

TEAC FD-54
MINI FLEXIBLE DISK DRIVE
MAINTENANCE MANUAL

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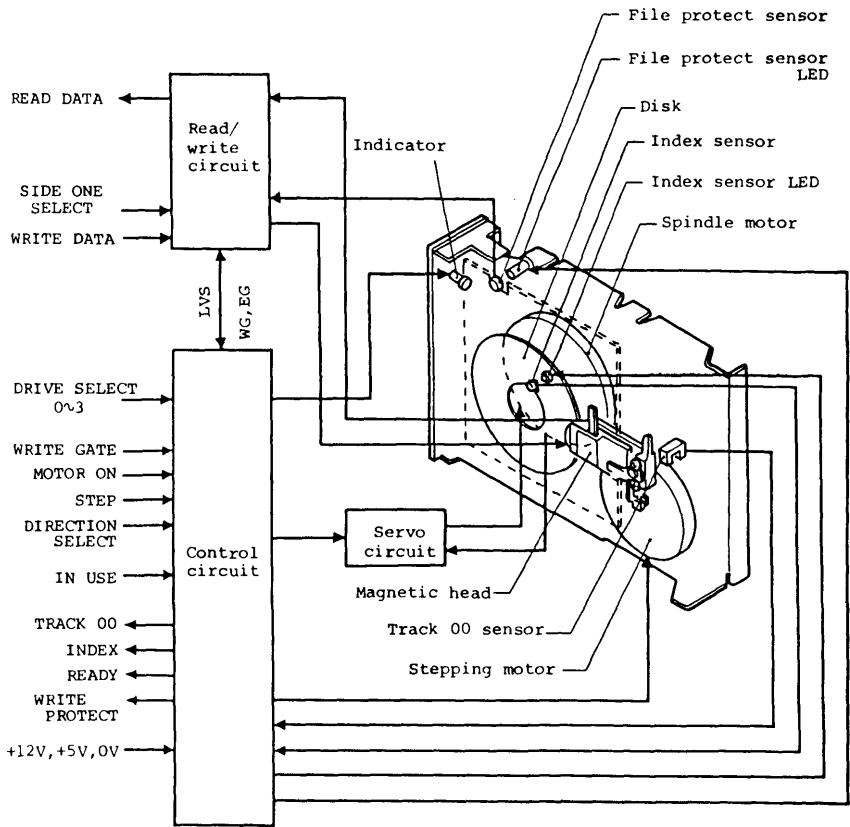
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SECTION 3

THEORY OF OPERATION

3-1. CONSTRUCTION AND FUNCTION

3-1-1. General Block Diagram



(Fig.301) General block diagram

3-1-2. Mechanical Section

Since the disk is a flexible recording media made of mylar film base and data interchangeability between disks and FDDs is required, the mechanical section of the FDD uses precision parts and it is also assembled with high precision. For this reason, only trained technicians can handle the internal mechanism. Never apply excessive impact nor drop the FDD down on the desk.

The mechanical section is constructed with frame (chassis), door mechanism, disk clamp mechanism, disk rotation mechanism, magnetic head and carriage, head seek mechanism, various detection mechanisms, etc.

(1) Frame (chassis)

The main structure for mounting the various mechanisms and printed circuit boards. The frame is made of sheet metal to maintain the stability of the FDD in strength, precision, durability, and expansion coefficient.

(2) Door mechanism and disk clamp mechanism

The door mechanism is constructed with clamp spring (plate spring), front lever, set arm, etc. The end of the clamp spring makes the disk clamp mechanism (collet Ass'y) move up and down.

When a disk is inserted and the front lever is closed, the tip of the collet is inserted in the central window of the disk and the window area is depressed to the spindle so that the center of the disk is clamped in the correct position along the outer circumference of the collet.

(3) Disk rotation mechanism

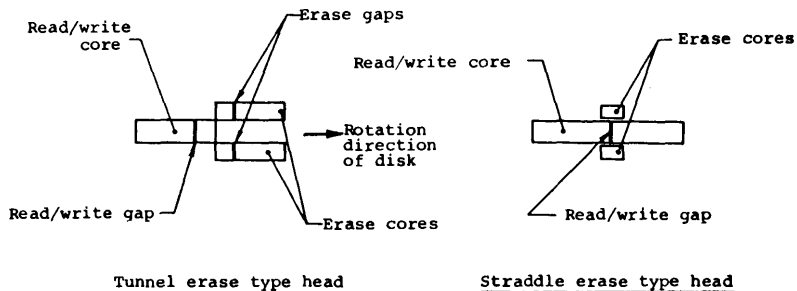
The disk rotation mechanism comprises DD motor Ass'y which includes spindle.

The DD motor is an outor-rotor type DC brushless motor which has the long life of 20,000 hours or more in continuous rotation.

The rotational speed is 300rpm and maintains stable rotational speed against load variations and environmental changes. This is achieved by a feedback signal from the internal AC tachometer.

The precisely combined collet and spindle are attached at the correct angle to maintain the center position correctly without damaging the center hole of the disk and so as to make the head be in contact with disk at the correct angle.

(4) Magnetic head and carriage



(Fig.302) External view of magnetic head core

For single sided FDDs, the external view of the magnetic head is button shaped and it is mounted on the carriage so that it is in contact with the SIDE 0 (the bottom side when the FDD is placed horizontally) head window area of the disk.

For double sided FDDs, both the SIDE 1 head and the SIDE 0 head are special flat type supported with the gimballed mechanisms. The two magnetic heads are mounted accross the disk on one carriage.

In both types of head, the surface is designed for minimum disk wear and maximum read output. The head itself is a long life type for

improved head wear.

For the FD-54 drives, either of tunnel erase type head or straddle erase type head is used. The core of the tunnel erase type head is constructed with a read/write gap which is used for data write and data read operations and two erase gaps which are used to erase the edges of the recorded track immediately after the recording (tunnel erase). For the straddle erase type head, the core is constructed with a read/write gap and two erase cores for erasing the edges of the recorded track at the same time with the recording.

Even though the core construction of these two types of head are different, their functions in the FD-54 drives are the same and have complete interchangeability between the data recorded on the disks. The magnetic head and the carriage on which the head is mounted form the most important part of the FDD and is specially assembled with high precision.

(5) Head seek mechanism

The head seek mechanism consists mainly of stepper motor with a capstan (pooly), steel belt (band), guide shafts, and carriage. The carriage is connected to the capstan of the stepping motor through the steel belt and is slid along the guide shafts. The flat type 4-phase stepping motor is adopted and it rotates 2 steps (3.6°) per one track space. The stepper motor is driven in a unique 1-2 phase driving method which brought a success in reducing the heat radiation and to obtain a high speed driving and positioning accuracy. The parallelism and the distance between the shafts and the center line of the disk, and shaft and disk themselves are precisely machined. Also the thermal expansion of the chassis, steel belt, carriage, etc. are taken into consideration in the process of design so that they are mutually offset with the expansion of the disk.

(6) Detection mechanisms

(a) File protect detection mechanism

This mechanism is constructed with an LED and a photo-transistor to detect the existence of the write enable notch of the disk jacket. When a disk with the notch covered is installed and the light pass for detection is disturbed, no write or erase current will be supplied to the read/write and erase heads and the recorded information on the disk is protected from an erroneous input of a write command. The LED is mounted on the PCBA DD motor servo and the photo-transistor on the front OPT Ass'y.

(b) Track 00 detection mechanism

This mechanism is constructed with a photo-interrupter for detecting the outermost track position (track 00) of the head and the track 00 stopper which is attached to the rear side of the head carriage. Inside tracks from the track 00 on the disk are used. Even if an erroneous step out command is input from the track 00 position, the command will be ignored by the internal circuit of the FDD. If the head moves out from the track 00 by some reason (such as impact during transportation), the head carriage strikes the track 00 stopper to protect the head from moving out of the returnable range at a next power on.

When step-in commands are input from the innermost track, the head seeks toward inward and stops with an appropriate space left against the head window edge of the disk. In order to recalibrate the track from this position (returning operation to the track 00), it is required to input the step-out commands with several additional steps to the maximum track number.

(c) Index detection mechanism

LED and photo-transistor for the detection of the index hole are

located at the index window area of the disk jacket.

The LED is mounted on the PCBA DD motor servo and the photo-transistor on the front OPT Ass'y. The index hole will be detected along the rotation of the disk.

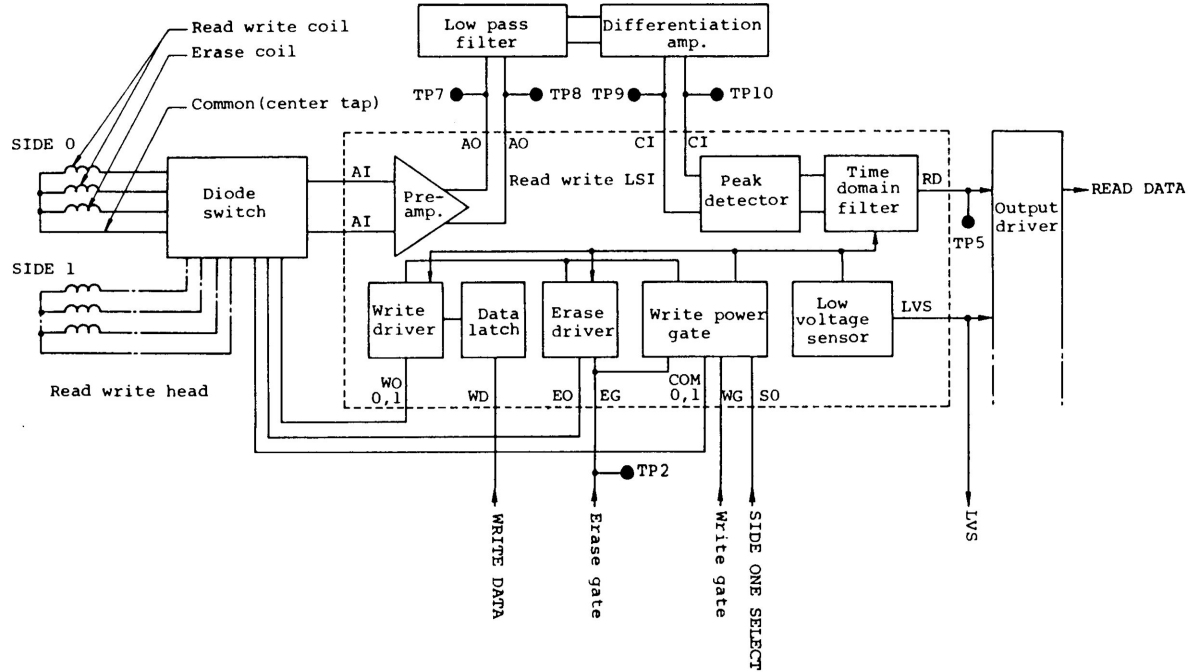
3-2. CIRCUIT DESCRIPTIONS

The electronics of the FDD is constructed with three sections which are read write circuit, control circuit, and servo circuit. Read write circuit and control circuit are mounted on the PCBA MFD control, and servo circuit is on the PCBA DD motor servo.

3-2-1. Read Write Circuit

The read write circuit is constructed with read circuit, write circuit, and low voltage sensor. They are mostly packed in a read write LSI (bipolar).

Fig.303 shows the block diagram.



(Fig.303) Read write circuit block diagram

(1) Read circuit

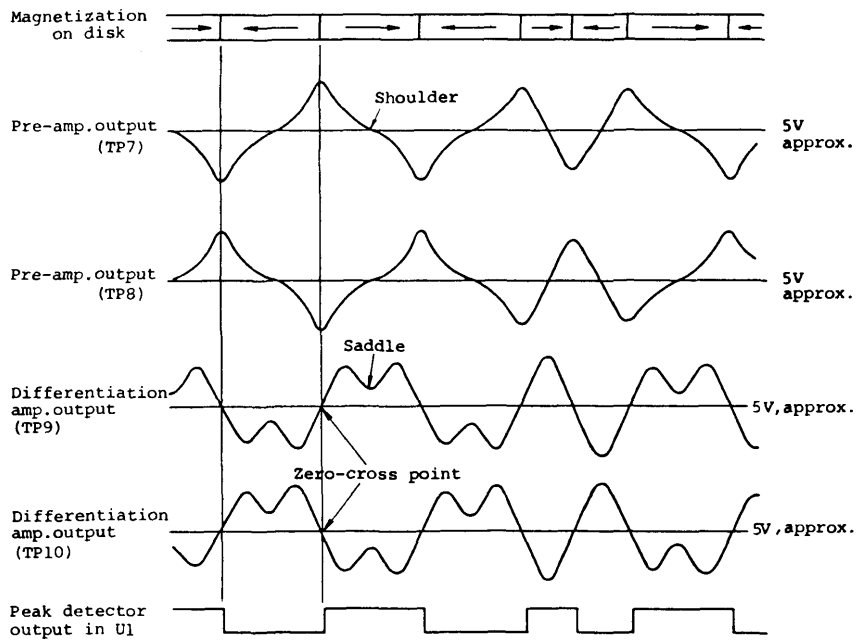
The read circuit consists of pre-amplifier, low pass filter, differentiation amplifier, peak detector, time domain filter and read gate (output driver).

In read operation, the minute voltage induced by the read/write head is amplified about 30dB by the pre-amplifier which is constructed with a video band differential amplifier. Undesirable high frequency noise is eliminated by the low pass filter (L1, L2, C30, etc.) and the read signal is supplied to the differentiation amplifier (Q3, Q4, L3, C35, etc.).

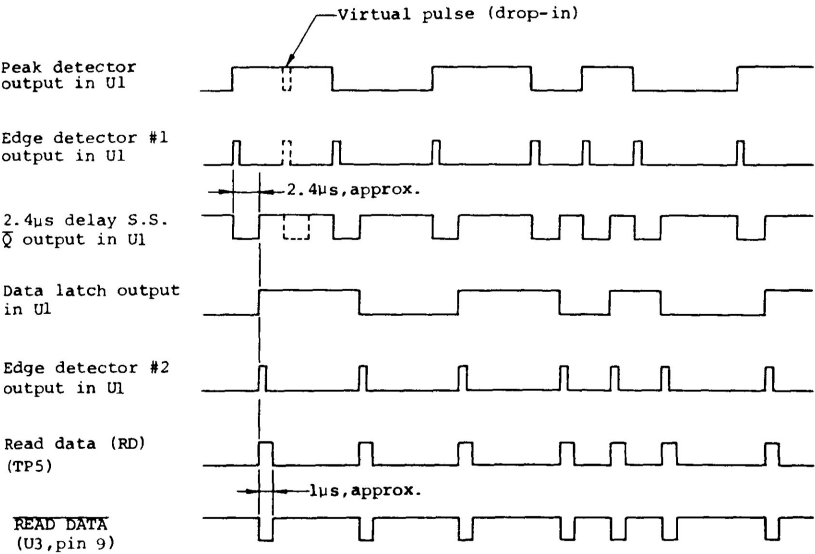
The differentiation amplifier phase-shifts the peak position of the reproduced waveform to the zero cross point, and at the same time, further amplifies the signal about 20dB with the most appropriate equalization. The peak detector which is constructed with a comparator converts the differentiated output into a square wave.

The time domain filter eliminates a virtual pulse caused by the saddle in the low frequency area (1F area, 62.5KHz, approx.) at outer tracks. The time domain filter is constructed with two edge detectors, 2.4μsec, delay single shot (LSI pin 7, RA5, C21), data latch, and 1μsec data single shot (LSI pins 8 and 9, RA5, C22).

Then the signal is output from the FDD through the read gate, U3 (pins 9, 10, 3-state output driver).



(Fig.304) Read amp. and peak detector waveforms



(Fig.305) Time domain filter and read gate waveforms

(2) Write circuit

The write circuit consists of write power gate (with side selector), select gate, data latch, write driver, and erase driver.

The write power gate output (COM0 or COM1) becomes high voltage when the write gate signal or the erase gate signal is TRUE (HIGH level). These signals are generated by the write/erase gate in the control circuit when all of the following three conditions are satisfied.

- (a) The file protect sensor detects the notch of the disk jacket (write enable condition).
- (b) The WRITE GATE input signal is TRUE.
- (c) MX strap is on or the DRIVE SELECT signal is TRUE (LOW).

The write power gate output is supplied to the common terminal of the head through the diode switch. Table 301 shows the output voltage of the write power gate in various operations.

Conditions	Write power gate output voltage	
	COM 0 (for Side 0)	COM 1 (for Side 1)
Side 0 write operation	High	Low
Side 1 write operation	Low	High
Side 0 read operation	Middle	Low
Side 1 read operation	Low	Middle

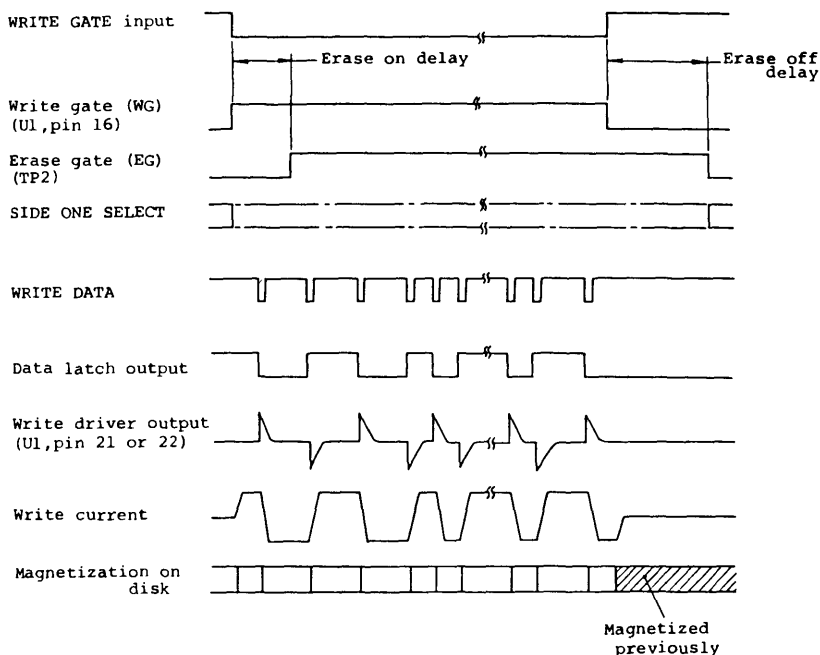
High: 10.5V, approx. Middle: 4V, approx. Low: 0V, approx.

