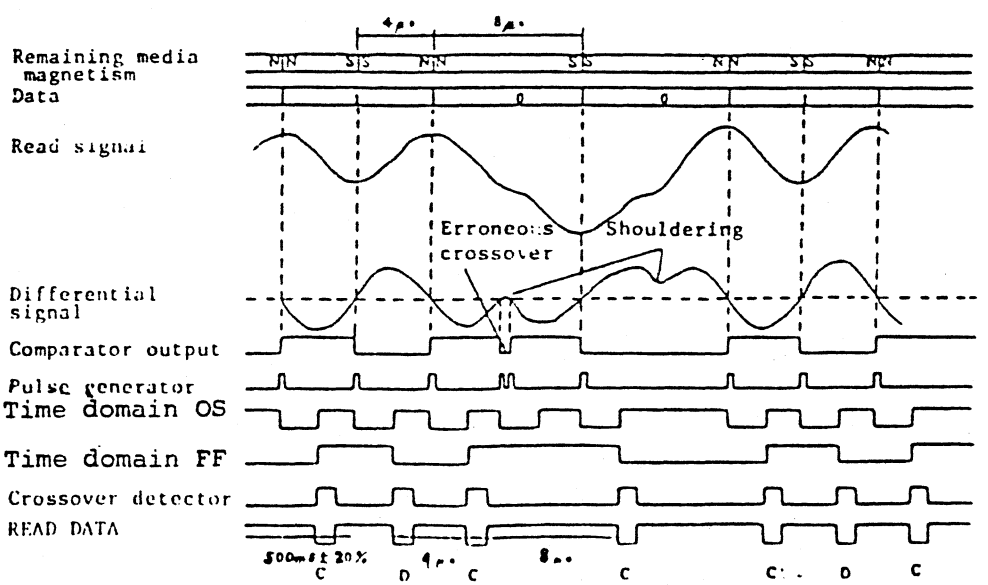


Fig. 3-31 Read timing

3.5.9 DC control circuit and power-ON reset circuit

3.5.9.1 DC control circuit

Fig. 3-32 shows the DC control circuit. This circuit is used to monitor the DC 5V and DC 12V power voltage. When it deviates from the following limits, the write current and erase current are not secured.

5V DC < 4.0V

12V DC < 8.3V

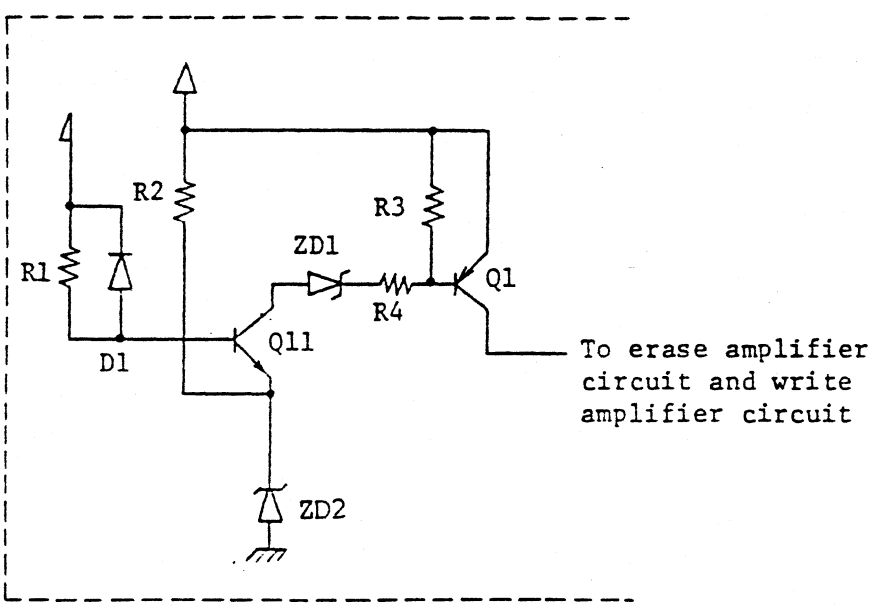


Fig. 3-32 DC control circuit

3.5.9.2 Power-ON reset circuit

Fig. 3-33 shows the power-ON reset circuit. When the power is turned on, capacitor C begins charging to 3V. When the capacitor C voltage is lower than the buffer threshold voltage, the power-ON reset signal becomes low. Hence, the initial reset pulse of 36 m sec can be generated.

The power-ON reset pulse resets the following circuits.

- o Erase-OFF delay one shot
- o Ready detection
- o Step one shot

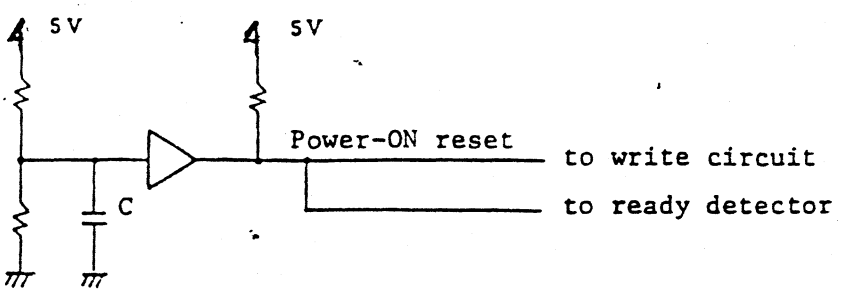


Fig. 3-33 Power-ON reset circuit

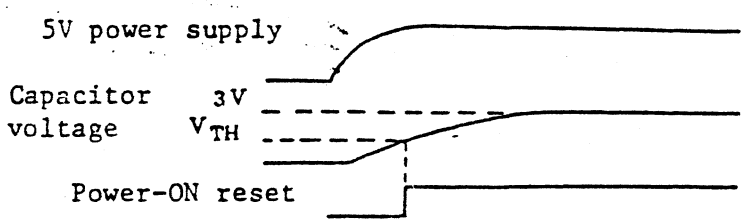


Fig. 3-34 Power-ON reset timing

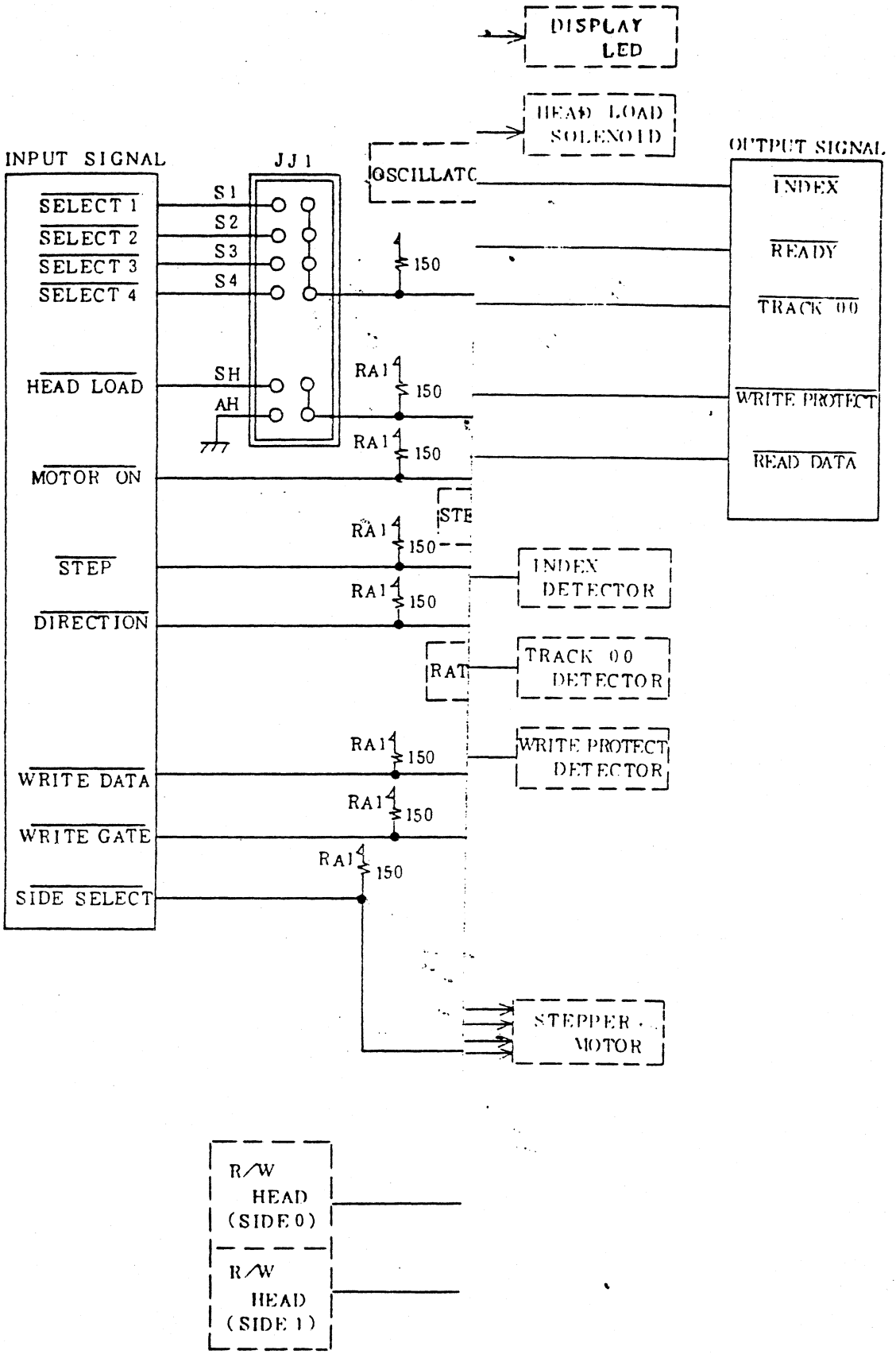
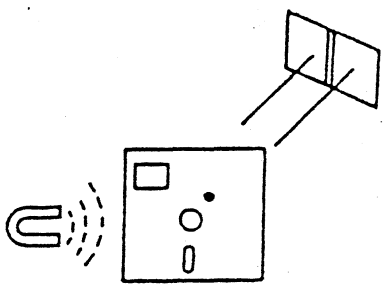

DISPLAY LED
HEAD LOAD SOLENOID
OSCILLATO
INPUT SIGNAL
JJ1
OUTPUT SIGNAL
SELECT 1
SELECT 2
SELECT 3
SELECT 4
S1
S2
S3
S4
150
INDEX
READY
TRACK 00
HEAD LOAD
SH
AH
RA1
150
WRITE PROTECT
READ DATA
MOTOR ON
STE
STEP
INDEX DETECTOR
DIRECTION
RAT
TRACK 00 DETECTOR
WRITE PROTECT DETECTOR
WRITE DATA
WRITE GATE
SIDE SELECT
STEPPER MOTOR
R/W HEAD (SIDE 0)
R/W HEAD (SIDE 1)

Fig. 3-35 Circ

4. Handling Mini Floppy Disks

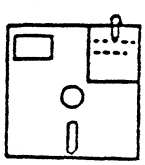
The following are the precautions to be observed when handling mini floppy disks.

[Unsatisfactory]



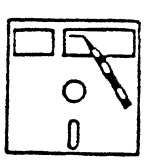
o Do not expose disks to direct sunlight or place them near a source of heat.

o Do not place disks in a place which is subject to the influence of a magnetic field.

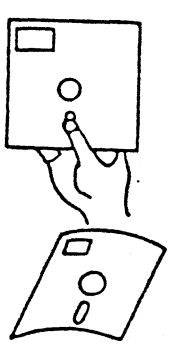


o Do not expose disks to cigarette smoke.

o Do not put clips or rubber bands on disks.



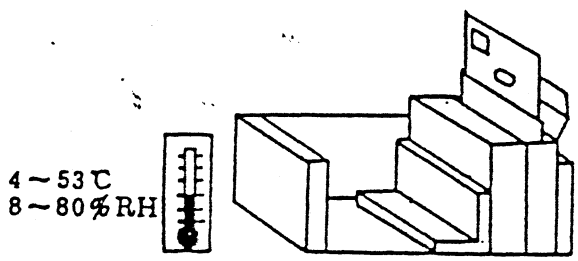
o Do not write directly on disks using a pen or pencil.



o Do not touch the recording face of disks (oblong hole portion).

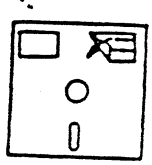
o Do not bend or fold disks.

[Satisfactory]

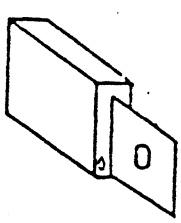


o Store disks in a clean environment at suitable temperature and humidity.

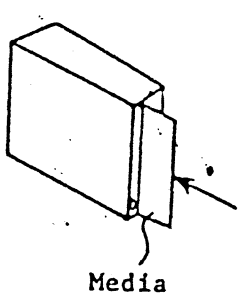
o When not using a disk, insert it in an envelope, then insert the envelope in a special-purpose case, and store it vertically.



o Paste labels on disks after writing on them first.



o Before using a disk, it is recommended that it be left for a suitable time in the same environment as the drive in order to acclimatize it.



o Completely insert the media to the back of the drive before pushing the button.

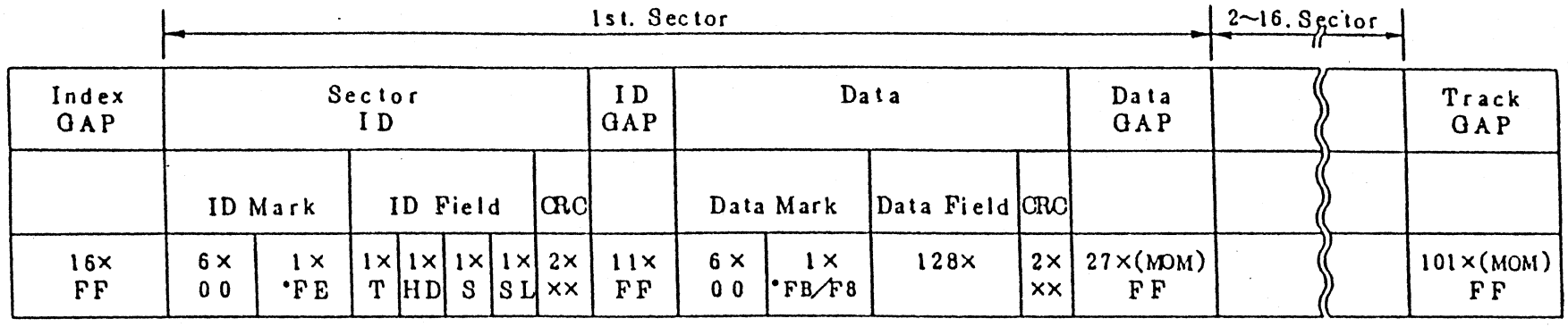
5. Format Example

The format of the soft selector used with the MDD is shown in the table below.

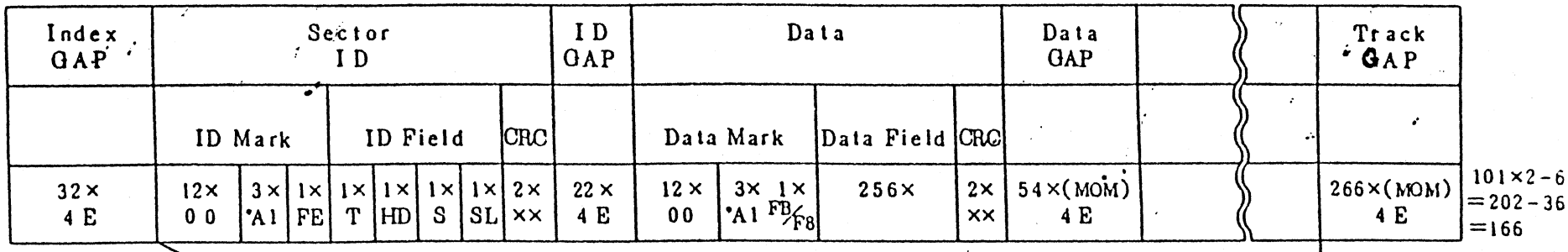
Format examples for F.M. 16-sector format and M.F.M. 16-sector format are shown in Fig. 5-1.

