

MAINTENANCE MANUAL

Micro Flexible Disk Drives

F-3503

F-3504

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Memory Products Div.

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This Maintenance Manual is subject to change without prior notice.

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SECTION 3

Explanation of Operation

3-1 Outline of Construction and Functions

3-1-1 Overall block diagram

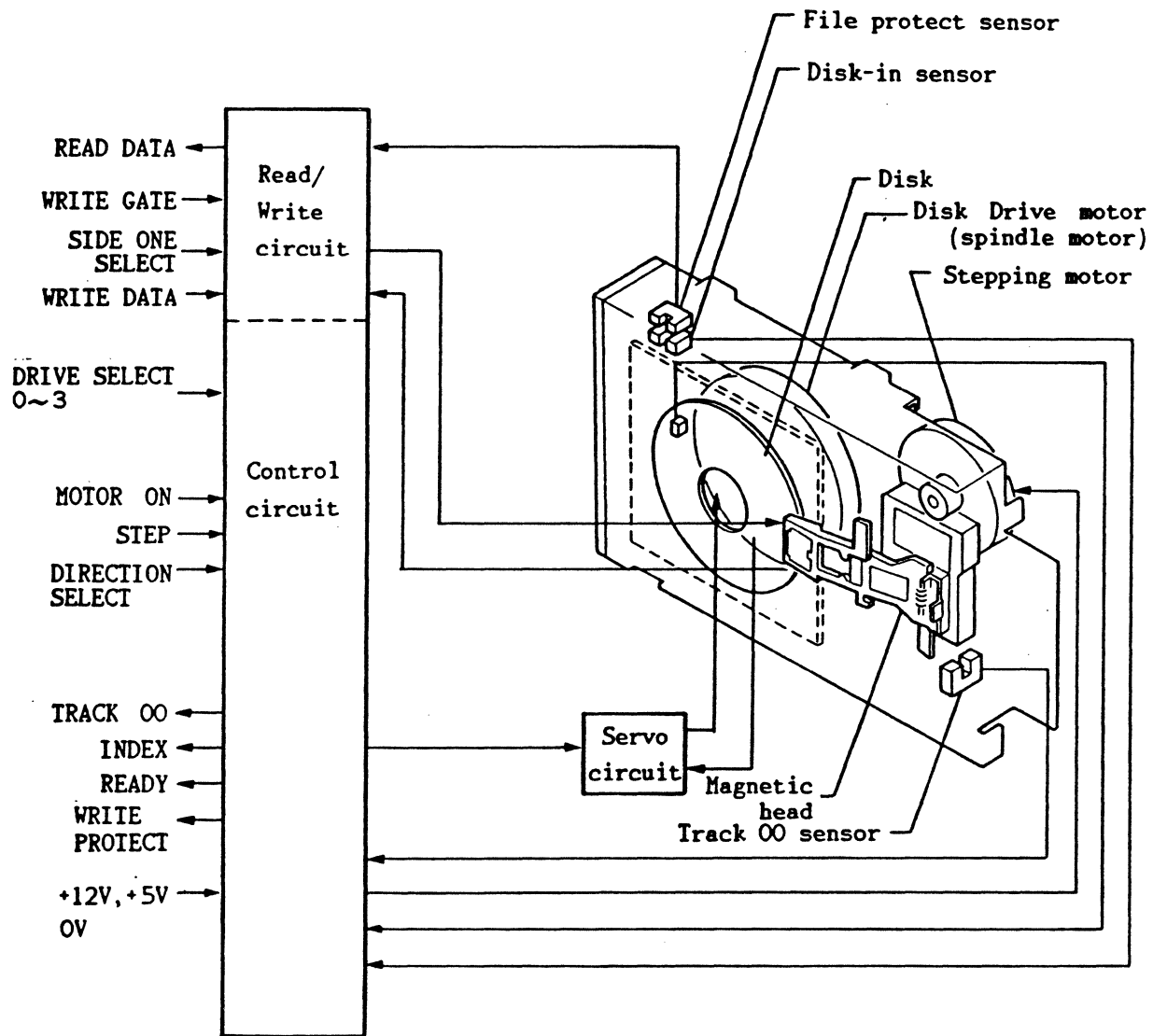


Fig. 301 Overall Block Diagram

3-1-2 Outline of mechanical section

The mechanical section of this Floppy Disk Drive is assembled carefully and accurately with precision parts because the recording medium is soft based on disk and polyethylene film, an arbitrary change is available and an interchangeability of data is required between Floppy Disk Drives. Therefore, the mechanism interior must not be tampered with by other than personnel trained for specialized maintenance. And the instrument must not be subjected to excessive shock nor dropped, and must be handled carefully.

The mechanical section is centered on the frame and consists of disk chucking mechanism and disk eject mechanism, disk rotation mechanism, magnetic heads and carriage, head seek mechanism, different detect mechanisms, etc.

(1) Frame

Constitutes a framework to mount on each mechanism and PWB. Consists of an iron chassis. Considerations have been given to sufficiently maintain stable the reliability of Floppy Disk Drive concerning the mechanical strength, accuracy, resistance to weathering expansion rate and all other respects.

(2) Disk chucking mechanism and eject mechanism

The disk chucking mechanism and eject mechanism consist of trigger lever, eject lever, etc. centered on the disk housing which serves as a guide for mounting a disk on the spindle.

On the disk chucking mechanism, inserting a disk disengages the trigger lever claw, the disk moves downward along with the disk housing, and the disk center is chucked to a correct position.

The eject mechanism is designed in such a manner that pushing the eject button causes the eject lever to push up the disk housing, whereby the pushup action lever pushes out the disk.

(3) Disk rotating mechanism

The disk rotating mechanism consists of Disk Drive motor including the spindle.

The Disk Drive motor is an outer rotor type DC brushless motor directly coupled with a spindle, and has a long life of 20,000 hours or more in continuous rotation. The rotation speed is 300rpm. A servosystem works to maintain the speed constant regardless of variations of load and ambient temperature through feedback signals from the AC tachometer built in the motor.

(4) Magnetic heads and carriage

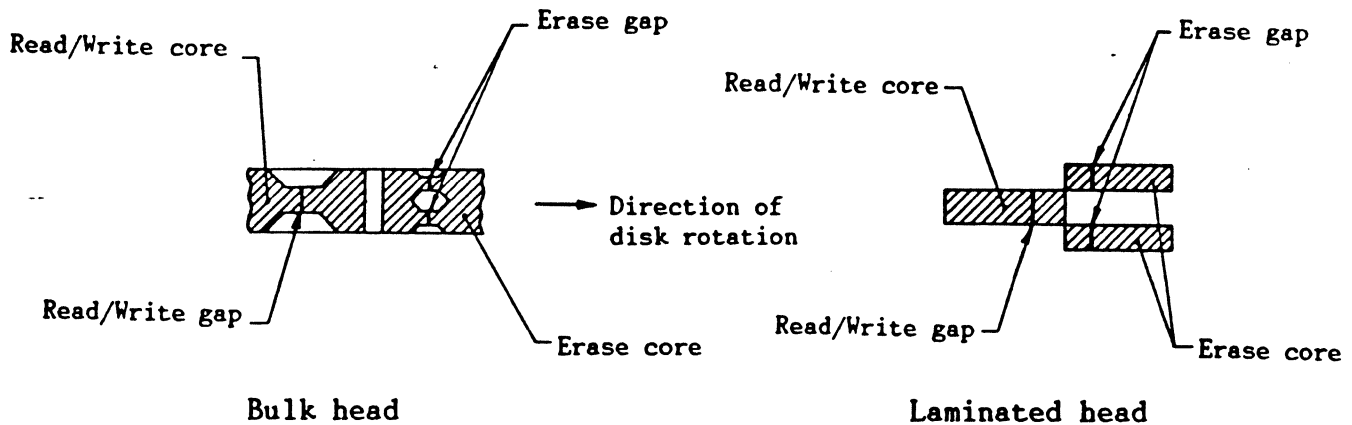


Fig. 302 External Appearance of Magnetic Head Core

On the single side Floppy Disk Drive (F-3503), the magnetic head is a button type and is mounted on the carriage so it touches the head window section of the disk side 0 (bottom when Floppy Disk Drive is placed horizontal). On the double side type Floppy Disk Drive (F-3504), on the other hand, both side 0 and 1 heads are a special flat type supported by a gimbal structure. The two heads are mounted on a single carriage so they pinch the respective disks from outside.

Each of the heads is designed so that the head surface minimizes the wear of disk and that a single reproduced from the disk is a maximum, and the head itself is along life type free from excessive wear. As shown in Fig.302, this Floppy Disk Drive adopts heads having a bulk or laminated core structure.

The head center consists of a Read/Write gap used for any of recording and playback of data, and two erase gaps for deleting (tunnel erase) the edge of recording track immediately after recording.

The two heads having different core structures have the same function. It is possible to provide a perfect interchangeability between data recorded on the disk. The magnetic heads and carriage where the heads are mounted are a vital part of Floppy Disk Drive and assembled particularly accurately.

(5) Head seek mechanism

The head seek mechanism consists of steel band, guide shaft and

carriage, centered on a stepping motor provided with a capstan (pulley). The carriage slides on two guide shafts and is connected through a steel belt with the capstan of stepping motor.

The stepping motor employed is a flat four-phase type and turns 1 step (corresponds to 1.8°) for a head movement of 1 track.

The shaft-to-disk axis parallelism and distance and shaft and capstan dimensions are accurate. The expansion by temperature has sufficiently been studied along with expansion of the chassis, steel band, carriage, etc. so they are offset with expansion of the disk itself.

(6) Different detect mechanisms

(a) File protect detection mechanism

Consists of sensor and sensor lever for detecting a presence of a write protector detect hole of the protective hard case. The write circuit operation is blocked if the sensor is not intercepted by the sensor lever when mounting a disk whose detect hole is open.

(b) Track 00 detect mechanism

Consists of a sensor for detecting the outermost peripheral position (track 00) of the head carriage and track 00 stopper.

The disk is used within the track 00. Even if the head moves outside on account of shock, etc., the head carriage hits to track 00 stopper and the head is prevented from moving outside the range where a self return is available by turning on power. Designing is made so as to ignore a stepout instruction from the track 00 position by judgement of the Floppy Disk Drive internal circuit.

If a stepin instruction is inputted further from the innermost track, the head further moves inside with an enough allowance to prevent the head from touching the head window edge. In order to perform a track recalibrate action (track 00 return) from this position, it is necessary to input a stepout instruction several steps in excess of the maximum number of tracks.

(c) Index detect mechanism

Consists of a reflector mounted on the rotor of the spindle motor (Drive Disk motor) and a sensor arranged on the motor side. The motor rotation turns the reflector, which reflects the beam coming from the sensor, and the reflected beam is detected by the sensor.

3-2 Circuit Operation

The circuitry consists of Read/Write circuit, control circuit and servo circuit, and they are mounted on the main PWB assembly.

3-2-1 Read/Write circuit

The Read/Write circuit consists of read section, write section, low voltage detect section, etc. and is housed in 1-chip bipolar IC along with the major part of the control circuit. Fig.303 shows its block diagram.

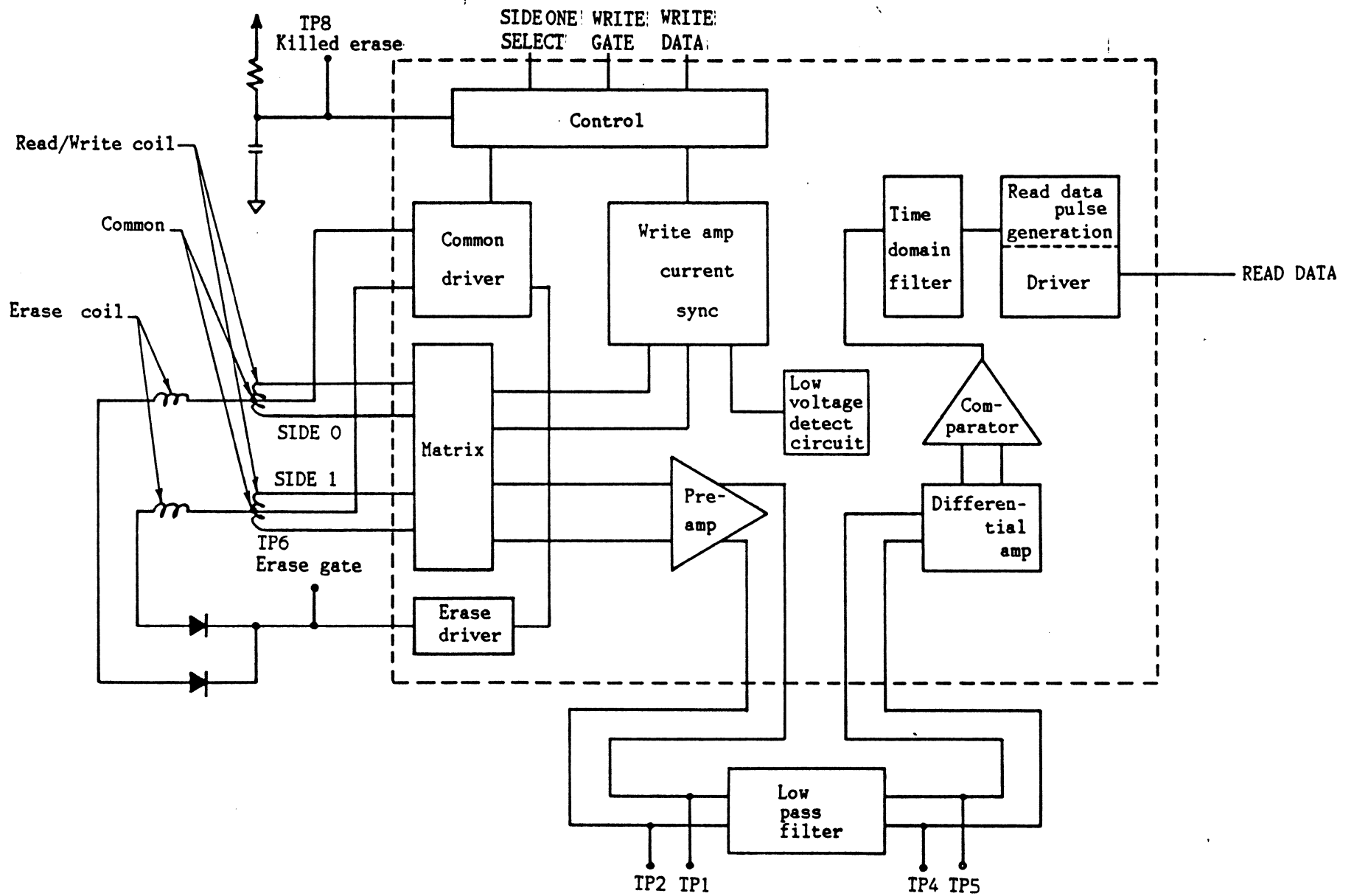


Fig. 303 Read/Write Circuit Block Diagram

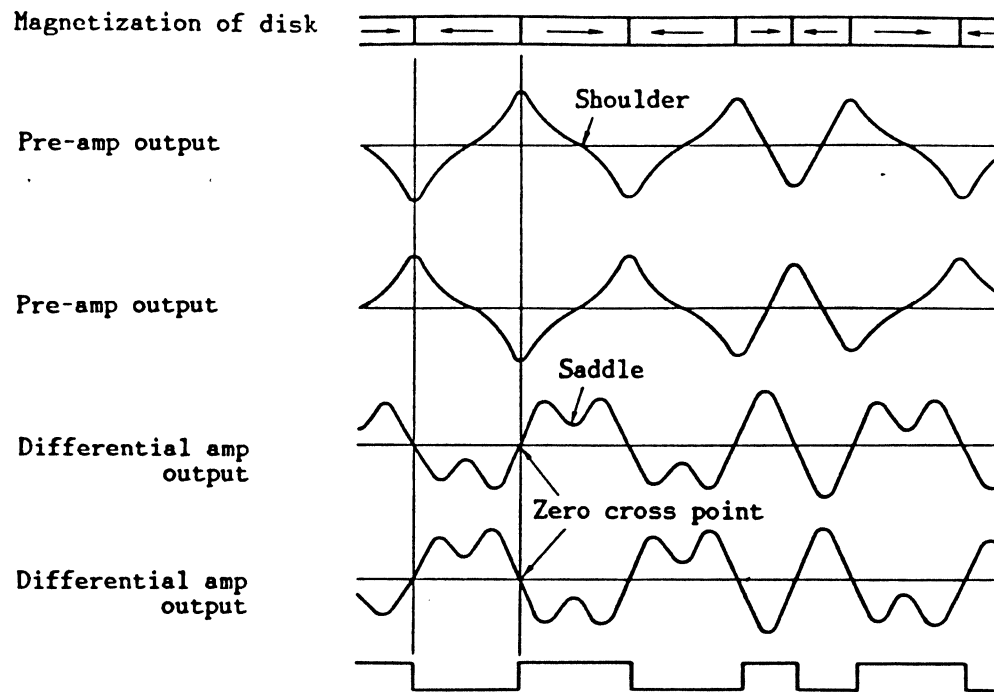


Fig. 304 Typical Read Circuit Operating Waveforms

(1) Read section

The read section consists of pre-amp, low-pass filter, derivative amp, time domain filter and read data pulse generator circuit (output driver).

At read time, a small voltage induced on the Read/Write head is boosted by the differential pre-amp, is deprived of noise and other undesired components by the low-pass filter, and is delivered to the derivative amp. The derivative amp shifts the peak position of the reproduced signal to the zero cross position and, by optimally applying a correction to offset the difference in the frequency component, further amplifies the signal. Its output is converted into a square wave by the peak detector consisting of a comparator, is deprived of undesirable influence by saddle produced at a reproduction of the low frequency section by the time domain filter, and is outputted from the Floppy Disk Drive through the read data pulse generator and output driver.

(2) Write section

The write section consists of control, write amp current sync, common driver, erase driver and other circuits.

The control circuit turns on when the file protect sensor detects

the disk jacket side notch (write enable status) and WRITE GATE input signal is TRUE, or when the erase gate signal produced by specified timing based on WRITE GATE signal is TRUE, and supplies power of about 10V to the center tap of the Read/Write head. These power gate-on conditions are generated by the control circuit.

The WRITE DATA pulse train from outside is latched by the data latch and, by turning on an off two write drivers alternately, an appropriate recording current is applied to the Read/Write head.

The erase head is located 0.7mm behind the Read/Write gap in such a manner that it is placed in between. The erase gate signal is delayed by the amount of 0.7mm offset of WRITE GATE input signal. The erase driver operates so as to cover the recording area by the Read/Write head. Delay timing is produced by the Write/Erase gate of the control circuit.

So long as the write driver is in an operating status, READ DATA pulse output is blocked.

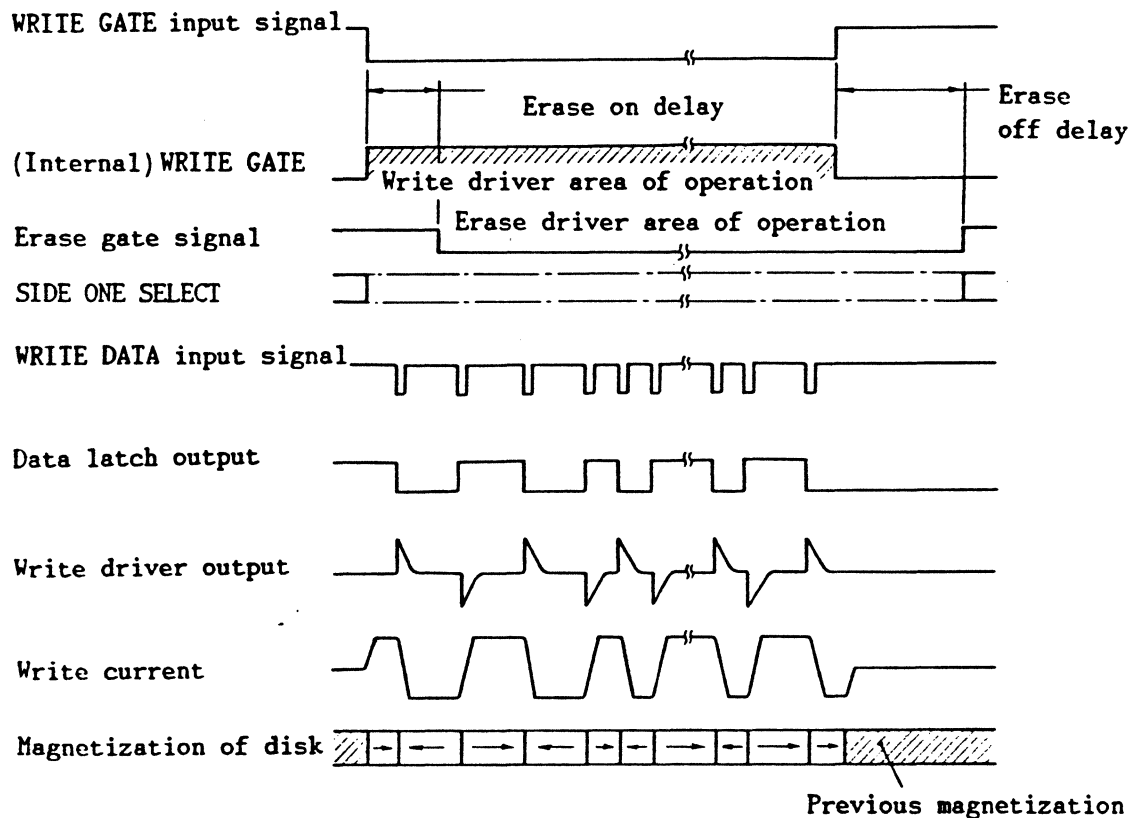


Fig. 305 Typical Write Circuit Operating Waveforms

(3) Low voltage detect circuit

The low voltage detect circuit is intended for avoiding an erratic operation due to the Floppy Disk Drive internal circuits when the

detect circuit covers the write circuit and function block, and prevents the write driver and erase driver from operating erratically when +5V is unstable and the Floppy Disk Drive internal logics do not function properly and when +12V is unstable and writing is not warranted.