(Table 301) Write power gate output voltage

For the tunnel erase head, the erase gate signal is delayed appropriately against the write gate signal. Since the erase gap is about 0.85mm behind the read/write gap, it is necessary for the erase driver to delay the write gate signal so that the written data is completely trimmed by the erase head (tunnel erase).

For the straddle erase head, the write gate and the erase gate signals have the same timing. The tunnel erase or the straddle erase produces a guard band between the tracks preventing deterioration of the S/N ratio resulting from a off-track (positioning error). It also ensures disk interchangeability.

The WRITE DATA input pulse is latched by the data latch. And appropriate write current is supplied to the read/write head by turning on and off the two write drivers alternately. When the write driver is active, no read data pulse is generated by the read circuit.

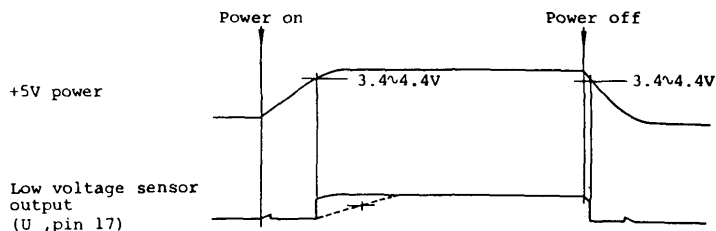


Note: Solid line of the Erase gate (EG) signal shows the tunnel erase type and dotted line shows the straddle erase type. Erase on delay and Erase off delay are applied only for the tunnel erase type.

(Fig.306) Write circuit waveforms

(3) Low voltage sensor

The low voltage sensor is equipped to protect the FDD from erroneous operation due to the internal circuit construction of the FDD during unstable condition of the supplied voltage such as at power on or off. The output of this sensor is supplied to almost all the functional blocks of the read write circuit, and control circuit to protect the write driver and erase driver from erroneous operation under the unstable condition of the DC power voltage.



Note: Dotted line shows the LVS input pin 34 of U2, control LSI.

(Fig.307) Low voltage sensor waveforms

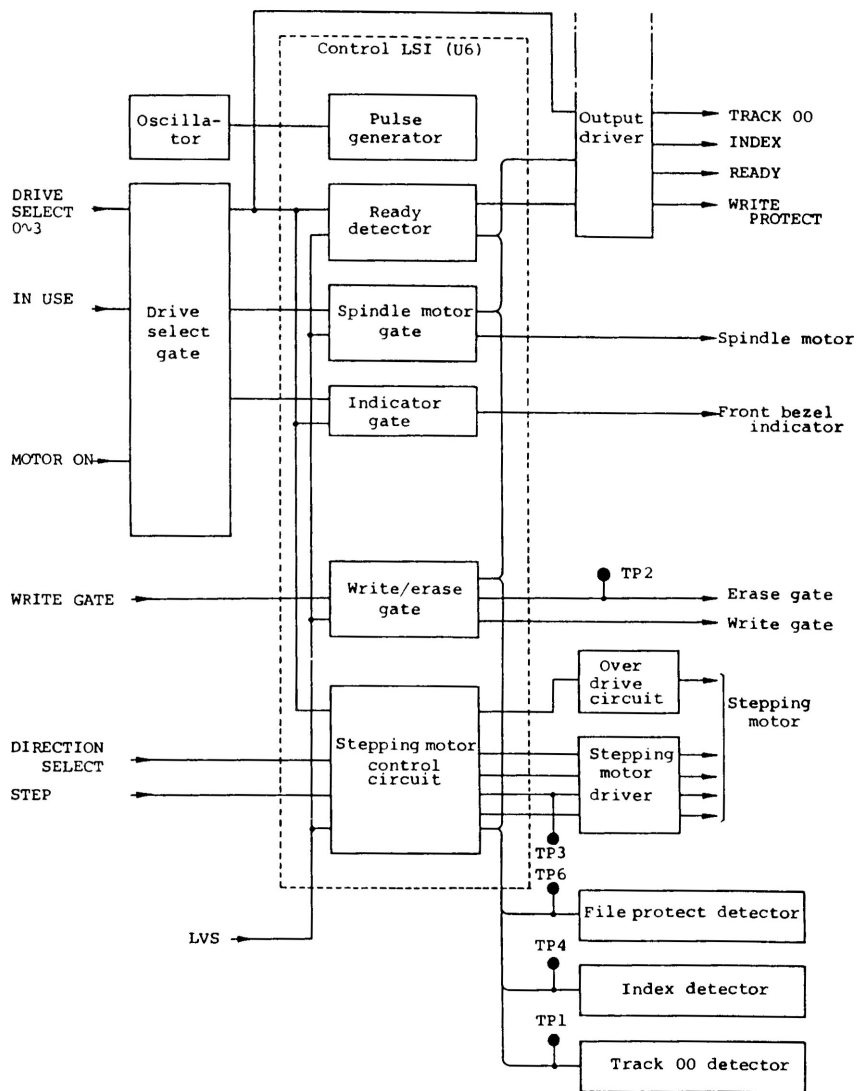
3-2-2. Control Circuit

The control circuit consists of gates, detectors, and the stepping motor control circuit. The gates are drive select gate to determine the drive select condition, spindle motor gate to determine the rotational condition of the spindle motor, write/erase gate to control the actual write operation, etc. The detectors are index/sector detector, track 00 detector, file protect detector, and ready detector. The former three detectors (photo-transistors) are mounted on the front OPT Ass'y and the transport frame. And the other circuits are mounted on the PCBA MFD control (mostly packed in a control LSI (CMOS)). Fig.308 shows the block diagram.

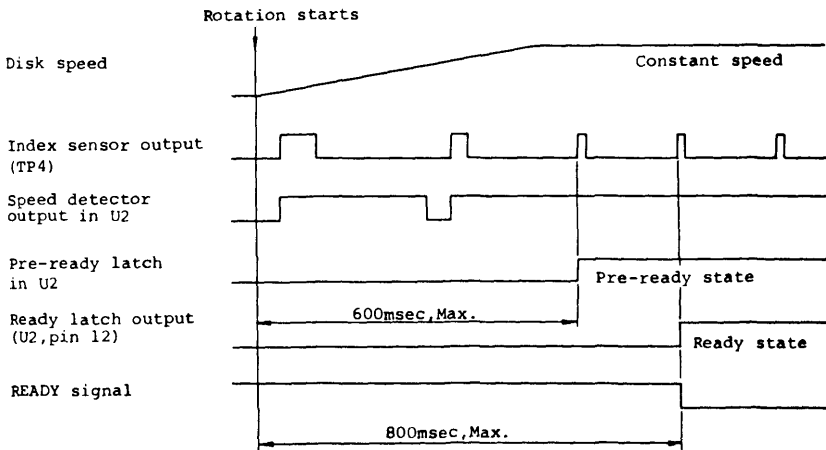
Drive select gate classifies the external input signals into several functions and transmits them into the control LSI. The selection of straps (short bars) determines the select condition of the drive, spindle motor operating conditions, and turn-on condition of the front bezel indicator. Refer to items 1-11 of the Specification as to the detailed function of each strap.

The write/erase gate judges the FDD whether it can execute write operation or not and issues write gate and erase gate signals for the write circuit. For the FDD with tunnel erase head, a specified delay time is established in the erase gate signal by an internal counter (refer to Fig.306).

The ready detector consists of speed detector and ready latch. The output of the speed detector which is constructed with a re-triggerable counter becomes always TRUE (HIGH) when the rotational speed of an installed disk (soft sectored) is more than 50%, approx. of the rated speed. The ready latch detects the second index pulse after the speed detector detects the 50% of the rated speed, then the READY condition is informed to the host system through the output driver, U7 (pin 13 ~ 14).



(Fig.308) Control circuit block diagram



(Fig.309) Ready detector waveforms

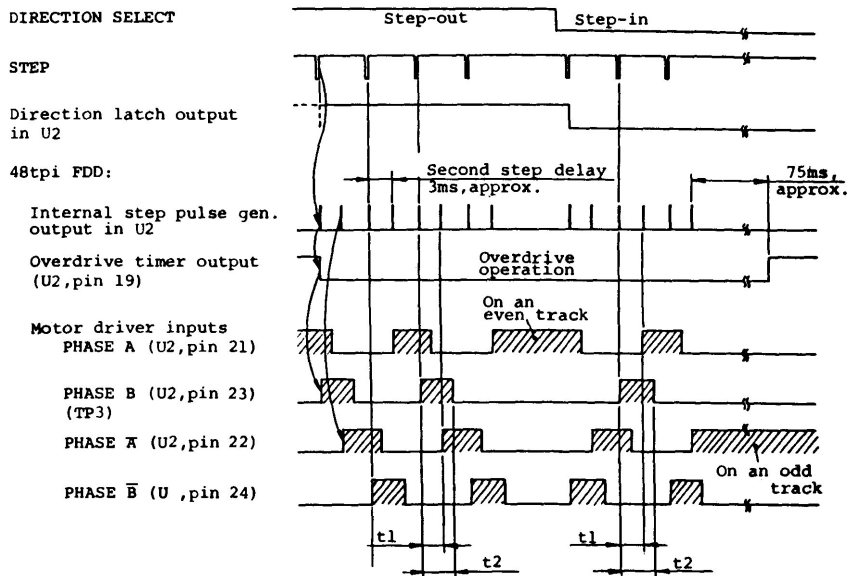
Stepping motor control circuit is constructed with direction latch, internal step pulse generator, shift register, phase drive selector, overdrive timer, etc.

Direction latch is a circuit to sample and hold the head seek direction designated by the DIRECTION SELECT signal at every input of the STEP pulses.

The internal step pulse generator is constructed with a counter and a pulse generator. The counter is triggered at the trailing edge of the STEP input pulse, and the second internal step pulse is generated with a delay of 3msec, approx. from each STEP input pulse by the pulse generator. It makes the stepping motor rotate for 2 steps (3.6°) in response to one STEP input pulse.

Outputs of the direction latch and the internal step pulse generator are input to the shift register and phase drive selector, and they are converted to the appropriate timing signals for uni-polar 1-2 phase drive of the 4-phase stepping motor. These phase drive signals are supplied to the stepping motor driver, U5 (output pins 12 ~ 15). In order to improve the torque margin in the seek operation, partially 2-phase drive period is provided by the phase drive selector only in the initial stage when the drive phase is changed. When the head stops on an even track, phase A is magnetized, while phase \bar{A} is magnetized when the head stops on an odd track. The phase B and \bar{B} are magnetized only during the seek operation.

The output from the internal step pulse generator is also supplied to the over-drive timer constructed with a re-triggerable counter. During the active period of this timer (75msec, approx.), +12V power is supplied to the stepping motor coils through the over-drive circuit (Q1) to produce enough torque required for the head seek and the settling operations. After the completion of the settling, only +5V power is supplied to the stepping motor through the diode, CR1, which minimize the power loss by supplying only the required torque for the holding of the stop position. By the above consideration, heat radiation from the motor is depressed to the minimum level and the stepping motor power consumption of 0.33W, approx. at the stop condition is achieved.



t1: Second step delay (3ms, approx.)
 t2: Phase B or \bar{B} magnetization (3.6ms, approx.)

(Fig.310) Stepping motor control circuit waveforms

3-2-3. Servo Circuit

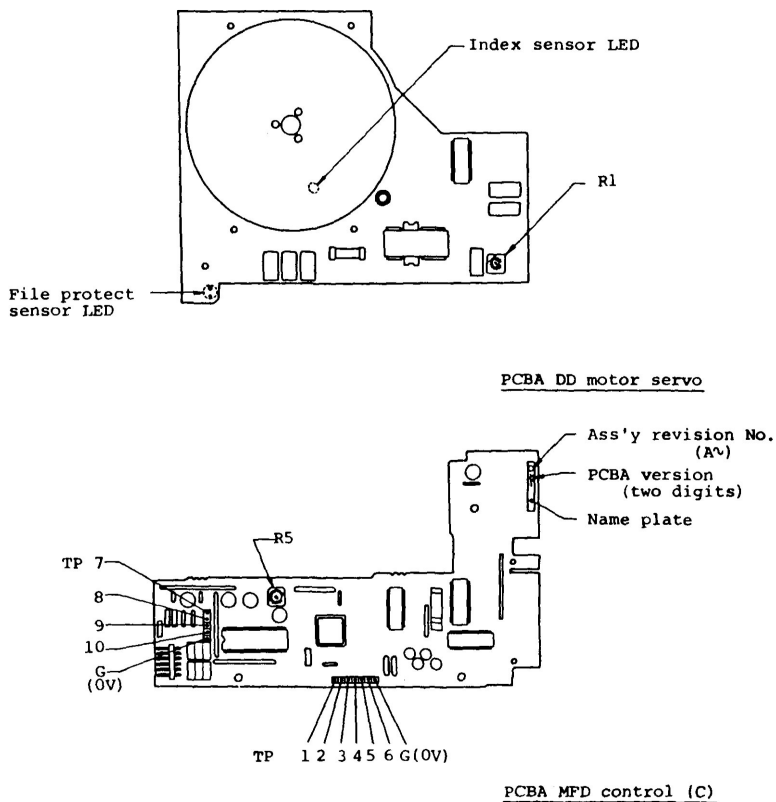
The servo circuit aims to maintain the rotational speed of the spindle motor at 300rpm, and the circuit is mounted on the PCBA assembled with the spindle motor.

Start and stop of the spindle motor (DD motor Ass'y) is controlled by the MOTOR ON signal supplied through the spindle motor gate in the control circuit.

The spindle motor is a long life DC brushless motor having 3-phase coils. The coils are driven by the exclusive drive IC. Energization and magnetized direction of the coils are controlled by the signal from the hall elements mounted on the PCBA around the rotor so that they are changed corresponding to the designated rotational direction. The rotational speed is maintained stably and precisely. The feedback signal from the AC tachometer in the rotor is converted into the drive voltage (F-V conversion) by servo IC, and supplied to the driver IC through the phase compensation circuit.

3-3. FUNCTION OF TEST POINTS AND VARIABLE RESISTORS

Fig.311 shows the mounting positions of the test points and variable resistors.



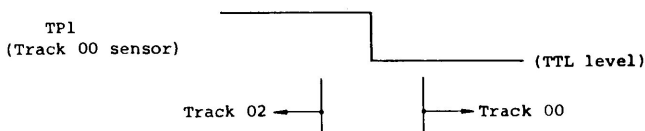
(Fig.311) Location of test points and variable resistors

3-3-1. Function of Test Points

Twelve test points (two for ground) are equipped on the PCBA MFD control for the check and adjustment of the FDD.

(1) TP1 (Track 00 sensor)

Test point to observe the output of the track 00 detection photo-transistor (shumitt inverter included). As well as TRACK 00 output signal, TP1 becomes LOW level when the head is on track 00 or around track 00 position.



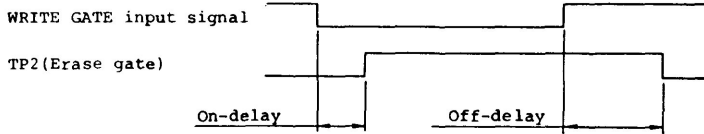
(Fig.312) Typical waveform of TP1

Note: The TRACK 00 output signal goes TRUE (LOW level) only when the phase A coil of the stepper motor is energized and the direction latch is set to the step-out direction (refer to Fig.310). Therefore, the level change timing of the TRACK 00 signal is not consistent with that of the TP1 signal.

(2) TP2 (Erase gate)

Test point to observe the output of the erase gate.

When TP2 is HIGH level, erase current flows through the erase head. This TP is used for the check and adjustment of the required delay time of the erase gate signal against the WRITE GATE input signal when the tunnel erase head is used.



(Fig.313) Typical waveform of TP2(for tunnel erase head)

Delay	Straddle erase head	Tunnel erase head
On-delay	0 μ s	200 ~ 320 μ s
Off-delay	0 μ s	860 ~ 950 μ s

(Table 302) Erase gate delay

(3) TP3 (Phase B)

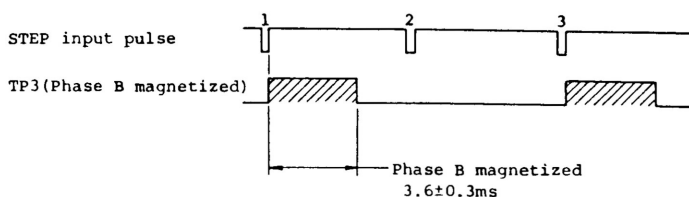
Test point to observe the phase B magnetized period of the stepping motor.

The stepping motor rotates for 2-steps in response to one STEP input pulse. Therefore, TP3 becomes HIGH level for a specified period when a step-out command from an even track or when a step-in command from an odd track is executed. Refer to Fig.310.