	FM/MFM	Sector format	Data amount/sector	Data amount/track
Conformance to ISO	FM	16 sectors	128 bytes	2048 bytes
		9 "	256 "	2304 "
		5 "	512 "	2560 "
	MFM	16 "	256 "	4096 "
		9 "	512 "	4608 "
		5 "	1024 "	5120 "
Conformance to IBM	FM	16 "	128 "	1920 "
		8 "	256 "	2048 "
		4 "	512 "	2048 "
	MFM	16 "	256 "	4096 "
		8 "	512 "	4096 "
		4 "	1024 "	4096 "

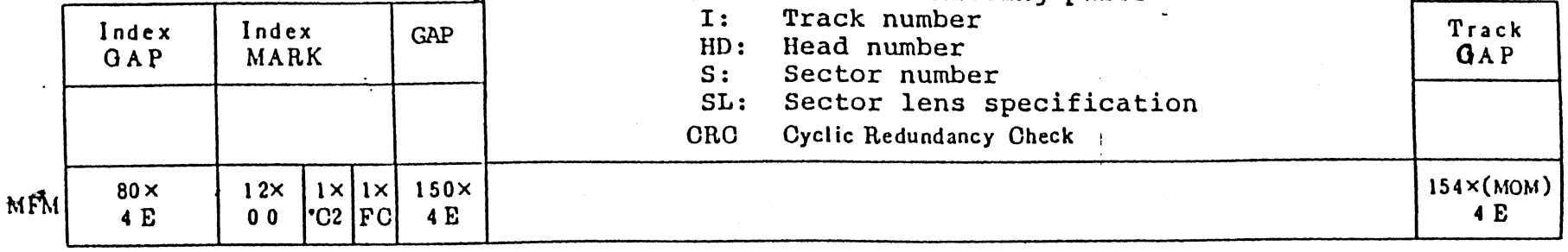
Format example (FM, 16 sectors, 128 bytes, conformance to ISO)



Format example 2 (MFM, 16 sectors, 256 bytes, conformance to ISO)



Format example 3 (MFM, 16 sectors, 256 bytes, conformance to IBM)



*: Includes missing pulse
I: Track number
HD: Head number
S: Sector number
SL: Sector lens specification
CRC Cyclic Redundancy Check

Fig. 5-1

6. Maintenance

6.1 Special tools and oil

Name	No.	Description
DD motor aligning tools	FT1-0095	For replacement of DD motor assembly
Steel belt plate spring mounting jig	FT1-0101	For replacement of steel belt
Mounting plate assy mounting jig	FT1-0102	For replacement of mounting plate assembly
Gap gauge	ST1-0178	For mounting of head load arm
CE-FlexyDisk 5.25" -2 96 tpi		For adjustment of track position
CE-FlexyDisk 5.25" -2 48 tpi		For adjustment of track position
Cleaning FlexyDisk 5.25' - S		For periodic inspection

Name	No.	Description
Rubble plate No oil	E73-113003	For dismounting of mounting plate ass'y III

Note: Precautions on handling the CE-diskette

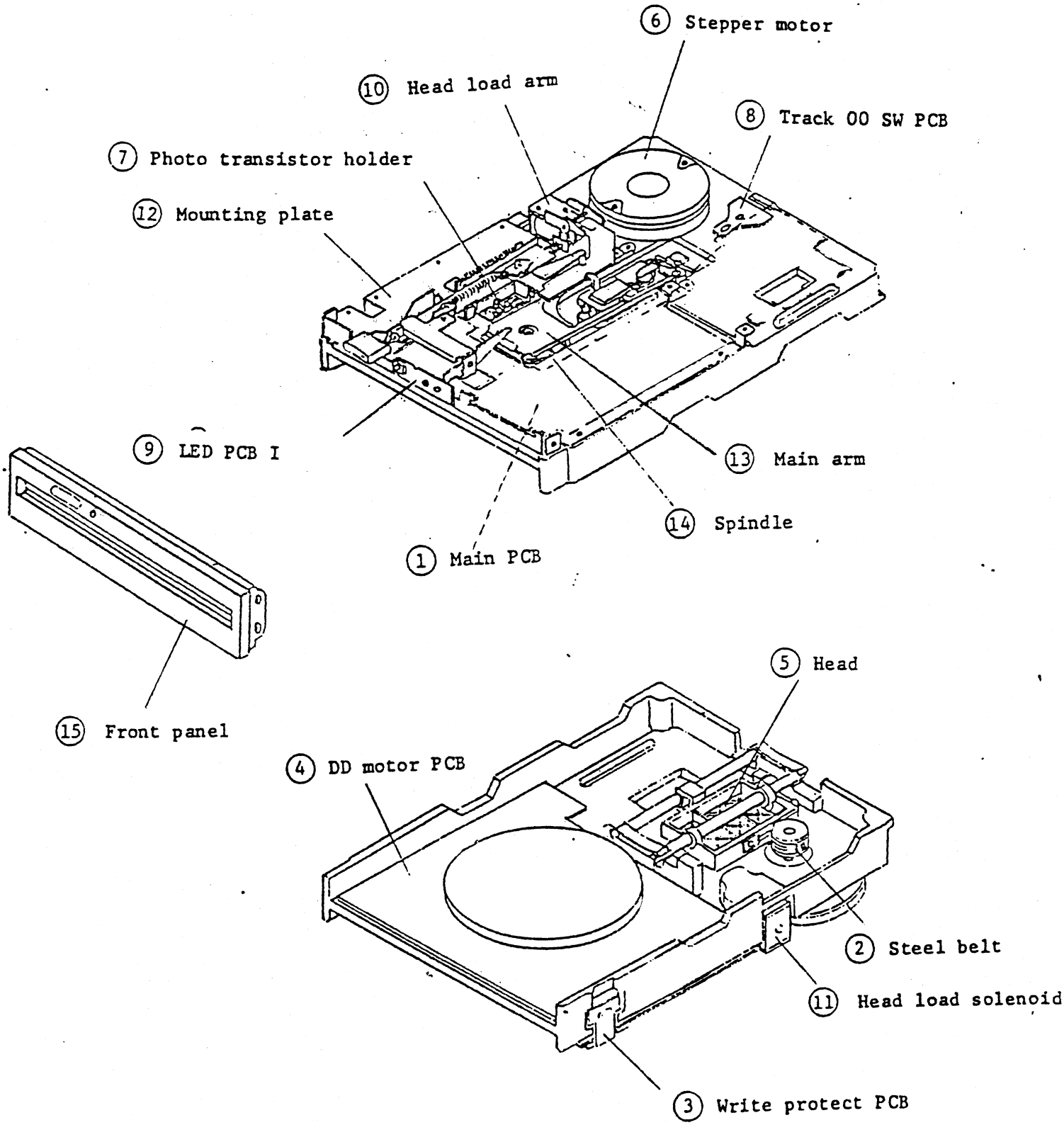
1. Leave the CE- diskette for 2 hours in the same condition as the drive prior to use.

The CE-diskette should be handled with care same as a standard disk.

6.2 Periodic inspection

Cleaning of head : Once per year

Both the side 0 and side 1 should be cleaned for 5 sec. each with a cleaning diskette.


⑥ Stepper motor
⑩ Head load arm
⑧ Track 00 SW PCB
⑦ Photo transistor holder
⑫ Mounting plate
⑨ LED PCB I
⑬ Main arm
⑭ Spindle
① Main PCB
⑮ Front panel
⑤ Head
④ DD motor PCB
② Steel belt
⑪ Head load solenoid
③ Write protect PCB

6.3 Assembly parts replacement procedure

Replaceable assembly parts

(1) Main PCB
(2) Steel belt
(3) Write protect PCB
(4) DD motor PCB
(5) Head
(6) Stepper motor
(7) Photo transistor holder
(8) Track 00 SW PCB
(9) LED PCB
(10) Head load arm
(11) Head load solenoid
(12) Mounting plate
(13) Main arm
(14) Spindle
(15) Front panel

6.3.1 Main PCB assy replacement

1. Remove the 4 mounting screws, and 2 spacers between the main PCB assy and the base.
2. Pull out the connectors J3 (2 pieces), J4, J5, and J6 (Fig. 6-2).
3. Mount the new main PCB assy in the reverse order.

Adjustment after replacement

1. Adjust playback output (see 6.4.2.).

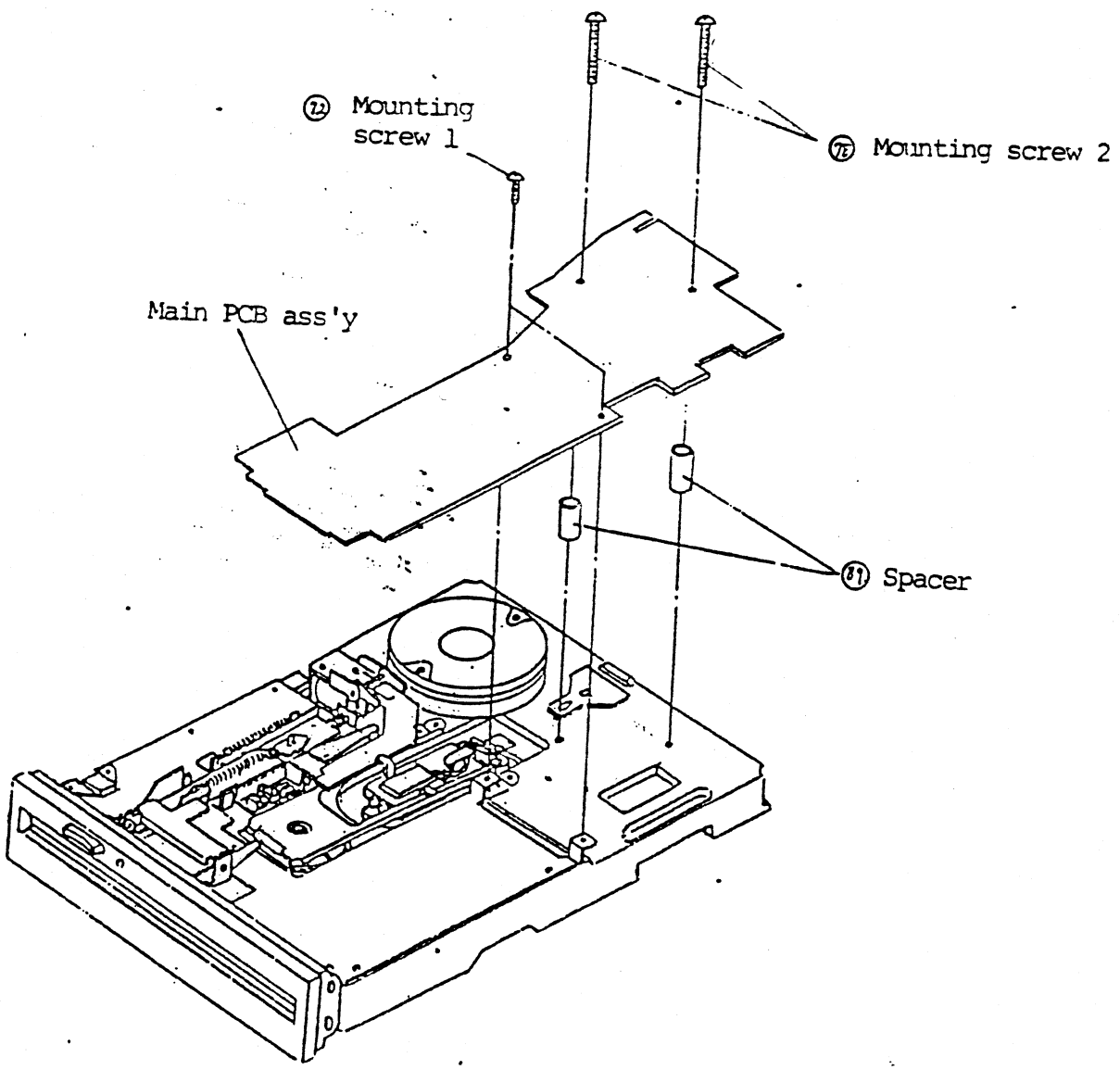


Fig. 6-1

Connector arrangement plan

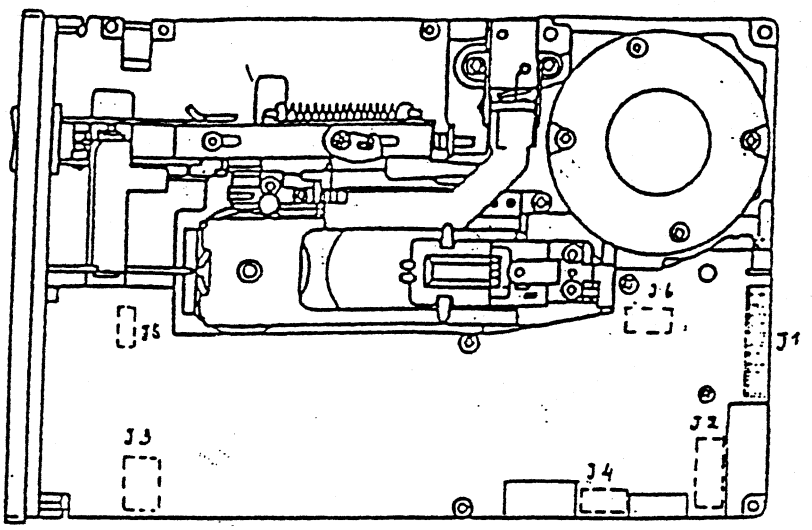
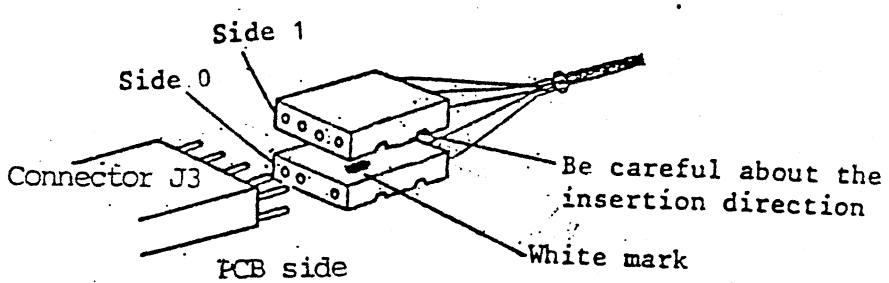


Fig. 6-2

Connector J3 ... 0 - 1 head cable (2 cables)



Heading the white mark of the side 0 connector upward, insert both the connectors to the connector J3.

Connector J4 ... Track 00 switch PCB + DD motor connector cable Align the Δ mark.
Connector J5 ... Index photo transistor + LED PCB
Connector J6 ... Stepper motor

6.3.2 Steel belt replacement

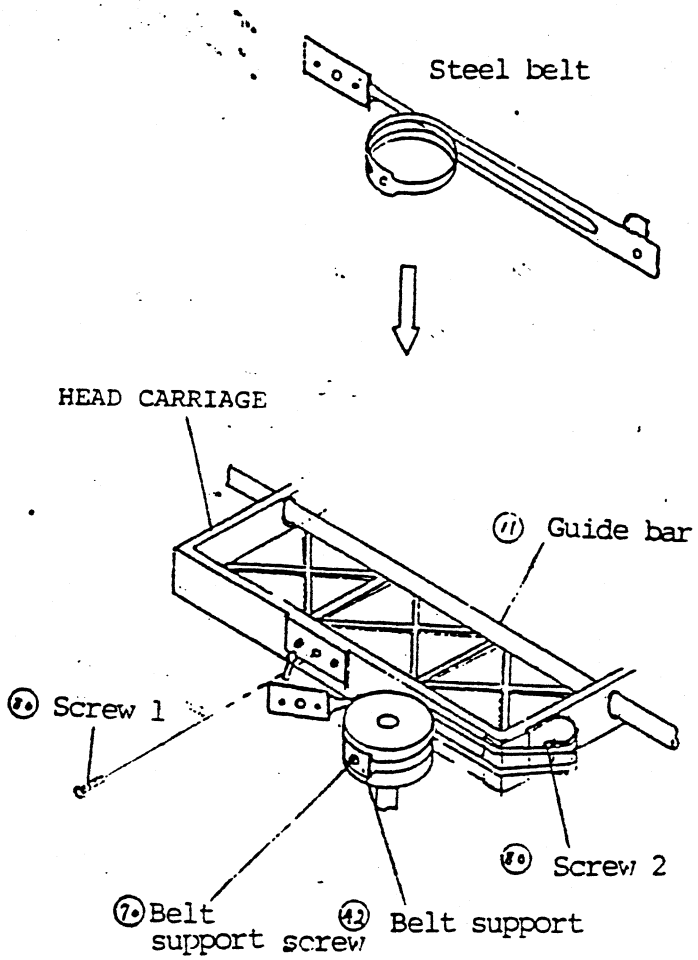


Fig. 6-3

1. Replace the steel belt in the order of the belt support, screws 1 and 2.
2. Mount the replacement steel belt with the screw 2.
3. Form a ring of the new steel belt as shown in Fig. 6-3. Mount the ring to the pulley with the belt support and the belt support screw temporarily.
4. Pull out the steel belt , hook 2 holes of the steel belt ass'y to the protruding portions of head carriage and tighten the screw 1.
5. Make it seek about ten times and tighten the belt support screw after the belt becomes parallel.
6. Apply lock tight on the screws 1, 2 and belt support screw.