3-2-2 Control circuit

The control circuit consists roughly of three circuits: Write/Erase gate for determining the timing for applying a current to the head when recording, spindle motor gate for determining the spindle motor turning conditions and other gates: index detector, track 00 detector, file protect detector, ready detect circuit and other detect circuits; and stepping motor control circuit, and is mainly accommodated in 1-chip bipolar IC.

Each detector (phototransistor) is mounted on the track 00 sensor PWB assembly, and all other control circuits are mounted on the sensor PWB assembly, index PWB assembly and main PWB assembly.

The drive select gate is a circuit consisting of straps (short bars) for transmitting the select status to the control LSI inside, and selecting the lighting conditions of the front bezel display.

The Write/Erase gate judges the conditions where writing is available by Floppy Disk Drive, and issues a write instruction (write gate and erase gate signal) to the write circuit and, by the internal one-shot multivibrator, the specified delay time is provided for the erase gate signal.

The ready detect circuit outputs a ready signal about 1 second after MOTOR ON signal and DISK IN sensor signal are inputted.

The stepping motor control circuit consists of direction, shift register, overdrive single shot, etc.

The direction is a circuit for sampling the head moving direction specified by DIRECTION SELECT signal every time STEP pulse is inputted. By the shift register, the direction is converted into a drive signal appropriate for the bipolar 2-phase exciter of the 4-phase stepping motor and is applied to the stepping motor.

The overdrive single shot turns on the overdrive circuit for a specified time (approx. 70msec). During this while, about 10V is applied across the stepping motor coil so as to obtain a necessary torque sufficiently in seek and settling operation. After end of settling, only +5V is applied to the stepping motor coil and unnecessary power loss is not caused except that a torque is kept enough to hold the head stop position. Thus, heating from the motor is suppressed low and the power consumption of the stepping motor is reduced to a low level at seek stop time.

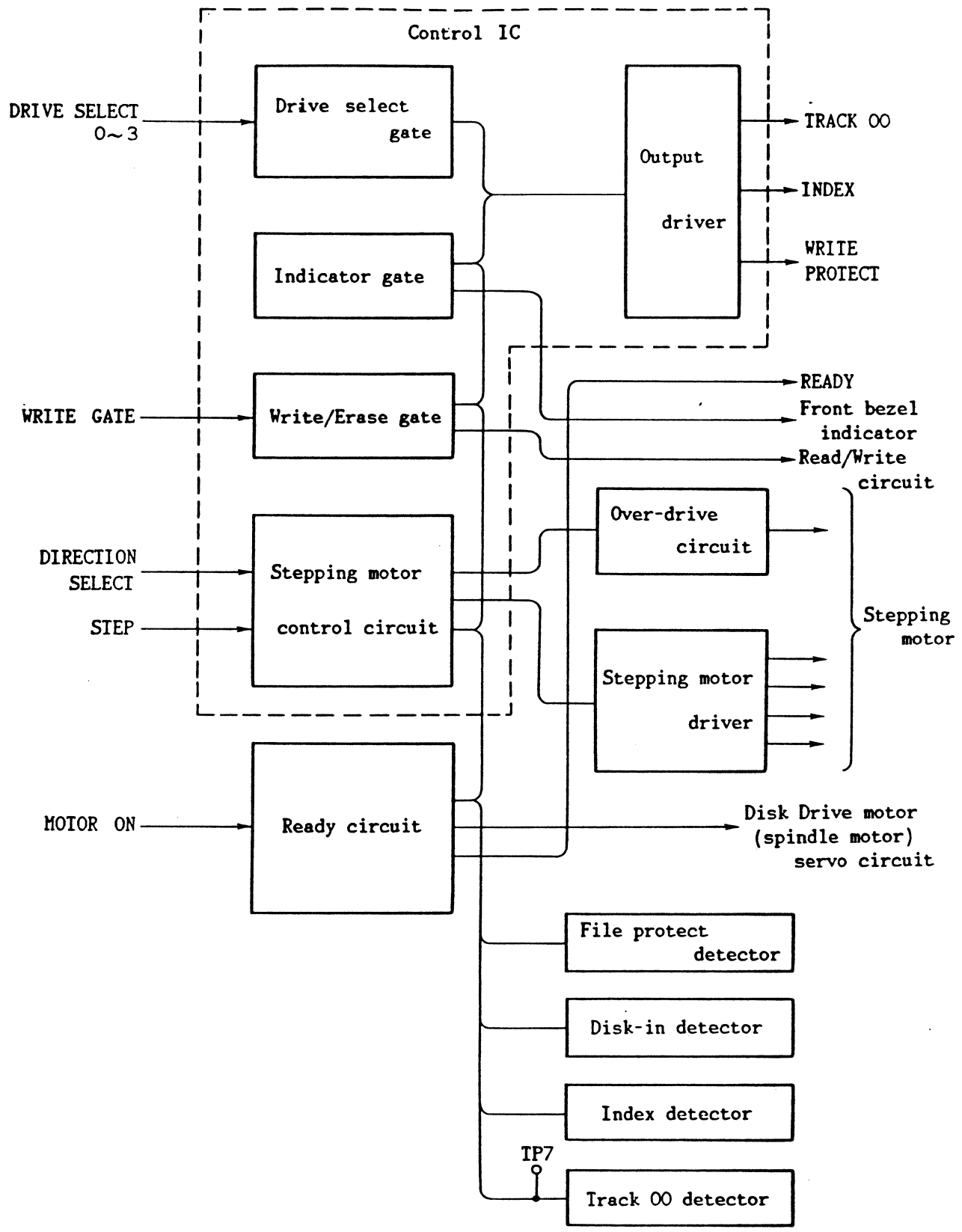


Fig. 306 Control Circuit Block Diagram

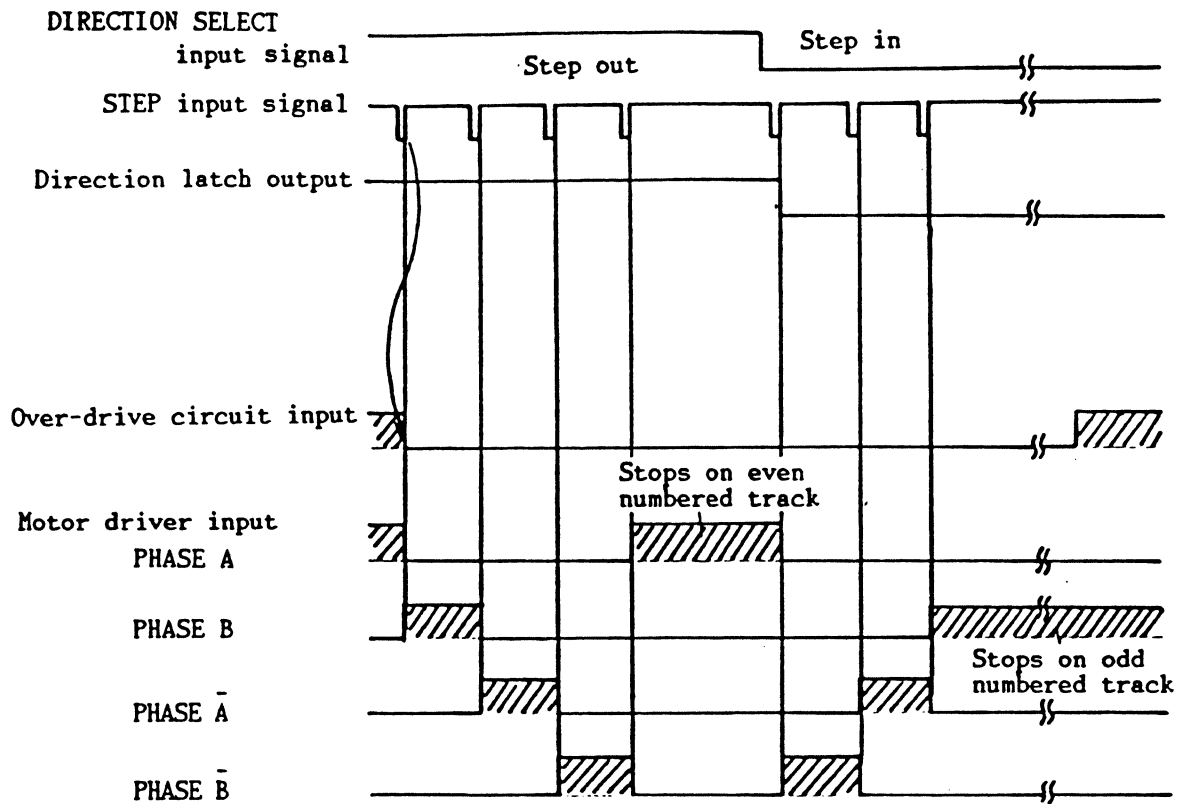


Fig. 307 Typical Stepping Motor Control Circuit Operation Waveforms

3-2-3 Servo circuit

The servo circuit keeps constant the spindle motor speed, and is mounted on the main PWB assembly separate from the spindle motor. Start and stop of the spindle motor (Disk Drive motor) are controlled by MOTOR ON signal by way of the control circuit.

The motor is a 2-phase excitation long-life brushless motor, and is driven by 2-phase driver IC intended for this purpose. The 2-phase energization and excitation direction is changed over by signals from Hall generator mounted on PWB in the rotor in such a manner that the drive coils and excitation direction are successively changed in the specified turning direction. The rotation speed is kept at a desired level stably and accurately by applying to the drive voltage control section of the driver the feedback signal from the AC tachometer pattern etched on PWB of the rotor periphery which is subjected to F-V conversion (frequency-voltage conversion) by another servo IC.

3-3 Functions of Test Points and Potentiometers

Fig.308 shows the arrangement of the test points and potentiometers.

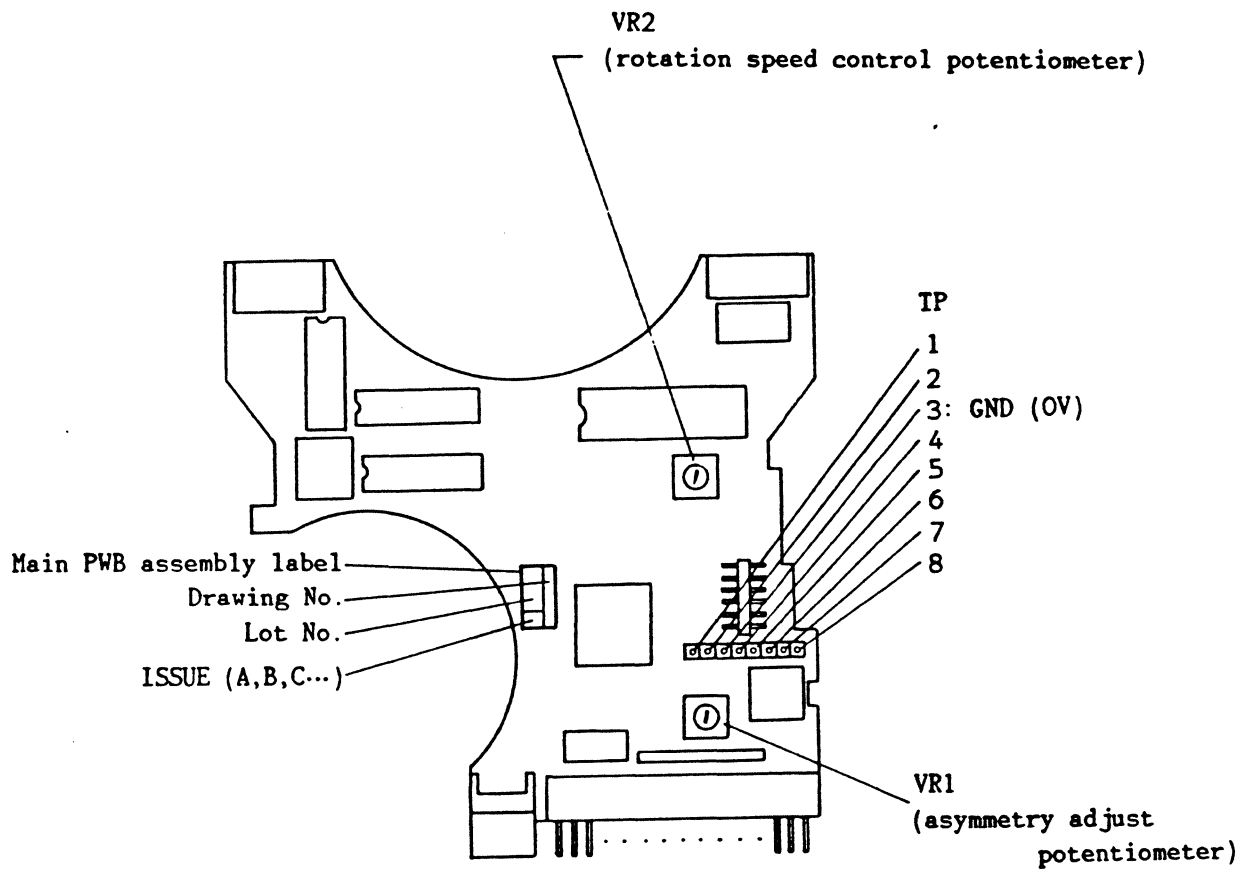


Fig. 308 Arrangement of Test Points and Potentiometers

3-3-1 Test point functions

On the main PWB assembly, seven test points (including 1 ground) are provided for observing the waveform necessary when adjusting or inspecting the Floppy Disk Drive.

(1) TP1 and TP2 (pre-amp)

Test points for observing the Read/Write amp output.

The pre-amp has two outputs of several ten to several hundred mVp-p of 180° off phase (reverse phase), and they are observed at TP1 and TP2, respectively. For an accurate waveform observation, one channel must be added in an invert mode, and a single waveform must be observed with TP1 and TP2 by means of 2-channel oscilloscope. As an oscilloscope ground, use the nearby TP3(OV) test point.

TP1 and TP2 are used for checking different characteristics of the Read/Write head and also for checking or adjusting mechanical factors of the head seek mechanism and magnetic head such as track alignment.



Fig. 309 Typical Waveform

(2) TP3 (OV)

Used as ground for measuring instrument. When an alligator clip is used, there is a fear of short-circuiting with an adjacent test point. Therefore, connect carefully.

(3) TP4 and TP5 (filter out)

Test points for observing the low-pass filter output.

The same as the pre-amp, two outputs of several hundred to several mVp-p are present and can be observed at TP4 and TP5, respectively.

For an accurate observation, use 2-channel oscilloscope. Set one channel to an invert mode and add the signals. Observe the waveform between TP4 and TP5 as a set. As an oscilloscope ground, use the nearby TP3(OV) test point.

IP4 and IP5 are used for checking the operation of the Read/Write head and entire amp, and also checking or adjusting mechanical factors of the head seek mechanism and magnetic head such as track alignment.

(4) IP6 (erase gate)

A test point for observing the erase gate signal.

At LOW level, a specified current flows to the erase head. It is used for checking the delay time of erase gate signal with respect to WRITE GATE input signal.

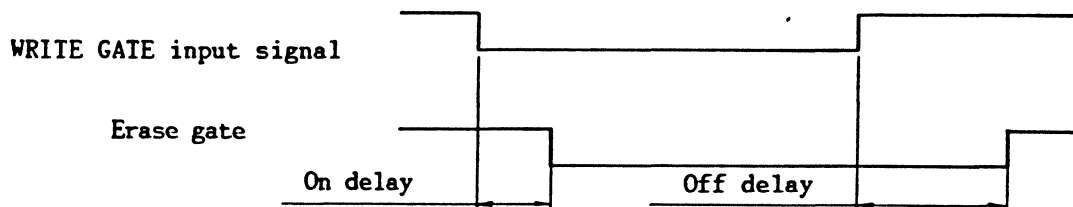


Fig. 310 Typical Waveform

Delay	Delay time
On delay	$450 \pm 60 \mu s$
Off delay	$1200 \pm 100 \mu s$

Table 301 Erase Gate Delay

(5) IP7 (track 00 sensor)

A test point for observing the output of track 00 detect photo-transistor. The same as TRACK 00 output signal, the level is LOW when the head is at track 00 or nearby.

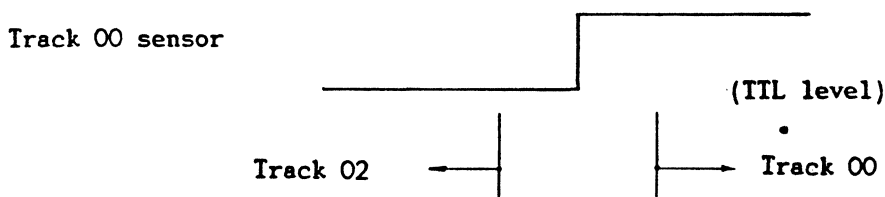


Fig. 311 Typical Waveform

Note: TRACK 00 output signal is TRUE (LOW level) only when the output of 39 (\bar{A}) and 37 (\bar{B}) of 1-clip IC U1 is "H". Therefore the timing does not coincide with the change of waveform at TP7.

(6) IP8 (Killed erase)

A test point for turning off the current to the erase coil. Dropping this terminal to 0V turns off the erase coil current even in a write mode.

Notes: 1. The circuit impedance is high at this test point. Beware of influence by noise, etc.

2. Use this test point with an open collector connection.

3-3-2 Potentiometer functions

The potentiometers have been accurately factory adjusted and must not be tapered with by other than maintenance personnel trained for maintenance.

There are two potentiometers on the main PWB assembly. The asymmetry adjusting potentiometer VR1 is adjusted so the asymmetry value is 600ns or less at 1F and 300ns or less at 2F. The disk speed adjusting potentiometer VR2 is adjusted so the pulse interval of INDEX output signal is 200 ± 4 msec.

SECTION 4

Explanation of Maintenance

4-1 Maintenance Outline

4-1-1 Periodic maintenance

As long as a Floppy Disk Drive is used at the normal rate, periodic maintenance such as parts replacement, lubrication, etc., should not be required for 5 years.

Using a cleaning disk to clean the magnetic heads, however, is effective for improving data reliability so we recommend doing this at the intervals given in Table 401. Concerning maintenance parts in the Floppy Disk Drive, we recommend periodic replacement of assemblies at the intervals shown in Table 403, especially when the unit is used more than normal or when the 5 year period has been exceeded. .

Change parts in accordance with the item 4-4, referring to the item 4-2.

Periodic Maintenance Item	Recommended Interval	Time Required	Item Explaining Maintenance
Magnetic head cleaning	Refer to 4-3-1, 4-3-2	5 min.	4-3-1
Replacement of maintenance parts	Refer to 4-1-3, 4-5		

Table 401 Periodic Maintenance Items

4-1-2 Inspection and adjustment

Table 402 shows all inspection and adjustment items.

The items listed here are not required at fixed intervals like periodic maintenance items. When replacing maintenance parts, or when a breakdown occurs, refer to the items in 4-2 or 4-3 as required.

The maintenance sequence shown in Table 402 is for complete inspection and adjustment.