(4) TP4 (Index)

Test point to observe the output of the index detection photo-transistor (shumitt inverter included).

The signal level at this TP is opposite to that of INDEX output signal. When the index hole or sector hole (hard sector disk) is detected, HIGH going pulse is observed at TP4. The photo-transistor is mounted on the front OPT Ass'y and the LED is mounted on the back side of the



(Fig.314) Typical waveform of TP3

PCBA DD motor servo.

The test point is used for the following purposes.

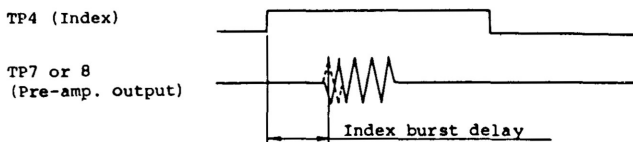
- (a) Confirmation and adjustment of the disk rotational speed. Speed is adjusted by the variable resistor R1 on the PCBA DD motor servo.
- (b) Confirmation and adjustment of the index burst timing. Burst timing is adjusted by the index sensor installation screw in the front OPT Ass'y



(Fig.315) Typical waveform of TP4 (Speed observation)

Items	Timing
Index interval	200±4ms
Pulse width	2 ~ 5.5ms
Burst delay	200±200μs

(Table 303) Index timing

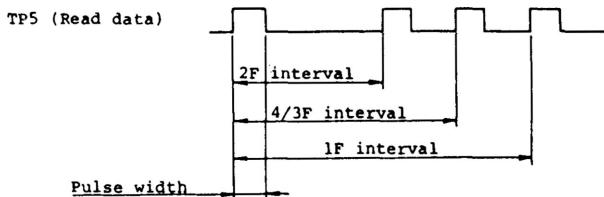


(Fig.316) Typical waveform of TP4 (Burst timing observation)

(5) TP5 (Read data)

Test point to observe the read data pulse.

The signal level at this TP is opposite to that of the READ DATA output signal.



(Fig.317) Typical waveform of TP5

Fig.317 shows the waveform at TP5 in normal data read operation.

In the FM method, 2F and 1F intervals are observed, while 2F, 4/3F, and 1F intervals are observed in the MFM method.

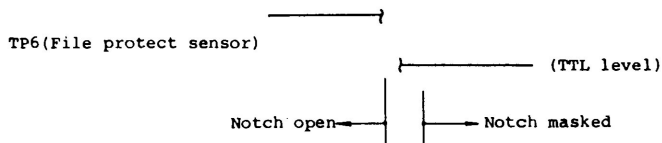
Items	Timing
2F interval	4 μ s, Nom.
4/3F interval	6 μ s, Nom.
1F interval	8 μ s, Nom.
Pulse width	1 \pm 0.5 μ s

(Table 304) Read data pulse timing

(6) TP6 (File protect sensor)

Test point to observe the output of the file protect detection photo-transistor (shumitt inverter included).

As well as the WRITE PROTECT output signal, TP6 becomes LOW level when a disk with the masked write protect notch (write operation cannot be done) is installed.



(Fig.318) Typical waveform of TP6

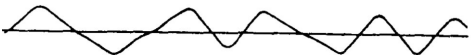
(7) TP7, TP8 (Pre-amplifier)

Test point to observe the read pre-amplifier output signals.

The pre-amplifier has two outputs of the order of several dozen to several hundred mVp-p, and they differ in phase by 180° (opposite phase). Both outputs are observed at TP7 and TP8 respectively.

For an accurate observation of the read waveforms, use two channels of an oscilloscope with one channel set to Invert mode and Add mode of both channels. Use G (0V) test point for the oscilloscope ground.

TP7 and TP8 are used for checking various characteristics of the read/write head and also for the check and adjustment of the head seek mechanism such as track alignment.

TP7, TP8
(Pre-amp.)  5V, approx.

(Fig.319) Typical waveform of TP7 and TP8

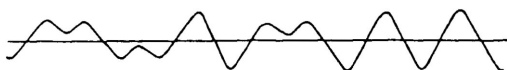
(8) TP9, TP10 (Differentiation amplifier)

Test points to observe the differentiation amplifier output signals. Like the pre-amplifier, the differentiation amplifier also has two outputs of the order of several hundred mVp-p to several Vp-p which differ in phase by 180°. Both outputs are observed at TP9 and TP10 respectively.

For an accurate observation of the waveforms, use two channels of the oscilloscope with one channel set to Invert mode and Add mode of both channels.

Use G (0V) test point for the oscilloscope ground.

TP9 and TP10 are used for checking the total operation of the read/write head and the read amplifier and for the check and adjustment of the head seek mechanism such as track alignment.

TP9, TP10
(Differentiation
amp.)  5V, approx.

(Fig.320) Typical waveform of TP9 and TP10

(9) TP G (0V) -- PCBA MFD control, PCBA read write amp.

TP G is equipped respectively for two test point blocks (TP1 ~ 6 and TP7 ~ 10). They are used as the ground terminals for measurement equipment. Be sure to use a small size clip to obtain a probe ground of the equipment.

3-3-2. Function of Variable Resistors

On the PCBA MFD control and the PCBA DD motor servo, maximum two variable resistors are mounted.

The PCBA MFD control of some PCBA versions and some revision numbers has not the variable resistor R5. Also some types of DD motor Ass'y have not the variable resistor R1 on the PCBA DD motor servo. However, there is interchangeability in function and performance between these PCBAs with the variable resistor and without the variable resistor as far as they have the same parts number (8 digits) and the same version number (2 digits).

The variable resistors are correctly adjusted before the shipment of the FDD and fundamentally they shall not be readjusted except for by a trained technicians.

(1) R1 on PCBA DD motor servo (Disk rotational speed adjustment)

Variable resistor for adjusting the rotational speed of the disk.

It is adjusted so that the index pulse interval at TP4 or at the INDEX output signal is 200msec±4msec (see Fig.315).

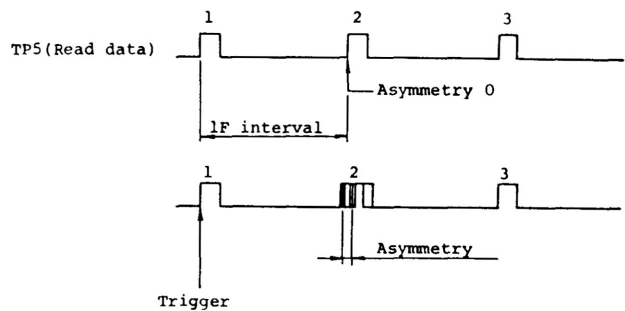
For the DD motor Ass'y without the variable resistor R1, the rotation speed of the motor is fixed by the ceramic oscillator in the servo circuit and no adjustment is required.

(2) R5 on PCBA MFD control (Read data asymmetry adjustment)

Variable resistor for adjusting the asymmetry of the read data pulse. Some PCBAs have this variable resistor and others have fixed resistor instead of it.

For a PCBA with the variable resistor, R5, write 1F data and observe the pulse intervals at TP5 or at the READ DATA output signal during read operation. Then adjust the variable resistor so that the read data asymmetry in Fig.321 takes the minimum value. For a double sided FDD, repeat this operation alternately for side 0 and side 1 heads to

obtain the minimum asymmetry for both sides.



(Fig.321) Read data asymmetry

SECTION 4

MAINTENANCE

4-1. GENERAL

4-1-1. Periodic Maintenance

The FDD is designed to be free from periodic maintenance such as replacement of parts, grease-up, etc. when it is operated at a normal operation duty.

However, cleaning of the magnetic head using a cleaning disk is recommended since it is effective to improve the reliability of the data. If some of the parts in the FDD are operated at a specially heavy duty condition, or if the FDD is operated over 5 years, it is recommended to replace the wear parts according to Table 403.

Periodic maintenance items	Recommended cycle	Required time	Referred items
Cleaning of magnetic head	Refer to 4-3-1 and 4-3-2	5 min.	4-3-1
Replacement of wear parts	Refer to 4-1-3 and 4-5.		

(Table 401) Periodic maintenance items

4-1-2. Check and Adjustment

Table 402 shows all of the check and adjustment items.

Following items do not require periodic maintenance. Check and adjustment should be done when required during replacement of the maintenance parts or during trouble shooting referring to items 4-2 and 4-3.

The numbered procedure in Table 402 shows a typical procedure of the general check and adjustment all over the FDD.

Steps	Check and adjustment items	Required time	Referred items
1	Adjustment of collet shaft plate	5 minutes	4-4-1
2	Adjustment of front lever position	5 minutes	4-4-2
3	Check and adjustment of disk pad lever (bail) (double sided only)	5 minutes	4-4-3
4	Check of file protect sensor	5 minutes	4-4-4
5	Check and adjustment of disk rotation speed	5 minutes	4-4-5
6	Check and adjustment of head touch	5 minutes	4-4-6
7	Check and adjustment of asymmetry	5 minutes	4-4-7
8	Check of read level	5 minutes	4-4-8
9	Check of resolution	5 minutes	4-4-9
10	Check and adjustment of track alignment	10 minutes	4-4-10
11	Check and adjustment of track 00 sensor	5 minutes	4-4-11
12	Check and adjustment of track 00 stopper	5 minutes	4-4-12
13	Check and adjustment of index burst timing	5 minutes	4-4-13

(Table 402) Check and adjustment items

4-1-3. Maintenance Parts Replacement

It is recommended to replace the wear parts periodically if the FDD is operated at a specially heavy duty condition or if it is operated over five years. Periodic replacement is not required for the parts if the FDD is operated at a normal operation duty.

Table 403 shows all of the maintenance parts. Replace the wear parts according to the recommended replacement cycle. Periodic replacement is not required for parts without a recommended replacement cycle.

The replacement of the parts should be done according to each referred item in Table 403.

Notes for Table 403:

- (1) Since the parts number versions of PCBA MFD control (C) vary depending on some factors such as signal interface condition, be sure to confirm the version by checking the name plate on the actual printed circuit board.
- (2) The head carriage Ass'y are used always in pair with two guide shafts. The head carriage Ass'y represented by listed parts number in Table 403 includes these guide shafts which parts number is different from that of a head carriage Ass'y itself without these guide shafts.
- (3) The listed parts numbers of the front bezel Ass'y and front lever Ass'y are those of standard color (black). For designating other color, use the corresponding parts number.
- (4) Periodic replacement is not required for parts without a recommended replacement cycle. Replace the parts when required such as during repair.
- (5) If two recommended cycles are listed, the cycle which the parts reach first should have priority.

- (6) The required time for replacement includes the time for basic check and adjustment after the replacement.
- (7) Order the maintenance parts using the parts number.

(Table 403-1) FD-54A (Single sided, 48tpi) Maintenance parts list

Maintenance parts			Replacement		
Parts name	Description	Parts No.	Replacement cycle	Required time	Referred items
Head carriage Ass'y (C) (For spare parts)	Note (2)	17966930-00	7,000 head load & motor on hrs. or 5×10^6 seeks	45 min.	4-5-1
Stepping motor Ass'y (C)		14733730-00	5×10^6 seeks	30 min.	4-5-2
Steel belt (C)		16792300-00	Replace with stepping motor Ass'y	-	4-5-2
DD motor Ass'y (C) (Spindle motor)		14733780-00	20,000 motor on hrs.	20 min.	4-5-3
Collet Ass'y (C)		17966923-00	3×10^5 clamps	15 min.	4-5-4
PCBA T00 sensor		15532004-00	-	10 min.	4-5-5
PCBA MFD control (C)	Note (1)	15532006-XX	-	30 min.	4-5-6
Front OPT Ass'y (C)		15090730-00	-	15 min.	4-5-7
Front bezel Ass'y	Note (3)	17966807-00	-	10 min.	4-5-9
Front lever Ass'y (C)	Note (3)	17966924-00	-	5 min.	4-5-10
Pad (Head pad)		16786634-01	2,500 head load & motor on hrs.	10 min.	4-5-8
Clamp cam Ass'y (C)		17966929-00	1.5×10^5 clamps	10 min.	
Eject Ass'y (C)	Option	17966926-00	1.5×10^5 clamps	10 min.	

(Table 403-2) FD-54B (Double sided, 48tpi) Maintenance parts list

Maintenance parts			Replacement		
Parts name	Description	Parts No.	Replacement cycle	Required time	Referred items
Head carriage Ass'y (C) (For spare parts)	Note (2)	17966928-00	7,000 head load & motor on hrs. or 5×10^6 seeks	45 min.	4-5-1
Stepping motor Ass'y (C)		14733730-00	5×10^6 seeks	30 min.	4-5-2
Steel belt		16792300-00	Replace with stepping motor Ass'y	-	4-5-2
DD motor Ass'y (C) (Spindle motor)		14733780-00	20,000 motor on hrs.	20 min.	4-5-3
Collet Ass'y (C)		17966923-00	3×10^5 clamps	15 min.	4-5-4
PCBA T00 sensor		15532004-00	-	10 min.	4-5-5
PCBA MFD control (C)	Note (1)	15532006-XX	-	30 min.	4-5-6
Front OPT Ass'y		15090730-00	-	15 min.	4-5-7
Front bezel Ass'y	Note (3)	17966807-00	-	10 min.	4-5-9
Front lever Ass'y (C)	Note (3)	17966924-00	-	5 min.	4-5-10
CSS Ass'y		17966927-00	3×10 clamps	10 min.	4-5-11
Clamp cam Ass'y (C)		17966929-00	1.5×10^5 clamps	10 min.	
Eject Ass'y (C)	Option	17966926-00	1.5×10^5 clamps	10 min.	

4-1-4. Maintenance Jigs and Tools

The following are the jigs and tools required for adequate maintenance of the FDD.

(1) Equipment

(A) When Simulator KA (off-line exerciser for FD-54, abbreviated to SKA) is used:

(a) SKA

The following accessories are necessary for operating the SKA (the accessories are supplied with the SKA).

- i) SKA/FDD interface cable (-00 type)
- ii) Check cable #1 (for observation of control signals)
- iii) Check cable #2 (for observation of read amp. output signals)
- iv) SKA/FDD power cable

(b) Oscilloscope (two channels)

(c) DC power supply (+12V, 1.2A and +5V, 2A) or SKA power supply.

The following accessory is required for the power supply (The accessory is supplied with the SKA power supply).

- i) Power cable (4P)

(d) Thermometer and hygrometer

(B) When SKA is not used:

(a) FDD controller and DC power supply (user's system)

(b) Oscilloscope (two channels)

(c) Frequency counter

- (d) Digital volt meter
- (e) DC clip-on ammeter
- (f) Thermometer and hygrometer

(2) Tools

- (a) Cross-point screwdrivers, M2.6 and M3
- (b) Common screwdrivers, small size and medium size
- (c) Hexagon wrench key, 1.5mm
- (d) A pair of tweezers
- (e) Round nose pliers
- (f) Cutting pliers
- (g) Solder and soldering iron
- (h) Hexagon screwdriver, M3

(3) Special jigs

- (a) MAX media jig (Jig D, P/N 17890746-01)

(4) Disks

- (a) Work disk (commercially available disk)
- (b) Cleaning disk (commercially available cleaning disk)
 - i) Single sided type
 - ii) Double sided type
- (c) Level disk (P/N 14900015-00)
- (d) Alignment disk
 - i) Single sided, 48tpi type (P/N 14900016-20)
 - ii) Double sided, 48tpi type (P/N 14900016-21)

(5) Other articles used during maintenance

- (a) Absolute alcohol (Ethanol)
- (b) Cotton swab or gauze
- (c) Locking paint (3 Bond, 1401B)
- (d) Binding agent (Sumitomo Chemical, Cyano-bond SF, Red)
- (e) Screws and washers (Refer to item 5-2-2)
- (f) Lubricant (Kantoh Kasei, 946P)

Note: Be sure to use well calibrated equipment and disks.

4-2. PRECAUTIONS

4-2-1. Torque Applied to Screws and Locking Paint

The following torque should be applied to screws, unless otherwise specified.

Size of screws	Torque
M2	2kg.cm
M2.6	4.5kg.cm
M3	6kg.cm
M3 set screw	4.5kg.cm

(Table 404) Torque applied to screws

For tightening or loosening M3 set screws for adjustment and parts replacement, the following procedure should be followed.

- (1) For adjustment, remove out the set screw and also remove the locking paint which had applied to the screw itself and around it.
- (2) Apply fresh locking paint to the first three threads of the set screw with some narrow object such as a pair of tweezers.
- (3) Adjust or tighten the set screw with the specified torque.

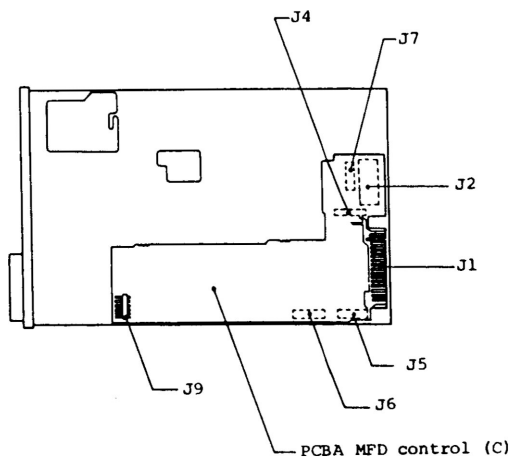
For other screws than set screws, apply a drop of locking paint to the designated points after tightening them.

4-2-2. Handling of Connectors

(1) Types of connectors

The following connectors are used for the FDD.