Adjustment after replacement

1. Adjust the track position (see 6.4.3).
2. Adjust the TR00 position (see 6.4.4).

6.3.3 Write protect PCB replacement

1. Remove the mounting screw of the write protect PCB
2. Unsolder the wires of the write protect PCB from the DD motor PCB by the use of a soldering iron.
3. Screw the new write protect PCB
4. Solder the write protect PCB to the DD motor PCB.

Adjustment after replacement

1. Check a write protect signal (see 6.4.7).

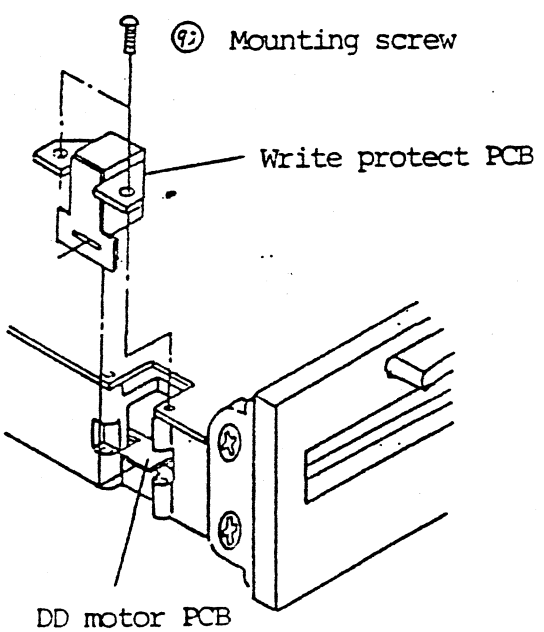


Fig. 6-4

6.3.4 DD motor PCB replacement

1. Remove the write protect PCB (see 6.3.3).
2. Turn the rotor mounting screw counterclockwise and remove the rotor and spacer.
3. Remove the DD motor PCB mounting screws A (4 pieces) and B (3 pieces), detach the connectors A and B, and remove the DD motor PCB.
4. Remove the bearing and waved washer associated with the base.
5. Place the new DD motor PCB, insert the centering jig of the DD motor into the spindle, adjust the position of the DD motor PCB , tighten the mounting screws A and B, and then apply lock tight to the screws B (3 pieces) taking care that the rotor does not touch the hole-element of the DD motor PCB.
6. Mount the individual parts dismounted in 4 above in the reverse order, place the spacer, and install the rotor.
7. Insert the connectors A and B.
8. Mount the write protect PCB (see 6.3.3).

Adjustment after replacement

1. Adjust the index burst position (see 6.4.1).
2. Adjust the rotation (see 6.4.5).
3. Inspect a write protect signal (see 6.4.7).
4. Check the amount of deflection of the spindle (see 6.4.9).

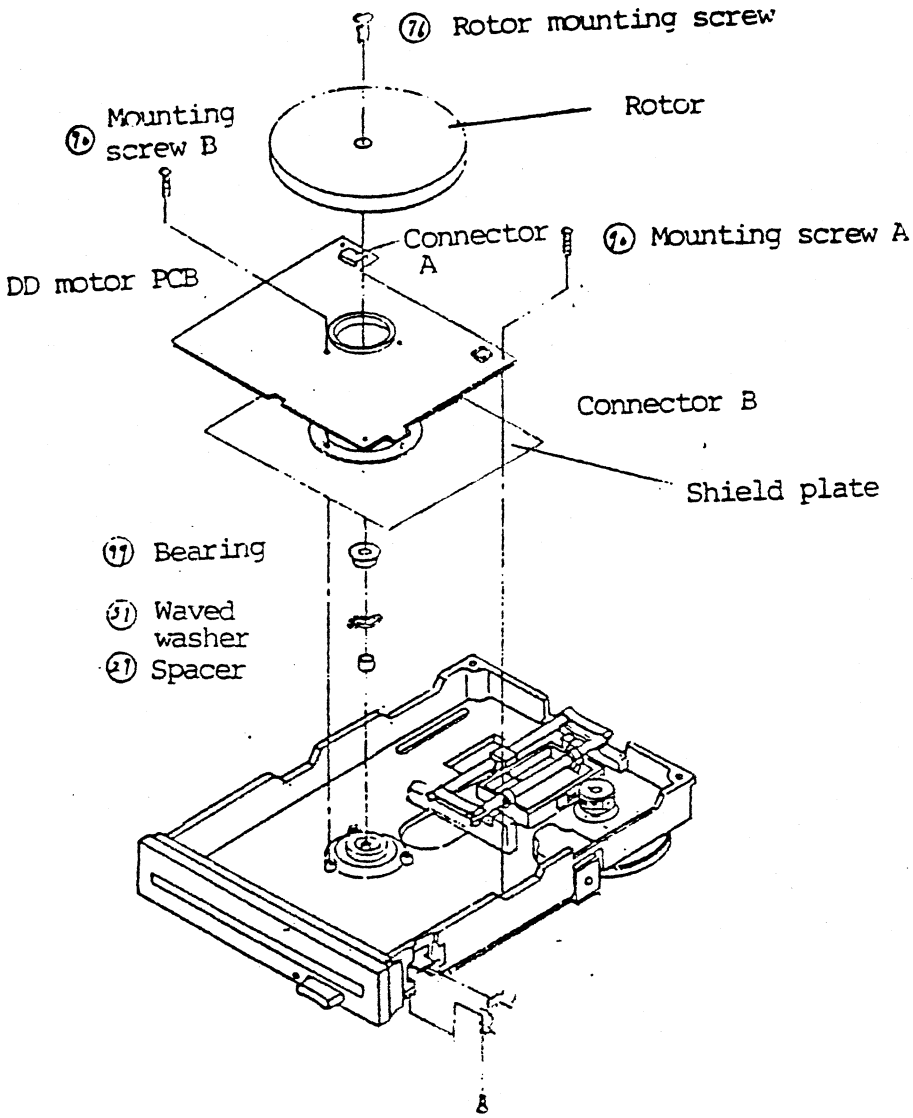

(71) Rotor mounting screw
Rotor
(70) Mounting screw B
Connector A
(72) Mounting screw A
DD motor PCB
Connector B
Shield plate
(77) Bearing
(31) Waved washer
(27) Spacer

Fig. 6-5

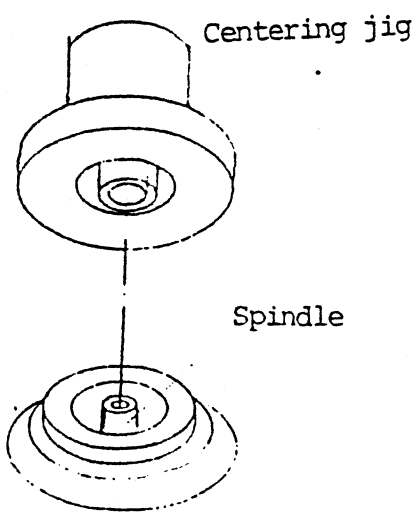

Centering jig
Spindle

Fig. 6-6

6.3.5 Head carriage replacement

1. Remove the main PCB (see 6.3.1).
2. Remove the steel belt (see 6.3.2).
3. Remove the 2 double clamps and pull out the 2 guide bars.
4. Remove the head carriage
5. Mount the 0-1 so that the head arm of the replacement 0-1 enters the lower position of the head load arm.
6. Insert the 2 guide bars into the 0-1 head carriage and tighten them with the double clamps.
7. Apply rubble plate oil to the 2 guide bars, repeat shuttle movement and check that the 0-1 head carriage falls due to its own weight.
8. Mount the steel belt (see 6.3.2).
9. Mount the main PCB (see 6.3.1).

Adjustment after replacement

1. Adjust the track position (see 6.4.3).
2. Adjust the track 00 position (see 6.4.4).
3. Adjust the index burst position (see 6.4.1).
4. Check playback output (see 6.4.2).
5. Adjust the main arm gap (see 6.4.11).
6. Adjust head load gap (see 6.4.6).

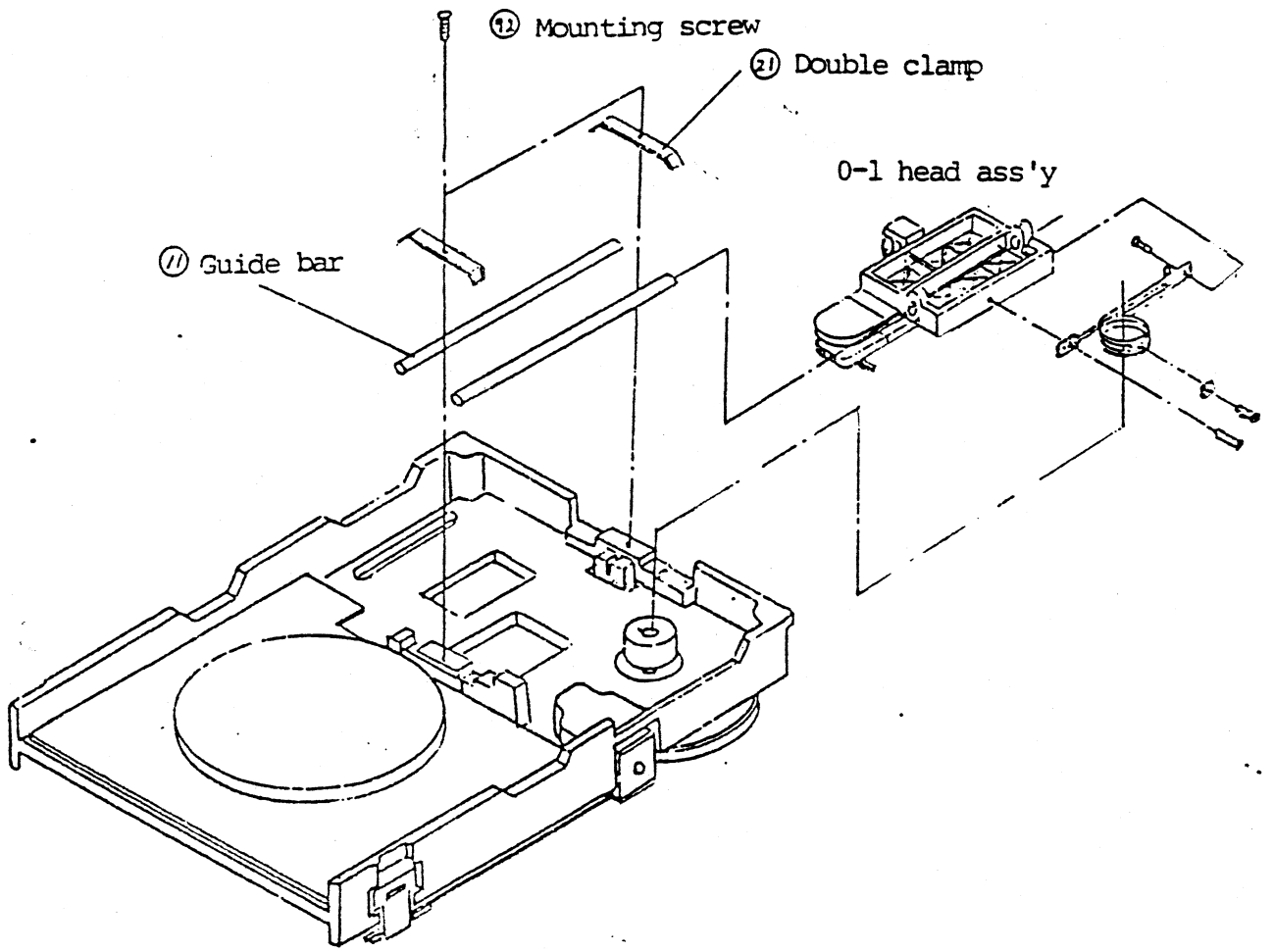


Fig. 6-7

6.3.6 Stepper Motor replacement

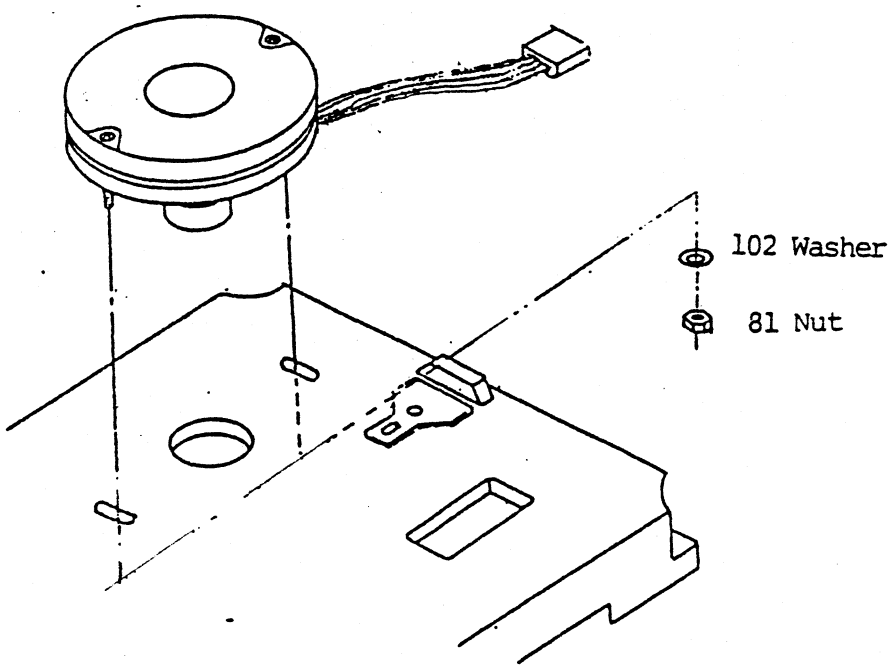
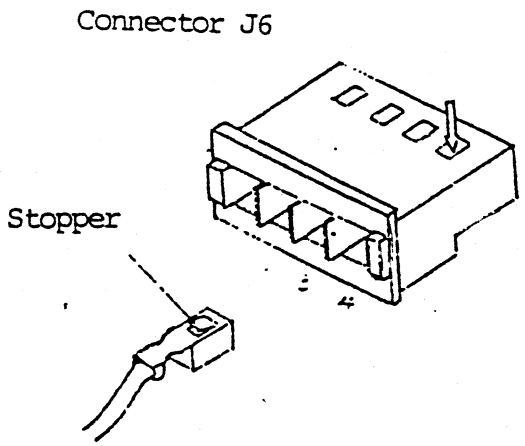


Fig. 6.8



1	2	3	4
Red	White	Blue	Yellow

Fig. 6.9

1. Remove the steel belt (see 6.3.2).
2. Remove the washers and nuts (2 pieces each) for mounting the stepp er motor and then the stepper motor itself.
3. Remove the connector J6.
4. Install the connector of the replacement stepper motor and temporarily fasten the stepper motor
5. Mount the steel belt (see 6.3.2).
6. Apply lock tight to the nuts after track adjustment (see 6.4.3).