Maintenance Sequence	Inspection and Adjustment Items	Time Required	Item Explaining Maintenance
1	File protect sensor inspection	5 min.	4-4-1
2	Disk speed inspection and adjustment	5 min.	4-4-2
3	Head touch inspection and adjustment	5 min.	4-4-3
4	Asymmetry inspection	5 min.	4-4-4
5	Read level inspection	5 min.	4-4-5
6	Resolution inspection	5 min.	4-4-6
7	Track alignment inspection and adjustment	10 min.	4-4-7
8	Track 00 sensor inspection and adjustment	5 min.	4-4-8
9	Track 00 stopper inspection and adjustment	5 min.	4-4-9
10	Index burst timing inspection and adjustment	5 min.	4-4-10

Table 402 Inspection and Adjustment Items

4-1-3 Replacement of maintenance parts

We recommend that maintenance parts be periodically replaced as indicated below when a Floppy Disk Drive is used frequently, or when 5 or more years have elapsed.

Table 403 is a complete list of maintenance parts. The parts recommended for periodic replacement should be replaced when the indicated period has passed. When a replacement period is not indicated, there is no need for periodic replacement.

Under normal usage, there is normally no need for periodic replacement of all consumable parts.

Cautions concerning the entries in the maintenance parts list:

- (1) The drawing number of the main PWB assembly differs depending on the signal interface, etc., so always check the actual on the actual PWB.
- (2) The drawing numbers for the front bezel, eject button and front door is for the standard color (black). For other colors, please order using the indicated color drawing number.
- (3) Parts not indicated for periodic replacement need not be replaced periodically. Only replace when a breakdown occurs.
- (4) When two replacement periods are given for a part, the one that elapses first has priority.
- (5) Times given for parts replacement include the time required for inspection and adjustment.
- (6) When ordering maintenance parts, always indicate the drawing number.

Table 403-1 F-3503 (single side, 135TPI) Maintenance Parts List

Maintenance Parts			Parts Replacement		
Parts Names	Application	Drawing No.	Recommended replacement Interval	Time Required	Reference Item
Head carriage assembly	Standard	JA3-5220	7000 hours with motor on or 5×10 ⁶ seek operations	45 min.	4-5-1
Stepping motor	Standard	J4-5481	5×10 ⁶ seek operations	30 min.	4-5-2
Steel band assembly	Standard	JA4-5482	Replace at same time as stepping motor	—	4-5-2
Disk Drive motor (spindle motor)	Standard	J3-5225	20000 hours with motor on	20 min.	4-5-3
Track 00 sensor assembly	Standard	JA4-5527	—————	10 min.	4-5-4
Main PWB assembly	Standard, caution (1) (Differs accord- ing to model).	JA2-5220	—————	15 min.	4-5-5
Index sensor PWB assembly	Standard	JA4-5537	—————	15 min.	4-5-6
Front bezel	Standard, caution (2)	J2-5217	—————	5 min.	4-5-8
Front door	Standard, caution (2)	J2-5215	—————	10 min.	4-5-9
Eject button	Standard caution (2)	J3-5211	—————	5 min.	4-5-10
Pad (head pad)	Standard	J4-5170	2500 hours with motor on	10 min.	4-5-7

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Table 403-2 F-3504 (double side, 135TPI) Maintenance Parts List

Maintenance Parts			Parts Replacement		
Parts Names	Application	Drawing No.	Recommended replacement Interval	Time Required	Reference Item
Head carriage assembly	Standard	JA3-5222	7000 hours with motor on or 5×10 ⁶ seek operations	45 min.	4-5-1
Stepping motor	Standard	J4-5481	5×10 ⁶ seek operations	30 min.	4-5-2
Steel band assembly	Standard	JA4-5482	Replace at same time as stepping motor	—	4-5-2
Disk Drive motor (spindle motor)	Standard	J3-5225	20000 hours with motor on	20 min.	4-5-3
Track 00 sensor assembly	Standard	JA4-5527	—————	10 min.	4-5-4
Main PWB assembly	Standard, caution (1) (Differs accord- ing to model).	JA2-5221	—————	15 min.	4-5-5
Index sensor PWB assembly	Standard	JA4-5537	—————	15 min.	4-5-6
Front bezel	Standard, caution (2)	J2-5217	—————	5 min.	4-5-8
Front door	Standard, caution (2)	J2-5215	—————	10 min.	4-5-9
Eject button	Standard caution (2)	J3-5211	—————	5 min.	4-5-10

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4-1-4 Tools required for maintenance

The measuring instruments, jigs and tools required for complete maintenance of this Floppy Disk Drive are as follows.

- (1) Measuring instruments
 - (a) Floppy Disk Drive control system and DC power supply (users system)
 - (b) Dual-trace oscilloscope
 - (c) Frequency counter
 - (d) Digital voltmeter
 - (e) DC clip-on ammeter
 - (f) Relative humidity gauge
- (2) Tools
 - (a) Phillips screwdrivers M2, M2.6, M3
 - (b) Minus screwdrivers, small and medium
 - (c) Allen wrench, 1.5mm flats
 - (d) Tweezers
 - (e) Radio pliers
 - (f) Nippers
 - (g) Solder and soldering iron
 - (h) Fine brush
- (3) Special jigs
 - (a) MAX media jig (jig D)
- (4) Disks
 - (a) Work disk (ordinary commercially available disk)
 - (b) Cleaning disk
(ordinary commercially available type, double side)
 - (c) Level disk
 - (d) Alignment disk (double side, 96tpi)
- (5) Maintenance parts
 - (a) Anhydrous alcohol (ethanol)
 - (b) Cotton, gauze
 - (c) Screw lock
 - (d) Epoxy
 - (e) Screws, washers (see item 5-2-2)
 - (f) Lubricating oil (KANTO KASEI 946P or any equivalent to it)
 - (g) Light oil (NIPPON KOYU LTD. HH-17 or any equivalent to it)

Note: Use only corrected measuring instruments and measurement disks.

4-2 Maintenance Cautions

4-2-1 Screw torque and screw lock

Unless otherwise indicated, all screws should be tightened to the torque listed in Table 404.

Screw Size	Screw torque
M2	2 kg.cm
M2.6	4.5 kg.cm

Table 404 Screw Torque

After tightening the threads, apply a thin coat of screwlock to specified points.

4-2-2 Handling the connectors

(1) Connector types

This Floppy Disk Drive uses for following connectors.

- (a) J1: Interface connector
- (b) J2: Power connector
- (c) J3: Head connector
- (d) J4: Track 00 connector
- (e) J5: Index sensor connector
- (f) J6: Stepping motor connector
- (g) J7: Spindle motor (Drive Disk motor) connector

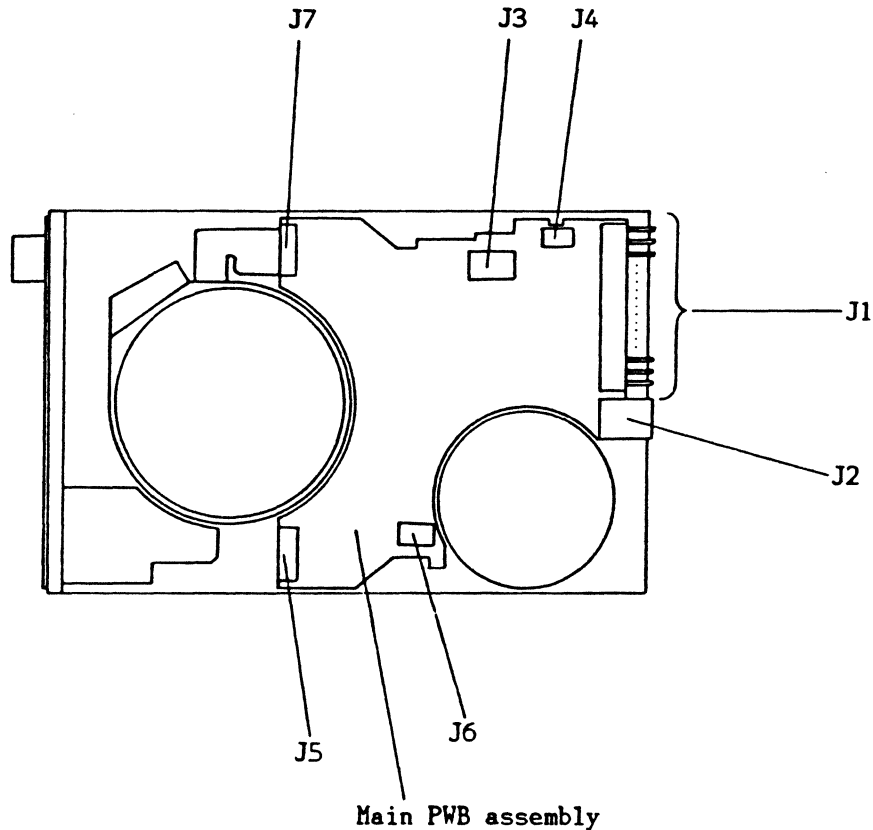


Fig. 401 Connector Types

(2) Inserting and removing connectors

Always be sure to turn off the power before inserting or removing a connector. Do not apply excessive force to cables or post pin. Pull out or insert straight and positively.

(3) Cautions in handling white connectors (J4, J5, J6)

(a) Removing connectors

As shown in Fig.402, disengage after pushing up the housing bottom by finger(fingernail) or tweezers in the arrow direction.

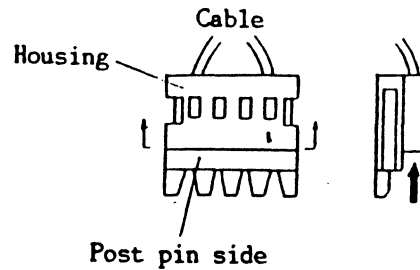


Fig. 402 Removing White Connectors

(b) Inserting the connector

Align the connector housing clamper and push in the post pins on the PWB.

(4) Cautions in handling black connector (J3)

(a) Removing connectors

Disengage J3 (head connector) straight after inserting the end of tweezers into the groove at the rear of housing as shown in Fig.403. Take care not to pull the thin cable.

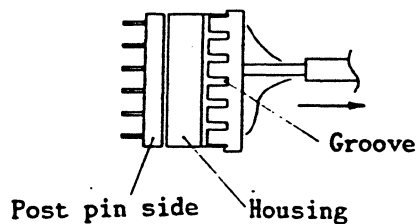


Fig. 403 Removing J3 (head connector)

(b) Inserting the connector

Align the key with the post pin and housing, and press into the back of the housing with a finger.

(5) Caution in handling FPC connector (J7)

(a) Engaging and disengaging flexible circuit board

The flexible circuit board is easy to be cut. Do not twist it but slide at a slant little by little and alternately.

4-2-3 Cable treatment

(1) Head cable

The head cable must be fixed correctly with a proper allowance of length so the head carriage can move smoothly on the tracks.

- (a) Fix the head cable on the cable clamber of the main chassis by a wire binder so it has some allowance when the head carriage is installed on track 00. The cable length is proper when it is about 55mm between the head carriage outlet and cable clamber. At the same time, make sure the head cable does not touch the guide shaft or other parts, and then fix it on track 00 sensor stand. (See Fig.404.)

(2) Track 00 sensor cable

- (a) Twist it 2~3 turns to the right and connect it to the connector (J4) so as not to touch the head cable or trigger lever spring. The cable must not go out of the main chassis (See Fig.404, 405.)

(3) Index sensor PWB cable

(a) Index sensor side

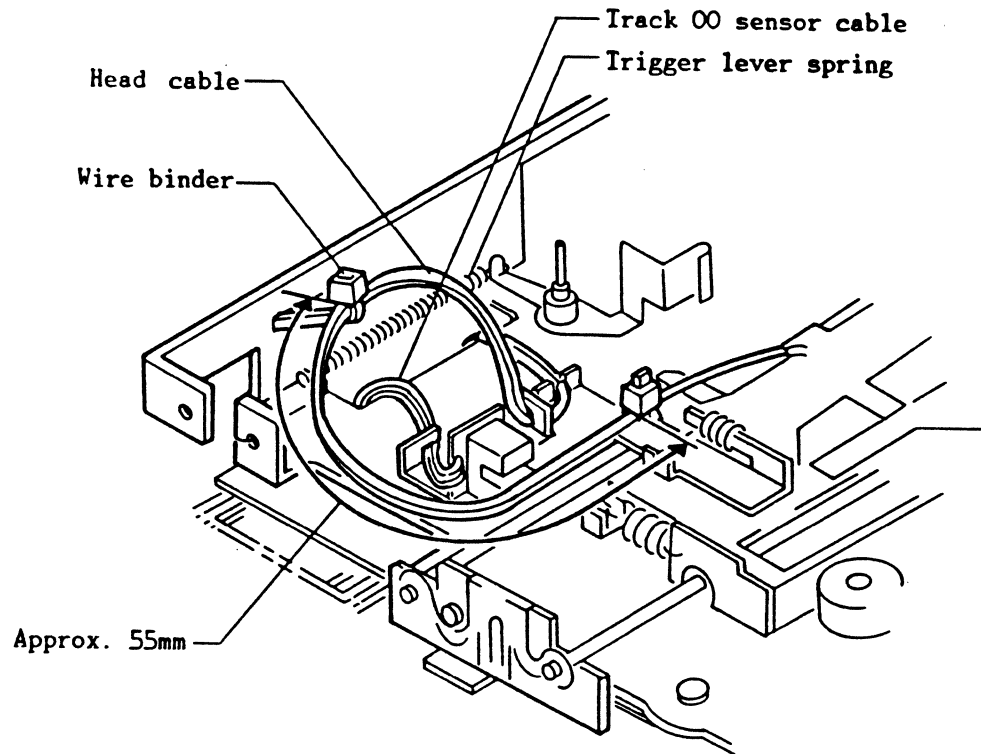
Twist it 2~3 turns to the right and fasten the index sensor so as not to touch the Disk Drive motor (spindle motor) or other parts. (See Fig.405.)

(b) Connector side

Twist it 2~3 turns to the right and connect it to the connector (J5) so as not to touch the Disk Drive motor (spindle motor) or other parts. (See Fig.405.)

(4) Stepping motor cable

- (a) Twist it 2~3 turns to the right, hook it to the cable clamber of the main PWB, and connect it to the connector (J6). (See Fig.405.)



*Note: The figure represents a double side type.
The single side type is similar.*

Fig. 404 Cable Dressing (1)

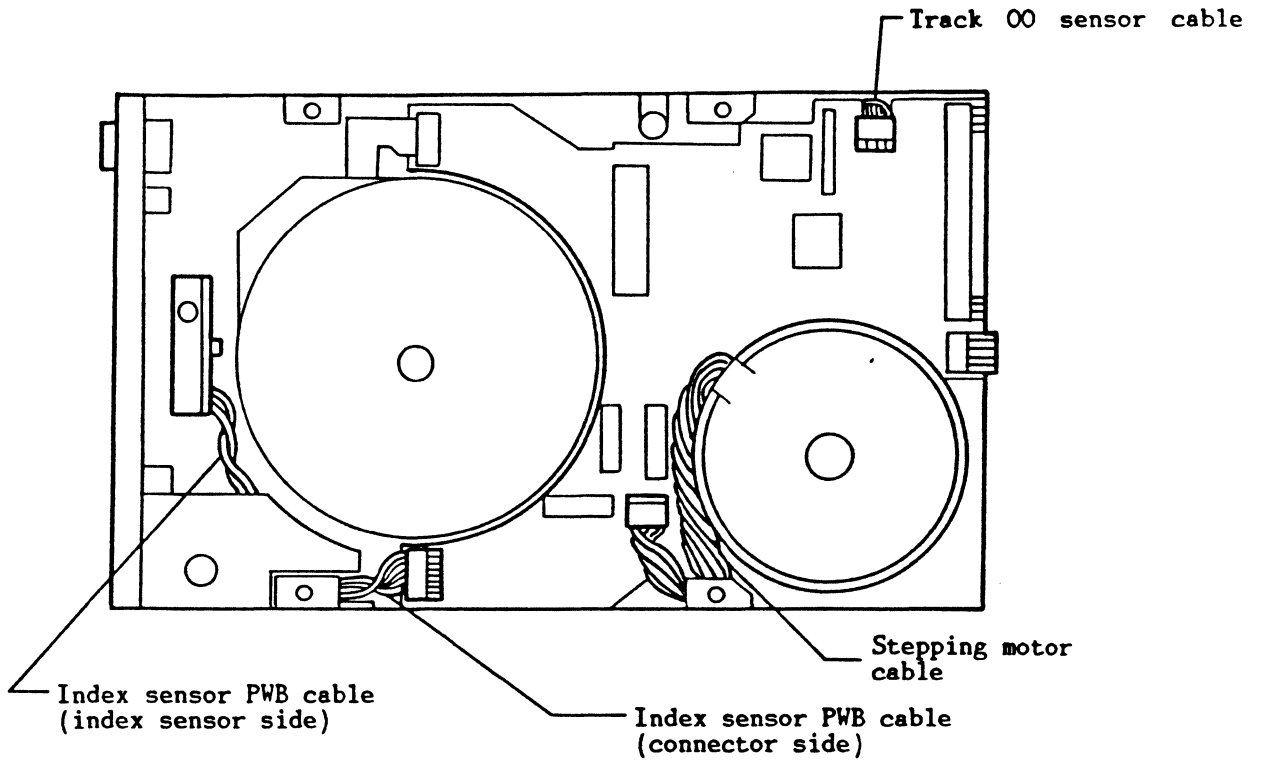


Fig. 405 Cable Dressing (2)

4-2-4 Others

(1) Overall error test

The data Read/Write error test is not included in the inspection and adjustment methods of item 4-4. When inspecting, adjusting or replacing parts, we advise connecting this Floppy Disk Drive to the users system or performing an error test (window margin test is most desirable).

(2) Setting the Floppy Disk Drive strap

First check whether or not the set value for the strap (short bar) on the main PWB is compatible with the system used for inspection and adjustment.

Notes: 1. In order to simplify the following explanations, we will assume that the DSO short bar is on.

2. When the setting of the Floppy Disk Drive strap has changed since the system was installed, always remember to return it to the original condition after completing the maintenance.

(3) Operating environment

Perform Floppy Disk Drive maintenance on a clean table or desk, where there is no dust, and under normal temperature and humidity conditions.

We recommend that track alignment inspection and adjustment be made after leaving the machine in the room for 2 hours or more to adjust to the temperature and humidity conditions. If the work bench or table is not clean, dust or dirt can easily adhere to the magnetic heads, disks, etc.

(4) Probe ground connection

Connect the probe grounds of measuring instruments as follows.

(a) When measuring test points TP1, 2, 3, 4, on the main PWB:

Use test point IP3 (OV) on the main PWB.

(b) When measuring other Floppy Disk Drive test points:

Use test point IP3 (OV) on the main PWB. System power supply GND (OV) terminal may be used.

(5) Floppy Disk Drive position

Unless indicated otherwise, Floppy Disk Drive inspections and adjustments may be made with the eject button placed either horizontal or vertical as shown below.

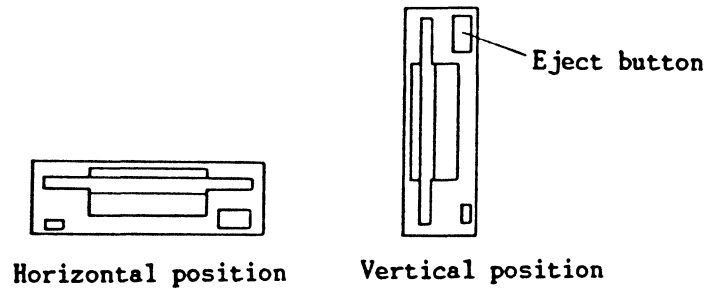


Fig. 406 Floppy Disk Drive Position During Maintenance

(6) Head load

This Floppy Disk Drive is not equipped with a head load solenoid so the head is always loaded when a test disk is inserted.

4-3 Periodic Maintenance

4-3-1 Cleaning the magnetic heads with a cleaning disk

When a Floppy Disk Drive is used in a dusty environment, it is advisable to periodically clean the magnetic heads with a cleaning disk. The heads of a double side Floppy Disk Drive are especially hard to clean directly so use the cleaning disk. This also improves data reliability when performed periodically, even in a normal environment.

(A) Tools required

- (1) Cleaning disk
- (2) Users system

(B) Cleaning procedure

- (1) Start the spindle motor and load the cleaning disk.

Note: 1. Do not use a scratched or damaged cleaning disk.