- (a) J1: Interface connector
- (b) J2: Power connector
- (c) J4: Track 00 connector
- (d) J5: Front OPT connector
- (e) J6: Stepping motor connector
- (f) J7: Spindle motor (DD motor Ass'y) connector
- (g) J9: Head connector



(Fig.401) Types of connectors

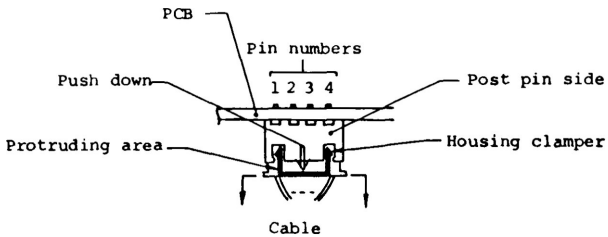
(2) Connection and disconnection of the connectors

Be sure to turn the power off before connecting and disconnecting the connectors. Connection or disconnection should be done straightly and correctly without applying excessive force to the cables and the post pins.

(3) Precautions for handling the white connectors (J4, J5, J6, J7)

(a) Disconnection of the connector

As shown in Fig.402, carefully push down the edges of the protruding area of the connector little by little with the finger nails or with a screwdriver.



(Fig.402) Disconnection of white connector

(b) Connection of the connector

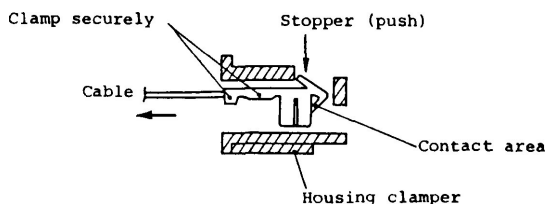
Push the connector into the post pin under the PCBA matching the housing clammer to the groove.

(c) Removal of the pin (for reference)

Refer to Fig.403.

Depressing the stopper of the pin lightly with a narrow object such

as a pair of tweezers, pull the cable in the direction indicated by the arrow.



(Fig.403) Sectional view of white connectors

(d) Insertion of the pin (for reference)

Before insertion, check the following three points.

- i) Confirm that the sheath and the core of the cable are securely clamped.
- ii) Confirm that the stopper is lifted as in Fig.403 and it inhibits accidental removal.
- iii) No tarnish or contamination should be on the contact area of the pin or the PCB side post pin. If there is, remove it.

Contact failure may happen if any of these three points is not satisfied.

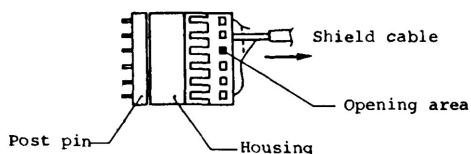
When you insert the pin, it should be so inserted that the stopper faces the opening side of the housing.

After the insertion, check the connection by pulling the cable lightly.

(4) Precautions for handling the black connector (J9)

(a) Disconnection of the connector

Pull out J9 connector straightly by inserting the narrow points of



(Fig.404) Disconnection of J9

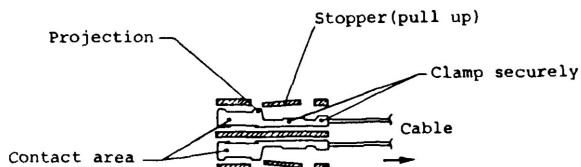
the tweezers into the opening area at the back side of the housing as shown in Fig.404. Be careful not to pull the fine wires.

(b) Connection of the connector

Make the polarizing key position of the housing correspond with the lack of the post pin, and push the housing carefully with the fingers.

(c) Removal of the pin

Lifting up the stopper of the housing with a narrow object such as cutter knife, pull the cable with a pair of tweezers in the direction indicated by the arrow. Refer to Fig.405.



(Fig.405) Sectional view of black connector

(d) Insertion of the pin

Before insertion, check the pins according to item (3)-(d), i) through iii).

When you insert the pin, it should be so inserted that the projection side faces the stopper of the housing. After the insertion, pull the cable with a pair of tweezers softly in order to confirm whether it is securely connected.

4-2-3. Head Cable Treatment

Head cable should be arranged correctly by the clampers with appropriate margin in length so that the head carriage can move on the guide shafts smoothly.

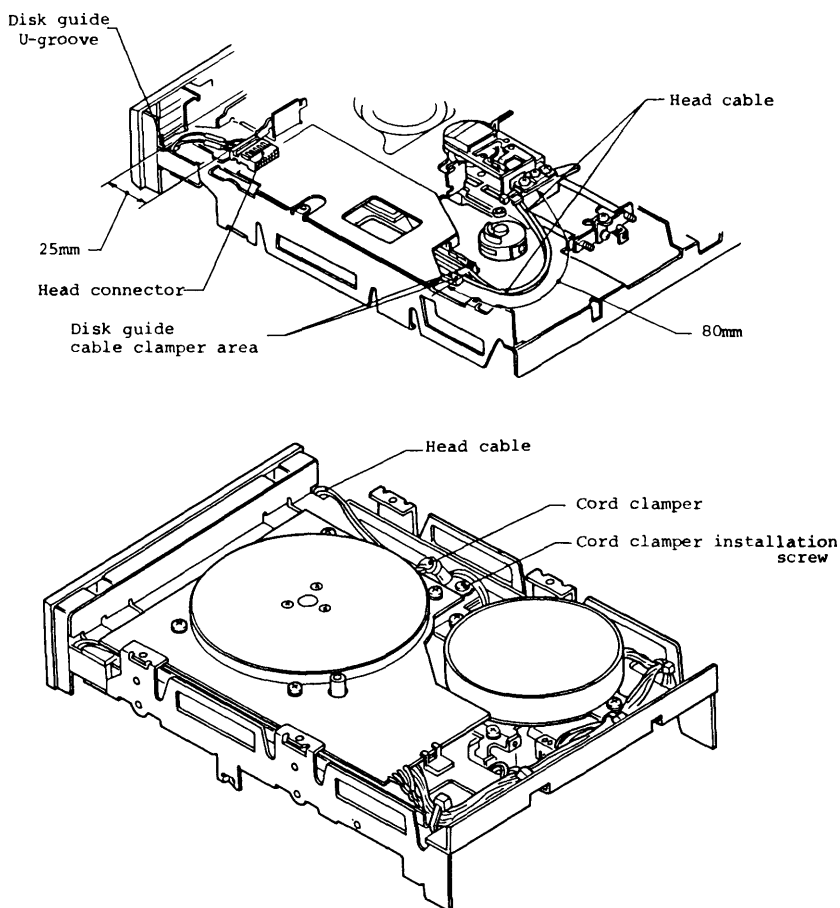
- (1) Clamp the head cable with cable clamber area of the disk guide so that the cable has appropriate looseness when the head carriage is set to track 00 (rear end of the moving area). The appropriate length of the head cable from the head carriage output to the cable clamber is approximately 80mm (see Fig.406).

Also confirm that the head cable do not touch the tail end of the steel belt.

- (2) Thread the head cable through the hole of the disk guide and arrange it under the chassis to hold with a cord clamber. There should be no excessive looseness of the cable between the cable clamber and the cord clamber which may cause undesirable contact of the cable to the disk when inserted. The cable length between the cable clamber and the cord clamber is 65mm, approx.

- (3) Remove the front bezel according to item 4-5-9. Thread the head cable along the U-groove of the disk guide and pull it up on the chassis to connect it to the head connector, J9. The cable length between the U-groove of the disk guide and the head connector is 25mm, approx. (see Fig.406).

If the head cable is too long, turn the cable around the cord clamber under the chassis.



Note: The figure uses the double sided FDD. The same cable arrangement is applied to the single sided FDD.

(Fig.406) Head cable arrangement

4-2-4. Initial Setting of SKA

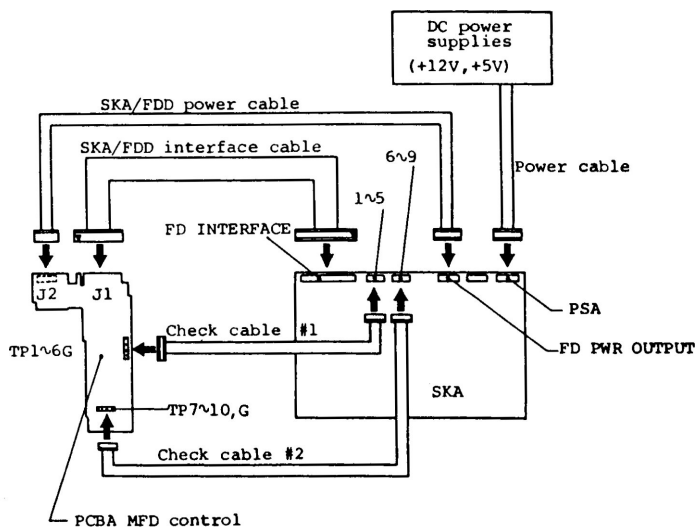
Following initial setting is required for operating the SKA.

Note: Use matched SKA for the FD-54 series. The SKA for the FD-54 has 430 Ω terminator at the interface receiver which is different from that conventionally used 150 Ω terminator for the FD-55 series. As to the other performance, SKA for the FD-54 and for the FD-55 are the same.

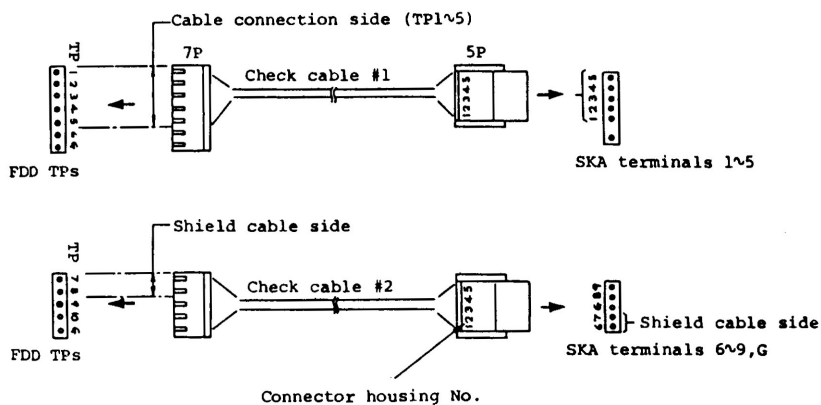
The SKA for the FD-54 series can also be used in the FD-55 series.

4-2-4-1. Cable connection and setting of power supply voltage

- (1) Set the output voltage of DC power supply to +12V and +5V, approx.
- (2) Turn the DC power off and connect the power cable to the PSA (SKA PWR) connector of the SKA.
- (3) Set the FD PWR switch of the SKA to the OFF position.
- (4) Connect the FD PWR OUTPUT of the SKA and the FDD with the SKA/FDD power cable.
- (5) Connect the SKA/FDD interface cable. Pay attention to the identification mark of the connector (V) so that it locates at the pin 1 and 2 side.
- (6) Connect the check cable #1 (Flat cable, 7P connector at the FDD side and 5P connector at the SKA side) between the terminals 1 ~ 5 of the SKA and TP1 ~ TP6, G of the FDD. For the SKA side, be sure to match the pin numbers of the connector housing and the terminal numbers of the connector. For the FDD, cable connection side pins should be connected to the TP1 ~ 5 side.
- (7) Connect the check cable #2 (shield cable is used partially, 5P connectors



(Fig.407) Connection of SKA cable



(Fig.408) Connection of check cable

at both ends) between the terminals 6 ~ 9, G of the SKA and TP7 ~ TP10, G of the FDD. Be sure to match the pin numbers of the connector housing and the terminal numbers of the SKA as in Fig.408.

The shield cable side is TP7, 8, and terminals 6, 7 of the SKA.

- (8) Turn the DC power on. Set the PD PWR switch of the SKA to the PSA side.
- (9) Key in "CB". (+5V VOLTAGE)
- (10) Adjust the DC power voltage so that the DATA indicator of the SKA
□□□ (V) indicates the value within the range of $5.00 \pm 0.1V$.
- (11) Key in "F". (STOP)
- (12) Key in "CC". (+12V VOLTAGE)
- (13) Adjust the DC power voltage so that the DATA indicator of the SKA
□□□ (V) indicates the value within the range of $12.00 \pm 0.24V$.
- (14) Key in "F". (STOP)

Note: The above items (1), (2), (9) ~ (14) may be omitted for replacement of the FDD or a temporary FDD power off. Remain DC power on and control the FDD power by the SKA PWR switch.

4-2-4-2. Setting of the maximum track number

Before the check and the adjustment of the FDD, set the maximum track number according to the following instructions.

Usually the maximum track number is set to 79 at the initial setting, change it to 39.

The setting will be maintained until the main DC power (for SKA) is turned off, or until the RESET switch of the SKA is depressed. Since the FD PWR switch is independent of this setting, it is convenient to maintain the main DC power on for the successive operations.

- (1) Key in "CF" (SET TMAX)
- (2) The maximum track number set at that time is indicated with the latter two digits of the DATA indicator (track).

Note: If there is no change in the maximum track number in item (2), depress "F" key.

- (3) Key in the maximum track number (39) of the FDD in two digits of decimal notation.

e.g. MAXIMUM TRACK NUMBER 39 (40 cylinders): CF 39

4-2-4-3. Setting of step rate and settling time

Generally, the step rate and the settling time of the FDD is the same as the initial value of the SKA (step rate: 6msec, settling time: 15msec) and no initial setting is required.

For the confirmation or the change of the initial setting, execute according to the following procedure. Once the setting is done, it will be maintained until the main DC power (for SKA) is turned off, or until the RESET switch of the SKA is depressed.

(1) Key in "DB". (SET STEP RATE)

(2) Step rate set at that time is indicated by 0.1msec scale on the DATA indicator (ms).

e.g. DATA indicator indicates 6.0msec.

(3) Key in a new step rate down to one decimal place (unit: msec).

Note: If there is no change in step rate in item (2), omit item (3) and forward to item (4).

(4) Key in "F". (STOP -- Setting of the step rate completes.)

(5) Settling time at that time is indicated by 0.1msec scale on the DATA indicator (ms).

e.g. DATA indicator indicates 15.0msec.

(6) Key in new settling time down to one decimal place (unit: msec).

Note: If there is no change in settling time in item (5), omit item (6) and depress "F" key to complete the operation.

(7) Depress "F" key. (STOP -- Setting of the settling time completes.)

e.g. STEP RATE 6msec, SETTLING TIME 15msec : DB 30 F 150 F

4-2-4-4. Level disk calibration

Setting of the following calibration value is required for accurate measurement before the check of the read level or the resolution.

Use a level disk with a calibration value (100% center) written on the label. The setting will be maintained until the main DC power (for SKA) is turned off or until the RESET switch of the SKA is depressed.

If the calibration value is the same as the initial value (100%) of the SKA, the initial setting of the following is not required.

(1) Innermost track read level

(a) Key in "D0". (CALIBRATION READ LEVEL)

(b) Calibration value set at that time is indicated in the latter three digits of the DATA indicator (%).

(c) Key in a new calibration value written on the level disk label (three digits, Max.)

(d) Key in "F". (STOP)

Note: If there is no calibration change in item (b), omit item (c) and depress "F" key.

(2) Innermost track resolution

(a) Key in "D1". (CALIBRATION RESOLUTION)

(b) Calibration value set at that time is indicated in the latter three digits of the DATA indicator (%).

(c) Key in a new calibration value written on the level disk label (three digits, Max.)

(d) Key in "F". (STOP)

Note: If there is no calibration change in item (b), omit item (c) and depress "F" key.

e.g. READ LEVEL 103%, RESOLUTION 96%: D0 103 F, D1 96 F

4-2-4-5. Alignment disk calibration

Setting of the following calibration value is required for accurate measurement before the check and adjustment of the track alignment. Use a correctly calibrated (0% center) alignment disk with a calibration value written on the label. The setting will be maintained until the main DC power (for SKA) is turned off or until the RESET switch of the SKA is depressed.

If the calibration value is the same as the initial value (0%) of the SKA, the initial setting of the following is not required.

(1) SIDE 0 alignment

(a) Key in "E0". (CALIBRATION SIDE 0 ALIGNMENT)

(b) The calibration value set at the time is indicated in the latter two digits of the DATA indicator (%), and the polarity is indicated in the initial digit. If a "0" is indicated, the polarity is positive. Polarity indication: plus \nearrow , minus -

(c) Key in a polarity and a new calibration value (two digits, Max.) written on the alignment disk label.

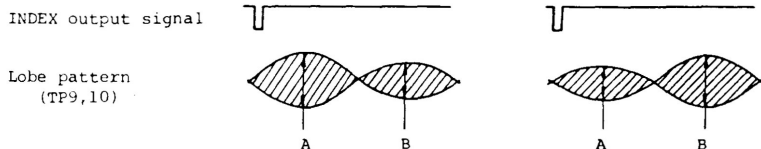
Designation of polarity: Depress "B" key only for minus designation.
(No designation is required for plus).

(d) Key in "F". (STOP)

(2) Side 1 alignment (Double sided only)

(a) Key in "E1". (CALIBRATION SIDE 1 ALIGNMENT)

(b) The same as in item (1)-(b) ~ (d).



Notes: 1. The lobe pattern ratio is calibrated in the SKA according to the following expression.

$$\text{Lobe pattern ratio after calibration} = \frac{A-B}{\text{Larger one of A \& B}} \times 100 - \text{Calibration value}$$

2. If the calculated value with the above expression is positive, the polarity is plus, while the polarity is minus when the value is negative.

(Fig.409) Calibration of alignment lobe pattern

(3) Index burst timing

(a) Key in "E5". (CALIBRATION INDEX TIMING)

(b) The calibration value set at that time is indicated in the latter three digits of the DATA indicator (μs), and the polarity is indicated in the initial digit. (Refer to item (1)-(b)).