Adjustment after replacement

1. Confirm the track position (see 6.4.3).
2. Adjust the track 00 (see 6.3.4).

6.3.7 · Photo transistor holder replacement

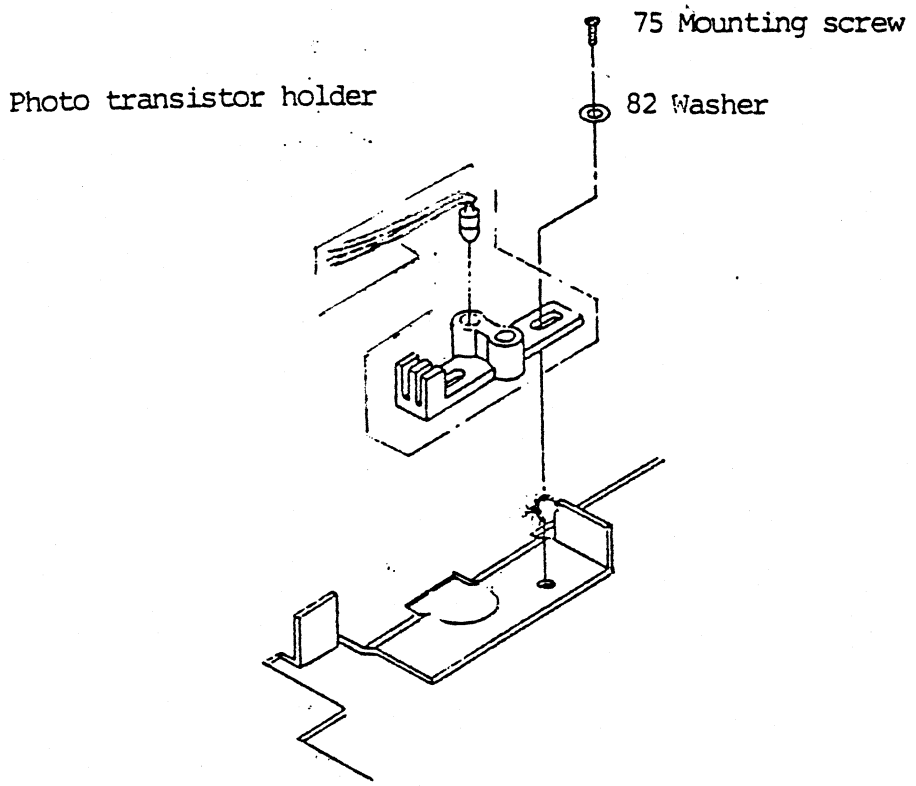


Fig. 6.10

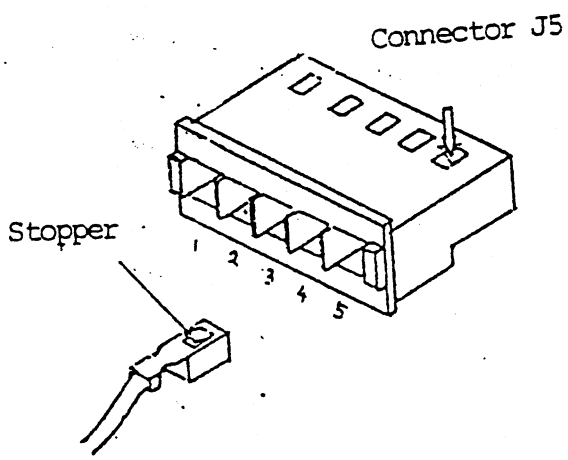


Fig. 6.11

1	2	3	4	5
Black	Blue	Purple	Green	Gray

1. Remove the main PCB (see 6.3.1).
2. Attach the stopper shown in Fig. 6-11 to the arrowed position of the connector J5 of the index photo transistor and pull out the wire pin.
3. Remove the mounting screw and then the photo transistor holder
4. Mount the new photo transistor holder
5. Insert the wire pin into the connector J5 (see 6.11).
6. Mount the main PCB (see 6.3.1).

Adjustment after replacement

1. Adjust the index burst position (see 6.4.1).

6.3.8 Track 00 switch PCB replacement

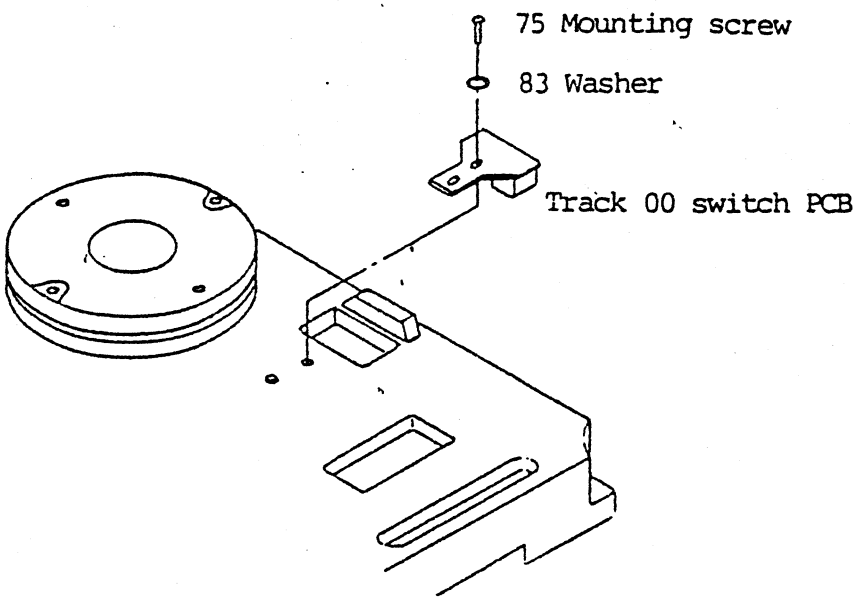
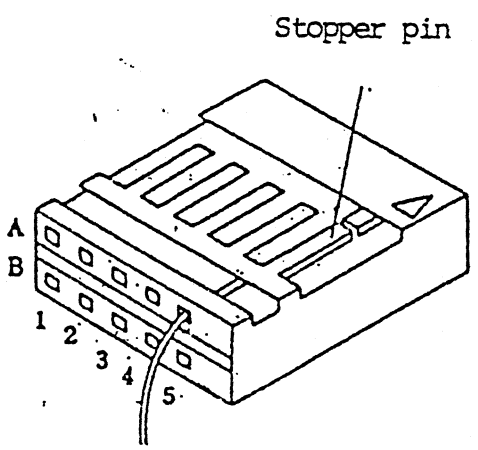


Fig. 6.12



	1	2	3	4	5
A	Yellow	Brown	Purple		Red
B	Green	Black	Orange	Yellow	Brown

Fig. 6.13

Track oo switch PCB A-5, B-4,5

DD motor cable connector: A-1,2,3, B-1,2,3,

1. Remove the main PCB (see 6.3.1).
2. Raise the stopper pin of the connector J4 as shown in Fig. 6-13 and pull out the wire pin of the track 00 switch PCB
3. Remove the track 00 switch PCB mounting screws
4. Mount the new track 00 switch PCB and insert the wire pin into the connector J4.
5. Mount the main PCB (see 6.3.1).

Adjustment after replacement

1. Adjust the TR00 (see 6.4.4).

6.3.9 LED PCB replacement

1. Remove the main PCB (see 6.3.1).
2. Remove the front panel mounting screws (4 pieces) and then the front panel itself.
3. Insert the stopper to the arrowed position of the connector J5 as shown in Fig. 4-11 and pull out the wire pin of the LED PCB ass'y.
4. Remove the LED PCB

5. Mount the new LED PCB and then insert the wire pin into J5.
6. Mount the front panel.
7. Mount the main PCB (see 6.3.1).

Adjustment after replacement

1. Check that the LED lights (see 6.4.8).

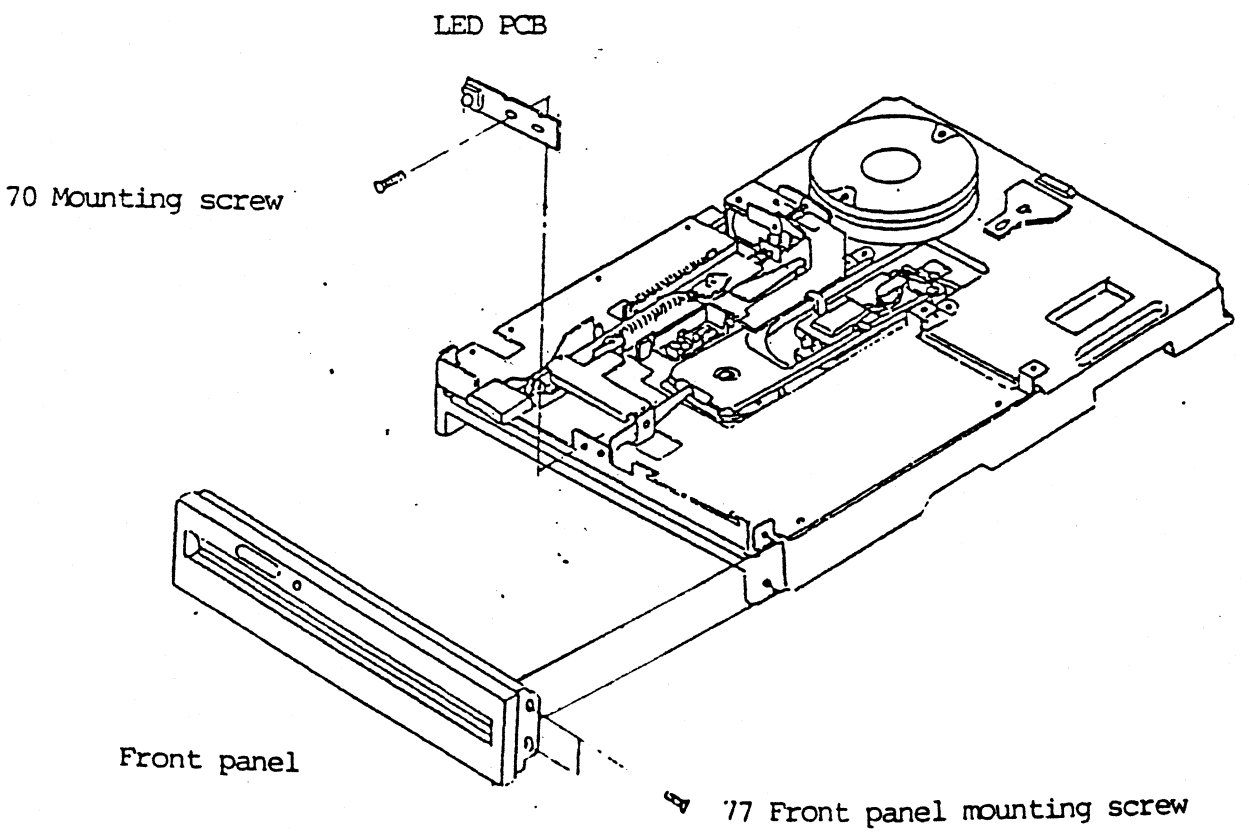


Fig. 4.14

6.3.10 Head load arm replacement

1. Remove the head load arm mounting screw and then the head load arm itself from the head load solenoid.
2. Temporarily fasten the new head load arm to the head load solenoid.
3. Adjust the mounting position of the head load arm so that when the assy is clamped without a media the gap between the heads side 0 and side 1 is 0.6 ± 0.2 mm, tighten the screw and then apply tight lock to it.
4. Confirm the solenoid operation.

Adjustment after replacement

1. Confirm the head load gap(see 6.4.6).

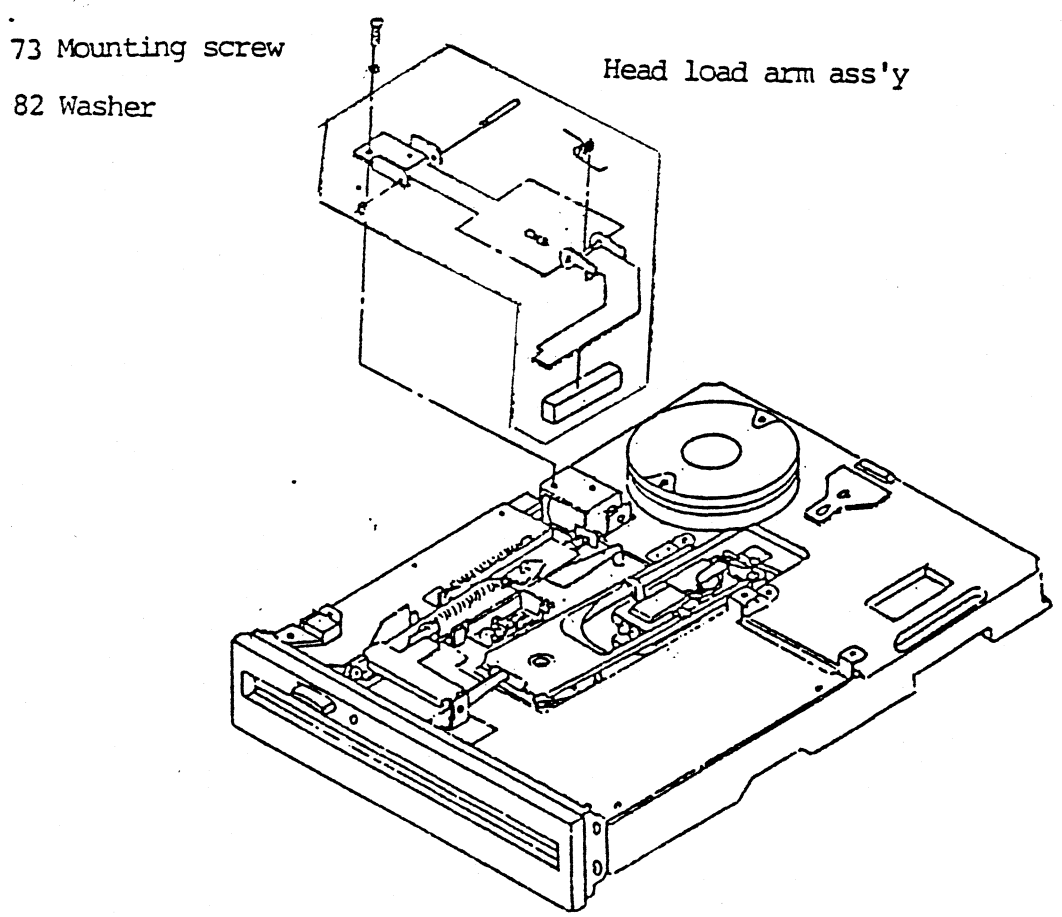


Fig. 6.15

6.3.11 Head load solenoid replacement

1. Pull out the connector B from the DD motor (see 6.5).
2. Insert the stopper into the arrowed position of the connector B as shown in Fig. 4.17 and then remove the 2 wire pins of the head load solenoid.
3. Remove the head load arm (see 6.3.10).
4. Install the new head load solenoid.
5. Mount the head load arm (see 6.3.10).
6. Insert the wire pins to the connector B of the DD motor

Adjustment after replacement

1. Adjust the head load gap (see 6.4.6).

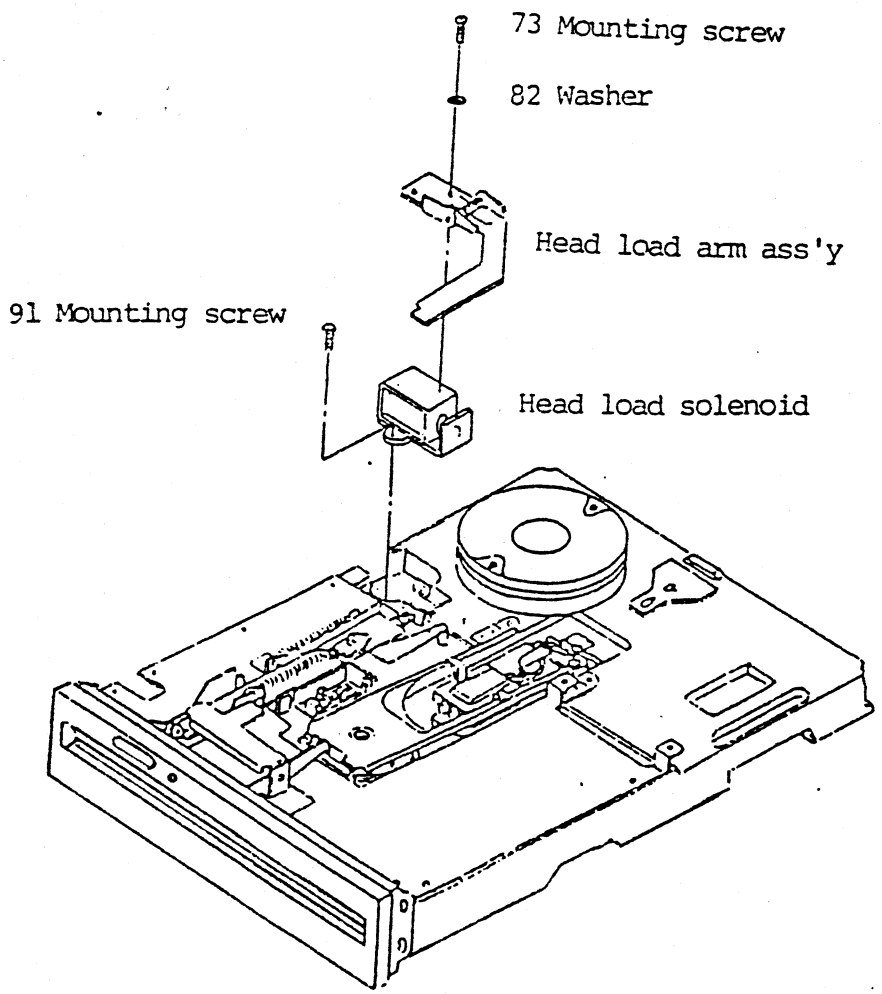
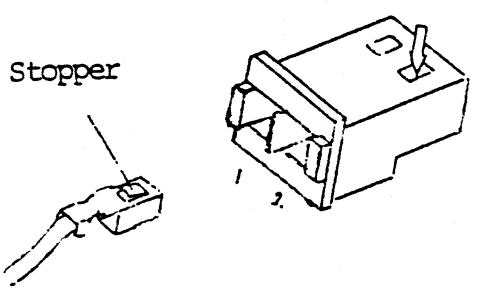