- 2. Always use a single and double side cleaning disks for a single side type Floppy Disk Drive (F-3503) and load so the magnetic head is in contact with the cleaning surface. The heads are on the bottom when the Floppy Disk Drive is placed horizontally, so place the cleaning surface downward.*

There is danger of damaging the head pads of a single side type Floppy Disk Drive if a double side cleaning disk is used.

- 3. Always use a double side cleaning disk for a double side type Floppy Disk Drive (F-3504). Both heads of side 0 (lower) and side 1 (upper) are cleaned at the same time.*

- (2) Clean for approximately 10~30 seconds at an appropriate track position. Effective cleaning is also possible by alternately moving back and forth between track 00 and the innermost track to avoid concentrating on one track position.

Note: The optimum cleaning time varies with the type of cleaning disk used. Cleaning for too long accomplishes nothing and can cause head wear.

- (3) Remove the cleaning disk.

4-3-2 Cleaning magnetic head by direct procedure (single side type)

This cleaning procedure applies to a single side type Floppy Disk Drive (F-3503). Do not apply this procedure to a double side type Floppy Disk Drive (F-3504), because it might damage the head gimbal mechanism.

Every time have an occasion of raising the head pad arm such as when replacing parts, check if soiling or dust stick on the magnetic head. If such is the case, perform cleaning as follows.

(A) Tools required

- (1) Absolute alcohol (ethanol)
- (2) Applicator or gauze

(B) Cleaning procedure

- (1) Wet the applicator or gauze slightly with alcohol.
- (2) Raise the pad arm (Fig.407), and clean the head surface carefully by the applicator or gauze.

Note: Do not touch the pad surface.

- (3) After the alcohol has evaporated, wipe off gently with dry rag.
- (4) Make sure soiling has been eliminated and that no lint or the like remains, and then drop the pad arm gently.

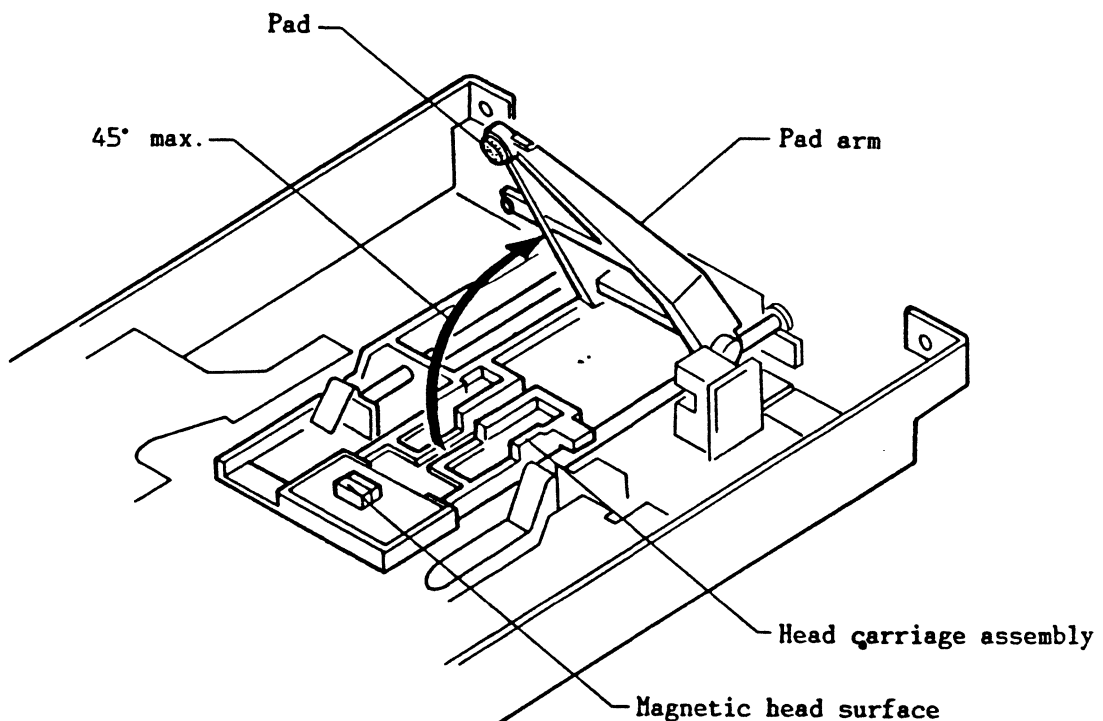


Fig. 407 Cleaning Magnetic Head

4-4 Inspection and Adjustment Methods

4-4-1 File protect sensor inspection

(A) Tools required

- (1) Work disk
- (2) Digital voltmeter (or oscilloscope)
- (3) Users system

(B) Inspection procedure

- (1) Connect the digital voltmeter or oscilloscope (DC range, 1V/div) to the WRITE PROTECT interface signal line (terminal No.28).
- (2) Keep closed (write enable status) the write protect detect hole of the work disk.
- (3) Place the Floppy Disk Drive horizontal, and mount the work disk mentioned in (2).
- (4) Make sure the WRITE PROTECT voltage is within the range shown below.
WRITE PROTECT voltage: 0.4V max.
- (5) Press the eject button and take out the disk.
- (6) Make sure the WRITE PROTECT voltage is within the range shown below.
WRITE PROTECT voltage: 3V min.

4-4-2 Disk rotation speed inspection and adjustment

(A) Tools required

- (1) Flat head screwdriver, small
- (2) Users system
- (3) Frequency counter
- (4) Work disk

(B) Inspection and adjustment procedure

- (1) Connect the frequency counter to the INDEX interface signal line (terminal No.8).
- (2) Mount the work disk and rotate the spindle motor.
- (3) Position the head at the track 00.
- (4) Make sure the index pulse interval is within the range of 200 ± 4 msec.
- (5) If (4) is not satisfactory, adjust the potentiometer VR2 on the main PWB assembly to an approximate middle of the specification in (4).

4-4-3 Head touch inspection and adjustment

Note: The adjustment applies to a single side Floppy Disk Drive (F-3503).

(A) Tools required

- (1) Work disk
- (2) Flat head screwdriver, small
- (3) Users system
- (4) Oscilloscope
- (5) DC clipon ammeter
- (6) Screwlock

(B) Adjustment procedure

- (1) Connect the oscilloscope to TP1 or TP2 (pre-amp out) on the main PWB assembly.
Oscilloscope range: AC mode, 0.2V.
- (2) Install the work disk and rotate the spindle motor.
- (3) Move the head to the innermost track.
- (4) Successively repeat the cycle of recording and playback for one track turn at 2F (250kHz with WRITE DATA frequency).
- (5) Note the average read level during execution of (4).
- (6) While pushing the head top with a slight force (just placing finger, 10~20g), carry out (4) and, the same as in (5), measure an average read level.
- (7) Make sure that, compared with the average read level in (6), the read level obtained in (5) is 80% or more.
- (8) In case of a double side Floppy Disk Drive (F-3504), carry out (4)~(7) for the side 0 and 1 heads separately.
- (9) Move the head to the track 00, and carry out (4)~(8) in the same way.
- (10) How to remedy poor head touch of single side Floppy Disk Drive (F-3503)

- (a) On the innermost track, rotate the head pad top groove in about 30° steps by the flat head screwdriver, and repeat recording and playback shown in (4) every time. (See Fig.408.)

When recording or playing back, the flat head screwdriver must be kept away from the head pad.

Note: Do not excessively press the head pad by the screwdriver. Do not touch the pad surface (touched by disk) either.

- (b) After the pad position has been turned 360° , set again to the position where the average read level obtained is a maximum, and carry out (4)~(7) at the innermost track.

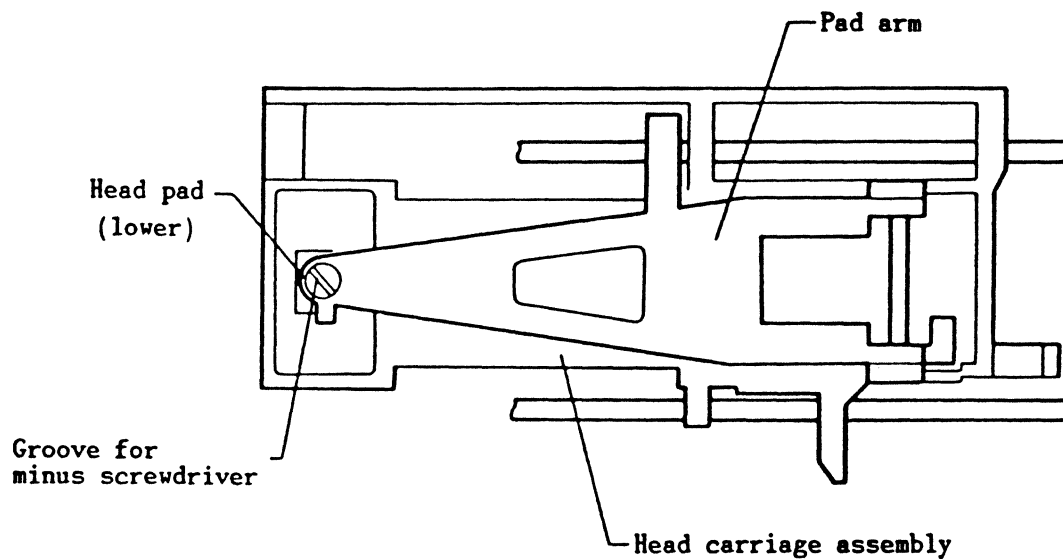
- (c) Repeat until (7) is properly satisfied. If (7) or (9) is not satisfied even by finely adjusting the pad position, it may be caused by the factors below.

(i) Head pad faulty: replace the head pad referring to 4-5-7.

(ii) Disk faulty: if the disk or jacket is deformed or damaged, replace the work disk with a good one and see the results.

(iii) Head faulty: replace the head carriage assembly according to 4-5-1.

- (d) Remove the work disk, and apply a thin coat of screwlock around the head pad turning section. Take care not to apply screwlock on the groove for flat head screwdriver.



**Fig. 408 Adjusting Head Pad Position
(single side Floppy Disk Drive)**

(11) Cause and remedy of poor head touch of double side Floppy Disk Drive

If (7)~(9) are unsatisfactory on a double side Floppy Disk Drive, the following causes may be the case.

(a) Disk faulty

If the disk is deformed or damaged, replace the work disk with a good one and see the results.

(b) Head flexure faulty

If the movable leaf spring (flexure) supporting the side 0 or 1 head piece (white portion) is deformed, the head carriage assembly must be replaced according to 4-5-1.

A deformation is deemed if, when observing the gap of the side 0 and 1 heads visually, the surface of the heads is not parallel with each other.

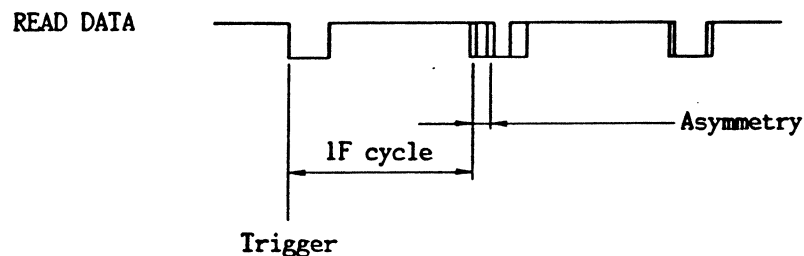
4-4-4 Asymmetry inspection

(A) Tools required

- (1) Work disk
- (2) Users system
- (3) Oscilloscope

(B) Inspection and adjustment procedure

- (1) Connect the oscilloscope to the READ DATA interface signal line (terminal No.30) on the main PWB assembly.
Oscilloscope range: DC mode, 2V, 1 μ sec.
- (2) Install the work disk. Rotate the spindle motor.
- (3) Move the head to the innermost track.
- (4) Perform recording for one track turn at a fixed frequency of 1F (125kHz at WRITE DATA frequency).
- (5) According to Fig.409, measure the asymmetry.



Note: Set so that 3 read data pulses can be observed and measure on the screen of the oscilloscope, and measure the width of the waveform with 2 trigger pulses.

Fig. 409 Measuring Asymmetry

- (6) Make sure the asymmetry is within the following range.
Asymmetry at 1F of innermost track: 0.6 μ sec. max.
- (7) In case of a double side Floppy Disk Drive, carry out (4)~(6) for the side 0 and 1 heads separately.

(8) If (6) or (7) is not satisfactory, the following causes may be the case.

(a) Leakage magnetic flux density around Floppy Disk Drive is high

If there is a magnetic flux source such as magnet, transformer, motor, CRT, magnetized iron sheet, etc. near the Floppy Disk Drive, keep the Floppy Disk Drive away from them, and recommence the measurement and adjustment of the asymmetry.

(b) Disk faulty: replace the work disk.

(c) Head faulty: according to 4-5-1, replace the head carriage assembly.

(d) Main PWB assembly faulty: according 4-5-5, replace the main PWB assembly.

4-4-5 Read level inspection

(A) Tools required

- (1) Level disk
- (2) Users system
- (3) Oscilloscope

(B) Inspection procedure

- (1) Set the oscilloscope to 2-phenomena mode, and connect it to TP1 and TP2 (pre-amp out) on the main PWB assembly.
Oscilloscope range: AC mode, 0.1V.
Set both channels 1 and 2 to the above range. Set one of the channels to an invert mode and add both channels.
- (2) Install the level disk and start the spindle motor.
- (3) Move the head to the innermost track
- (4) Perform recording for one track turn at a fixed frequency of 2F (250kHz with WRITE DATA frequency).
- (5) According to Fig.410, measure the average read level (V_{p-p}).
- (6) Substitute the following formula with the values measured in (5) and calibrated of READ LEVEL (see label on level disk).

$$\text{Read level (true value)} = \text{measured value} \times \frac{100}{\text{calibrated value}}$$

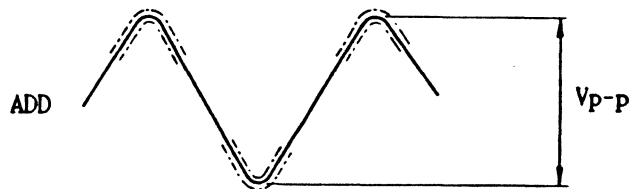


Fig. 410 Measuring Average Read Level (2F)

- (7) Make sure the true value of read level is within the range given below.
Innermost track read level: 0.23Vp-p min.
- (8) In case of a double side Floppy Disk Drive, carry out (4)~(7) for the side 0 and 1 heads separately.
- (9) If (7) and (8) are not satisfactory, the following causes may be the case.
- (a) Disk faulty: if the disk or jacket is deformed or damaged, replace the level disk with a new one and see the results.
 - (b) Disk speed abnormal: perform inspection and adjustment referring to 4-4-2.
 - (c) Head touch poor: perform inspection and adjustment according to 4-4-3.
 - (d) Head faulty: replace the head carriage assembly according to 4-5-1.
 - (e) Main PWB assembly faulty: replace the main PWB assembly according to 4-5-5.
- (10) Remove the level disk, and cancel the invert the ADD modes of the oscilloscope.

4-4-6 Resolution inspection

(A) Tools required

- (1) Level disk
- (2) Users system
- (3) Oscilloscope

(B) Inspection procedure

- (1) Set the oscilloscope mode to 2-phenomena mode, and connect it to IP1 and IP2 (pre-amp out) on the main PWB assembly.
Oscilloscope range: AC mode, 50mV~0.1V.
Set both channels 1 and 2 to the above range. Set one of the channels to an invert mode, and add both channels.
- (2) Install the level disk and start the spindle motor.
- (3) Move the head to the innermost track.
- (4) Perform recording for one track turn at a fixed frequency of 1F (125kHz with WRITE DATA frequency).
- (5) According to Fig.411, measure the average read level V1F.
- (6) Perform recording the same as in (4) at 2F [frequency double 1F in (4)].
- (7) According to Fig.411, measure the average read level V2F.

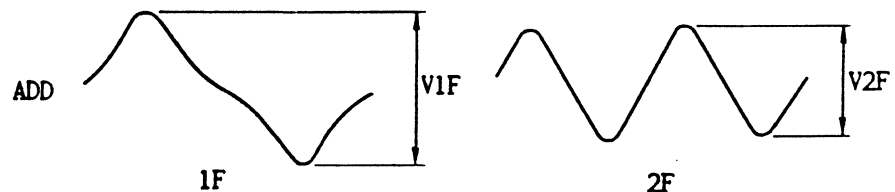


Fig.411 Measuring Resolution

- (8) Substitute the following formula with the measured values V1F and V2F and RESOLUTION calibrated value (see label of level disk).

$$\text{Resolution (true value)} = V2F/V1F \times 100/\text{calibrated value (\%)}$$

- (9) Make sure the true value of resolution is within the following range. Resolution of innermost track: 60% min.
- (10) In case of a double side Floppy Disk Drive, carry out (4)~(9) for the side 0 and 1 heads separately.
- (11) If (9) and (10) are not satisfactory, the following causes may be the case.
 - (a) Disk faulty: if the disk or jacket is deformed or damaged, replace the level disk with a good one and see the results.
 - (b) Disk speed abnormal: perform inspection and adjustment referring to 4-4-2.
 - (c) Head touch poor: perform inspection and adjustment referring to 4-4-3.
 - (d) Head faulty: replace the head carriage assembly according to 4-5-1.
 - (e) Main PWB assembly: replace the main PWB assembly according to 4-5-5.
- (12) Remove the level disk, and cancel the invert and ADD mode of the oscilloscope.

4-4-7 Track alignment inspection and adjustment

(A) Tools required

- (1) Flat head screwdriver M2.6
- (2) Alignment disk
- (3) Users system
- (4) Oscilloscope
- (5) Relative hygrometer
- (6) Screwlock

(B) Inspection and adjustment procedure

Note: Carry out the inspection and adjustment of the track alignment at a normal room temperature. Even if the environmental conditions are within the operating conditions for Floppy Disk Drive and disk, avoid excessively low or high temperature or humidity. Make it a rule to leave the Floppy Disk Drive and disk for 2 hours or more in normal line.

It is recommended that the Floppy Disk Drive when inspecting the track alignment is the same as when the Floppy Disk Drive is accommodated in the system itself.

- (1) Set the oscilloscope to 2-phenomena mode and connect it to TP1 and TP2 (pre-amp out) of the main PWB assembly. Connect the external trigger of the oscilloscope to the main PWB assembly, and apply (-) trigger.

Oscilloscope range: AC mode, 0.5V, 20msec.

Set both channels 1 and 2 to the above range. Set one of the channels to an invert mode and add both channels.

- (2) Install the alignment disk and start the spindle motor.
- (3) Move the head to the alignment inspection track (track 40).
- (4) Make sure two lobe patterns (VA and VB levels need not coincide) shown in Fig.412 are observed.

If only one lobe pattern is observed or when two lobe patterns are connected, the alignment inspection track position is off. In such a case, carry out stepout or stepin for 4 tracks, and set the track to a position where a waveform the most similar to Fig.412 is obtained.

Note: The above track number is required so the alignment track position matches the excitation status of the basic excitation phase A of the stepping motor. If the moved track number is unknown, return to the track 00 once (TRACK 00 output signal is TRUE) and perform setting again.

With 135tpi Floppy Disk Drive, it is necessary to perform setting so the track where a lobe pattern observed is as shown in Fig.412 is an even track.

- (5) After termination of (4), step out 1 to several tracks, move the head from the alignment inspection track, move the head again to the alignment inspection track by a stepin action, and measure VA and VB.

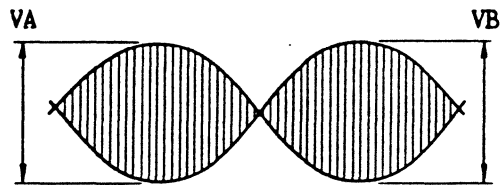


Fig. 412 Lobe Pattern for Alignment Inspection

- (6) Substitute the following formula with the value measured in (5), ALIGNMENT calibrated value (refer to label of alignment disk. Attention to side.) and ambient relative humidity (%), and calculate the true value of alignment error.

$$\text{Alignment error (true value)} = \left(\frac{\text{VA} - \text{VB}}{\text{VA or VB whichever is greater}} \times 100 - \text{calibrated value} \right) - (\text{relative humidity} - 50) \times k$$

k is the humidity compensation factor.

$$k = 0.28$$

Example: Given VA=0.58(V), VB=0.61(V), calibrated value=-6(%), relative humidity=65(%):

$$\begin{aligned} \text{Alignment error (true value)} &= \left\{ \frac{0.58 - 0.61}{0.61} \times 100 - (-6) \right\} \\ &- (65 - 50) \times 0.28 \doteq -3.1(\%) \end{aligned}$$

If the calculated result is positive, the head is off positioned inward from the basic position, and vice versa.