If a "0" is indicated, the polarity is positive.

(c) Key in a polarity and a new calibration value (three digits, Max.) written on the alignment disk label. Refer to item (1)-(c) for the polarity designation.

(d) Key in "F". (STOP)

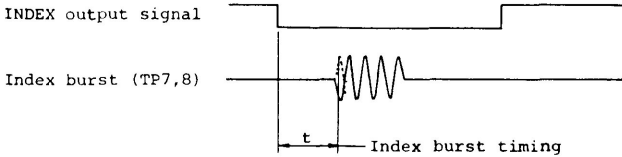
Note: If there is no change in the calibration value in item (b), omit

item (c) and depress "F" key.

e.g. Double sided FDD, SIDE 0 ALIGNMENT +3%, SIDE 1 ALIGNMENT -5%,

INDEX TIMING -25 μ s:

E0 3 F, E1 B 5 F, E5 B 25 F



Notes: 1. The index timing is calibrated in the SKA according to the following expression.

Calibrated timing = t - calibration value (μ s)

2. If the calculated value with the above expression is positive, the polarity is plus, while the polarity is minus when the value is negative.

(Fig.410) Calibration of index burst timing

4-2-4-6. Humidity setting

For the check and adjustment of the track alignment using an alignment disk, set the environmental relative humidity to the SKA in order to improve the precision of measurement.

This setting is important when the relative humidity is considerably different from 50%.

The initial setting of the following is not required if the relative humidity is the same as the initial value (50%) of the SKA.

- (1) Key in "E2". (CALIBRATION RH ALIGNMENT)
- (2) The relative humidity set at that time is indicated in the latter two digits of the DATA indicator (%).
- (3) Input the relative humidity percentage in the measurement environment (two digits, Max.).

e.g. RELATIVE HUMIDITY 58%: E2 58

4-2-4-7. Setting of SKA gain

For this FDD, the SKA gain should be maintained at the initial state (H GAIN indicator is off). If the H GAIN indicator turns on by an erroneous key-in, turn it off by keying in "DD".

4-2-5. Others

(1) Total error test

In the check and adjustment in item 4-4, read/write error test is not included. After the adjustment or the replacement of the maintenance parts, it is recommended to perform a data error test by connecting the FDD to the user's system or the TEAC simulator KB. The window margin test is the most recommended item.

(2) Setting of FDD straps

It is required to confirm before the operation that the straps (short bars) on the PCBA MFD control are at the appropriate position for the system to be used in the check and adjustment.

When the SKA is used, depress a key which number is the same as the on-state short bar among DS0 ~ 3 straps of the FDD and confirm that the indicator is on before various key operations.

If the IU short bar is on, you can turn on the front bezel indicator by "A" (IN USE) key of the SKA.

Notes: 1. For simplifying the explanation, following shows only the case when the DS0 short bar is on.

2. If the strap position of the FDD is changed from the initial setting at the system installation, be sure to change it back to the initial position after the maintenance operations.

(3) Connection of the probe ground

Connect the probe ground of the equipment as follows:

(a) For the observation at the test points (TP) 7 ~ 10:

Connect the probe ground to the G test point (OV) on the PCBA MFD control.

(b) For the observation at the other test point:

Connect the probe ground to the G test point (0V) on the PCBA MFD control. Or GND (0V) terminal of the system power supply unit, or the SKA GND terminal may be used.

(c) For the observation of the SKA test point:

Connect the probe ground to the SKA GND terminal.

Note: When you use the SKA, almost all checks including the read amp.

output at TP7 ~ TP10 of the FDD will be done automatically through the check cables #1 and #2 and interface cable. Also these signals can be observed by an oscilloscope using the test points on the SKA.

(4) Maintenance environment

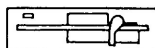
Maintenance of the FDD should be done on a clean bench at room temperature and humidity. It is recommended to execute the check and adjustment of the track alignment after leaving the FDD for at least 2 hours at room temperature and humidity. The magnetic head, disk, steel belt, etc. might suffer from dust and dirt if the maintenance is not undertaken in a clean environment.

(5) Orientation of the FDD

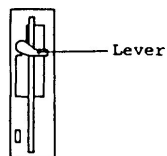
Position the FDD as shown in Fig.411 unless otherwise specified. Horizontal and vertical orientations with lever side up should be used.

(6) Head load

The FD-54 series have no head load solenoid. They are always in head load condition as far as a disk is inserted and the front lever is closed.



Horizontal setting



Vertical setting

(Fig.411) General orientation of the FDD during maintenance

(7) Work disk

When you use the SKA, use a soft sector disk.

4-3. PREVENTIVE MAINTENANCE

4-3-1. Cleaning of Magnetic Head by Cleaning Disk

When you use the FDD in dusty environment, it is recommended to clean the magnetic head surface periodically (e.g. once a month) with a commercially available cleaning disk. Especially for a double sided FDD, it is difficult to clean the head surface, be sure to use the cleaning disk.

For typical usage under typical environmental condition, the cleaning is recommended when data errors often occur.

(A) Equipment

- (1) Cleaning disk
- (2) SKA or user's system

(B) Cleaning procedure

- (1) General method

- (a) Start the spindle motor and install an appropriate cleaning disk.

Notes: 1. Do not use a damaged cleaning disk on the surface.

2. For a single sided FDD, be sure to install a single sided cleaning disk. The cleaning surface of the disk should be in contact with the head surface.

When the FDD is placed horizontally, the magnetic head is located down and it faces the back side of the disk.

If a double sided cleaning disk is installed in a single sided FDD, it may damage the head pad.

3. For a double sided FDD, a double sided cleaning disk should be used. Side 0 (lower side) and side 1 (upper side) heads are cleaned simultaneously.

- (b) Clean the head at a suitable track position for 10 ~ 30 seconds, approx. In order to avoid the concentration on a specific track, it is a good way to make the head move between track 00 and the innermost track during cleaning.

Note: The most appropriate cleaning time is different for each type of cleaning disk used.

Excessively long cleaning time is not effective but has possibility to accelerate the head wear.

- (c) Remove the cleaning disk.

(2) SKA method

- (a) Connect the SKA referring to item 4-2-4 and set the FD PWR switch to the PSA side.
- (b) Start the spindle motor by key "5". (MON indicator turns on).
- (c) Execute drive select by key "0". (DS0 indicator turns on).
- (d) Key in "C0" and confirm that the TRACK indication of the SKA becomes "00". (RECALIBRATE)
- (e) Install an appropriate cleaning disk. See item (1)-(a), "Notes".
- (f) Key in "C6". (SEEK TEST)
- (g) After 10 ~ 30 seconds, depress "F" key.
- (h) Eject the cleaning disk.

4-3-2. Direct Cleaning (Single sided FDD only)

This cleaning method is applied only to a single sided FDD.

If this method is applied to a double sided FDD, gimballed mechanism of the head might be damaged.

If visible dirt is on the head surface when the head pad arm is lifted up manually during maintenance, perform direct cleaning as follows:

(A) Equipment

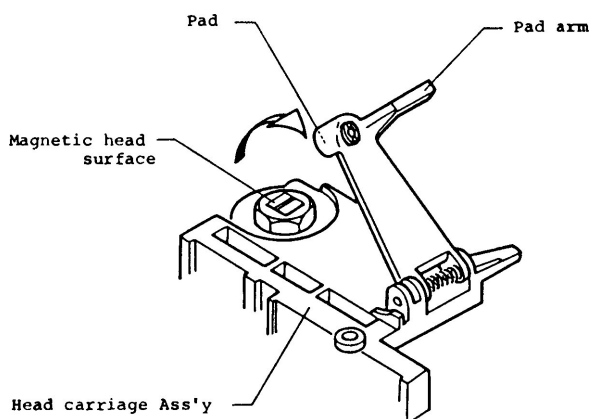
- (1) Absolute alcohol (Ethanol)
- (2) Cotton swab or gauze

(B) Cleaning procedure

- (1) Lightly dampen a cotton swab or a gauze with alcohol.
- (2) Lift up the pad arm (see Fig.412) and clean the head surface carefully with the cotton swab or the gauze.

Note: Do not touch the pad surface.

- (3) Wipe the head surface with clean dry cloth after the evaporation of the alcohol.
- (4) After confirming that the dirt is cleaned off and no fluff is left on the head surface, let the pad arm down carefully.



(Fig.412) Direct cleaning of magnetic head (Single sided only)

4-4. CHECK AND ADJUSTMENT

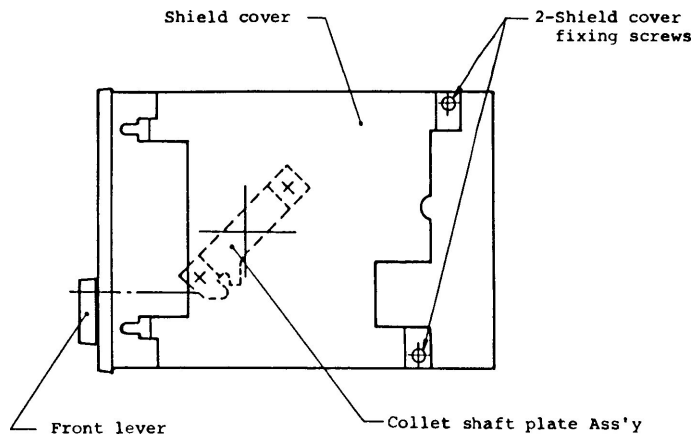
4-4-1. Adjustment of Collet Shaft Plate

(A) Equipment

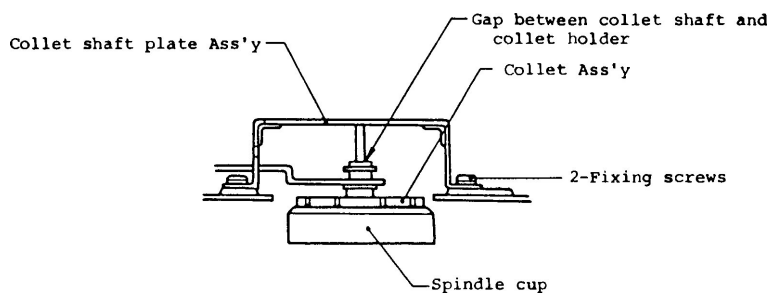
- (1) Cross point screwdriver, M3
- (2) Locking paint

(B) Adjustment procedure

- (1) Remove two fixing screws of the shield cover (see Fig.413) and remove it.
- (2) Loosen two fixing screws of the collet shaft plate Ass'y so that the collet shaft plate can be moved manually without getting out of place.
- (3) Clamp the collet by turning the front lever.
- (4) In this condition, adjust the collet shaft plate and tighten two fixing screws with the specified torque so that the visual distance of the gap between the collet shaft and the hole of the collet holder becomes even (see Fig.414).
- (5) Up and down the collet by turning the front lever and confirm that it does so smoothly without being caught by the spindle cup.
- (6) Apply a drop of locking paint of the fixing screws.
- (7) Install the shield cover in the reverse order of item (1).



(Fig.414) Location of collet shaft plate



(Fig.413) Gap of collet shaft plate

4-4-2. Adjustment of Front Lever Position

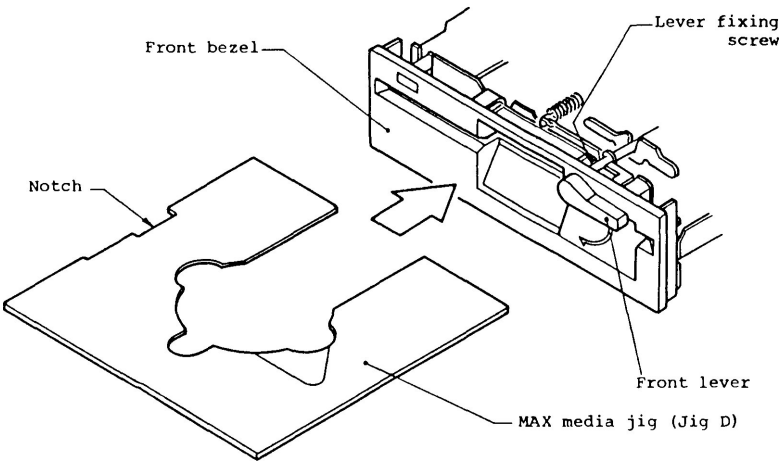
(A) Equipment

- (1) Hexagon wrench key, 1.5mm
- (2) MAX media jig (Jig D)

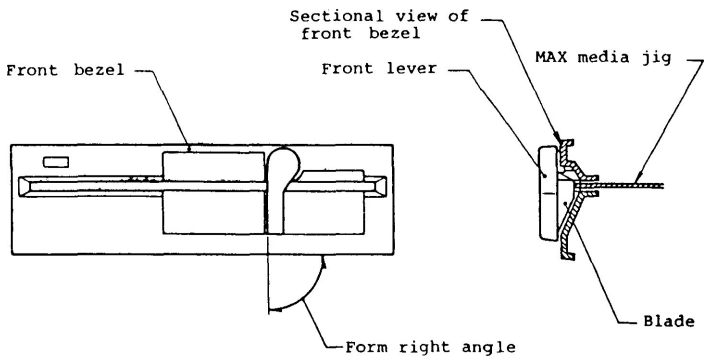
(B) Adjustment procedure

- (1) Turn the front lever to close position and loosen a lever fixing set screw to pull out the lever for 0.5mm, approx.
- (2) Tighten the set screw.
- (3) Turn the front lever to open position and insert the MAX media jig as shown in Fig.415 (the notch side to be left).
- (4) Turn the front lever to close position and loosen the set screw again. Then push the lever against the MAX media jig. Confirm that the pin of the lever shaft goes into the slot of the front lever.
- (5) Position the handle of the front lever forms right angle against the longitudinal side of the front bezel. And tighten the set screw with the specified torque. (See Fig.416).
- (6) Close the front lever and confirm that the blade of the lever does not nip the MAX media jig.
- (7) Open the front lever and remove the jig.

Note: Refer to item 4-2-1 as to handling of the set screws.



(Fig.415) Adjustment of front lever



(Fig.416) Front lever position

4-4-3. Check and Adjustment of Disk Pad Lever (Bail)

This item applies only to the double sided FDDs.

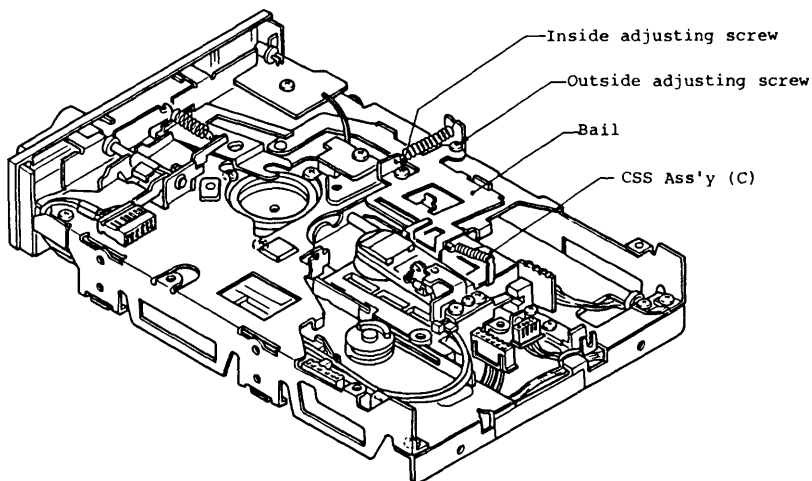
(A) Equipment

- (1) Cross point screwdriver, M2.6
- (2) Binding agent

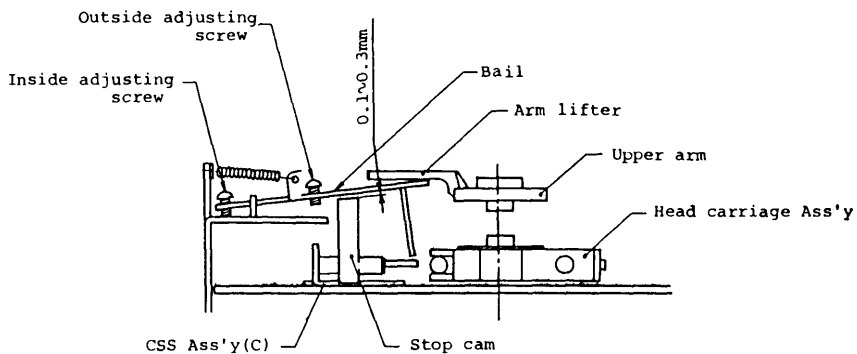
(B) Check and adjustment procedure

- (1) Open the front lever to be able to insert the disk.
- (2) Confirm a little gap (0.1 ~ 0.3mm, approx.) is spaced between the bail and the top of the stop cam of the CSS Ass'y (C). (See Fig.418).
- (3) If the item (2) is not satisfied, turn the outside adjusting screw (see Fig.417) of the bail so that the bail and the top of the stop cam are separated with 0.2mm, approx.
- (4) In the process of inserting a disk slowly, confirm that the disk jacket does not touch the side 0 nor the side 1 head and goes into the FDD smoothly with appropriate space margin.
- (5) Open and close the front lever two or three times to confirm the clampings of the disk are done smoothly.
- (6) In the process of ejecting the disk slowly, confirm that the side 0 and side 1 heads do not catch the head window edge of the disk jacket (opening area of the jacket to make the head be in contact with the disk surface) and that the disk can be drawn out smoothly with appropriate space margin.