Fig. 6.16



1	2
Red	Black

Fig. 6.17

6.3.12 Mounting plate replacement

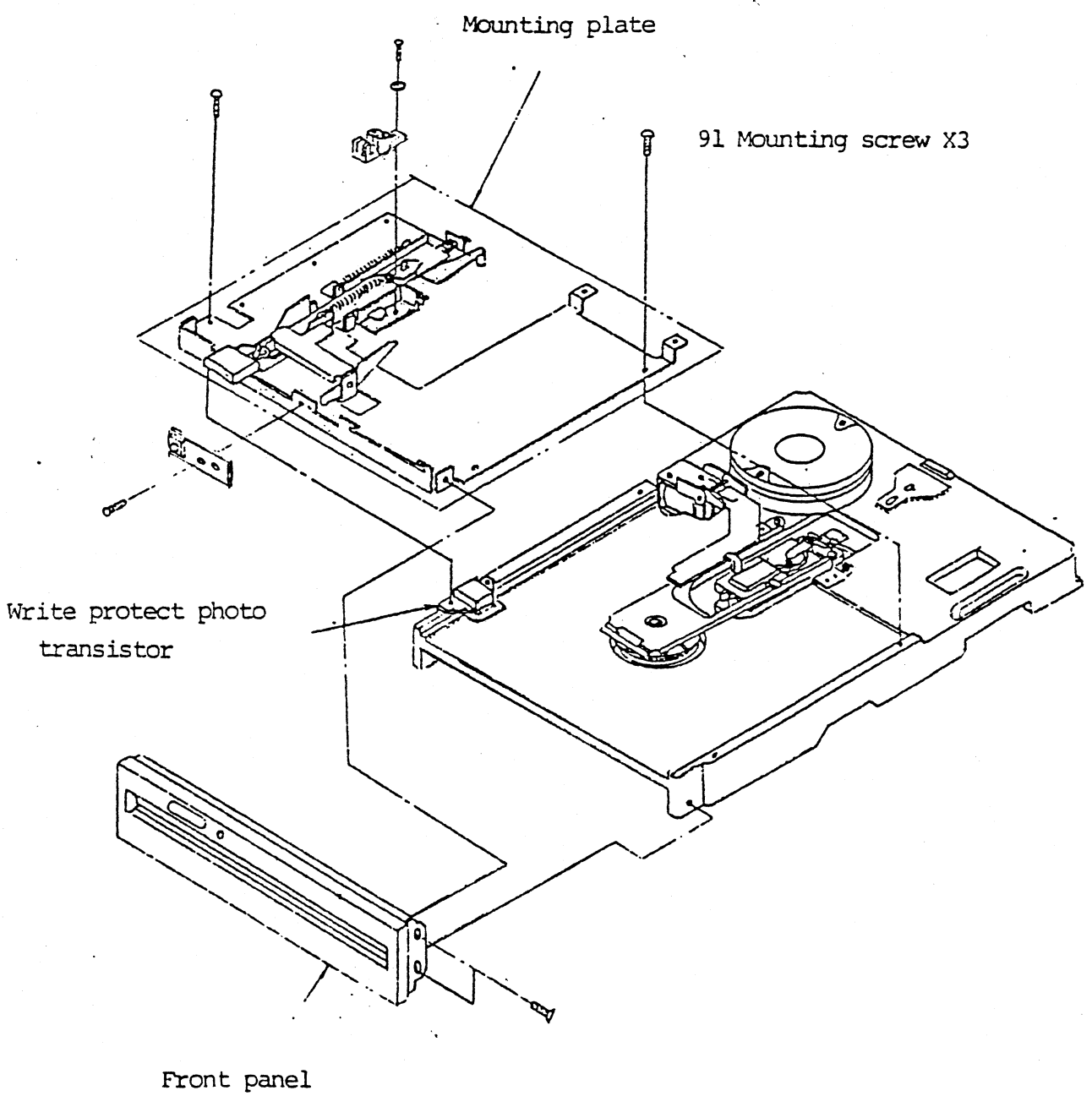


Fig. 6.18

1. Remove the main PCB (see 6.3.1).
2. Remove the front panel.
3. Remove the write protect photo transistor PCB mounting screw.
4. Remove the photo transistor holder and the LED PCB (see 6.3.7 and 6.3.9).
5. Remove the mounting assembly
6. Mount the new mounting plate
7. Tighten the write protect PCB mounting screws.
8. Mount the photo transistor holder and the LED PCB (see 6.3.7 and 6.3.9).
9. Mount the front panel.
10. Mount the main PCB (see 6.3.1).

Adjustment after replacement

1. Adjust the index burst position (see 6.4.1).
2. Confirm the button gap (see 6.4.11).

6.3.13 Main arm replacement

1. Remove the main PCB (see 6.3.1).
2. Remove the mounting plate ass'y (see 6.3.12).
3. Remove the main arm mounting screw and then the main arm
4. Mount the new main arm ass'y. Adjust the center of the spindle and the center cone.
5. Mount the mounting plate (see 6.3.12).
6. Mount the main PCB (see 6.3.1).

Adjustment after replacement

1. Adjust the main arm gap (see 6.4.11).
2. Adjust the track position (see 6.4.3).

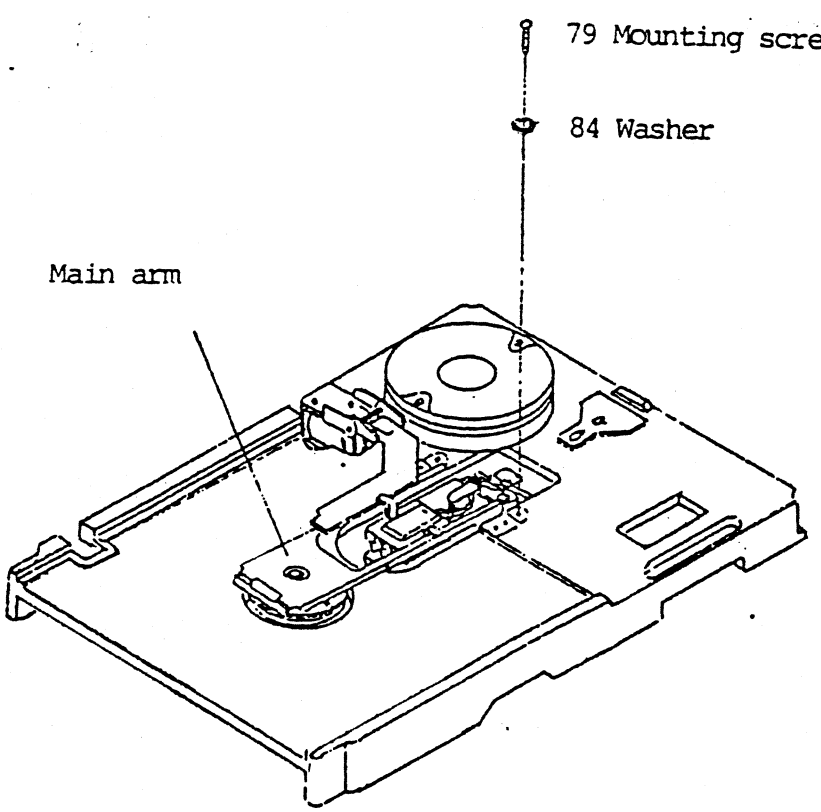


Fig. 6.20

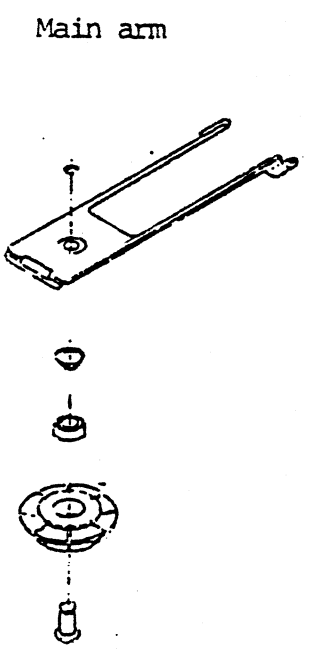


Fig. 6.21

6.3.14 Spindle replacement

1. Remove the main arm (see 6.3.13).
2. Remove the rotor mounting screw, rotor itself, and spacer (see Fig. 6.21).
3. Remove the spindle and mount the new spindle instead.
4. Mount the spacer and rotor.
5. Mount the main arm , mounting plate , and main PCB in the order (see individual paragraphs).

Adjustment after replacement

1. Check the amount of deflection of the spindle (see 6.4.9).

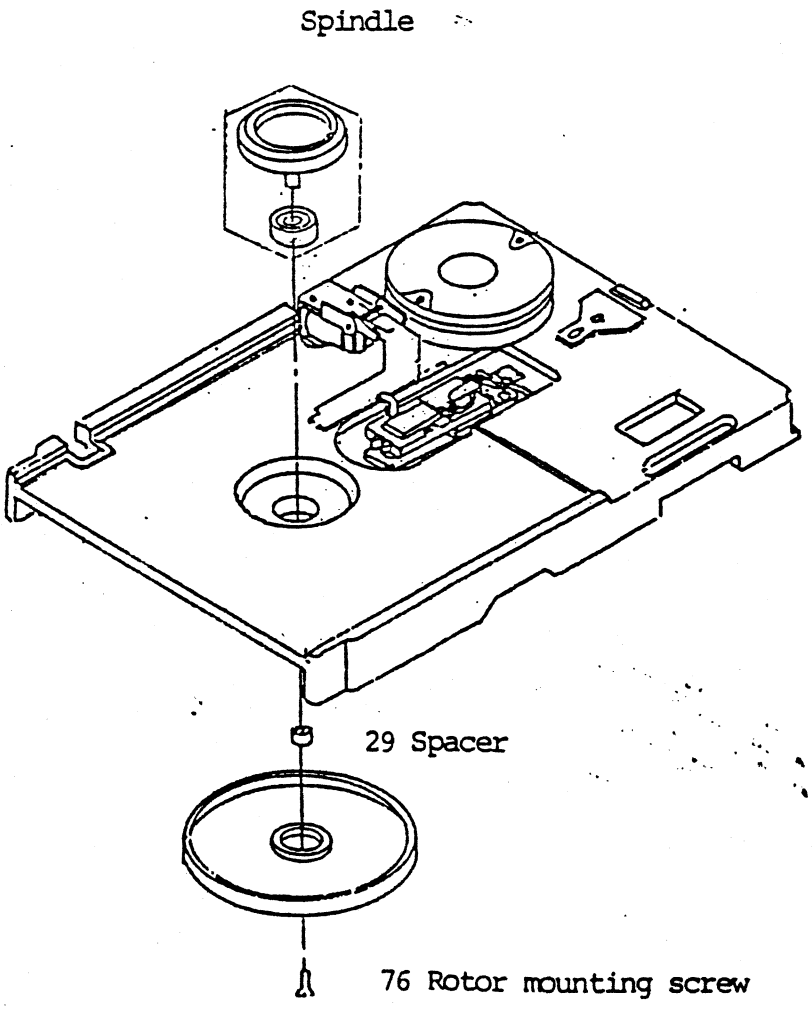


Fig. 6.21

6.3.15 Front panel replacement

1. Remove the mounting screws (4 pieces) and mount the new front panel.

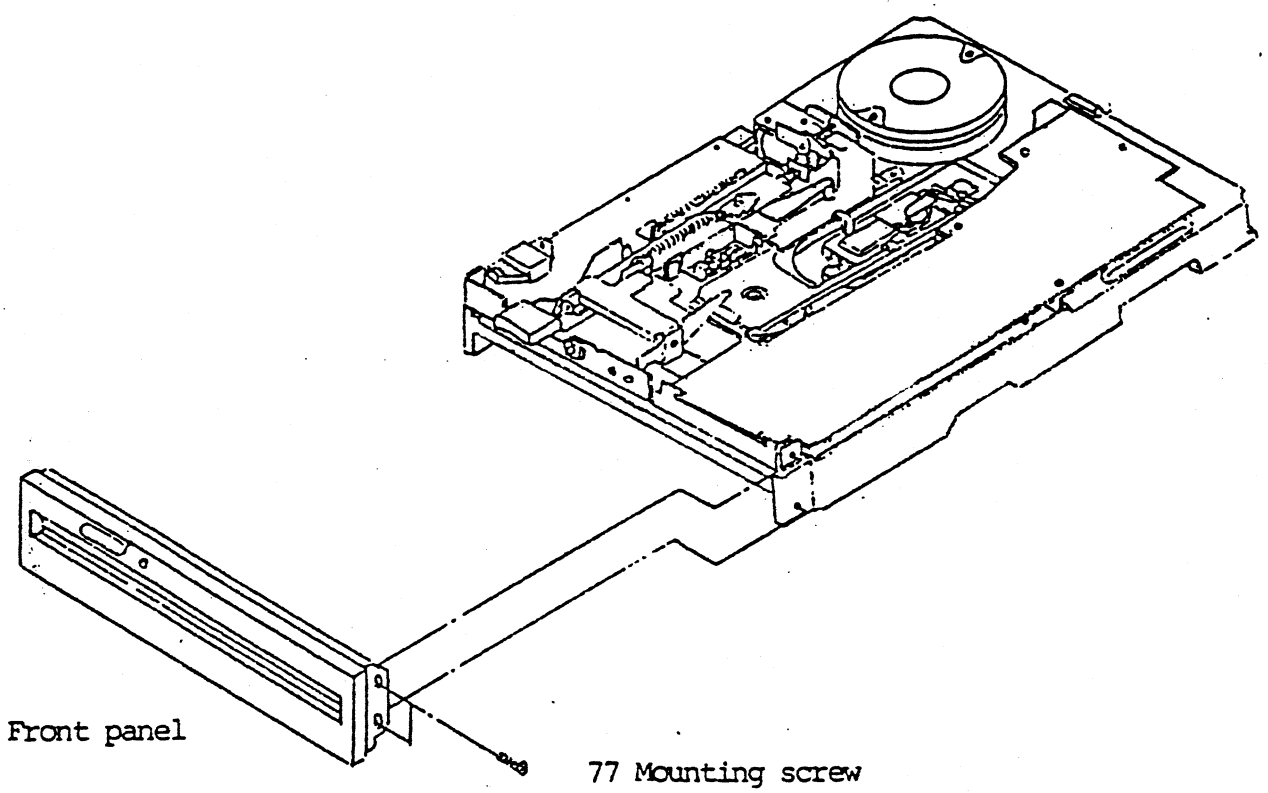


Fig. 6.22

Adjustment after replacement

1. Confirm the button gap (see 6.4.11).

6.4 Adjustment and verification procedures

After replacing the assemblies, the following adjustments and checks should be conducted.

1 Index burst position adjustment
2 Playback output check
3 Track position adjustment
4 Track 00 position adjustment
5 Rotation adjustment
6 Headload gap adjustment
7 Write protect signal check
8 LED lighting check
9 Spindle deflection check
10 Modulation check
11 Media clamp feature motion check (main arm gap check)

6.4.1.1 INDEX DETECTOR ADJUSTMENT CHECK

On the CE-FlexyDisk the track 00 is prewritten with 1F containing an index alignment gap at the beginning of the track. The index sensor is aligned properly when the beginning of the gap is time coincident with the leading edge of the index pulse as shown in the figure

a) Load a BASF CE-FlexyDisk

b) Select the head 0

c) Start the drive motor and select the Mini Disk Drive

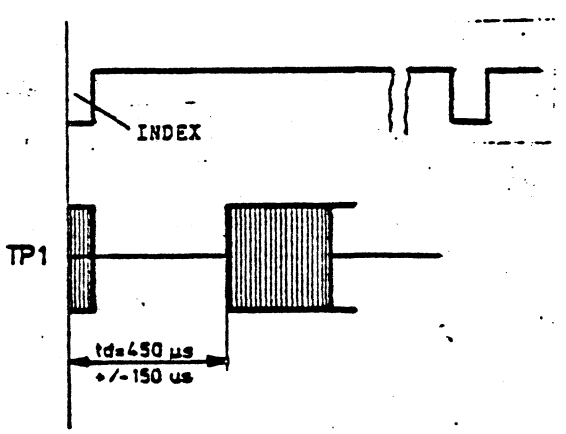
d) Step to the track 00

e) Set up the oscilloscope:

SYNC	: INT	POS	CH 1
CH 1	: DC	2V	inverted (INDEX Pin 49 IC1)
CH 2	: AC	100mV	TP1
MODE	: ALT		
TIME BASE	: 100 µs		
TRIGGER	: CH1		

f) Check the timing between the start of the sweep and the end of the gap to be td = 450 µs ± 150µs

g) Provide the index detector adjustment if necessary.