- (7) Reverse to (5), step in by 1 to several steps to move the head from the alignment inspection track and, by a stepout action, return it to the alignment inspection track. Measure VA and VB.
- (8) Perform a calculation the same as in (6) to obtain the true value of misalignment.
- (9) Make sure both values calculated in (6) and (8) are within the following range.
True value of misalignment: within $\pm 32\%$
- (10) In case of a double side Floppy Disk Drive, perform (3)~(9) for side 0 and 1 heads separately.
- (11) If (9) and (10) are not satisfactory, adjust the track alignment referring to the procedure shown below.
 - (a) Slightly loosen 2 setscrews for stepping motor.
 - (b) Repeat stepin and stepout actions and, on the alignment inspection track position, minimize the alignment error in both stepin and stepout directions by turning the stepping motor little by little. (See Fig.413)

Note: When performing adjustment while observing the lobe pattern on the oscilloscope, pay attention to the calibrated value of the alignment disk and ambient relative humidity.

- (i) When calibrated value + (relative humidity - 50) \times k ≥ 0

Adjust the lobe pattern ratio so the right lobe pattern VB is:

$$VB = 1 - \frac{\text{calibrated value} + (\text{relative humidity} - 50) \times k}{100}$$

When the left lobe pattern level VA is 1.

(ii) When calibrated value + (relative humidity - 50) × k ≤ 0

Adjust the lobe pattern ratio so that the left lobe pattern VA is:

$$VA = 1 - \frac{\text{calibrated value} + (\text{relative humidity} - 50) \times k}{100}$$

When the right lobe pattern level VB is 1.

Example: Given calibrated value = -6(%), relative humidity = 35(%):

$$-6 + (35 - 50) \times 0.28 = -5.88 < 0$$

$$VA = 1 + \frac{-6 + (35 - 50) \times 0.28}{100} \doteq 0.94$$

The adjustment has only to be made so that VA is 0.94 when VB is 1.

- (c) In case of a double side Floppy Disk Drive, perform the same thing on the side 1 head. Minimize the alignment error on both sides 0 and 1.
- (d) Tighten the two setscrews for stepping motor little by little successively and repeatedly perform adjustment so the true value of misalignment when they have been tightened at a specified torque is within ±20% in both cases. The tightening torque for the stepping motor setscrews is 4.5kg · cm.
- (e) Remove the alignment disk.
- (f) Apply screwlock to the head of stepping motor setscrews.
- (g) According to 4-4-8, inspect or adjust the track 00 sensor.
- (h) According to 4-4-9, inspect or adjust the track 00 stopper.

(12) Cancel the invert and ADD mode of the oscilloscope.

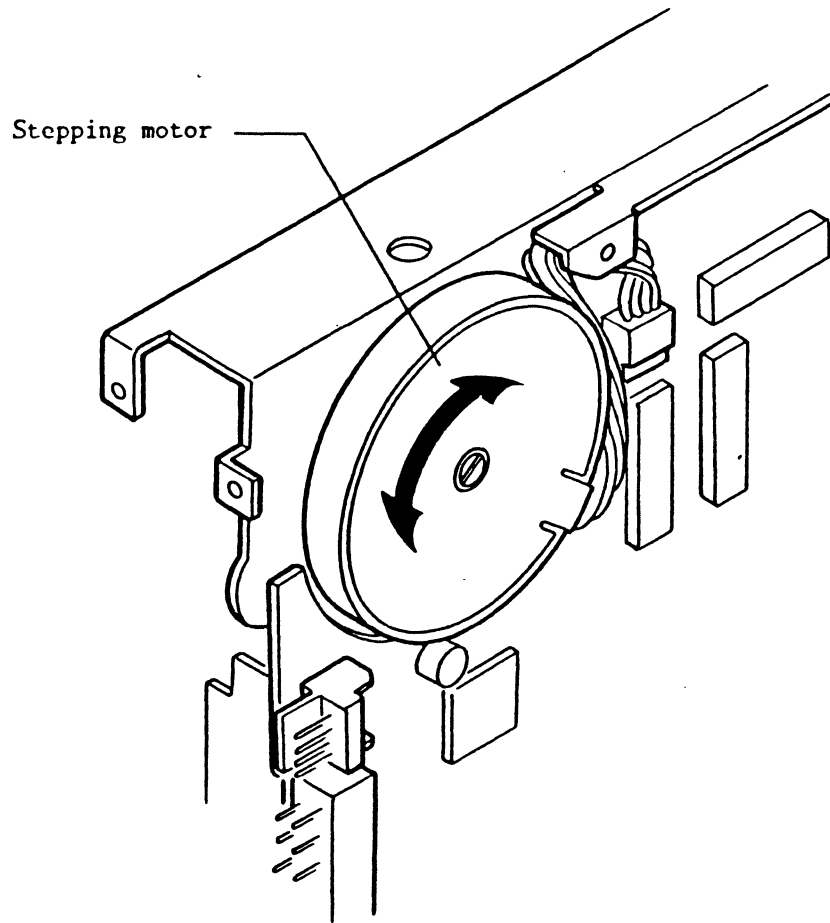


Fig. 413 Adjusting Track Alignment

4-4-8 Track 00 sensor inspection and adjustment

(A) Tools required

- (1) Phillips screwdrivers M2.6
- (2) Work disk
- (3) Alignment disk
- (4) Users system
- (5) Oscilloscope
- (6) Screwlock

(B) Inspection and adjustment procedure

- (1) Connect an oscilloscope to TP9 (track 00 sensor) on the main PWB assembly.
Oscilloscope range: DC mode, 1V
- (2) Start the spindle motor and insert the work disk.
- (3) Check whether or not the voltage at TP9 is 0.5V or less after the head is shifted to track 00.
- (4) Shift the head to track 04.
- (5) Check whether or not the voltage at TP9 is 3V or more after the head is shifted to track 04.
- (6) If the voltage in items (3) and (5) above are not within the specified range, adjust the track 00 sensor position using the following procedure.
 - (a) Loosen the track 00 stopper mounting screw (refer to Fig. 415) and move the stopper in the step-out direction (away from the back part of the head carriage).
 - (b) Connect the oscilloscope to TP3 or TP4 (differential amp) of the main PWB assembly.
Oscilloscope range: AC mode, 0.2V, 20msec.
 - (c) Insert the alignment disk. It is assumed, however, that track alignment was correctly performed in item 4-4-7.
 - (d) Shift the head to a track where a lobe pattern like that shown in Fig.412 can be observed.
 - (e) Remove the alignment disk.

- (f) Connect the oscilloscope to TP9 (track 00 sensor) on the main PWB assembly.

Oscilloscope range: DC mode, 1V.

- (g) Step-out the head 30 tracks (track 02) from the position where the correct lobe pattern can be observed.
- (h) Insert the work disk.
- (i) Shift the head to track 02, loosen the track 00 sensor mounting screw (refer to Fig.414), move the sensor backward and forward, fine adjust to near the intermediate point where the TP9 voltage changes from approximately 0.5V to 3.0V, and then tighten the mounting screw.

Note: Use caution since the TP9 output voltage changes suddenly.

- (j) Check items (3)~(5).
- (k) After tightening the mounting screw to the specified torque, repeat the adjustment until all of the values in items (i) and (j) are within the specified range.
- (l) Apply screwlock to the head of the mounting screw.
- (m) Adjust the track 00 stopper as described in item 4-4-9.

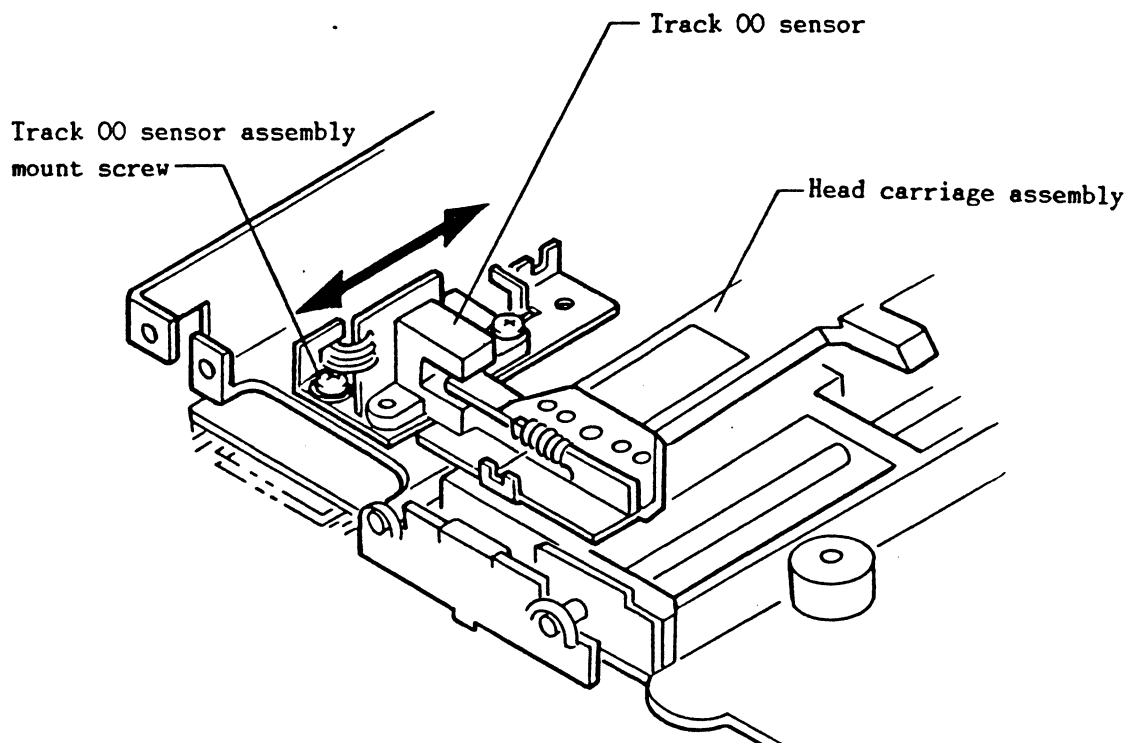


Fig. 414 Adjusting Track 00 Sensor

4-4-9 Track 00 stopper inspection and adjustment

(A) Tools required

- (1) Phillips screwdriver M2.6
- (2) Users system
- (3) Screwlock

(B) Inspection and adjustment procedure

- (1) Position the head to the track 00.
- (2) Make sure there is a slight gap between the track 00 stopper end and head carriage.
- (3) Make sure that, when the head is repeatedly moved backwards and forwards between the track 00 and a track of several tracks inward, no sound of contact between the head carriage and track 00 stopper is produced.
- (4) If (2) and (3) are not satisfied, adjust the track 00 stopper position in the following procedure.
 - (a) Loosen the adjust screw for track 00 stopper, and move it outward.
 - (b) Position the head to the track 00.
 - (c) Screw in the stopper so the gap is 0.05~0.3mm between the stopper end and head carriage.
 - (d) Carry out (1)~(3).
 - (e) Apply screwlock on the adjust screw head.

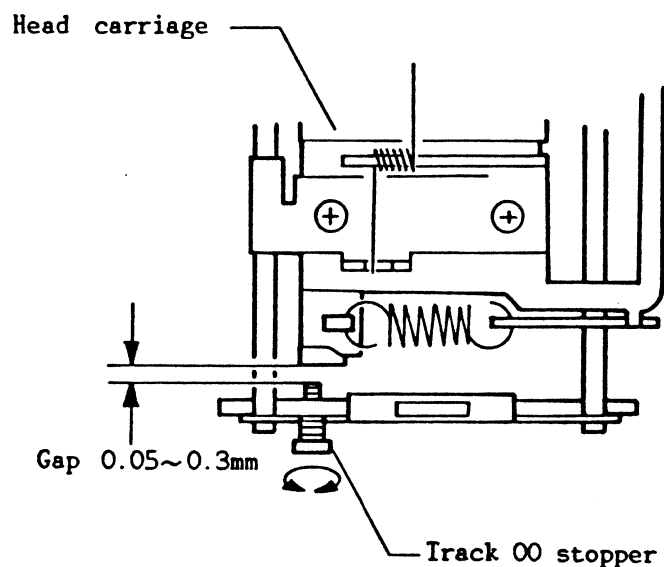


Fig. 415 Adjusting Track 00 Stopper

4-4-10 Index burst timing inspection and adjustment

(A) Tools required

- (1) Phillips screwdriver M2.6
- (2) Alignment disk
- (3) Users system
- (4) Oscilloscope
- (5) Screwlock

(B) Inspection and adjustment procedure

- (1) Set the oscilloscope to 2-phenomena mode, and connect the channel 1 to the INDEX interface signal (terminal No.8) on the main PWB assembly, and the channel 2 to IP1 or IP2 (pre-amp out). Set the trigger to positive (+) and apply it to the channel 1.

Oscilloscope range

Channel 1: DC mode, 2V, 50 μ sec.

Channel 2: AC mode, 1V, 50 μ sec.

- (2) Install the alignment disk and rotate the spindle motor.
- (3) Move the head to the track 40.
- (4) Measure t in Fig.416.

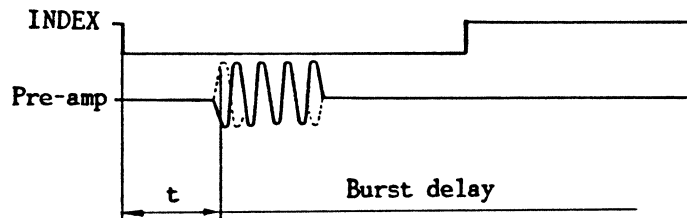


Fig. 416 Index Burst Timing

- (5) Substitute the following formula with the value measured in (4) and INDEX TIMING calibrated value (see label of alignment disk), and calculate the true value.

$$\text{Index burst timing (true value)} = \text{measured value} - \text{calibrated value } (\mu\text{s})$$

- (6) Make sure the true value of index burst timing is within the range of $200 \pm 200 \mu \text{ sec}$.
- (7) If (6) is not satisfactory, adjust the index sensor position in the following procedure.
 - (a) Loosen the setscrews for index sensor (see Fig.417), and perform adjustment so the true value of index burst timing is within the range shown in (6).
 - (b) Repeatedly adjust the true value of index burst timing so it will be within the range shown in (6) when the setscrews have been tightened to a specified torque.
 - (c) Apply a thin coat of screwlock on the setscrew head.
- (8) Remove the alignment disk.

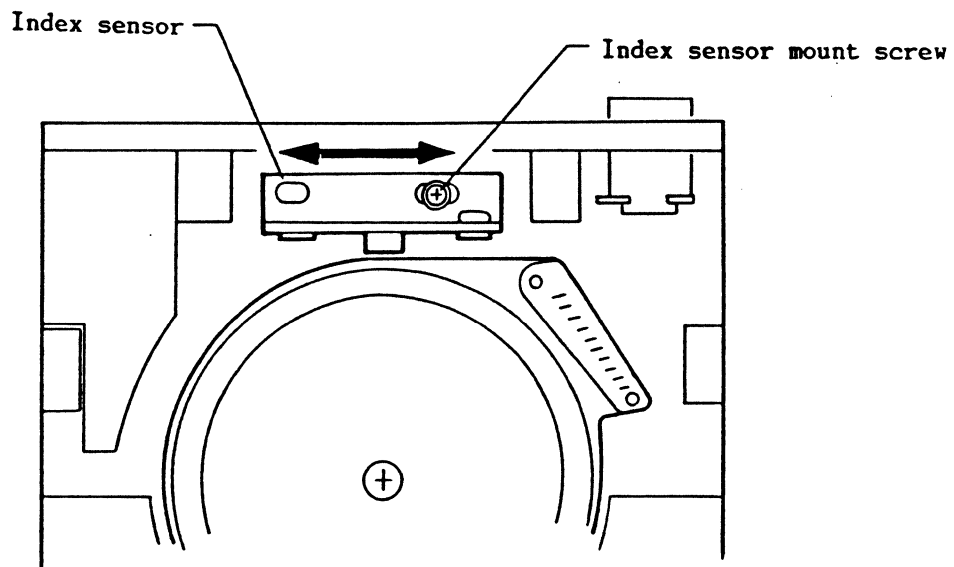


Fig. 417 Adjusting Index Sensor

4-5 How to Replace Parts

4-5-1 Head carriage assembly replacement

(A) Tools required

- (1) Phillips screwdriver
- (2) Flat head screwdriver
- (3) Tweezers
- (4) Oil
- (5) Alcohol and gauze (several sheets)
- (6) Screwlock
- (7) Users system

(B) Replacement procedure

- (1) Remove the shield plate (Fig.505, ③) by loosening two set-screws (Fig.505, ⑤).
- (2) Remove the head cable by cutting the wire binder (Fig.505, ⑥) by a knife or others taking care not to damage the head cable.
- (3) Extract the connector (J3) from the main PWB assembly taking care not to pull the connector cord part.
- (4) By the tweezers, remove from the head carriage the band spring (Fig.505, ⑩) hooked on the head carriage assembly (Fig.505, ⑪).
- (5) Remove the other coupled portion from the head carriage assembly. The removal is facilitated by pulling the head carriage perpendicularly after moving the coupled portion toward the front.
- (6) Remove the capstan screw (Fig.505, ⑫) of the stepping motor (Fig.505 ⑬), and remove the band fixing plate (Fig.505, ⑭) and steel band (Fig.505, ⑮).
- (7) Remove the track 00 stopper (Fig.505, ⑯) taking care not to lose the track 00 stopper spring (Fig.505, ⑰).
- (8) Remove the claw of the guide shaft pressure A (Fig.505, ⑱) by

expanding the claw via the tweezers. Then remove two guide shaft pressures B (Fig.505, ⑰) after loosening the setscrew (Fig.505 ⑳).

- (9) Remove the head carriage assembly with two guide shafts (fig.505, ⑱) kept mounted.
- (10) Prepare a new head carriage assembly and two guide shafts.
Note: When replacing the head carriage assembly, also replace the guide shafts with a view to fitting them with the carriage hole diameter. And replace the guide shaft presser A and B with new ones. The guide shafts are specified combinedly with the head carriage assembly.
- (11) Apply specified lubricant on a guide shaft, and mount it on the head carriage.
Note: Wet a gauze with lubricant, wipe the entire shaft gently with it, and then wipe off lightly with another gauze. The lubricant volume is proper when the guide shaft is coated with a thin oil film.
- (12) Coat the other guide shaft with lubricant in the same way, and mount it on the head carriage.
- (13) Place on the main chassis (Fig.505, ①) the head carriage assembly in (12) and, matching the guide shaft presser A with the guide shaft groove, mount by setscrews.
- (14) Mount the track OO stopper.
- (15) Mount two guide shaft presser B by setscrews.
- (16) In the procedure reverse to (6), mount the steel band to the capstan section of the stepping motor assembly.
Note: If the surface of the steel band, capstan, etc. is soiled, clean them carefully with alcohol and gauze.
- (17) Connect the steel band on the head carriage assembly in the procedure reverse to (4)~(5).

- (18) Loosely hold the screws fastening the steel band on the capstan of the stepping motor.
- (19) Move the head carriage several times by hand, and then carefully tighten the steel band setscrew in (6) to a specified torque taking care that the band is stretched straight without undulation and that the band and capstan will not be damaged.
- (20) According to 4-2-3, carry out forming of the head cable and mount the connector (J3) on the main PWB assembly.
- (21) Allow the head carriage to seek continuously between the track 00 and innermost track to make sure the steel band does not meander nor undulate. If it meanders or undulate, remedy it by means of the screw in (6). After the adjustment, carefully tighten the screw to the specified torque.
- (22) Referring to 4-4-3, inspect the head touch.
- (23) Referring to 4-4-4, inspect the asymmetry.
- (24) Referring to 4-4-7, adjust the track alignment.
- (25) Referring to 4-4-8, adjust the track 00 sensor.
- (26) Referring to 4-4-9, adjust the track 00 stopper.
- (27) Referring to 4-4-10, inspect or adjust the index burst timing.
- (28) Referring to 4-4-5, inspect the read level.
- (29) Referring to 4-4-6, inspect the resolution.
- (30) Mount the shield plate in the procedure reverse to (1).
- (31) Connect the Floppy Disk Drive to the system. It is advised to perform an overall test.