- (7) Insert the disk again and close the front lever.
- (8) Confirm that a little gap ($0 \sim 0.5\text{mm}$, approx.) is spaced between the stop cam and the disk jacket without activating the stop cam of the CSS Ass'y when the disk jacket is depressed lightly with a finger from the front bezel side.
- (9) If the item (8) is not satisfied, turn the inside adjusting screw (see Fig. 417) of the bail so that the gap between the disk jacket and the stop cam becomes $0.1 \sim 0.2\text{mm}$, approx.
- (10) Apply binding agent to the two adjusting screw to fix it to the bail.
- (11) Open the front lever to draw out the disk.



(Fig.417) Adjustment of bail



Note: The figure is viewed from the front bezel side.

(Fig.418) Gap of bail and stop cam

4-4-4. Check of File Protect Sensor

(A) Equipment

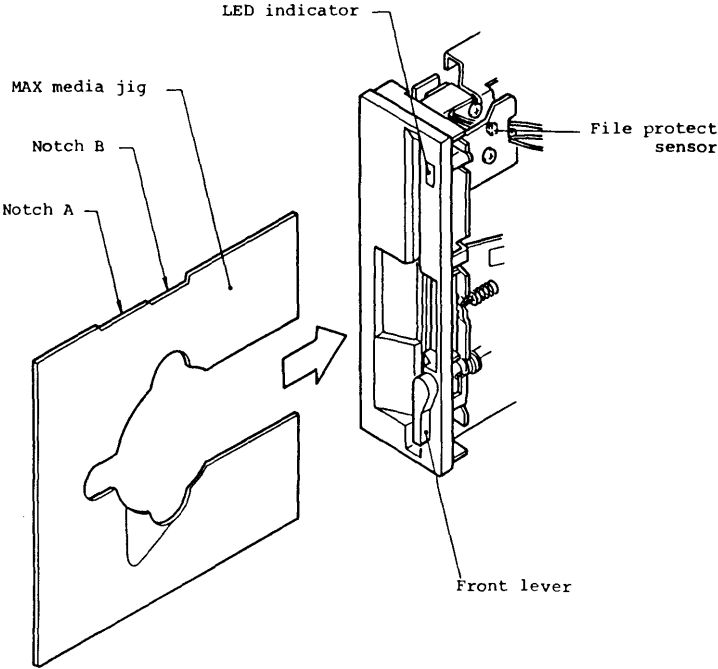
- (1) MAX media jig (Jig D)
- (2) Digital voltmeter (or oscilloscope)
- (3) SKA or user's system

(B) Check procedure

(1) General method

- (a) Place the FDD on the work bench with the LED indicator up and the front lever down. (See Fig.421).
- (b) Connect a digital voltmeter or an oscilloscope (DC range, 1V/div) to TP6 (File protect sensor) on the PCBA MFD control.
- (c) Install the MAX media jig as in Fig.421 and set it so that the notch A area is located on the light pass from the file protect sensor.
- (d) Adjust the orientation of the FDD so that it is not exposed with strong light outside.
- (e) Confirm that the voltage measured at TP6 when power is supplied to the FDD is within the following range.
Notch A position TP6 voltage: 0.5V, Max.
- (f) Pull out the jig a little so that the notch B area is located on the light pass.
- (g) Confirm that the voltage measured at TP6 when power is supplied to the FDD is within the following range.

Notch B position TP6 voltage: 3V, Min.



(Fig.421) Check of file protect sensor

(2) SKA method

- (a) Connect the SKA according to item 4-2-4 and set the FD PWR switch to the PSA side.
- (b) Execute the general method described in item (1)-(a) through (e).
WRROT indicator of the SKA turns on when drive selection is executed by key "0". (DS0 indicator turns on).
- (c) Execute the general method described in item (1)-(f) and -(g).
WRROT indicator of the SKA turns off.

4-4-5. Check and Adjustment of Disk Rotation Speed

This item is only applied to the FDD which has a DD motor Ass'y with the variable resistor R1 for adjusting the rotational speed of the disk on the PCBA DD motor servo. Refer to Fig.311 as to the mounting position of the variable resistor R1.

For the DD motor Ass'y without the variable resistor, the rotation speed is fixed by the ceramic oscillator in the servo circuit and no adjustment is required.

(A) Equipment

- (1) Common screwdriver, small size
- (2) SKA or user's system
- (3) Frequency counter (not required when the SKA is used)
- (4) Work disk (soft sector)

(B) Check and adjustment procedure

(1) General method

- (a) Connect the frequency counter to TP4 (Index) of the PCBA MFD control or to the INDEX interface signal line.
- (b) Start the spindle motor and install a work disk.
- (c) Set the head to track 00.
- (d) Confirm that the pulse interval at TP4 is within the following range.
TP4 pulse interval: $200 \pm 3 \text{ msec}$
- (e) If the value in item (d) is out of the specified range, adjust the variable resistor R1 on the PCBA DD motor servo to obtain the median value in the specified range in item (d).

(2) SKA method

- (a) Connect the SKA referring to item 4-2-4 and set the FD PWR switch to PSA side.
- (b) Start the spindle motor by key "5". (MON indicator turns on).
- (c) Insert a soft sectored work disk.
- (d) Execute drive select by key "0". (DS 0 indicator turns on).
- (e) Key in "C0" and confirm that TRACK indication becomes "00".
(RECALIBRATE)
- (f) Key in "C3". (INDEX PERIOD)
- (g) Confirm that the DATA indicator ☐☐☐☐ (ms) indicates a value within the following range.
INDEX interval: 200.0 ± 3.0 msec
- (h) If the value in item (g) is out of the specified range, adjust the variable resistor R1 on the PCBA DD motor servo to obtain the median value in the specified range in item (g).

4-4-6. Check and Adjustment of Head Touch

Note: The adjustment applies to a single sided FDD only.

(A) Equipment

- (1) Work disk
- (2) Common screwdriver, small size
- (3) SKA or user's system
- (4) Oscilloscope (not required when the SKA is used)
- (5) DC clip on ammeter (not required when the SKA is used)
- (6) Locking paint

(B) Adjustment procedure

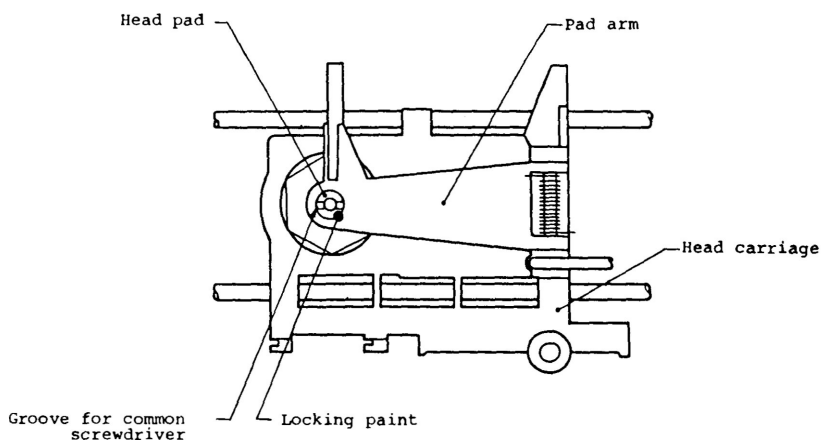
(1) General method

- (a) Connect an oscilloscope to TP9 or TP10 (Differentiation amp.) on the PCBA MFD control.

Oscilloscope range: AC mode, 0.2V

- (b) Start the spindle motor and install a work disk.
- (c) Set the head to the innermost track.
- (d) Repeat the cycle of one write rotation and one read rotation.
Write data should be the fixed pattern of 2F (250KHz of WRITE DATA frequency).
- (e) Write down the average read level measured during the read operation of item (d).

- (f) Execute item (d) and (e) with a slight depression (very slight depression easy to release: 10 ~ 20g) by a finger on the top of the upper head (double sided) or of the pad arm (single sided), and measure the average read level as in item (e).
- (g) Confirm that the read level measured in item (e) is greater than 80% of that in item (f).
- (h) For a double sided FDD, execute items (d) through (g) respectively for the side 0 and the side 1 heads.
- (i) After making the head move to track 00, execute items (d) through (h).
- (j) Head touch adjustment for a single sided FDD:
 - i) At the innermost track, turn the groove on the upper side of the head pad by 30° steps, approx. with a common screwdriver (see Fig.420). At each turning of the groove, execute write and read operations in item (d).
Be sure to take apart the common screwdriver from the head pad during write or read operation.
Note: Be careful not to push the head pad strongly with the common screwdriver. Also do not touch the pad surface to which a disk will be in contact.
 - ii) After turning the pad position around 360°, set the position again to the position where the highest read level was obtained. Then execute items (d) through (g) at the innermost track.
 - iii) Continue the operation until the items (g) and (i) are sufficiently satisfied. Following causes are assumed for the insufficient result in item (g) or (i) after fine adjustment of the pad position.



(Fig.420) Adjustment of head pad position (single sided FDD)

① Inferior head pad:

Replace the pad according to item 4-5-8.

② Inferior disk:

Disk and/or jacket is deformed or damaged. Replace the work disk with a new one.

③ Inferior head:

Replace the head carriage Ass'y according to item 4-5-1.

- iv) Remove the work disk and apply a drop of locking paint around the rotating area of the head pad. Be careful not to smear the groove for common screwdriver with the locking paint.

(k) Possible causes for the insufficient head touch in a double sided FDD:

Following causes are assumed for the insufficient result in items (g) through (i) on a double sided FDD.

i) Inferior disk:

Disk and/or jacket is deformed or damaged. Replace the work disk with a new one.

• ii) Inferior head flexure:

Because of the failed performance of the bail or the CSS Ass'y in item 4-4-3, the flexure on which the head piece is located may be deformed. Remove the disk. Then open and close the front lever slowly to observe the gap between the side 0 and the side 1 heads from the front bezel. If the two head surfaces are not in parallel each other, it is considered to be the deformation.

Replace the head carriage Ass'y according to item 4-5-1.

(2) SKA method

- (a) Connect the SKA according to item 4-2-4 and set the FD PWR switch to the PSA side.
- (b) Start the spindle motor by key "5". (MON indicator turns on).
Install a work disk and execute drive select by key "0". (DS0 indicator turns on).
- (c) Key in "C0" and confirm that the TRACK indicator becomes "00".
(RECALIBRATE)
- (d) Key in "C1" (SEEK TMAX)
- (e) Key in "D3". (WRITE/READ LEVEL PRE 2F)
- (f) Write 2F and read operations are repeated.
The DATA indicator (mV) indicates the average read level of TP7 and TP8 (Pre-amp.) after each cycle of operation (one rotation of write and one rotation of read) is finished.
- (g) Observe the DATA indicator (mV) with a slight depression (very slight depression easy to release: 10 ~ 20g) by a finger on the top of the upper head (double sided) or of the pad arm (single sided).
- (h) Confirm that the read level measured in item (f) is more than 80% of that in item (g).
- (i) For a double sided FDD, depress "F" key to stop and then depress "4" key to execute items (e) through (h) for the side 0 and the side 1 heads respectively. The side is changed alternately by a depression of "4" key. If side 1 is selected, SIDE 1 indicator of the SKA turns on.

(j) Key in "CO" (RECALIBRATE) and execute items (e) through (i) in the similar way.

(k) Head touch adjustment for a single sided FDD:

Refer to item (j) of "General method".

(L) Possible causes for the inferior head touch in a double sided FDD:

Refer to item (k) of "General method".

4-4-7. Check and Adjustment of Asymmetry

(A) Equipment

- (1) Work disk
- (2) SKA or user's system
- (3) Oscilloscope

(B) Check and adjustment procedure

(1) General method

- (a) Connect an oscilloscope to TP5 (Read data) on the PCBA MFD control or to the READ DATA interface line.

Oscilloscope range : DC mode, 2V, 1 μ sec

- (b) Start the spindle motor and install a work disk.

- (c) Set the head to the innermost track.

- (d) Execute 1F write operation (125KHz of WRITE DATA frequency).

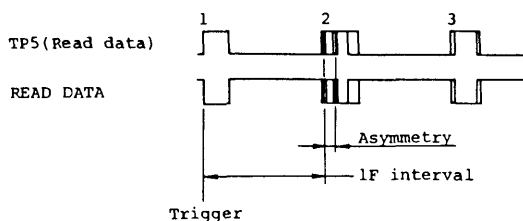
- (e) Measure the asymmetry referring to Fig.421.

Note: Oscilloscope should be so set that three read data pulses can be observed. Asymmetry width should be measured at the second read data pulse from the trigger pulse.

- (f) Confirm that the asymmetry is within the following range.

Innermost track 1F asymmetry : 0.6 μ sec, Max.

- (g) For a double sided FDD, execute items (d) through (f) for the side 0 and the side 1 heads respectively.



(Fig.421) Measurement of asymmetry

- (h) If the value in item (f) or (g) is out of the specified range, adjust according to the following procedure.

The adjustment can be done only for the PCBA versions or the PCBA revision numbers with the variable resistor R5 on the PCBA MFD control. No adjustment can be done without R5.

- i) Adjust the variable resistor R5 so that the asymmetry takes the minimum value while repeating 1F write and 1F read operations alternately.
 - ii) For a double sided FDD, repeat the operation in item i) for the side 0 and the side 1 heads alternately. The variable resistor shall be so adjusted that both asymmetry for side 1 and side 0 heads take the minimum value.
- (i) If the values in items (f) and (g) are out of the specified range in the PCBA without the variable resistor R5, or if the adjustment in item (i) cannot be done sufficiently even if R5 is mounted, following causes are assumed.
- i) Leakage flux density in the environmental condition of the FDD is high:
If there is some flux source near the FDD such as magnet, transformer, motor, Brown tube, magnetized iron plate, etc., take

it apart from the FDD. Then measure the asymmetry and adjust again.

ii) Inferior disk:

Replace the work disk.

iii) Inferior head:

Replace the head carriage Ass'y according to item 4-5-1.

iv) Inferior PCBA MFD control:

Replace the PCBA according to item 4-5-6.

(2) SKA method

- (a) Connect the SKA according to item 4-2-4 and set the FD PWR switch to the PSA side.
- (b) Key in "B1F". (1F DUTY)
- (c) Connect an oscilloscope to the DOUT terminal of the SKA.
Oscilloscope range : DC mode, 2V, 0.2 μ sec
- (d) Start the spindle motor by key "5". (MON indicator turns on).
- (e) Install a work disk.
- (f) Execute drive select by key "0". (DS0 indicator turns on).
- (g) Key in "C0" and confirm that the TRACK indicator becomes "00".
(RECALIBRATE)
- (h) Key in "C1". (SEEK TMAX)
- (i) Key in "D4". (WRITE/READ LEVEL PRE 1F)
- (j) Measure the asymmetry as in Fig.422.



(Fig.422) Measurement of asymmetry (SKA)

- (k) Confirm that the asymmetry is within the following range.

Innermost track 1F asymmetry : 0.6 μ sec, Max.

- (L) For a double sided FDD, depress "4" key and execute items (i) through (k) for the side 0 and the side 1 heads respectively. The side is changed alternately by a depression of "4" key. If side 1 is selected, SIDE 1 indicator of the SKA turns on.

- (m) If the value in item (k) or (L) is out of the specified range, adjust according to the following procedure. The adjustment can be done only for the PCBA versions or the PCBA revision numbers with the variable resistor R5 on the PCBA MFD control. No adjustment can be done without R5.

i) Adjust the variable resistor R5 so that the asymmetry takes the minimum value by keying in "D4".

- ii) For a double sided FDD, execute the operation in item i) for both sides alternately by changing the side by key "4". The variable resistor shall be so adjusted that both asymmetry for side 1 and side 0 heads take the minimum value.

- (n) If the values in items (K) and (L) are out of the specified range in the PCBA without the variable resistor R5, or if the adjustment in item (m) cannot be done sufficiently even if R5 is mounted, refer to item (j) of "General method".

4-4-8. Check of Read Level

(A) Equipment

- (1) Level disk
- (2) SKA or user's system
- (3) Oscilloscope (not required when the SKA is used)

(B) Check procedure

(1) General method

- (a) Use two channels of an oscilloscope and connect them to TP9 and TP10 (Differentiation amp.) on the PCBA MFD control.

Oscilloscope range : AC mode, 0.5V

Set both channels, 1 and 2 to the above range. Set either of the channels to Invert mode and ADD both channels.

- (b) Start the spindle motor and install a level disk.

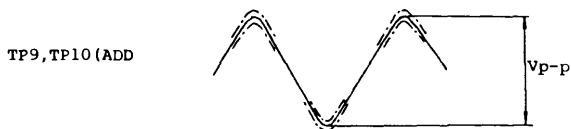
- (c) Make the head move to the innermost track.

- (d) Execute 2F write operation for one rotation of the disk (250KHz of WRITE DATA frequency).

- (e) Measure the average amplitude (Vp-p) of the read waveform as in Fig.423.

- (f) Calculate the read level by substituting the following expression with the measured value in item (e) and READ LEVEL calibration value (see level disk label).

$$\text{Read level (true value)} = \text{Measured value} \times \frac{100}{\text{Calibration value}}$$



(Fig.423) Measurement of average read level (2F)

- (g) Confirm that the true value of the read level is within the following range.

Innermost track read level : $1.4V_{p-p}$, Min.

- (h) For a double sided FDD, execute items (d) through (g) for the side 0 and the side 1 heads respectively.

- (i) If the value in item (g) or (h) is out of the specified range, following causes are assumed.

- i) Inferior disk:

Disk and/or jacket is deformed or damaged. Replace the level disk with a new one.

- ii) Abnormal disk rotational speed:

Check and adjust according to item 4-4-5.