6.4.1.2 INDEX DETECTOR ADJUSTMENT

a) Load a BASF CE-FlexyDisk

b) Start the drive motor and select the Mini Disk Drive

c) Step to the track 00

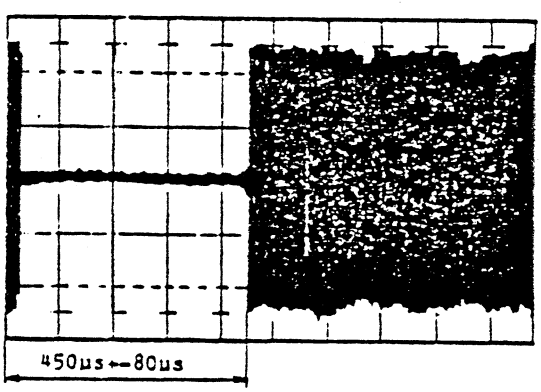
d) Set up an oscilloscope:

SYNC	: EXT	POS	INDEX (Pin 49 IC1)
CH 1	:AC	50 mV inv	TP1
CH 2	: AC	50 mV	TP2
MODE	: ADD		
TIME BASE	: 100µs		
TRIGGER	: INDEX		

e) Loosen the set screw of the index holder

f) Adjust the time delay between the start of the sweep and the end of the gap to td = 450µs $\pm$ 80 µs

g) Tighten the index holder set screw.



6.4.2 READ AMPLITUDE CHECK

a) Load a BASF FlexyDisk

b) Turn on the drive motor

c) Step to the track 79

d) Select the head 0

e) Write all ONES

f) Set up the oscilloscope:

SYNC	: EXT	POS	
CH 1	: AC	50 mV inverted	TP1
CH 2	: AC	50 mV	TP2
MODE	: ADD		
TRIGGER	: INDEX (Pin 49 IC1)		
TIME BASE	: 20ms		

g) Check the measured read voltage at TP1/TP2 to be > 50mVpp

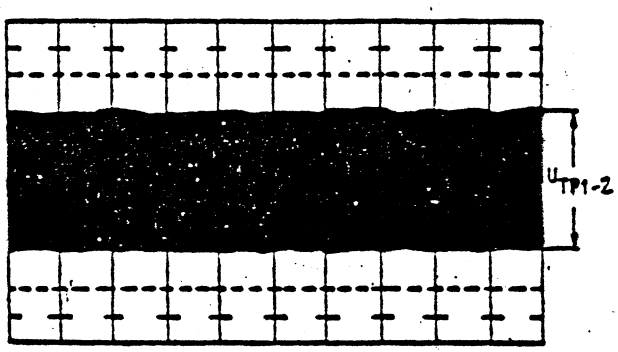
h) Step to track 00

i) Write all ONES

j) Check the measured read voltage at TP1/TP2 to be ≤ 150mVpp

k) Select the head 1

l) Continue with items e) to f) above.



6.4.3 TRACK ADJUSTMENT CHECK

a) Load a BASF CE-FlexyDisk

b) Start the drive motor and select the Mini Disk Drive

c) Select the head 0

d) Step to the track 16 (40)

e) Set up an oscilloscope:

SYNC : EXT. POS

CH 1 : AC 50 mV uncalibrated inverted TP1

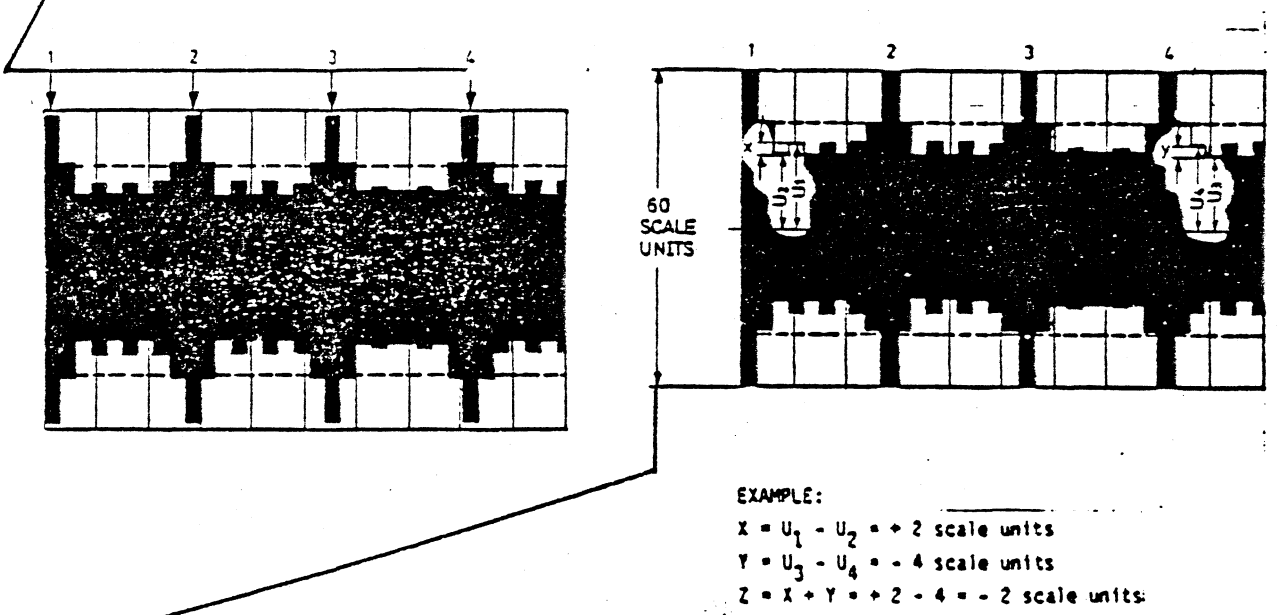
CH 2 : AC 50 mV uncalibrated TP2

MODE : ADD

TRIGGER : INDEX (Pin 49 IC1)

TIMEBASE : 10 ms uncalibrated

f) Monitor the read signal and adjust the time base of the scope until four orientation bursts are displayed.



g) Turn the variable gain potentiometer of the scope until the amplitude of the orientation bursts reaches 60 scale units (6 divisions)

h) Determine X and Y as shown in the example to the right:

X = U1 - U2 Y = U3 - U4 (observe the sign)

i) Calculate Z: Z = X + Y

j) If Z exceeds 10 scale units perform the track adjustment procedure. If Z is less than 10 scale units the head 0 track adjustment is OK.

k) Select the head 1

l) Proceed through item f to i given above for head 0

m) If Z exceeds 20 scale units perform the track adjustment procedure
If Z is less than 20 scale units the track adjustment is OK.

6.4.3.1 TRACK ADJUSTMENT PROCEDURE

a) Load a BASF CE-FlexyDisk

b) Start the drive motor and select the Mini Disk Drive

c) Select head 0

d) Step to track 16 (40)

e) Set up an oscilloscope:

SYNC : EXT. POS.

CH 1 : AC 50 mV uncalibrated inverted TP1

CH 2 : AC 50 mV uncalibrated TP2

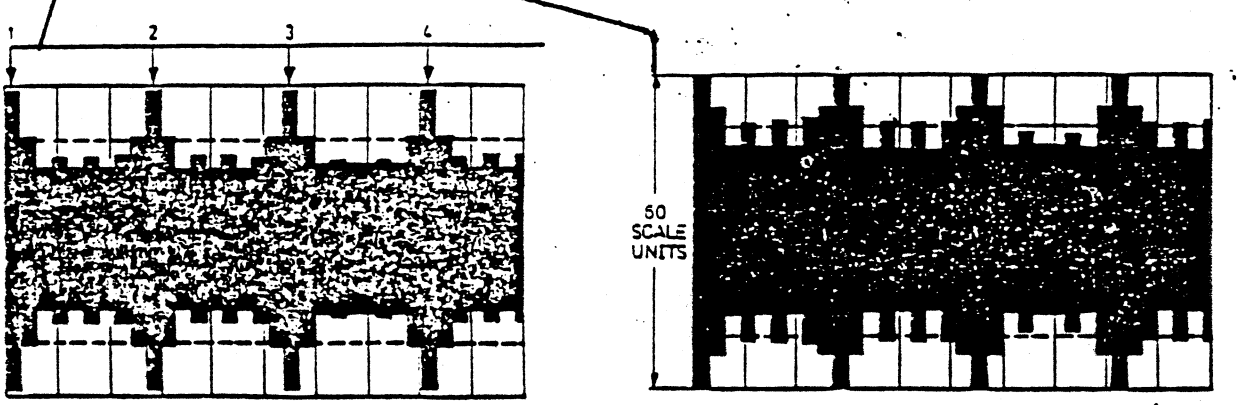
MODE : ADD

TRIGGER : INDEX (Pin 49 IC1)

TIME BASE : 10 ms uncalibrated

f) Loosen the mounting nuts of the stepper motor and rotate the body of the stepper motor until the maximum amplitude of the orientation bursts is displayed

g) Monitor the read signal on the screen and adjust the time base of the scope until four orientation bursts are shown



h) Turn the variable gain potentiometer until the amplitude of the orientation bursts reaches 60 scale units (1div = 10 scale units)

i) Rotate the body of the stepper motor until X and Y have the same value but opposite sign or until both are zero

j) Tighten the mounting nuts of the stepper motor

k) Recheck the adjustment. If Z = X + Y exceeds four scale units readjust the stepper motor (pay attention to the sign)

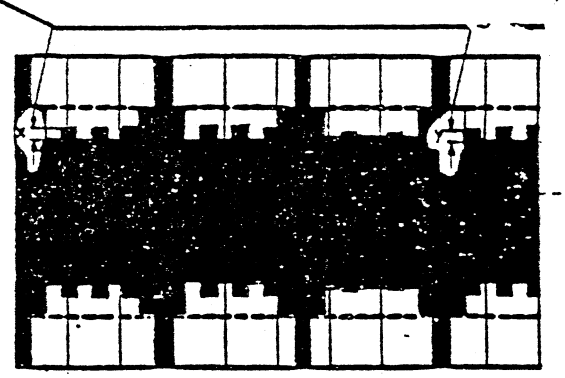
l) Select head 1, recalibrate and step to track 16 (40)

m) Perform items f) through j) as given above for head 0

n) Measure Z = X + Y. Z must be less than 4 scale units. Readjust the heads if necessary

o) Select head 0. Check the adjustment. Z = X + Y must be less than 14 scale units. If not restart with item d.

p) Perform the track zero switch adjustment check



6.4.4 Track 00 position adjustment

a. Set the drive to the motion state.

b. Load a normal disk.

c. Step the head between track 00 and 06 alternatelv.

d. Use an oscilloscope for the measurement.

The connection is as follows.

CH1 5V DC step signal terminal (Note 1)

CH2 Inv 2V DC CHK-3

MORE ADD

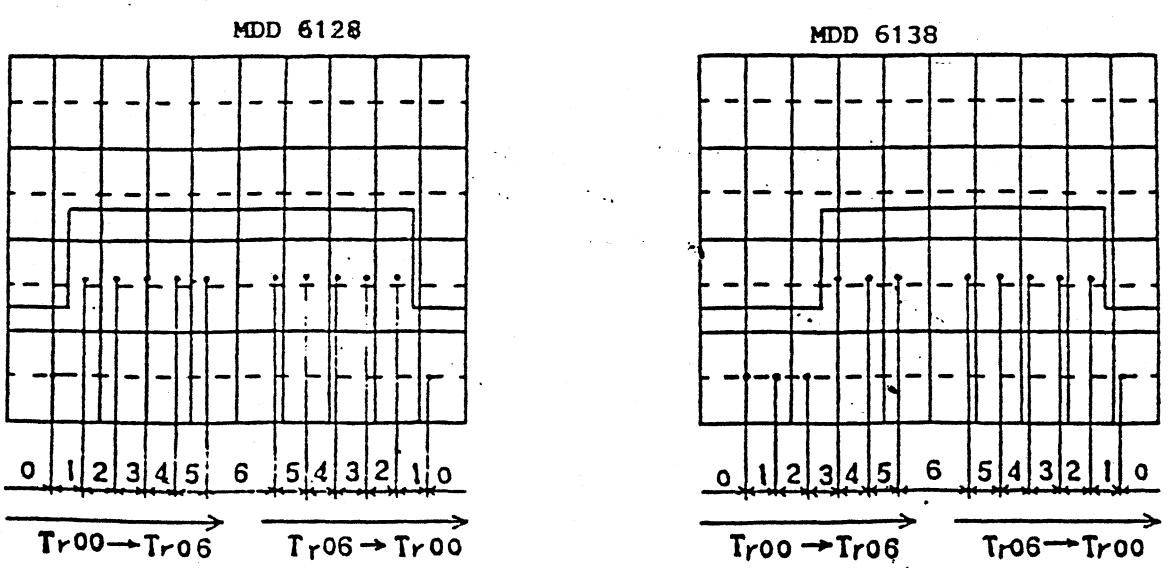
TIME BASE 5 msec

TRIGGER INT. CH2 NORM NEG

e. Confirm the switching as follows.

In the case of MDD 6128	In the case of MDD 6138
Track 01 in the direction from track 00 to 06	Track 03 in the direction from track 00 to 06
Track 00 in the direction from track 06 to 00	Track 06 in the direction from track 00 to 01

If necessary, loosen the screw mounting the track 00 switch PCB ass'y for adjustment.



Note 1: IC1-pin 5 of main PCB ($\overline{\text{STEP}}$ signal)

6.4.5 Rotation adjustment

a. Set the drive to the motion state.

b. Load a normal disk

c. Connect the universal counter to the INDEX

d. Adjust the VR1 of the DD motor PCB so that the period of the index becomes the following value.

200 ± 1 ms in tracks 00 and 79 (39)

6.4.6 Load gap adjustment

a. Adjust the position of the head load arm so that the gap between side 0 and side 1 becomes 0.6 ± 0.2 mm when the arm is clamped without a media.

b. Mount the head load arm so that it is parallel to the arm portion of the main arm.

6.4.7 Write protect signal check

a. Set the drive to the motion state.

b. Insert a media without write protect into the drive and check that a wave form changes when pin 58 of the IC of the main PCB is connected to an oscilloscope.

6.4.8 LED lighting check

a. When a disk is charged in the drive and the control is in the ready state, check that the LED lights green.

b. When a disk is charged in the drive and the read/write head is loaded to the disk, check that the LED lights red.

6.4.9 Spindle deflection check

a. Set the drive to the motion state.

b. Load a normal diskette and step the head to track 00.

c. Write all "1" to data division of side 0 and track 00.

d. Measure the amount of spindle deflection with an oscilloscope.

CH1 500 mV AC CHK-1
CH2 Inv 500 mV AC CHK-2
MODE ADD
TIME BASE 20 msec
TRIGGER NORM. NEG
Index signal (Note 1)

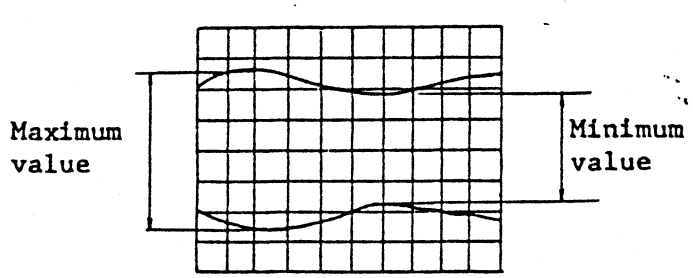
e. Clamp the media once again, monitor the playback wave form on the screen, and measure the maximum and minimum values of the wave form, and calculate the amount of spindle deflection by means of the following equation.

$$\frac{\text{Maximum value - minimum value}}{\text{Maximum value + minimum value}}$$

f. Conduct step e above three times and check that the difference of the maximum value and minimum value calculated in that step is 0.03 or less.

* If this step can not be successfully conducted, mount the rotor of the DD motor once again from the beginning.

Note 1) IC1-pin 49 of main PCB



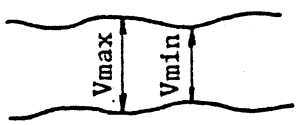
Maximum value = Maximum voltage of data
Minimum value = Minimum voltage of data

6.4.10 Modulation check

a. Load a normal disk, write pattern 1F, and check that the amplitude is in the following value.