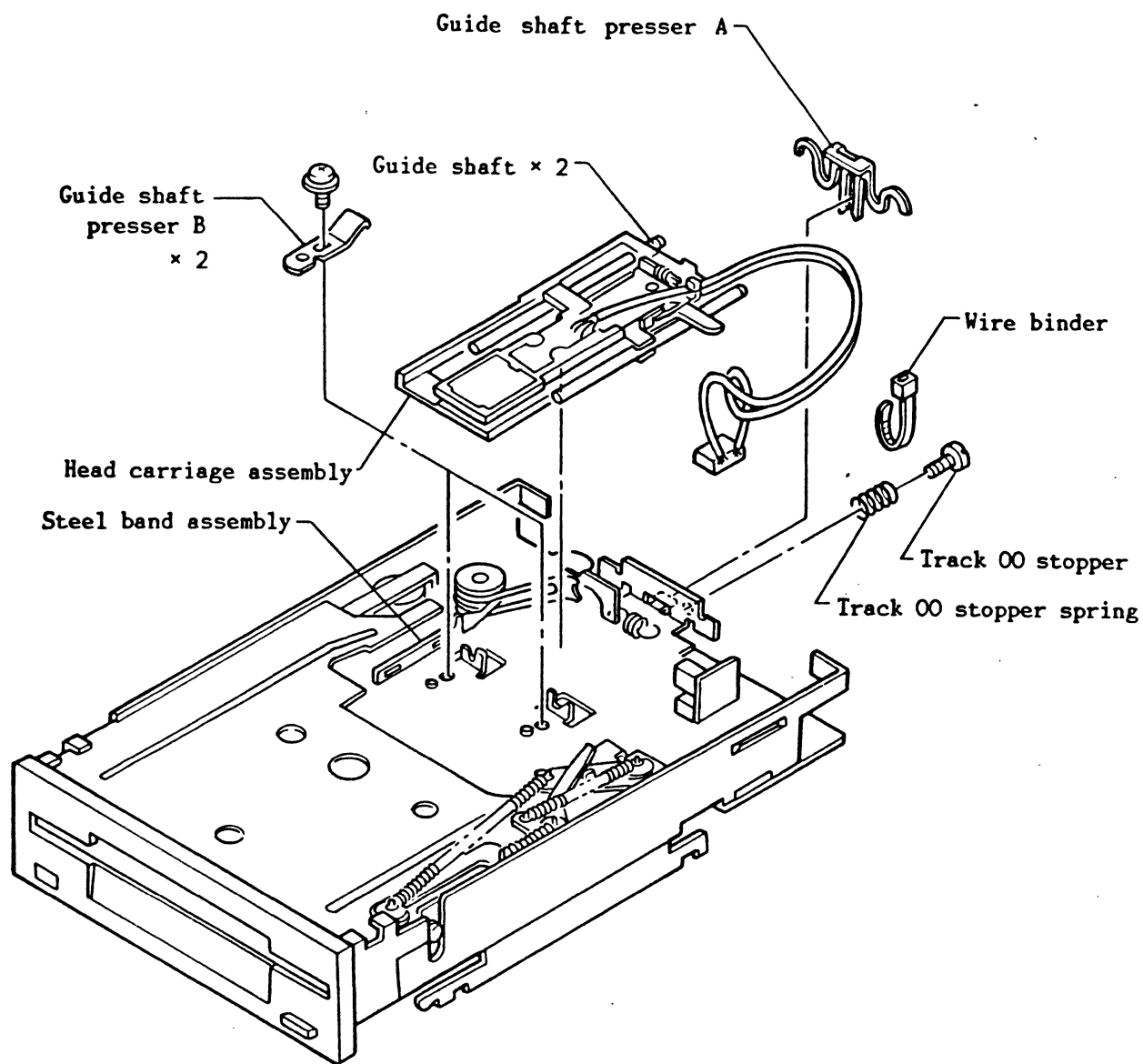


Fig. 418 Replacing Head Carriage Assembly

4-5-2 Stepping motor and steel belt replacement

(A) Tools required

- (1) Phillips screwdriver
- (2) Tweezers
- (3) Alcohol and gauze
- (4) Screwlock
- (5) Users system

(B) Replacement procedure

- (1) Remove the shield plate (Fig.505, ③) by loosening two setscrews (Fig.505, ⑤).
- (2) By the tweezers, remove the band spring (Fig.505, ⑩) hooked on the head carriage assembly (Fig.505, ④) from the head carriage.
- (3) Disengage the other connected portion from the head carriage assembly.
- (4) Loosen the capstan screw (Fig.505, ⑥) of the stepping motor (Fig.505, ⑧), and remove the band fixing plate (Fig.505, ⑪) and steel band (Fig.505, ⑫).
- (5) Remove the stepping motor by loosening two setscrews (Fig.505, ⑦).
- (6) Mount in place a new stepping motor assembly.
- (7) Wind a new steel band in the form of α , and hold it loosely as before on the capstan of the stepping motor with the band fixing plate and screw in (4).
Note: When replacing the stepping motor, the steel band and band spring must also be replaced as a rule.
- (8) In the procedure reverse to (2) and (3), connect the steel band to the head carriage as before by a new band spring.
- (9) After moving the head carriage several times by hand, carefully tighten the steel band setscrew in (7) seeing that the belt

is stretched straight without undulation and that the band and capstan are not damaged.

- (10) Referring to 4-2-3, carry out forming of the cable and mount the connector (J6) on the main PWB assembly.
- (11) Allow the head carriage to seek continuously between the track 00 and innermost track to make sure the steel band does not meander nor undulate.
- (12) If the movement is defective, readjust the screw in (7) so it moves straight without meandering. After the adjustment, carefully tighten the screw to the specified torque.
- (13) Allow a continuous seek operation for about five minutes.
- (14) Mount the shield plate by two setscrews.
- (15) Referring to 4-4-7, adjust the track alignment.
- (16) Referring to 4-4-8, adjust the track 00 sensor.
- (17) Referring to 4-4-9, adjust the track 00 stopper.

4-5-3 Disk Drive motor (spindle motor) replacement

(A) Tools required

- (1) Phillips screwdriver
- (2) Tweezers
- (3) Users system

(B) Replacement procedure

- (1) Remove the shield plate (Fig.505, ③) by loosening two setscrews (Fig.505, ②)
- (2) Disengage the spindle motor connector (J7).
- (3) Remove two screws (Fig.505, ⑤) holding the body of Disk Drive motor (spindle motor) (Fig.505, ②), and pull out the Disk Drive motor (spindle motor) through the rotor side (PWB side).
- (4) Mount a new Disk Drive motor (spindle motor) in the procedure reverse to (2) and (3).

Note: The spindle section (where disk is chucked) of Disk Drive motor (spindle motor) is machined accurately. When mounting the motor on the chassis (frame), push in the spindle gently in parallel with the chassis. Handle with utmost care so as not to scratch the fitted faces and spindle surface.

- (5) According to 4-4-2, adjust the disk rotation speed.
- (6) According to 4-4-7, inspect or adjust the track alignment.
- (7) According to 4-4-10, inspect or adjust the index burst timing.
- (8) In the procedure reverse to the step in (1), fasten the shield plate by the two setscrews.

4-5-4 Track 00 sensor replacement

(A) Tools required

- (1) Phillips screwdriver
- (2) Tweezers
- (3) Screwlock
- (4) Users system

(B) Replacement procedure



- (1) Remove the shield plate (Fig.505, ③) by loosening two setscrews (Fig.505, ②).
- (2) Extract the track 00 sensor connector (J4).
- (3) Remove the track 00 sensor assembly (Fig.505, ①) by loosening the setscrew (Fig.505, ④).
- (4) Mount a new track 00 sensor assembly in the reverse procedure. The track 00 sensor assembly must be slid behind the Floppy Disk Drive beforehand. For the cable forming, refer to "4-2-3 Cable treatment".
- (5) Loosen the track 00 stopper (Fig.505, ⑤).
- (6) According to 4-4-8, adjust the track 00 sensor.
- (7) According to 4-4-9, adjust the track 00 stopper.
- (8) Mount the shield plate by the setscrews.

4-5-5 Main PWB assembly replacement

(A) Tools required

- (1) Phillips screwdriver
- (2) Tweezers

(B) Replacement procedure

- (1) Remove all the connectors from the main PWB assembly (Fig.505 ) , loosen four setscrews (Fig.505, ), and dismount the main PWB assembly.
- (2) Mount a new main PWB assembly in the procedure reverse to (1). For the cable forming, refer to "4-2-3 Cable treatment".
- (3) According to 4-4-4, inspect the asymmetry.
- (4) According to 4-4-5, inspect the read level.
- (5) According to 4-4-6, inspect the resolution.
- (6) According to 4-4-8, inspect the track 00 sensor.
- (7) Connect the Floppy Disk Drive to the system. It is recommended to carry out an overall test.

4-5-6 Index sensor PWB assembly replacement

(A) Tools required

- (1) Phillips screwdriver
- (2) Screwlock
- (3) Users system

(B) Replacement procedure

- (1) Extract the index sensor PWB connector (J5).
- (2) Loosen the setscrews (Fig.505, $\textcircled{S2}$, $\textcircled{S4}$) mounting the index sensor PWB assembly (Fig.505, $\textcircled{3}$) at two points separately, and remove the latter.
- (3) Mount a new index sensor PWB in the procedure reverse to (1) and (2). For the cable forming, refer to "4-2-3 Cable treatment".
- (4) According to 4-4-10, adjust the index burst timing.

4-5-7 Head pad replacement (single side type)

This section applies to a single side Floppy Disk Drive.

(A) Tools required

- (1) Tweezers
- (2) Alcohol and gauze

(B) Replacement procedure

- (1) Remove the shield plate (Fig.505, ③) by loosening two set-screws (Fig.505, ②).
- (2) Raise the pad arm by hand, and carefully peel off the pad by the tweezers (see Fig.419).
- (3) Attach a new pad in the original position carefully. Do not excessively press the pad surface.
- (4) According to 4-3-2, clean the magnetic head surface.
- (5) According to 4-4-3, adjust the head pad position.
- (6) According to 4-4-5, inspect the read level.
- (7) According to 4-4-6, inspect the resolution.
- (8) In the procedure reverse to (1), mount the shield plate.

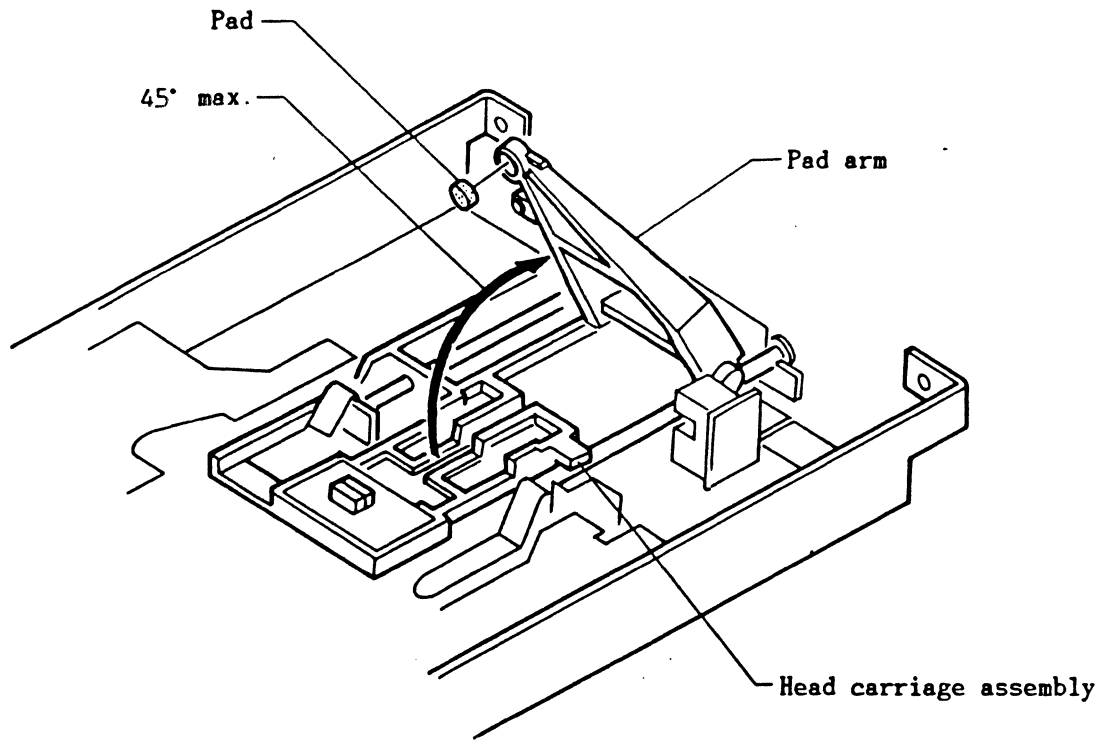


Fig. 419 Replacing Head Pad

4-5-8 Front bezel replacement

(A) Tools required

- (1) Phillips screwdriver

(B) Replacement procedure

- (1) Loosen the screw (Fig.505, $\text{\textcircled{S8}}$) mounting the front bezel (Fig. 505, $\text{\textcircled{37}}$), and pull the front bezel this side to remove. Take care not to drop the eject button.

- (2) Remount a new front bezel in the reverse procedure.

Note: When mounting the front bezel, pay attention to the front bezel display. While pressing the bezel against the main chassis assembly, tighten the setscrews to a specified torque. (See Fig.420.)

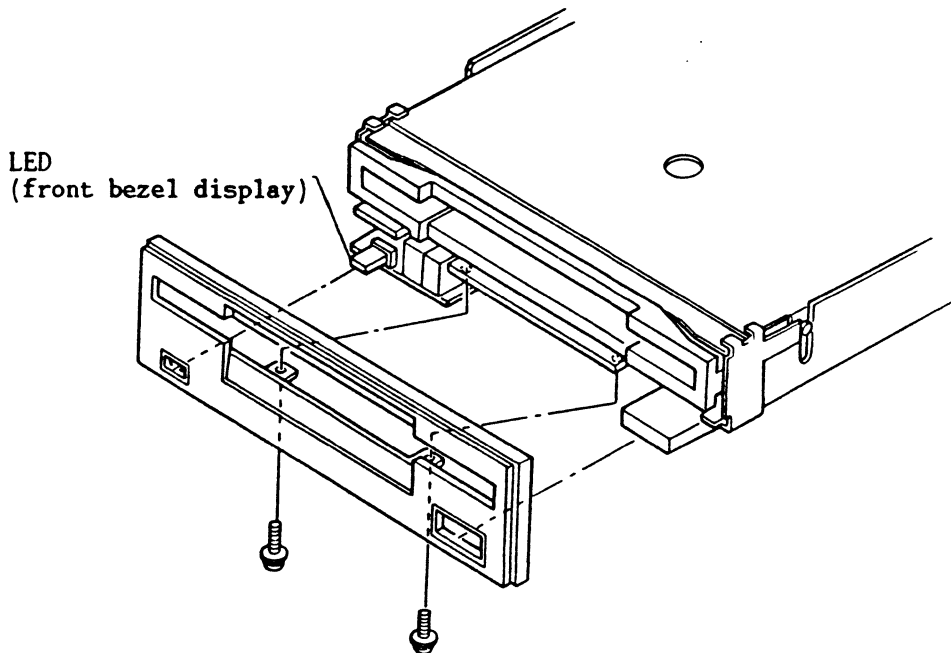


Fig. 420 Replacing Front Bezel

4-5-9 Front door replacement

(A) Tools required

- (1) Phillips screwdriver
- (2) Tweezers

(B) Replacement procedure

- (1) Remove the shield plate (Fig.505, ③⑥) by loosening the set-screws (Fig.505, ⑤②).
- (2) Remove the front bezel (Fig.505, ③⑦) by loosening the set-screws (Fig.50, ⑤⑧).
- (3) Remove the eject button (Fig.505, ⑦).
- (4) Remove the front door (Fig.505, ②④) from the disk housing assembly (Fig.505, ②③). The removal is facilitated by pulling while expanding by the tweezers the portion engaged with the claw of the disk housing assembly (see Fig.421).
- (5) In the procedure reverse to (4), mount a new front door.
- (6) Remount the eject button, and attach the front bezel by the setscrews.
- (7) Mount the shield plate by the setscrews.

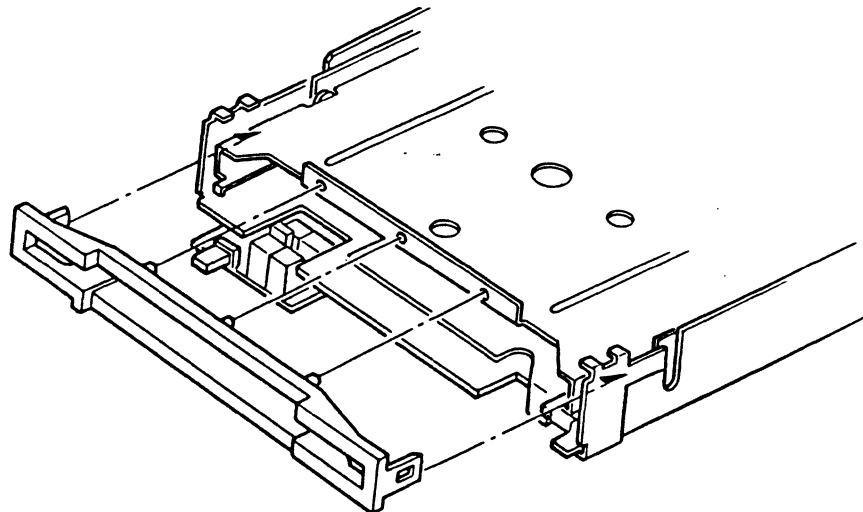


Fig.421 Replacing Front Door

4-5-10 Eject button replacement

(A) Tools required

- (1) Phillips screwdriver

(B) Replacement procedure

- (1) Remove the front bezel (Fig.505, ③7) by loosening the setscrews (Fig.505, ③8).
- (2) Remove the eject button and replace it with a new one.
- (3) Mount the front bezel by the setscrews.

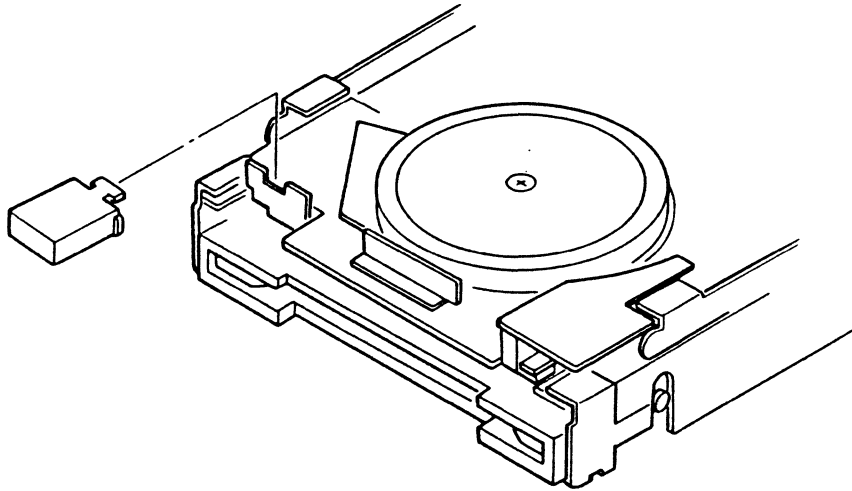


Fig. 422 Replacing Eject Button

SECTION 5

DRAWINGS AND PARTS LISTS

5-1 Construction

The F-3503 and F-3504 includes the following main components. (Refer to Fig.501~Fig.504) For a detailed parts breakdown, see items 5-2 and 5-3.