- iii) Inferior head touch:

Check and adjust according to item 4-4-6.

- iv) Inferior head:

Replace the head carriage Ass'y according to item 4-5-1.

- v) Inferior PCBA MFD control:

Replace the PCBA MFD control according to item 4-5-6.

- (k) Eject the level disk and release the Invert and ADD modes of the oscilloscope.

(2) SKA method

- (a) Connect the SKA referring to item 4-2-4 and set the FD PWR switch to the PSA side.
- (b) Start the spindle motor by key "5". (MON indicator turns on).
- (c) Install a level disk.
- (d) Execute drive select by key "0". (DS0 indicator turns on).
- (e) Key in "C0" and confirm that the TRACK indication becomes "00".
(RECALIBRATE)
- (f) Key in "C1". (SEEK TMAX)
- (g) Key in "D7". (WRITE/READ LEVEL DIF 2F)
Calibration value of the level disk should be set previously in the SKA.
- (h) Confirm that the DATA indicator (mVo-p) indicates the value within the following range.
Innermost track read level : 700mVo-p, Min.
- (i) For a double sided FDD, depress key "4" and execute items (g) and (h) for the side 0 and the side 1 heads respectively. The side is changed alternately by a depression of "4" key. If the side 1 is selected, SIDE 1 indicator of the SKA turns on.
- (j) If the value in item (h) or (i) is out of the specified range, refer to item (i) of "General method".
- (k) Eject the level disk.

4-4-9. Check of Resolution

(A) Equipment

- (1) Level disk
- (2) SKA or user's system
- (3) Oscilloscope (not required when the SKA is used)

(B) Check procedure

(1) General method

- (a) Use two channels of an oscilloscope and connect them to TP7 and TP8 (Pre-amp.) on the PCBA MFD control.

Oscilloscope range : AC mode, 50mV ~ 0.1V

Set both channels, 1 and 2 to the above range. Set either of the channels to Invert mode and ADD both channels.

- (b) Start the spindle motor and install a level disk.

- (c) Make the head move to the innermost track.

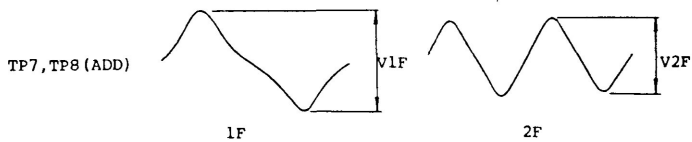
- (d) Execute 1F write operation for one rotation of the disk (125KHz of WRITE DATA frequency).

- (e) Measure the average amplitude (V1F) as in Fig.424.

- (f) Execute 2F write operation as in item (d) (double in frequency to that in item (d)).

- (g) Measure the average amplitude (V2F) as in Fig.424.

- (h) Calculate the resolution by substituting the following expression with the measured values V1F, V2F, and RESOLUTION calibration value (see level disk label).



(Fig.424) Measurement of resolution

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

- (i) Confirm that the true value is within the following range.
Innermost track resolution: 55%, Min.
- (j) For a double sided FDD, execute items (d) through (i) for the side 0 and the side 1 heads respectively.
- (k) If the value in item (i) or (j) is out of the specified range, following causes are assumed.
 - i) Inferior disk:
Disk and/or jacket is deformed or damaged. Replace the level disk with a new one.
 - ii) Inferior disk rotational speed:
Check and adjust according to item 4-4-5.
 - iii) Inferior head touch:
Check and adjust according to item 4-4-6.
 - iv) Inferior head: Replace the head carriage Ass'y according to item 4-5-1.
 - v) Inferior PCBA MFD control:
Replace the PCBA MFD control according to item 4-5-6.
- (L) Eject the level disk and release the Invert and Add modes of the oscilloscope.

(2) SKA method

- (a) Connect the SKA referring to item 4-2-4 and set the FD PWR switch to the PSA side.
- (b) Start the spindle motor by key "5". (MON indicator turns on).
- (c) Install a level disk.
- (d) Execute drive select by key "0". (DS0 indicator turns on).
- (e) Key in "C0" and confirm that the TRACK indication becomes "00".
(RECALIBRATE)
- (f) Key in "C1". (SEEK TMAX)
- (g) Key in "D8". (RESOLUTION)
The calibration value of the level disk should be set previously in the SKA.
- (h) Confirm that the DATA indicator ☐☐☐☐ (%) indicates the value within the following range.
Innermost track resolution: 55%, Min.
- (i) For a double sided FDD, depress key "4" and execute items (g) and (h) for the side 0 head and the side 1 head respectively. The side is changed alternately by a depression of "4" key. If the side 1 is selected, SIDE 1 indicator of the SKA turns on.
- (j) If the value in item (h) or (k) is out of the specified range, refer to item (k) of "General method".
- (k) Eject the level disk.

4-4-10. Check and Adjustment of Track Alignment

(A) Equipment

- (1) Cross point screwdriver, M3
- (2) Common screwdriver, medium
- (3) Alignment disk
- (4) SKA or user's system
- (5) Oscilloscope
- (6) Hygrometer.
- (7) Locking paint

(B) Check and adjustment procedure

Note: Check and adjustment of track alignment should be done in an environment of general room temperature and humidity. Even if the environmental condition is within the specified operational condition, extremely high or low temperature, or extremely high or low humidity should be avoided. Check and adjustment should be done after two hours, Min. of storing in the above mentioned condition.

It is recommended that the orientation of the FDD for the track alignment check is the same as when the FDD is actually installed in the user's system.

(1) General method

- (a) Use two channels of an oscilloscope and connect them to TP9 and TP10 (Differentiation amp.) on the PCBA MFD control. Also connect the external trigger of the oscilloscope to TP4 (Index) and apply positive trigger.

Oscilloscope range : AC mode, 0.5V, 20msec

Set both channels, 1 and 2 to the above range. Set either of the channels to Invert mode and Add both channels.

(b) Start the spindle motor and install an alignment disk.

(c) Set the head to the alignment check track.

Alignment check track: track 16

(d) Confirm that two lobe patterns as in Fig.425 can be observed (it is not necessary that the levels of VA and VB are equal).

If only one lobe pattern can be observed or if two lobes become one pattern, the head is not on the alignment check track.

In such event, execute step-out or step-in operation for 2 tracks space to obtain the most similar waveform to that in Fig.425.

Note: The above number of tracks to be stepped is required to make the alignment track position be fit with the magnetized condition of the basic magnetized phase "A" of the stepping motor. If the stepped track numbers are inassured, set it again from track 00 (TRACK 00 output signal becomes TRUE).

For the FDD, the lobe pattern as in Fig.425 should be observed at the track of even number.

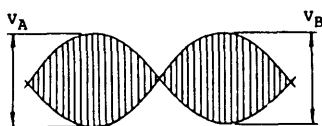
(e) After one or several step-outs from the check track, step in the head to the check track again and measure VA and VB at that time.

(f) Calculate the true value of misalignment by substituting the value in item (e) and ALIGNMENT calibration value (see alignment disk label, attention to the side).

$$\text{Misalignment (true value)} = \frac{VA - VB}{\text{Larger value in VA \& VB}} \times 100$$
$$- \text{Calibration value} - (\text{Relative humidity} - 50) \times K$$

K is humidity compensation factor.

K = 0.26



(Fig.425) Alignment check lobe pattern

e.g. $V_A=0.58V$, $V_B=0.61V$, Calibration value= -6%,

Relative humidity=65%

$$\text{Misalignment (true value)} = \left\{ \frac{0.58 - 0.61}{0.61} \times 100 - (-6) \right\} - (65 - 50) \\ \times 0.26 \approx -2.8\%$$

If the calculated value is positive, the magnetic head is shifted inward from the reference position, while the head is shifted outward from the reference position when the value is negative.

- (g) Conversely, measure V_A and V_B when the head is on the alignment check track by stepping-out after one or several step-ins.
- (h) Calculate the true value of misalignment as described in item (f).
- (i) Confirm that both of the calculated values in items (f) and (h) are within the following range.
True value of misalignment: 30%, Max.
- (j) For a double sided FDD, execute items (c) through (i) for the side 0 and the side 1 heads respectively.
- (k) If the value in item (i) or (j) is out of the specified range, adjust the track alignment according to the following procedure:
 - i) Loosen two fixing screws of the stepping motor a little.

- ii) Insert a common screwdriver from the back side of the FDD as shown in Fig.426 and depress it to the geared area of the stepping motor.
- iii) Repeat step-in and step-out operations and adjust the misalignment to be the smallest on the alignment check track during both step-in and step-out operations by the screwdriver (stepping motor moves little by little).

Note: When you adjust the alignment by observing the lobe pattern using the oscilloscope, pay attention to the calibration value on the alignment disk label and the ambient relative humidity.

- ① Calibration value + (Relative humidity - 50) x K \geq 0:

When the left side lobe pattern level, VA is assumed as "1", lobe pattern ratio should be so adjusted that the right side lobe pattern level VB takes the following value:

$$VB = 1 - \frac{\text{Calibration value} + (\text{Relative humidity} - 50) \times K}{100}$$

- ② Calibration value + (Relative humidity - 50) x K \leq 0:

When the right side lobe pattern level, VB is assumed as "1", lobe pattern ratio should be so adjusted that the left side lobe pattern level VA takes the following value.

$$VA = 1 - \frac{\text{Calibration value} + (\text{Relative humidity} - 50) \times K}{100}$$

e.g. Calibration value = -6%, Relative humidity = 35% :

$$-6 + (35 - 50) \times 0.26 = -9.9 < 0$$

$$VA = 1 - \frac{-6 + (35 - 50) \times 0.26}{100} = 0.90$$

- iv) For a double sided FDD, repeat the adjusting operation in item iii) alternately for the side 0 and the side 1 heads until the both

misalignment take the smallest value.

- v) Tighten the two fixing screws of the stepping motor little by little for adjusting the true value of misalignment after tightening the screws with the following specified torque to be within $\pm 20\%$.
Stepping motor fixing torque: 9Kg.cm

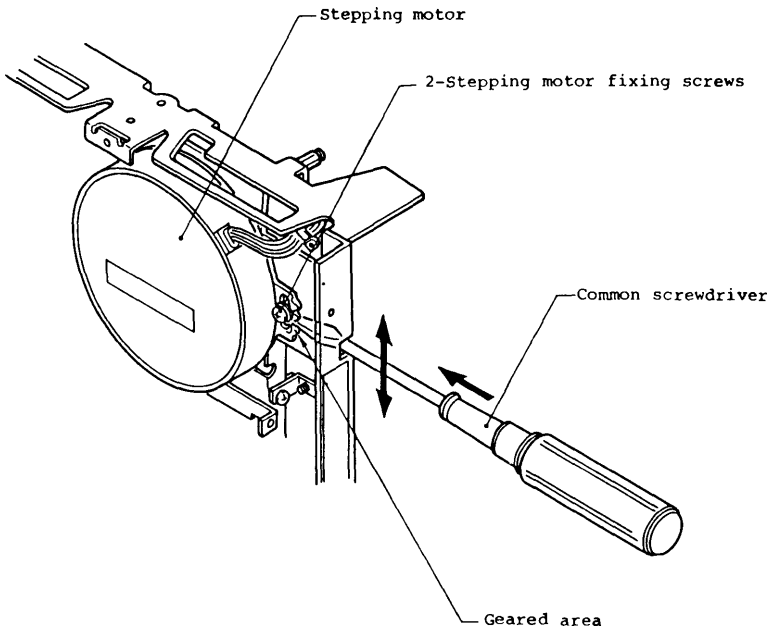
- vi) Remove the alignment disk.

- vii) Apply a drop of locking paint to the head of the stepping motor fixing screws.

- viii) Check and adjust the track 00 sensor according to item 4-4-11.

- ix) Check and adjust the track 00 stopper according to item 4-4-12.

(L) Release the Invert and Add modes of the oscilloscope.



(Fig.426) Adjustment of track alignment

(2) SKA method

- (a) Connect the SKA referring to item 4-2-4 and set the FD PWR switch to the PSA side.
- (b) Use two channels of an oscilloscope. Connect the 1st channel to the DOUT terminal of the SKA and the 2nd channel to the DIF terminal of the SKA. Apply positive trigger by DOUT terminal.
Oscilloscope range
 The 1st channel: DC mode, 2V, 20msec
 The 2nd channel: AC mode, 1V, 20msec
- (c) Key in "B9F" (INDEX observation)
- (d) Start the spindle motor by key "5". (MON indicator turns on).
- (e) Install an alignment disk.
- (f) Execute drive select by key "0". (DS0 indicator turns on).
- (g) Key in "C0" and confirm that the TRACK indicator becomes "00".
 (RECALIBRATE)
- (h) Set the head to the alignment check track.
 Key in "C2 16" and confirm that the TRACK indication becomes "16".
- (i) Confirm that two lobe patterns as in Fig.425 can be observed by the oscilloscope (it is not necessary that the levels of VA and VB are equal).
 If only one lobe pattern can be observed or if two lobes become one pattern, the head is not on the alignment check track.
 In such event, execute step-in or step-out operation for 2 track space to obtain the most similar waveform to that in Fig.425. Step operation can be done by key "8" (STEP-IN) and key "9" (STEP-OUT).

By a depression of these keys, head will move for one track space.

Note: The above number of tracks to be stepped is required to make the alignment track position be fit with the magnetized condition of the basic magnetized phase "A" of the stepping motor.

For the FDD, the lobe pattern as in Fig.425 should be observed at the track of even number.

(j) Confirm that the H GAIN indicator of the SKA is off. If it is on, turn it off by depressing "DD" key.

(k) Key in "E3" (ALIGNMENT)

Calibration value of the alignment disk and environmental relative humidity should be set previously in the SKA.

(L) Confirm all the indications on the DATA (%) indicator are within $\pm 30\%$.

The initial digit of the DATA indicator is the symbol. \nearrow (+) mark indicates that the head is shifted inward from the reference position, while - mark indicates that the head is shifted outward.

(m) For a double sided FDD, execute the same check for the side 1 head according to the following procedure.

i) Key in "0" following the operation of item (L) (during execution of E3 command) and confirm that SIDE 1 indicator of the SKA turns on.

ii) Confirm as in item (L).

Note: In order to change the head to side 0, key in "0" again.
(SIDE 1 indicator turns off).

(n) Depress "F" key (STOP).

(o) If the value in items (L) or (m) is out of the specified range, adjust

the track alignment according to the following procedure.

- i) Loosen the two fixing screws of the stepping motor a little.
 - ii) Insert a common screwdriver from the back side of the FDD as shown in Fig.426 and depress it to the geared area of the steppint motor.
 - iii) Key in "E3" and adjust the misalignment so that the DATA indicator (4) shows the smallest value. The stepping motor moves little by little by the screwdriver.
 - iv) For a double sided FDD, repeat the adjusting operation in item iii) alternately for side 0 and side 1 heads until the both misalignment take the smallest value.
 - v) Tighten the two fixing screws of the stepping motor little by little to obtain the value within $\pm 20\%$ on the DATA indicator when the screws are tightened with the following specified torque.
Stepping motor fixing torque: 9Kg.cm.
 - vi) Remove the alignment disk.
 - vii) Apply a drop of locking paint to the screw head of the stepping motor fixing screws.
 - viii) Check and adjust the track 00 sensor according to item 4-4-11.
 - ix) Check and adjust the track 00 stopper according to item 4-4-12.
- (p) Release the Invert and Add modes of the oscilloscope.

4-4-11. Check and Adjustment of Track 00 Sensor

(A) Equipment

- (1) Common screwdriver, M3
- (2) Work disk
- (3) Alignment disk
- (4) SKA or user's system
- (5) Oscilloscope (or digital voltmeter)
- (6) Locking paint

(B) Check and adjustment procedure

(1) General method

(a) Use two channels of an oscilloscope and connect them as follows:

- i) The 1st channel: STEP interface signal (pin No.20) or PCBA MFD control U4, pin 5.
- ii) The 2nd channel: PCBA MFD control TP1 (Track 00 sensor).
1V range
- iii) External trigger: DIRECTION SELECT interface signal (pin No.18)
or PCBA MFD control U4, pin 11.
(+) trigger

(b) Start the spindle motor and install a work disk.

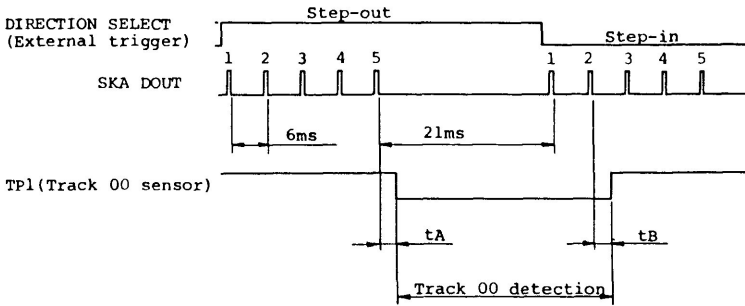
(c) Make the head move to track 00.

(d) Confirm that the timings t_A and t_B of the Track 00 sensor signal (TP1) is within the following range when the DIRECTION SELECT (trigger signal) and the STEP signal (6ms interval) as shown in Fig.427 is supplied.