10 % MAX. both in tracks 00, 39 (79) and in sides 0 and 1

$$\text{Modulation} = \frac{\text{Vmax} - \text{Vmin}}{\text{Vmax} + \text{Vmin}} \times 100$$



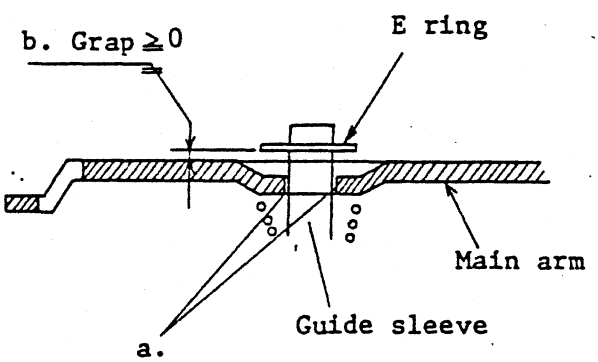
Output

6.4.11 Media clamp feature motion check

1) Main arm

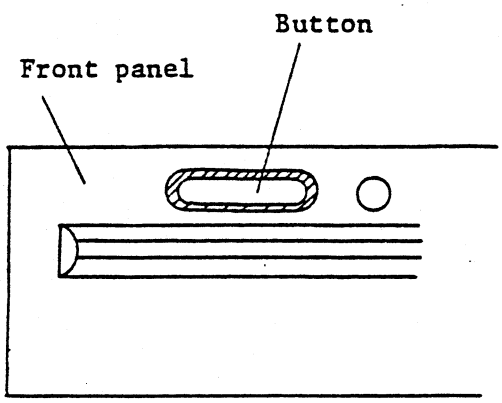
a. Check that the guide sleeve does not touch the hole of the main arm when a media is clamped (a gap should occur in any direction).

b. Check that the lower side of the E ring raised equal to or greater than the upper side of the main arm.



2) Button

a. Check that the button does not touch the front panel when the media clamp and clamp are released.



N	KEY NO	PART NO	Q'TY	DESCRIPTION	REMARKS
	1	K01-0061	1	BASE	
	2	K06-0083	1	FRONT PANEL 1	
	3	K07-0040	1	CLAMP LEVER 1	
	4	K07-0042	1	INTERLOCK ARM	
	5	K07-0044	1	SLIDE PLATE 1	
	6	K07-0046	1	EJECT PLATE 1	
	7	K07-0048	1	HEAD LOAD ARM 1	
	8	K11-0116	1	LINK	
	9	K11-0117	2	ROLLER	
	10	K13-0095	1	STEEL BELT	
	11	K16-0050	2	GUIDE BAR	
	12	K16-0051	1	GUIDE SLEEVE	
	13	K16-0052	1	HEAD LOAD ARM SHAFT	
	14	K16-0053	1	LATCH SHAFT	
	15	K16-0054	1	LATCH PIN	
	16	K16-0055	1	GUIDE PIN	
	17	K16-0056	1	CLAMP LEVER SHAFT	
	18	K16-0057	1	SLIDE PLATE SHAFT	
	19	K16-0059	1	INTERLOCK ARM SHAFT	
	20	K21-0073	1	PLATE SPRING FOR STEEL BELT	
	21	K21-0074	2	DOUBLE CLAMP	
	22	K22-0040	1	SLIDE PLATE SP	
	23	K22-0041	1	EJECT SP	
	24	K22-0042	1	LATCH SPRING 1	
	25	K22-0044	1	SP FOR HEAD LOAD ARM	
	26	K22-0045	1	CONE SPRING	
	27	K22-0046	1	INTERLOCK ARM SP	
	28	K22-0051	1	SLIDE PLATE RETURN SP	
	29	K26-0030	1	SPACER	
	30	K27-0112	(2)	ADJUST WASHER	
	31	K28-0013	1	WAVE WASHER	
	32	K32-0001	1	BUTTON	
	33	K36-0045	1	MAIN PCB	

N	KEY NO	PART NO	Q'TY	DESCRIPTION	REMARKS
	34	K36-0048	1	TRACK 00 SWITCH PCB	
	35	K36-0049	1	WRITE PROTECT PCB	
	36	K36-0050	1	PCB FOR LED	
	37	K38-0036	1	SPONGE	
	38	K38-0037	1	SPONGE FOR LED	
	39	K38-0038	1	DAMPER	
	40	K38-0043	1	PTORECT MEDIA	
	41	K41-0152	1	LATCH 2	
	42	K41-0103	1	STEEL BELT HOLDER B	
	43	K41-0145	1	SHIELD PLATE FOR DD MOTOR	
	44	K41-0146	1	CENTER CONE	
	45	K41-0147	1	HEAD LOAD ARM BR	
	46	K41-0148	1	SPINDLE 1	
	47	K41-0154	1	STEEL BELT HOLDER PLATE	
	48	K41-0158	1	HOLDER FOR LED	
	49	K41-0159	1	PHOTO TRANSISTOR HOLDER	
	50	K41-0174	1	MAIN ARM ASSY	
	51	K53-0040	2	INSIDE TRIM BOX	
	52	K53-0049	1/10	ASSEMBLY BOX	
	53	K79-0205	1	DD MOTOR PCB	
	54	K79-0209	1	STEPPER MOTOR	
	55	K79-0210	1	HEAD LOAD SOLENOID	
	56	K79-0211	1	W.P. PHOTO COUPLER	
	57	K79-0212	1	LEAD WIRE	
	58	K79-0213	1	"	
	59	K79-0214	1	"	
	60	K79-0215	1	"	
	61	K79-0216	1	"	
	62	K79-0217	1	"	
	63	K79-0218	1	"	
	64	K79-0219	1	"	
	65	K79-0234	1	ROTOR FOR SLIM TYPE	
	66	K79-0246	1	MOUNTING PLATE I ASSY	
	67	H-4906-8000	1	HEAD ASSY SLIM TYPE 48 TPI	MDD211
	68	H-4904-8000	1	HEAD ASSY, SLIM TYPE 96TPI	MDD221
	69	K79-0248	1	DD MOTOR CABLE ASSY 1	
	70	XA1-1200307	2	SCREW, PAN HEAD, M2x3	
	71	XA1-1251007	3	" M2.5x10	
	72	XA1-1261507	2	" M2.6x15	

N	KEY NO	PART NO	Q'TY	DESCRIPTION	REMARKS
	73	XB1-1200305	2	SCREW, PAN HEAD, M2x3	
	74	XB1-1200405	1	" M2x4	
	75	XB1-1250405	1	" M2.5x4	
	76	XB1-3250805	1	" PLATE HEAD, M2.5x8	
	77	XB1-3300605	4	" M3x6	
	78	XB1-2250605	2	" BIND HEAD, M2.5x6	
	79	XB1-2300405	2	" M3x4	
	80	XB3-2260605	2	" 2.6x6	
	81	XB7-2100305	2	M3 NUT	
	82	XD1-1102135	3	WASHER, 2.1x4.2xt0.5	
	83	XD1-1102635	1	" 2.6x5xt0.5	
	84	XD1-1103133	2	" 3.2x5.6xt0.3	
	85	XD1-2100307	1	" 3.2x7xt0.5	
	86	XD2-1100102	1	E RING 1.0	
	87	XD2-1100172	4	" 1.7	
	88	XD2-1100282	1	" 2.8	
	89	XZ1-1261055	1	SPACER, ø2.6xℓ10.5	
	90	E09-250001	4	SCREW WITH WASHER, M2.5x6	
	91	E09-300004	4	" M3x8	
	92	E09-300006	5	" M3x6	
	93	E33-420005	1	PARALLEL PIN 2x6, 1610801-20060	
	94	E62-6940	1	BUNDLE WIRE BAND	
	95	E62-6956	2	CORD KEEP	
	96	E68-0125	1	TUBE $\phi 2 \times \phi 3.4 \times 25$	
	97	E69-0095	1	INSULATE TAPE 10x30	
	98	E71-0041	1	BEARING F604ZZ	
	99	E71-0042	2	" F695ZZ	
	100	E71-5004	1	CA STOPPER RING	
	101	E98-010042	1	FLAT WASHER, 2.7x9xt0.2	
	102	E98-030035	2	" 3.3x8xt0.5	
	103	96-8076	1	CORRECTION NUMBER SEAL	
	104	K37-0070	1	NAMEPLATE	

N	KEY NO	PART NO	Q'TY	DESCRIPTION	REMARKS
	105	E72-111004	N	SCREW LOCK G	
	106	E72-131010	N	PASTE	
	107	E73-113003	N	OIL	
	108	E73-143029	N	OIL	
	109	E74-150001	N	EUTECTIC SOLDER	
	110	E74-230002	N	RESINOUS EUTECTIC SOLDER	
	111	E75-991008	N	LACQUER	
	112	E72-111041	N	TACK PACK	

N	KEY NO	PART NO	Q'TY	DESCRIPTION	REMARKS
				(IC)	
	IC1	K79-0232	1	DH-IC	
	IC2	K79-0233	1	AH-IC	
	IC3, 4	E60-0056	2	IC FOR STEPPER, M54543L	
		(E60-0055)	1	PARTS OF AH-IC, HA1663MP	
				(TRANSISTOR)	
	T1	E65-6112	1	PNP TYPE, 2SB793	
	T2, 3, 4	E65-6111	3	PNP TYPE, 2SB643	
				(DIODE)	
	D1, 2	E65-5002	2	10D1	
				(OSCILLATOR)	
	X1	E62-9956	1	CERAMIC CLOCK GENERATOR CSA4,00MS11	
				(CONDENSER)	
	C1, 2	E63-2104	2	680pF ± 10% 50V, ECK-F1H681KB	
	C3	E63-3098	1	33μ ± 20% 16V, ECE-A1CKS330	
	C5,6,7,8,9	E63-3099	5	47μ ± 20% 16V, ECE-A1CKS470	
	C10,11,12 13,14,15	F63-2145	6	0.01μ + 80% 50V, HE 10J5Y5103Z - 20%	
				(RESISTOR ARRAY)	
	RA-1	E62-9656	1	150 OHM ± 5% 1.5W 7 ELEMENTS ARN 7C-ZV-150-J	
	RA-2	E62-9645	1	2.2K ± 5% 0.1W 4 ELEMENTS EXB-EQ4222J	
				(VARIABLE RESISTOR)	
	VR1	E62-9570	1	50K OHM ± 20% ½W, PN822H503V	
	VR2	E62-9569	1	3K OHM " PN822H302V	
				(INDUCTOR)	
	L1	E62-8914	1	47μH ± 10%, LALD4NA470K	
				(FIXED RESISTOR)	
	R4	E64-5224	1	150 OHM 2W, ERG-2ANG151	MDD211
		E64-0255	1	390 OHM ± 5% ½W CR37 390 OHM ± 5%	MDD221
	R3	E64-6328	1	2.05K OHM ½W, MR25 2.05K OHM ± 1%	MDD211
		E64-6330	1	2.37K OHM ± 1% ½W MR25 2.37K OHM ± 1%	MDD221

N	KEY NO	PART NO	Q'TY	DESCRIPTION	REMARKS
	R1, 6	E64-0229	2	150 OHM ¼W	
	R8, R10(WP)	E64-0201	2	220 OHM "	
	R7	E64-0412	1	22K OHM "	
	R5	E64-0409	1	47K OHM "	
	R9	E64-0307	1	2.2K OHM "	
				(CONNECTOR)	
	J2	E62-5658	1	4 PIN FOR POWER SUPPLY, 172294-1	
	J5	E62-5653	1	5 PIN WRITE ANGLE, 5268-05A	
	J3	E62-5098	1	10 PIN " FCN-725P010-AU/G	
	JJ2	E62-5642	1	12 PIN " FCN-725P012-AU/G	
	JJ1	E62-5645	10	10 PIN STRAIGHT, FCN-724P010-AU/W	
	J4	E62-5652	1	4 PIN WRITE ANGLE, 5268-04A	
				(OTHERS)	
	J2	E62-5906	1	CONNECTOR CLAMP, 172296-1	
	FOR RA-1	E62-5220	1	IC SOCKET 14 PIN, CA-14S-TRACI-01	
	JP1, 2	E62-5302	2	JUMPER PIN, 66464-102	
	CHK1,2,3 TPG	E62-7907	4	TEST PIN, IPS-1134-2	
				(HOUSING)	
		E62-5706	1	5 PIN 5x1, 5264-05	
		E62-5199	1	2 PIN 2x1, MOLEX 5264-02	
				(OTHERS)	
		E65-5086	1	TWO COLORED LED, LN15WP	
		E65-6118	1	PHOTO TRANSISTOR, PN120S-SL	
		E61-0034	1	PHOTO INTERRUPTER, EE-SJ3-B	
		E62-6640	3	RECEPTACLE PIN, FCN-723J-AU	
		E62-6662	5	TERMINAL PIN, 5263PBTL	

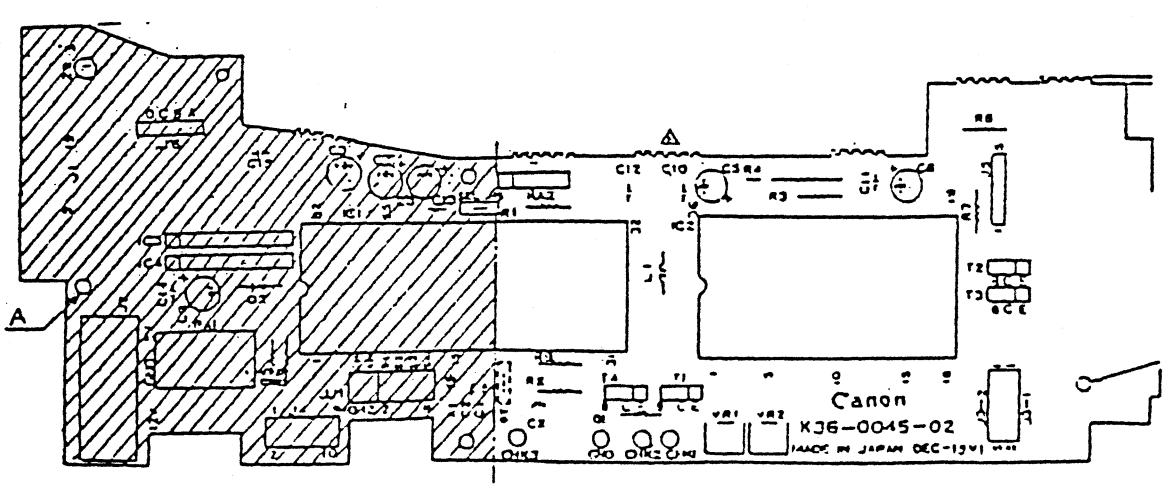
Ass'y components

N	KEY NO	PART NO	Q'TY	DESCRIPTION	REMARKS
		K90-1033	1	Main PCB	MDD 6138
		K90-1095	1	Main PCB	MDD 6128
		K90-1024	1	Steel belt	
		K90-1027	1	Write protect PCB	
		K79-0205	1	DD motor PCB	
		H-4904-8000	1	Head	MDD 6138
		H-4906-8000	1	Head	MDD 6128
		K79-0209	1	Stepper motor	
		K90-1025	1	Photo transistor holder	
		K90-1029	1	Track 00 SW PCB	
		K90-1031	1	LED PCB	
		K90-1022	1	Head load arm	
		K79-0210	1	Head load solenoid	
		K90-1018	1	Main arm	
		K90-1010	1	Spindle	
		K06-0083	1	Front panel	
		K90-1012	1	Mounting plate	

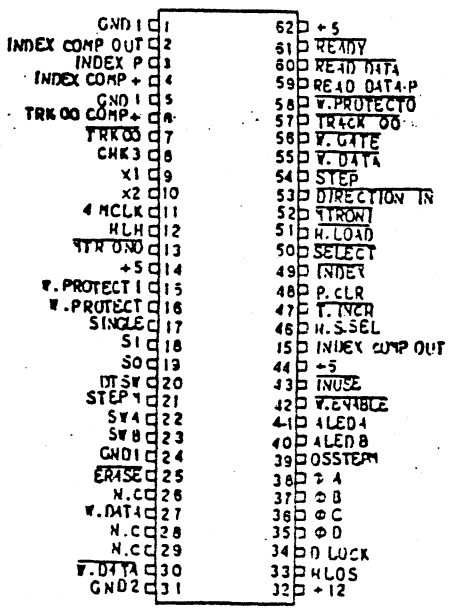
MAIN PCB ASSY

KEY NO	PART NO	DESCRIPTION
IC1	K79-0232	DH-IC
IC2	K79-0233	AH-IC
IC3,IC4	E60-0056	M54543L
T1	E65-6112	2SB793
T2,T3,T4	E65-6111	2SB643
D1,D2	E65-5002	10D1
X1	E62-9956	CSA4.00MS11
C1,C2	E63-2104	ECK-FIH681KB
C3	E63-3098	ECEA1CKS330
C5,C6,C7 C8,C9	E63-3099	ECEA1CKS470
C10,C11,C12 C13,C14,C15	E63-2145	HE70SJYF103Z
RA1	E62-9656	ARN7C-7V-150J
RA2	E62-9645	EXB-EQ4222J
VR1	E62-9570	PN822H503V
VR2	E62-9569	PN822H302V
L1	E62-8914	LAL04NA470K