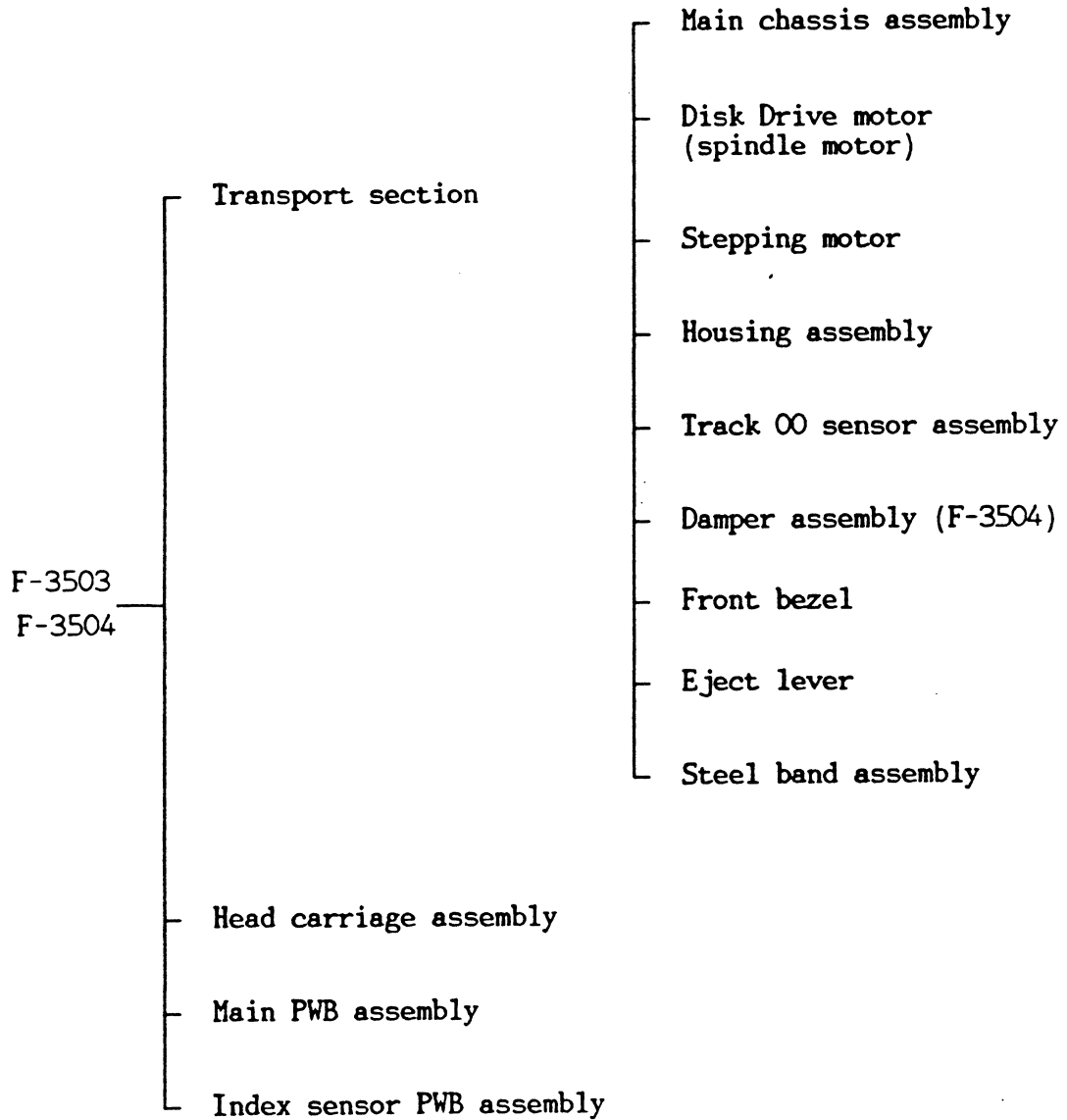


Table 501 F-3503, F3504 Main Components Chart

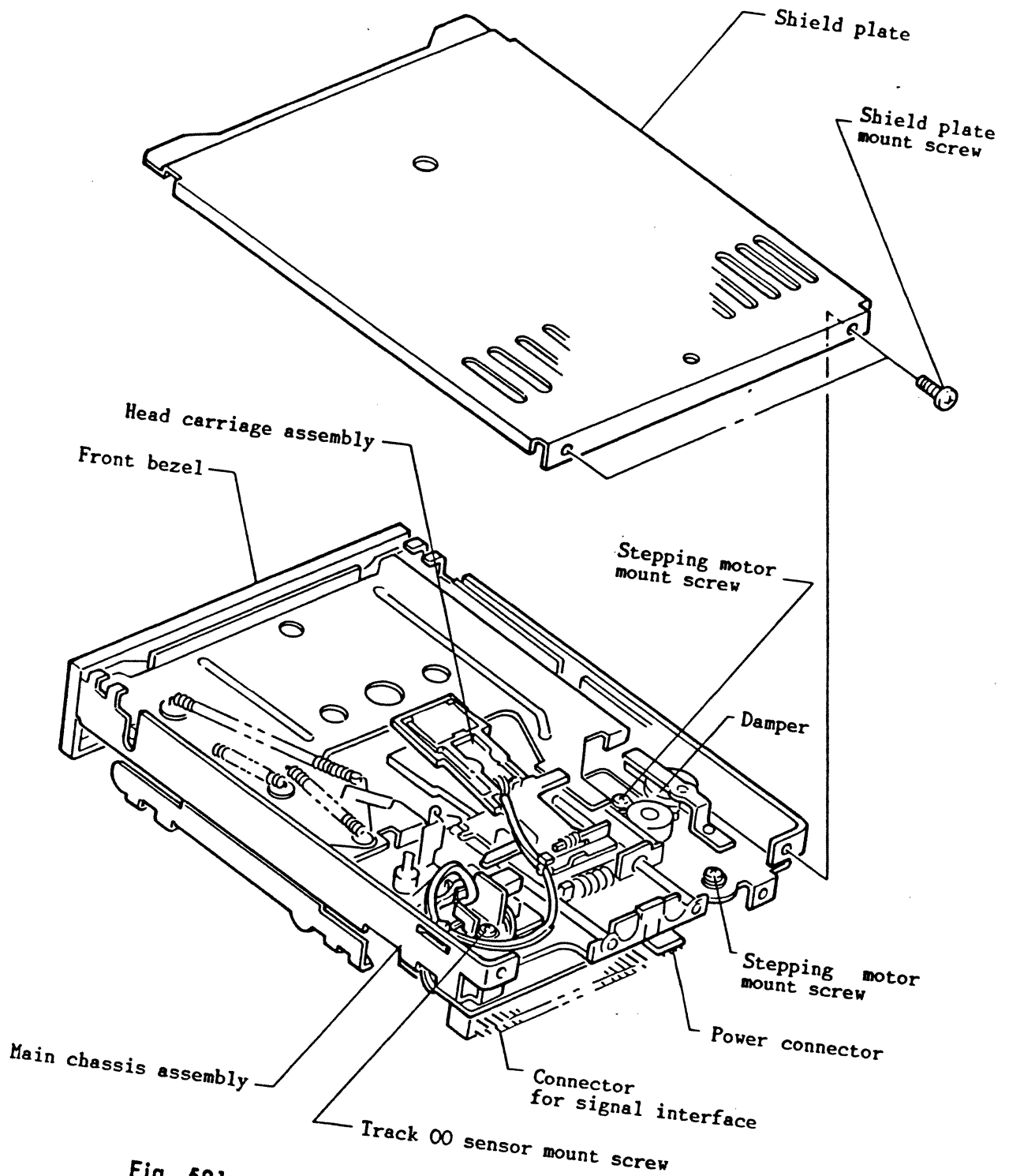


Fig. 501 External Appearance Drawing (1)

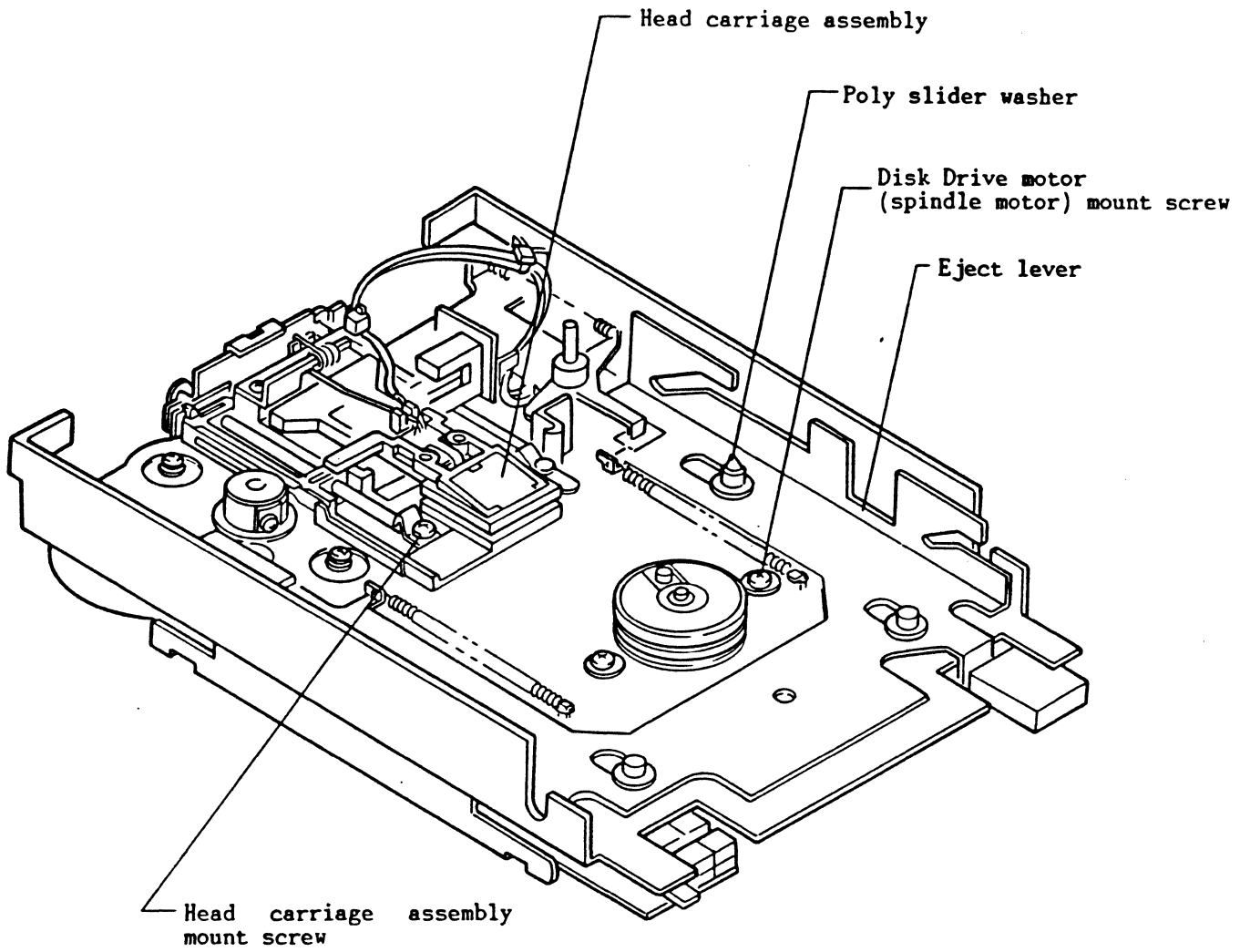


Fig. 502 External Appearance Drawing (2)

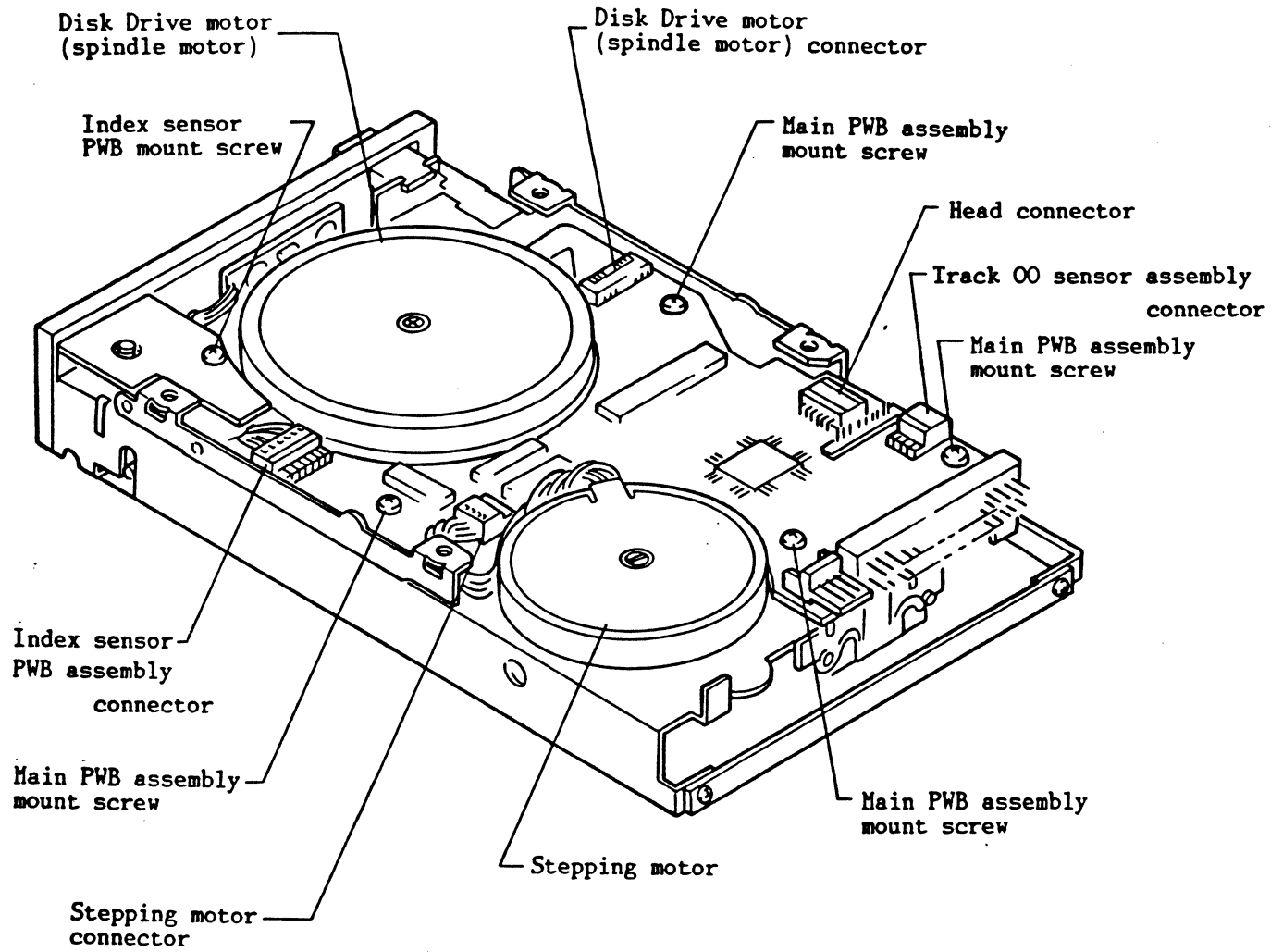


Fig. 503 External Appearance Drawing (3)

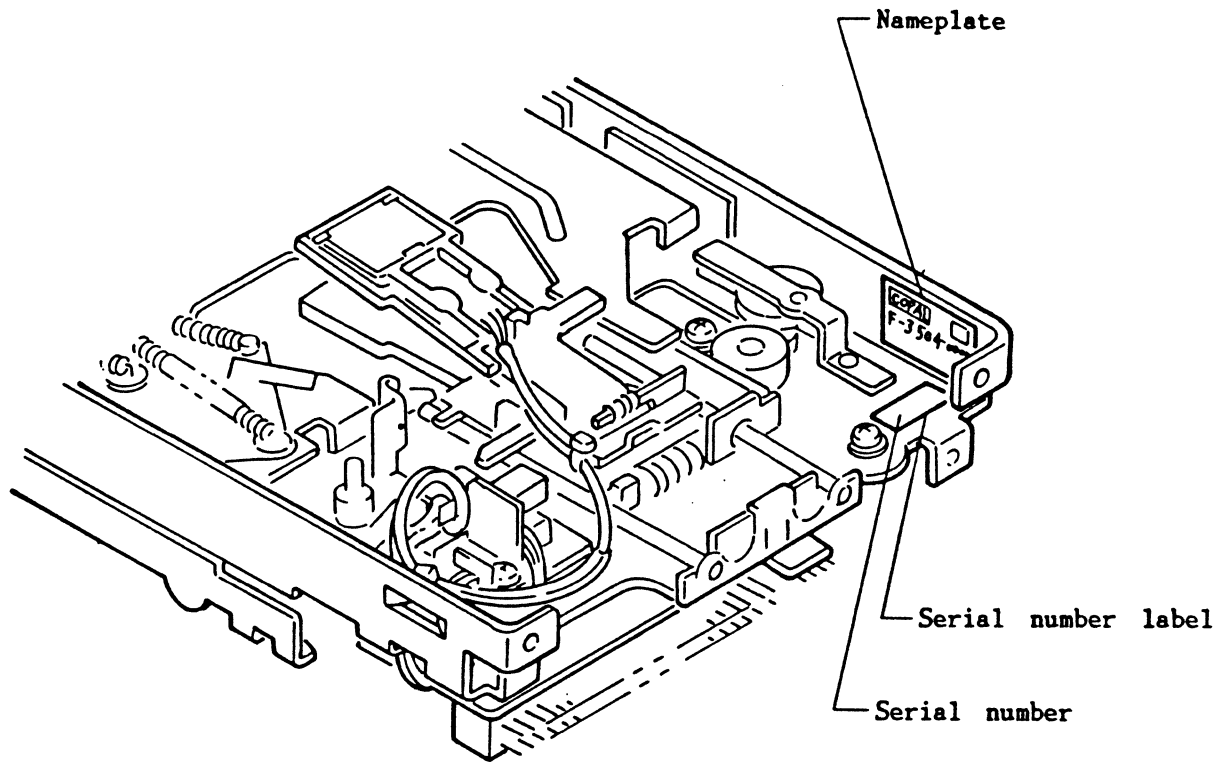


Fig. 504 External Appearance Drawing (4)

5-2 Structural Parts Exploded Drawing, Parts List

5-2-1 Floppy Disk Drive chassis (Refer to Fig.505)

Part no.	Drawing no.	Parts Name	Q'ty	Remarks
1	J4-5210	Main chassis assembly	1	
2	J4-5459	Holding plate A	1	
3	J4-5460	Holding plate B	1	
4	J4-5461	Cushion bush	4	
5	J4-5462	Cushion piece	4	
6	J2-5211	Eject lever	1	
7	J3-5211	Eject button	1	Refer to Notes 5.
8	J4-5464	Eject roller	2	
9	J4-5465	Eject lever spring	2	
10	JA4-5466	Trigger lever assembly	1	
11	J4-5468	Trigger lever spring	1	
12	J4-5469	Sensor lever	1	
13	J4-5470	Sensor lever spring	1	
14	JA3-5220	Head carriage assembly	※1	F-3503
	JA3-5222	Head carriage assembly	※1	F-3504
15	J4-5478	Guide shaft	2	Refer to Notes 3.
16	J4-5479	Guide shaft holder A	1	
17	J4-5480	Guide shaft holder B	2	
18	J4-5481	Stepping motor	1	
19	JA4-5482	Steel band assembly	1	
20	J4-5486	Band fixing plate	1	
21	J4-5487	Band spring	1	
22	J3-5225	Disk Drive motor (spindle motor)	1	
23	JA3-5213	Drisk housing assembly	1	
24	J2-5215	Front door	1	Refer to Notes 5.
25	J4-5500	Operation lever spring	1	

Table 502 Floppy Disk Drive chassis, Parts List (1/2)

Part no.	Drawing no.	Parts Name	Q'ty	Remarks
26	J4-5501	Spring	1	
27	J4-5502	Brake lever spring	1	
28	J4-5503	Housing roller	6	
29	J4-5504	Side plate A	1	
30	J4-5505	Side plate B	1	
31	JA4-5527	Track 00 sensor assembly	1	
32	JA4-5537	Index sensor PWB assembly	1	
33	J4-5514	Track 00 stopper	1	
34	J4-5515	Track 00 stopper spring	1	
35	J4-5528	Wire binder	1	
36	J2-5216	Shield cover	1	
37	J2-5217	Front bezel	1	Refer to Notes 5.
38	JA2-5220	Main PWB assembly	※ 1	F-3503 Refer to Notes 4.
	JA2-5221	Main PWB assembly	※ 1	F-3504 Refer to Notes 4.
39	J4-5523	Dumper receiving plate	1	F-3504
40	J4-5524	Dumper assembly	1	F-3504

Table 502 Floppy Disk Drive chassis, Parts List (2/2)

- Notes:*
1. When the quantity column is marked ※, select one which is applied.
 2. When a model name is indicated in the remarks column, the relevant part is used for that model only.
 3. The guide shaft is always combined with the head carriage assembly to fit the diameter with the head carriage hole. Replace it together when replacing the head carriage assembly. Also replace the guide shaft holder A and B.
 4. The drawing number for main PWB assembly differs for every model. Check the main PWB assembly label on the installed PWB and specify the same symbol (issue) as that on the employed instrument.
 5. The drawing numbers indicated of the eject button, front door and front bezel are for standard black ones.

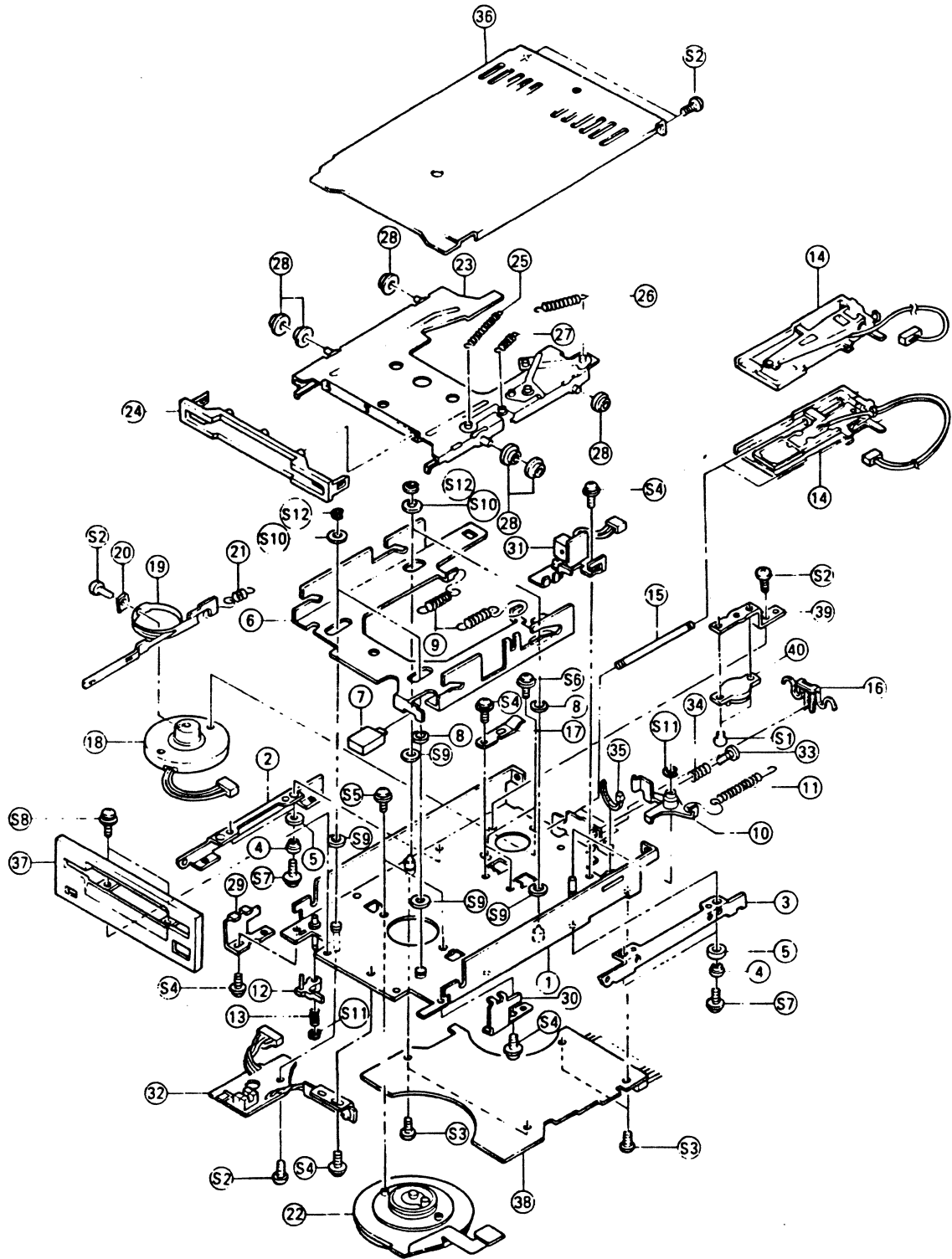


Fig. 505 Disassembled View of Mechanism

5-2-2 Screws and washers

Part no.	Drawing no.	Part Name	Remarks	
S1	9000-2003	Screw M2 × 3		
S2	9000-2603	Screw M2.6 × 3		
S3	9020-2603	Screw M2.6 × 3		
S4	9060-2603	Screw M2.6 × 3 plain washer		
S5	9061-2603	Screw M2.6 × 3 plain washer		
S6	JZ4-0027	Screw M2.6 × 3.3 plain washer		
S7	9061-2605	Screw M2.6 × 5 plain washer		
S8	9067-2605	Screw M2.6 × 5 plain washer spring washer		
S9	JZ4-0022	Plain washer ϕ 5.1×0.5(Teflon)		
S10	JZ4-0023	Plain washer ϕ 5.1×0.5 (Polyacetal)		
S11	JZ4-0025	Poly slider washer ϕ 2.1×0.25		
S12	JZ4-0024	Poly slider washer ϕ 4.1×0.25		

Table 503 Screw and Washer Parts List

5-3 PWB Assembly Parts & Drawing No. List

5-3-1 Main PWB Assembly

Drawing No.	Parts Name	Q'ty	Parts No.	
JA2-5220	Main PWB assembly A	1	For F3503	
JA2-5221	Main PWB assembly B	1	For F3504	
J4-5534A	Main PWB assembly label	1	For F3503	
J4-5534B	Main PWB assembly label	1	For F3504	
J3-5216	Main PWB	1		
JY4-0097	IC M51017AP	1		
JY4-0098	CX10060	1		
JY4-0099	IC HA13421A	1		
JY4-0100	TTL 74LS123	1		
JY4-0101	TTL 7438	1		
SBXM07662R	Transistor 2SB766 (R,S)	1	Q1	
SDXM06013Q	Transistor 2SD601 (Q,R,S)	2	For F3503 Q2,3,4	
SDXM06013Q	Transistor 2SD601 (Q,R,S)	3	For F3504 Q2,3,4	
JY4-0102	Transistor built in resistor DTC114K	4	Q5,6,7,8	
JY4-0103	UN2211			
JY4-0104	Diode MA151WK	3	CR1,2,3	
JY4-0528	Mini mold diode DAN202K			
CEME0J107E	Aluminum electrolytic capacitor 100 μ F6.3V	1	C2	
CEME1C476E	47 μ F16V	2	C3,29	
CEME1C336E	Aluminum electrolytic capacitor 33 μ F16V	1	C41	

Drawing No.	Parts Name	Q'ty	Parts No.	
CEME0J226E	22 μ F6.3V	1	C7	
CEME1C475E	4.7 μ F16V	1	C36	
CEME1V225E	2.2 μ F35V	1	C33	
CNME1C226E	Aluminum electrolytic capacitor, bipolar 22 μ F16V	2	C42,43	
CSME1C105A	Dip tantalum capacitor 1 μ F16V \pm 20%	1	C24	
CSME0J475A	4.7 μ F6.3V \pm 10%	1	C28	
CSKNOJ226D	Dip tantalum (low profile) 22 μ 6.3V \pm 10%	1	C12	
CQJS1H683C	Polyester film capacitor 0.068 μ F50V \pm 5%	1	C31	
CQJS1H223C	0.022 μ F50V \pm 5%	1	C30	
CQJS1H223S	0.022 μ F50V \pm 5%	1	C38	
CFGY1H222N	Polypropylene film capacitor 2200PF50V \pm 2%	1	C20	
CFGY1H102N	1000PF50V \pm 2%	2	C19,21	
CFGY1H681N	680PF50V \pm 2%	1	C18	
CFGY1H471N	470PF50V \pm 2%	1	C17	
HAZX1H104F	Laminated ceramic chip capacitor (3216type, solder pole) 0.1 μ F50VZ (F characteristics)	2	C22,23	
HAZX1H333F	0.033 μ F50VZ (F characteristics)	1	C37	
HAMX1H223B	0.022 μ F50VM (B characteristics)	10	C4,5,8,9,10, 11,25,32, 40,45	
HAMX1H103B	0.01 μ F50VM (B characteristics)	1	C6	
HAKX1H103X	1000PF50VK (SL characteristics)	3	C34,35,39	
PAJX21560A	Square chip fixed resistor (3216type, solder pole) 56 Ω 1/8W \pm 5%	1	R15	
PAJX21101A	100 Ω 1/8W \pm 5%	3	R13,53,54	

Drawing No.	Parts Name	Q'ty	Parts No.	
PAJX21221A	Square chip fixed resistor (3216type, solder pole) 220 1/8W ±5%	3	R17,18,45	
PAJX21821A	820 "	1	R3	
PAJX21102A	1K "	1	R16	
PAJX21302A	3K "	1	R36	
PAJX21332A	3.3K "	1	R14	
PAJX21472A	4.7K " For F3503	7	R1,7,8,9,19, 44,51	
PAJX21472A	4.7K " For F3504	8	R1,7,8,9,19, 20,44,51	
PAJX21512A	5.1K "	3	R12,33,34	
PAJX21562A	5.6K " For F3503	1	R22	
PAJX21562A	5.6K " For F3504	2	R21,22	
PAJX21103A	10K "	4	R5,6,47,49	
PAJX21753A	75K "	1	R25	
PAJX21333A	33K "	1	R2	
PAJX21363A	36K "	1	R38	
PAJX21513A	51K "	1	R24	
PAJX21563A	56K "	1	R28	
PAJX21104A	100K "	1	R4	
PAJX21184A	180K "	1	R37	
PAGXD8201A	8.2K 1/8W ±2%	1	R32	
PAJX21474A	470K 1/8W ±5%	1	R35	
PAJX21000A	Square chip jumper resistor 0Ω For F3503	2	R20,46	
PAJX21000A	Square chip jumper resistor 0Ω For F3504	0		
RDJM21392A	Square chip fixed resistor (3216type, solder pole) 3.9KΩ 1.8W ±5%	1	R52	
RDGM27681A	Carbon film fixed resistor 680Ω 1/2W ±2%	1	R23	
RDGR27681A	"			

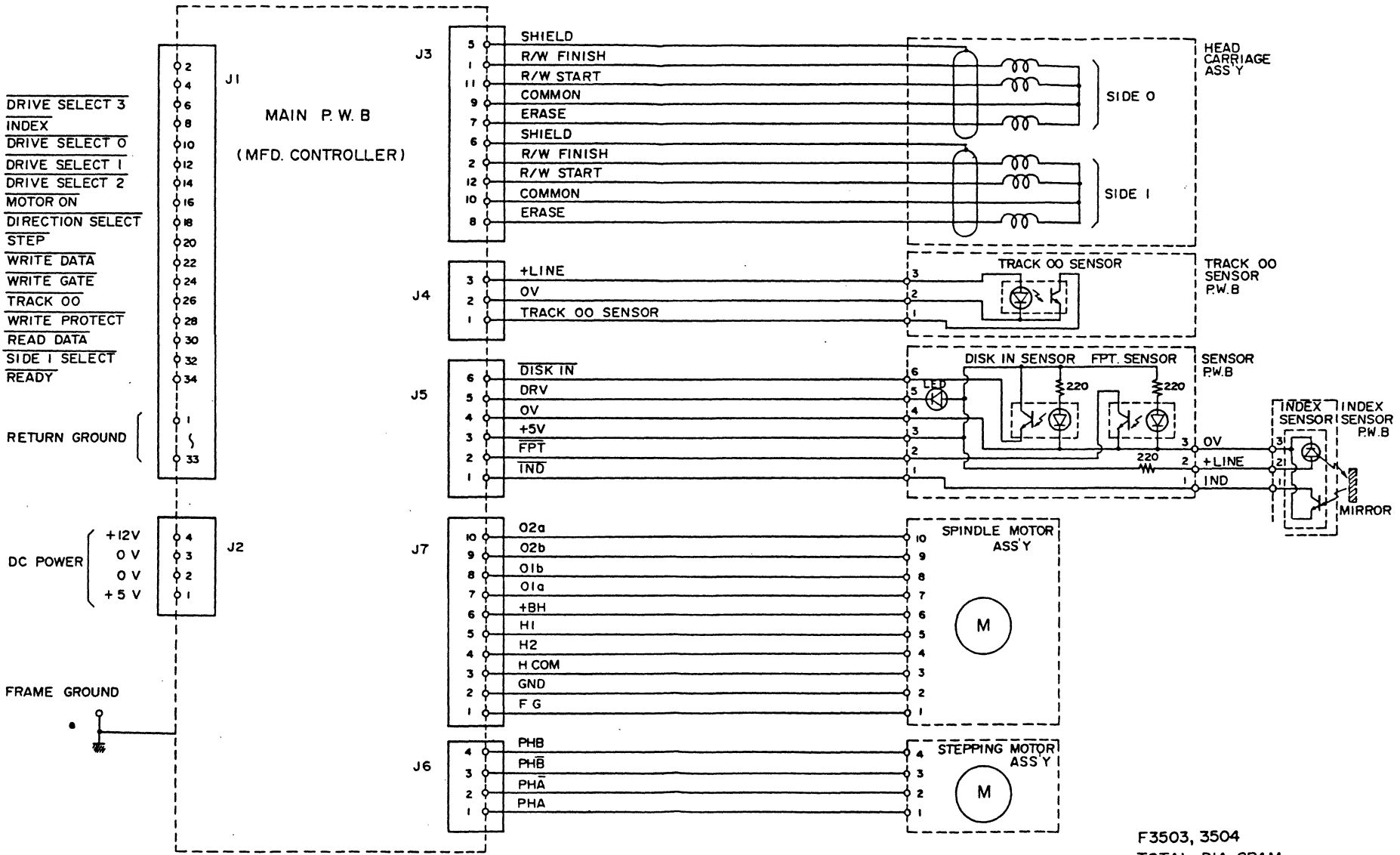
Drawing No.	Parts Name	Q'ty	Parts No.	
JY4-0113	Resistor array 8 elements, 1K Ω J	1	RA1	
JY4-0105A				
JY4-0114				
JY4-0065B	Semi-fixed resistor 50k Ω	1	VR1	
JY4-0516A				
JY4-0516B	100K Ω	1	VR2	
JY4-0065C				
JY4-0106A	Axial lead inductor 270 μ H \pm 10%	2	L1,2	
JY4-0115				
JY4-0106B	Axial lead inductor 220 μ H \pm 10%	1	L3	
JY4-0116				
JY4-0132	Square chip fixed resistor (3216type, solder pole) 390 Ω 1/8W \pm 5%	1	R29	
PAJX21242A	2.4K //	1	R11	
PAGX21683A	68K 1/8W \pm 2%	1	R31	
PAGX21753A	75K //	1	R30	
PAJX21273A	27K Ω 1/8W \pm 5%	1	R50	
JY4-0127	Block header (S) For F3503 5P	1	J3	
JY4-0128	11P For F3504	1	J3	
JY4-0109A	Shorting connector 1 row 8P	1	TP1~TP8	
JY4-0076D	Shorting connector 2 row 8P	1	1DSS1	
JY4-0077	Short bar	1		
JY4-0131	Interface pin header 2 row right angle 34P	1	J1	
JY4-0111C	Power connector 4P	1	J2	
JY4-0112	FPC connector 10P	1	J7	
JY4-0080B	Post with base (side type) 3P	1	J4	

Drawing No.	Parts Name	Q'ty	Parts No.	
JY4-0080C	Post with base (side type) 4P	1	J6	
JY4-0080E	Post with base (side type) 6P	1	J5	
GY4-0473A	Jumper lead	2		

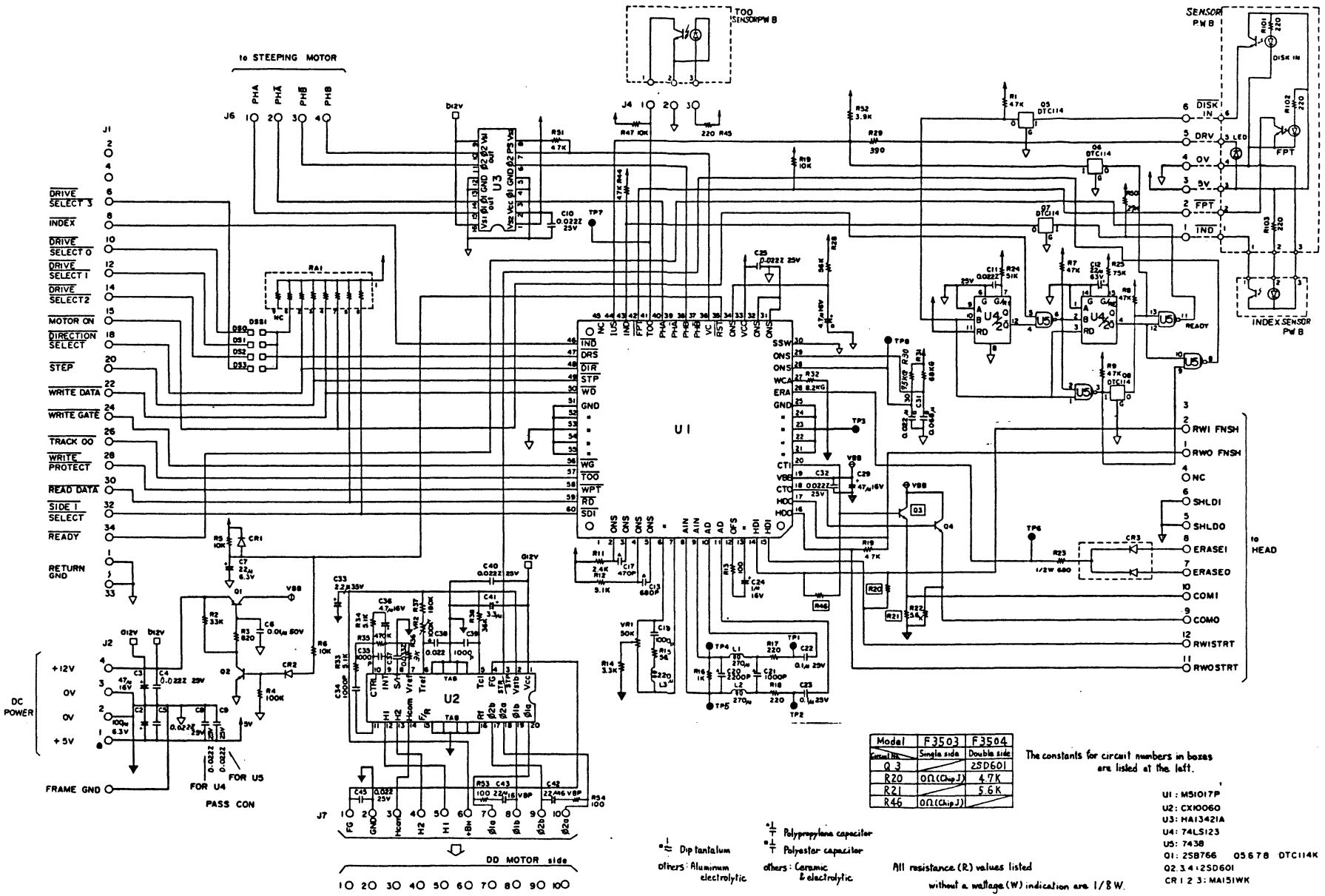
5-4 Circuit Diagram and Actual Wiring Diagram

Cautions concerning the circuit diagram

- (1) Unless otherwise indicated, resistances (R) are given in ohms with a voltage rating of 1/6W and tolerance of $\pm 5\%$ (J).
- (2) Unless otherwise indicated, resistance arrays (RA) are given in ohms with a voltage rating of 1/8W and tolerance of $\pm 5\%$ (J).
- (3) Unless otherwise indicated, capacitors (C) are rated in picofarads (PF) with a voltage rating of 50V and tolerance of $\pm 20\%$ (M).
Example : 223Z \rightarrow $22 \times 10^3 \text{PF} = 22000\text{PF} +80\%$ to -20% .
- (4) Tolerances for resistances, resistance arrays and capacitors are coded as follows.
G: $\pm 2\%$; K: $\pm 10\%$; M: $\pm 20\%$; Z: $+80\%$ to -20% .



F3503, 3504
TOTAL DIA GRAM



Model	F3503	F3504
Smallest	Single side	Double side
Q 3		2SD601
R20	0Ω (Chip J)	4.7K
R21		5.6K
R46	0Ω (Chip J)	

The constants for circuit numbers in bases are listed at the left.

- U1: MS1017P
- U2: CX10060
- U3: HA13421A
- U4: 74LS123
- U5: 7438
- Q1: 2SB766 05 6 7 8 DTC114K
- Q2 3 4: 2SD601
- CR 1 2 3: MA151WK

$\text{---} \text{---} \text{---}$ Dip tantalum
 others: Aluminum electrolytic
 $\text{---} \text{---} \text{---}$ Polypropylene capacitor
 $\text{---} \text{---} \text{---}$ Polyester capacitor
 others: Ceramic & electrolytic

All resistance (R) values listed without a wattage (W) indication are 1/8W. (3.2 x 1.6 type)