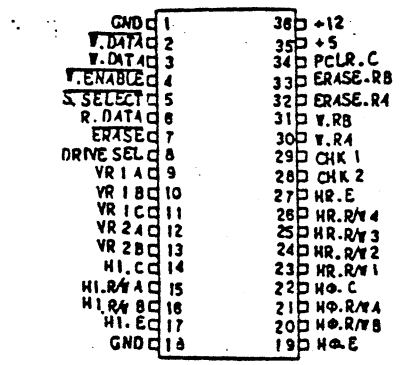
KEY NO	PART NO	DESCRIPTION	
R1,R6	E64-0229	150Ω ±5% ¼W	
~~R3~~	E64-6328	MR25 205KΩ ±1%	MDD 6128
R3	E64-6330	MR25 237KΩ ±1%	MDD 6138
~~R4~~	E64-6224	ER 4-2ANQ151	MDD 6128
R4	E64-0255	CR37 390Ω ±5%	MDD 6138
R5	E64-0409	47KΩ ±5% ¼W	
R7	E64-0412	22KΩ ±5% ¼W	
R8	E64-0201	220Ω ±5% ¼W	
R9	E64-0307	22KΩ ±5% ¼W	
CHK1,2,3	E62-7907	IPS-1134-2	
GND	E62-7907	IPS-1134-2	
J2	E62-5658	172294-1	
J3	E62-5098	FCN-725P010-AU/0	
J4	E62-5645	FCN-724P010-AU/W	
J5	E62-5653	5268-05A	
J6	E62-5652	5268-04A	
JJ1	E62-5642	FCN-725P012-AU/0	
(J2)	E62-5906	172296-1	
(RA1)	E62-5220	CA-14S-TRAC1-01	
(JJ1)	E62-5302	66464-102	
DT	E67-0950		
SEL HS	E67-0950		



D H I C

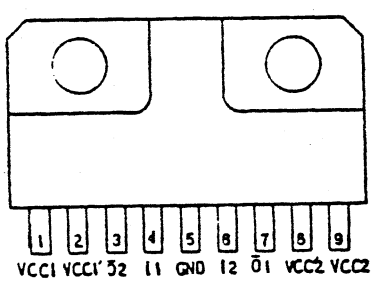


A H I C

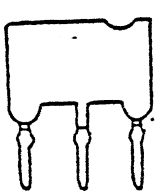


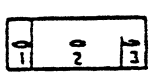
(H0/H1/HR).C = Common
" .E = Erase coil
.R/W = R/W. Coil

M 5 4 5 4 3 L



2SB643
2SB793
2SD636



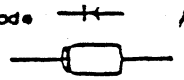


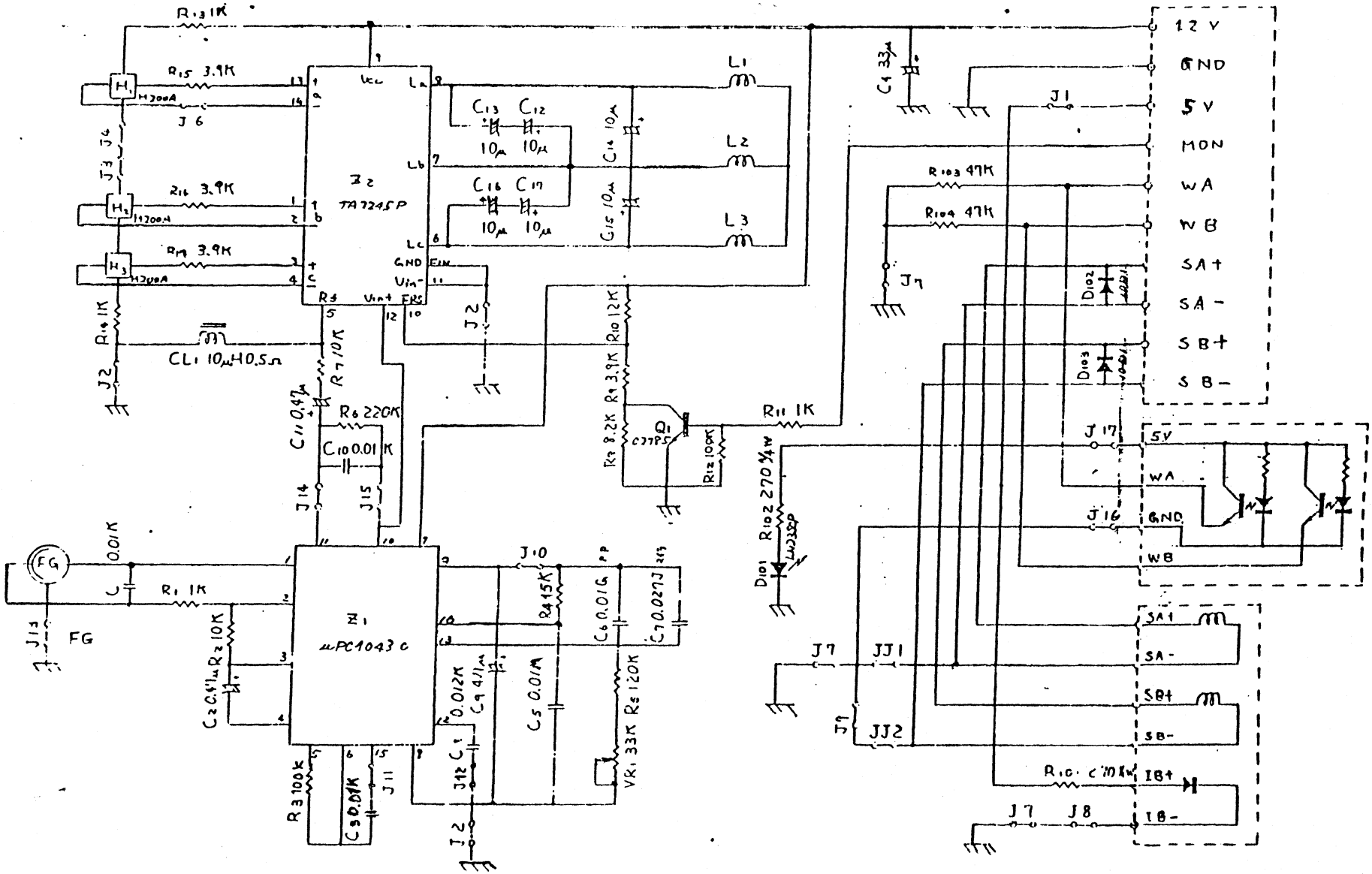
1. Base
2. Collector
3. Emitter

Silicon diode

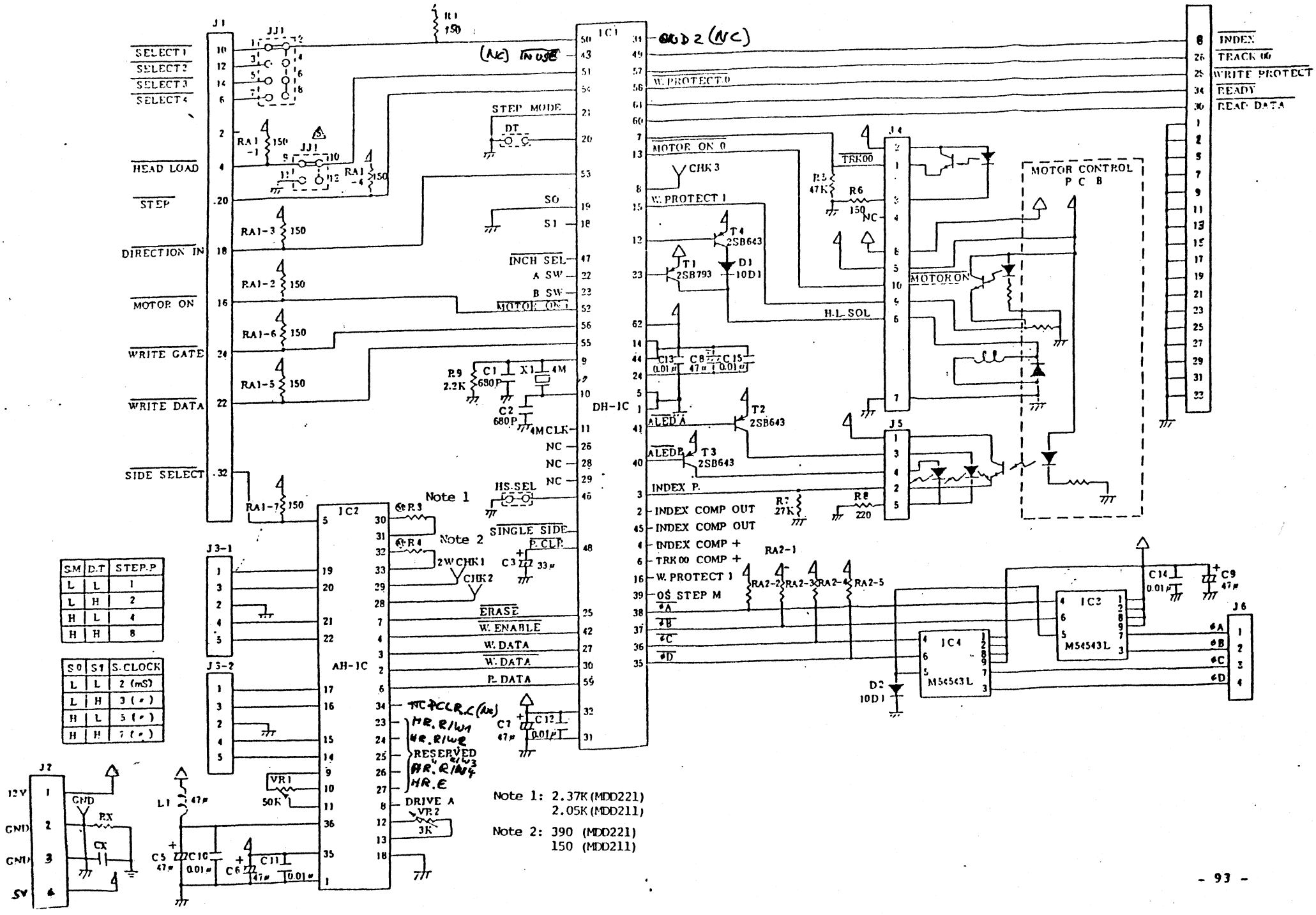
1 0 D 1

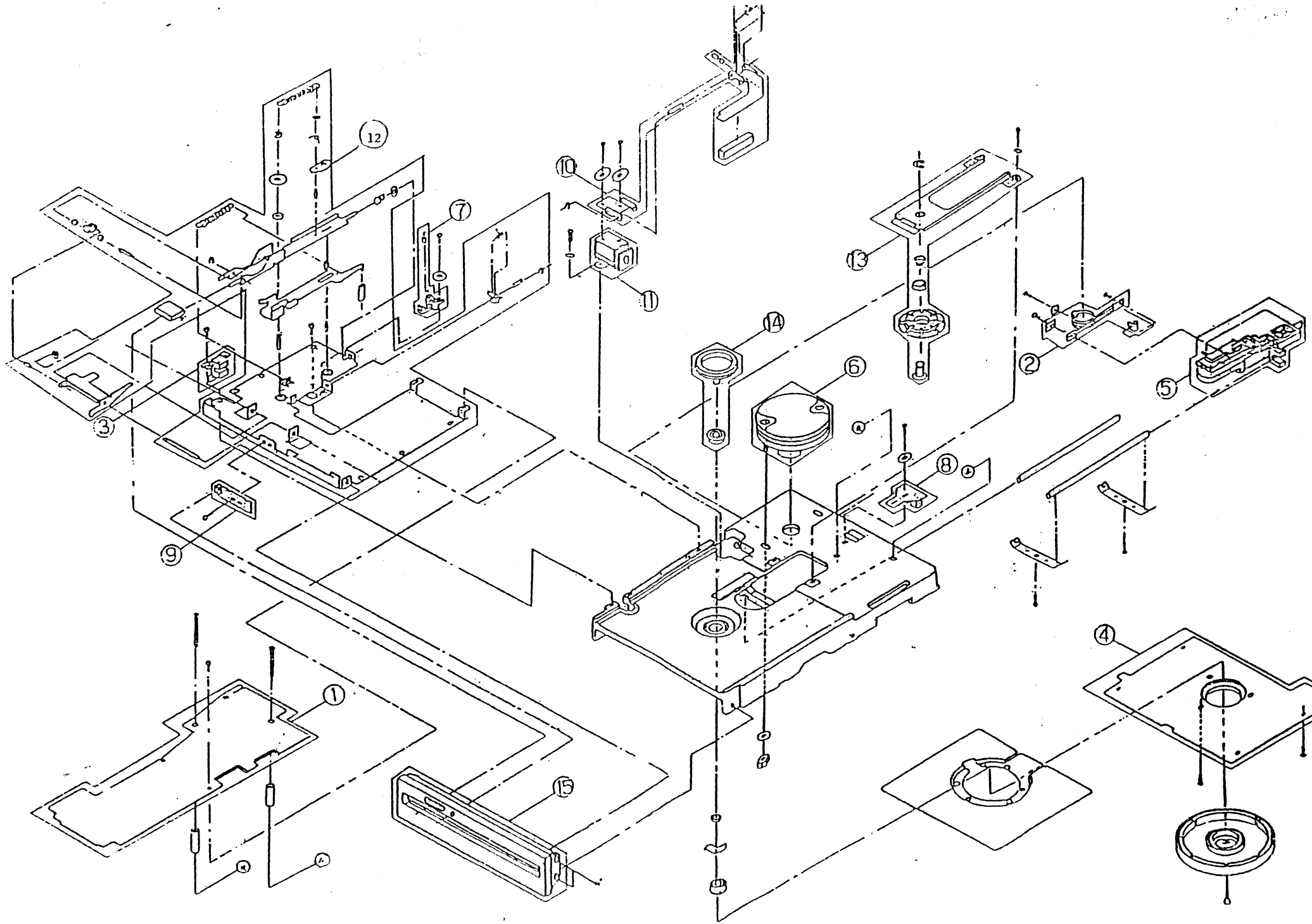
Cathode Anode





DD MOTOR PCB CIRCUIT DIAGRAM


J1
SELECT 1
SELECT 2
SELECT 3
SELECT 4
HEAD LOAD
STEP
DIRECTION IN
MOTOR ON
WRITE GATE
WRITE DATA
SIDE SELECT
RA1 150
RA1-2 150
RA1-3 150
RA1-4 150
RA1-5 150
RA1-6 150
RA1-7 150
R1 150
(NC) IN USE
STEP MODE
DT
SO
S1
INCH SEL
A SW
B SW
MOTOR ON
HS.SEL
SINGLE SIDE
P.CLR
ERASE
W. ENABLE
W. DATA
W. DATA
P. DATA
DRIVE A
IC1
DH-IC
IC2
AH-IC
R9 2.2K
C1 680P
X1 4M
C2 680P
4MCLK
NC
NC
NC
W. PROTECT 0
MOTOR ON 0
CHK3
W. PROTECT 1
T4 2SB643
T1 2SB793
D1 10D1
H.L SOL
C13 0.01μ
C8 47μ
C15 0.01μ
T2 2SB643
T3 2SB643
ALEDA
ALEDB
INDEX P.
INDEX COMP OUT
INDEX COMP OUT
INDEX COMP +
TRK00 COMP +
W. PROTECT 1
OS STEP M
ΦA
ΦB
ΦC
ΦD
J4
J5
TRK00
R5 47K
R6 150
NC
MOTOR ON
MOTOR CONTROL P C B
R7 27K
R8 220
RA2-1
RA2-2
RA2-3
RA2-4
RA2-5
IC4 M54543L
D2 10D1
IC3 M54543L
C14 0.01μ
C9 47μ
J6
INDEX
TRACK 00
WRITE PROTECT
READY
READ DATA
Note 1
R3
R4
2W CHK1
CHK2
C3 33μ
J3-1
J3-2
S.M D.T STEP.P
L L 1
L H 2
H L 4
H H 8
S0 S1 S.CLOCK
L L 2 (mS)
L H 3 (")
H L 5 (")
H H 7 (")
J2
12V
GND
GND
5V
RX
CX
L1 47μ
C5 47μ
C10 0.01μ
C6 47μ
C11 0.01μ
VR1 50K
VR2 3K
C7 47μ
C12 0.01μ
NC HCLR.C (IN)
HR.R/W1
HR.R/W2
RESERVED R/W3
HR.R/W4
HR.E
Note 1: 2.37K (MDD221)
2.05K (MDD211)
Note 2: 390 (MDD221)
150 (MDD211)


12
7
10
11
13
14
6
8
2
5
3
9
1
15
4