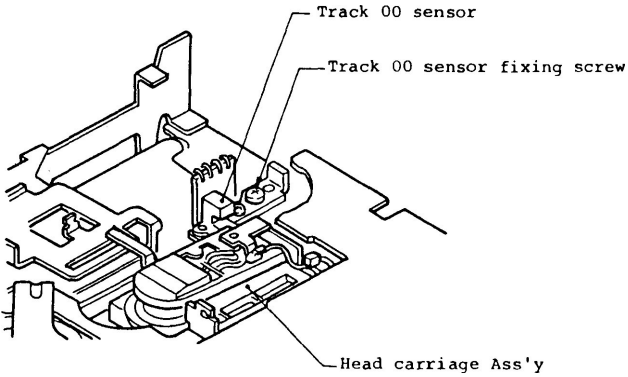
TP1 tA: 3.1 ~ 5.4msec

TP1 tB: 0 ~ 5.8msec

- (e) If the value in item (d) is out of the specified range, adjust the position of the track 00 sensor according to the following procedure.
- i) Loosen the fixing screw of the track 00 stopper (see Fig.429 and shift the stopper in the step-out direction (make apart from the rear side of the head carriage).
 - ii) Connect an oscilloscope to TP9 or TP10 (Differentiation amp.) of the PCBA MFD control.
Oscilloscope range: AC mode, 0.2V, 20msec
 - iii) Install an alignment disk. The track alignment should be adjusted correctly according to item 4-4-10.
 - iv) Make the head move to the position where the lobe pattern as in Fig.425 can be observed.
 - v) Remove the alignment disk.
 - vi) Step out the head for 16 tracks' space. (The head moves to track 00).
 - vii) Change the connection of the oscilloscope as item (a).
 - viii) Loosen the fixing screws of the track 00 sensor (see Fig.428) and move the sensor a little so that the timing tA in Fig.427 falls within the following range.
Adjusting target of TP1 tA: 3.4 ~ 4.6msec
 - ix) Repeat the adjustment of the track 00 sensor position so that the value in item viii) satisfy the specification when the screw has been tightened with the specified torque.
 - x) Apply a drop of locking paint on the fixing screw head.
 - xi) Adjust the track 00 stopper according to item 4-4-12.



(Fig.427) Track 00 sensor waveform



(Fig.428) Adjustment of track 00 sensor

(2) SKA method

- (a) Connect the SKA referring to item 4-2-4 and set the FD PWR switch to the PSA side.
- (b) Use two channels of oscilloscope and connect them as follows:
 - i) The 1st channel: SKA DOUT terminal
DC mode, 5V, 10msec
 - ii) The 2nd channel: PCBA MFD control TP1 (Track 00 sensor), 1V range
 - iii) External trigger: DIRECTION SELECT interface signal (Interface connector pin No.18) or Pin 3 of J3 (resistor network RAL for terminator) on the PCBA MFD control.
(+) trigger.
- (c) Key in "B8 F". (STEP observation)
- (d) Start the spindle motor by key "5". (MON indicator turns on).
- (e) Install a work disk.
- (f) Execute drive select by key "0". (DS0 indicator turns on).
- (g) Set the step rate and the settling time as follows referring to item 4-2-4-3.
 - Step rate : 6msec
 - Settling time : 15msec
- (h) Key in "C0" and confirm that the TRACK indicator becomes "00".
- (i) Key in "C5". (T00 TIMING, SEEK ± 5)
- (j) Measure the tA and tB timings according to Fig.427 and confirm the

timings are within the following range:

tA: 3.1 ~ 5.4msec

tB: 0 ~ 5.8msec

(k) Key in "F". (STOP)

(L) Turn the FD PWR switch of the SKA off at the track 00 position and then set it again to the PSA side. Confirm that the stop position of the head carriage did not change at power off and on.

(m) If the value in item (j) or (L) is out of the specified range, adjust the position of the track 00 sensor according to the following procedure.

i) Loosen the fixing screw of the track 00 stopper (see Fig.429) and shift the stopper in the step-out direction (make apart from the rear side of the head carriage).

ii) Connect the 2nd channel of the oscilloscope to TP9 or TP10 (Differentiation amp.) of the PCBA MFD control and change the trigger to this channel.

Oscilloscope range: AC mode, 0.2V, 20msec

iii) Install an alignment disk. The track alignment should be correctly adjusted according to item 4-4-10.

iv) Key in "C0" and confirm that the track indicator becomes "00". (RECALIBRATE).

v) Key in "C2 16" and confirm that two lobe patterns as in Fig.425 can be observed.

If normal lobe pattern cannot be observed, move the head to the track position where the typical lobe pattern can be observed by stepping in by key "8" or by stepping out by key "9".

vi) Remove the alignment disk.

vii) Key in "E4 16". (SET TRACK NUMBER)

viii) Key in "C2 00". (SEEK 00)

Don't key in "C0". (RECALIBRATE)

- ix) Change the connection of the oscilloscope as in item (b).
- x) Key in "C5". (T00 TIMING SEEK ± 5)
- xi) Loosen the fixing screw of the track 00 sensor (see Fig.428) and adjust the sensor position so that the timing tA in Fig.427 falls within the following range.
Adjusting target of tA: $3.4 \sim 4.6\text{msec}$
- xii) Repeat the adjustment so that the values in item xi) fall within the specified range when the fixing screw has been tightened with the specified torque.
- xiii) Apply a drop of locking paint to the fixing screw head.
- xiv) Adjust the track 00 stopper according to item 4-4-12.

4-4-12. Check and Adjustment of Track 00 Stopper

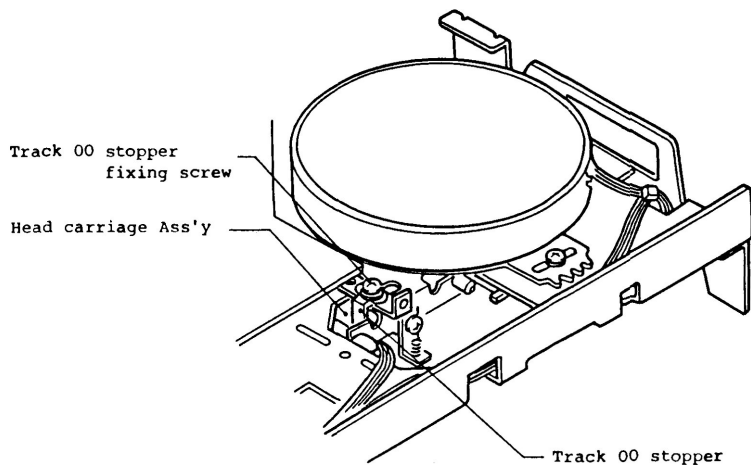
(A) Equipment

- (1) Cross point screwdriver, M3
- (2) SKA or user's system
- (3) Locking paint

(B) Check and adjustment procedure

(1) General method

- (a) Set the head to track 00.
- (b) Step out the head from the track 00 position.
- (c) Confirm that the head carriage does not move by the step-out command (head carriage rests on track 00).
- (d) Confirm that the gap between the head carriage and the extreme end of the track 00 stopper is 0.1 ~ 0.4mm. (See Fig.429).
- (e) Repeat step-in and step-out operations between track 00 and track 05. Confirm that no impact sound can be heard between the head carriage and the track 00 stopper.
- (f) Turn off the FDD power and depress the head carriage lightly against the track 00 stopper with fingers.
- (g) Confirm that the head carriage automatically returns to the initial position (track 00) when the power is turned on again.
- (h) If any one of the items (d), (e), and (g) is not satisfied, adjust the track 00 stopper position according to the following procedure.



(Fig.429) Adjustment of track 00 stopper

- i) Set the head to track 00.
- ii) Loosen the fixing screw of the track 00 stopper. (See Fig.429).
- iii) Adjust the stopper position so that the gap between the stopper and the head carriage becomes 0.25mm, approx. And then tighten the screw with the specified torque.
- iv) Execute items (a) through (g).
- v) Apply a drop of locking paint on the fixing screw head.

(2) SKA method

- (a) Connect the SKA referring to item 4-2-4 and set the FD PWR switch to the PSA side.
- (b) Execute drive select by key "0". (DSO indicator turns on).
- (c) Key in "C0" and confirm that the TRACK indicator becomes "00".
(RECALIBRATE).
- (d) Set the step rate and the settling time as follows referring to item 4-2-4-3.
Step rate : 6msec
Settling time : 15msec
- (e) Key in "9". (STEP OUT)
- (f) Confirm that the head carriage does not move even if "9" is keyed in
(head carriage rests on track 00).
- (g) Confirm that the gap between the head carriage and the extreme end
of the track 00 stopper is 0.1 ~ 0.4mm. (See Fig.429).
- (h) Key in "C0" and key in "C5". (STEP TIMING, SEEK ±5)
- (i) Confirm that no impact sound can be heard between the head carriage
and the track 00 stopper.
- (j) Turn off the FD PWR switch of the SKA and depress the head carriage
lightly against the track 00 stopper.
- (k) Confirm that the head carriage automatically returns to the initial
position (track 00) when the FD PWR switch is set to the PSA side
again.

(L) If any one of the items (g), (i), and (k) is not satisfied, adjust the track 00 stopper position according to the following procedure.

- i) Key in "C0" and confirm that the TRACK indicator becomes "00"
(RECALIBRATE)
- ii) Loosen the fixing screw of the track 00 stopper. (See Fig.429).
- iii) Adjust the stopper position so that the gap between the stopper and the head carriage becomes 0.25mm, approx.
And then tighten the screw with the specified torque.
- iv) Execute items (a) ~ (k).
- v) Apply a drop of locking paint on the fixing screw head.

4-4-13. Check and Adjustment of Index Burst Timing

(A) Equipment

- (1) Cross point screwdriver, M3
- (2) Alignment disk
- (3) SKA or user's system
- (4) Oscilloscope (not required when the SKA is used)
- (5) Locking paint

(B) Check and adjustment procedure

(1) General method

- (a) Use two channels of the oscilloscope. Connect the 1st channel to TP4 (Index) on the PCBA MFD control and the 2nd channel to TP7 or TP8 (Pre-amp.). Apply positive trigger by TP4.

Oscilloscope range

The 1st channel: DC mode, 2V, 50 μ sec

The 2nd channel: AC mode, 1V, 50 μ sec

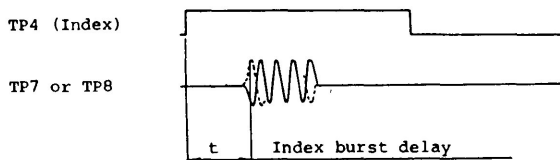
- (b) Start the spindle motor and install an alignment disk.

- (c) Set the head to track 01.

- (d) Measure "t" in Fig.430.

- (e) Substitute the following equation with the measured value in item (d) and INDEX TIMING calibration value (see alignment disk label).

Index burst timing (true value) = Measured value - Calibration value(μ s)

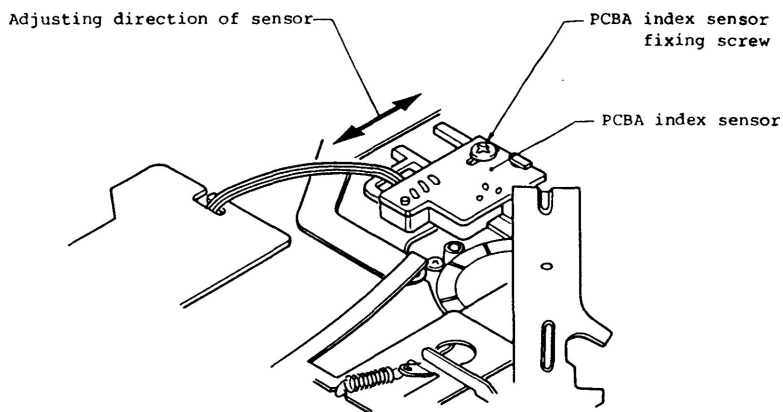


(Fig.430) Index burst timing

- (f) Confirm that the true value of the index burst timing is within the following range.

Index burst timing : $200 \pm 200 \mu\text{sec}$

- (g) If the value in item (f) is out of the specified range, adjust the index sensor Ass'y position according to the following procedure.
- i) Loosen the fixing screws (see Fig.431) of the PCBA index sensor and adjust its position to make the true value of the index burst timing fall in the specified range in item (f).
 - ii) Repeat the adjustment so that the true value of the index burst timing falls in the range of item (f) when the fixing screw has been tightened with the specified torque.
 - iii) Apply a drop of locking paint on the fixing screw head.
- (h) Remove the alignment disk.



(Fig.431) Adjustment of index sensor

(2) SKA method

- (a) Connect the SKA referring to item 4-2-4 and set the FD PWR switch to the PSA side.
- (b) Start the spindle motor by key "5". (MON indicator turns on).
- (c) Install an alignment disk.
- (d) Execute drive select by key "0". (DS0 indicator turns on).
- (e) Key in "C0" and confirm that the TRACK indicator becomes "00".
(RECALIBRATE)
- (f) Set the head to the index check track.
Key in "C2 01" and confirm that the TRACK indication becomes "01".
- (g) Key in "E6". (INDEX TIMING)
The calibration value of the index timing should be set previously in the SKA.
- (h) Confirm that the DATA indicator ☐☐☐☐ (μ s) indicates the value within the following range.
Index burst timing: $200 \pm 200 \mu$ sec
- (i) Key in "F". (STOP)
- (j) If the value in item (h) is out of the specified range, adjust the index sensor Ass'y position according to the following procedure.
 - i) Loosen the fixing screws (see Fig.431) of the PCBA index sensor and its position so that the DATA indication under execution shows the median value in the specified range of item (h).

- ii) Repeat the adjustment so that the DATA indication takes the median value when the fixing screw has been tightened with the specified torque.
 - iii) Depress "F" key. (STOP).
 - iv) Apply a drop of locking paint on the fixing screw head.
- (k) Remove the alignment disk.

4-5. MAINTENANCE PARTS REPLACEMENT

4-5-1. Replacement of Head Carriage Ass'y

(A) Tools

- (1) Cross point screwdriver, M3
- (2) Cross point screwdriver, M2.6
- (3) Hexagon wrench key, 1.5mm
- (4) Box screwdriver for hexagon nut, M3
- (5) A pair of tweezers
- (6) Lubricant, Kantoh Kasei 946P
- (7) Alcohol and gauze (several sheets)
- (8) Locking paint
- (9) SKA or user's system

(B) Replacement procedure

- (1) Turn the front lever (Fig.505, No.42) to close position and remove the fixing screw (Fig.505, S11).
- (2) Turn the front lever to open position and draw out the front lever Ass'y.
- (3) Remove the fixing screws (Fig.505, S5) of the front bezel Ass'y (Fig. 505, No.41) to remove the Ass'y.
- (4) Remove the fixing screw (Fig.505, S1) of the cord clasper to remove the clasper (Fig.505, No.39).
- (5) Remove two fixing screws (Fig.505, S1) of the shield cover (Fig.505, No.44) to remove the cover.
- (6) Remove three fixing screws (Fig.505, No.37 and S1) of the PCBA MFD

control (Fig. 505, No. 35) and lift it up.

- (7) Disconnect all of the connectors mounted on the PCBA MFD control and remove the PCBA.
- (8) Pull out the head cable from the disk guide U-groove and cable clamper and draw it out to the head carriage Ass'y (Fig. 505, No. 13) side.
- (9) Holding the top of the band fixing plate B (Fig. 505, No. 17) and the head carriage Ass'y with your fingers to release the hook of the steel belt (Fig. 505, No. 19) and the band fixing plate B.
- (10) Pull out the band fixing plate B and the band spring (Fig. 505, No. 18) at the same time from the head carriage Ass'y.
- (11) Separate the steel belt from the hook of the band fixing plate A (Fig. 505, No. 16) to remove the band fixing plate A from the head carriage Ass'y.
When removing the band fixing plate A from the head carriage, it will be removed easily if it is shifted toward the front bezel side and then drawn out in a right angle.
- (12) Remove the belt fixing screw (Fig. 505, S8) on the capstan of the stepping motor Ass'y (Fig. 505, No. 12) and then remove the band washer (Fig. 505, No. 20) and the steel belt.
- (13) Remove one of the two guide shaft clips (Fig. 505, No. 15) which fix the guide shafts. The clip for the rear side one should be removed.
- (14) Draw out two guide shafts (Fig. 505, No. 14) toward the rear of the FDD and remove them from the fixing area of the front side chassis (Fig. 505, No. 1).
Then remove the head carriage Ass'y with two guide shafts and the front

side clip. Refer to Fig.432.

- (15) Draw out two shafts from the head carriage and remove the front guide shaft clip.
- (16) Prepare a new head carriage Ass'y and two guide shafts for installation.

Note: When replacing the head carriage Ass'y, replace the guide shafts at the same time because of matching the hole diameter of the carriage with that of the guide shaft. Guide shafts are to be designated in combination with the head carriage Ass'y. (Refer to item 4-1-3, (2)).

Guide shaft which goes through the hole of the head carriage smoothly with a little clearance is considered to be the best.

- (17) Apply specified lubricant to the surface of one guide shaft. Then install it again to the new head carriage as it was.

Note: When applying the lubricant to the guide shaft, dip a piece of gauze to the lubricant and wipe the shaft and then wipe it again lightly with a dry and clean gauze.

The most appropriate quantity of the lubricant for the surface of the shafts forms a thin oil coating.

- (18) Apply the lubricant to the another guide shaft and install it to the new head carriage as it was.
- (19) Attach the guide shaft clip to the front bezel side groove of the shafts.
- (20) Attach the new head carriage Ass'y in item (19) in the reverse order of items (13) and (14).

Note: Pre-load is applied between the two guide shafts to make them approach each other by the guide shaft clip in order to reduce the

variety of the installation position of the head carriage Ass'y.

For installing the two guide shafts to the chassis, mount them with pressure to separate them.

- (21) Install the steel belt (C) to the capstan of the stepping motor Ass'y in the reverse order of item (12).

Note: If the surface of steel belt or capstan is smeared, clean it carefully with alcohol and gauze.

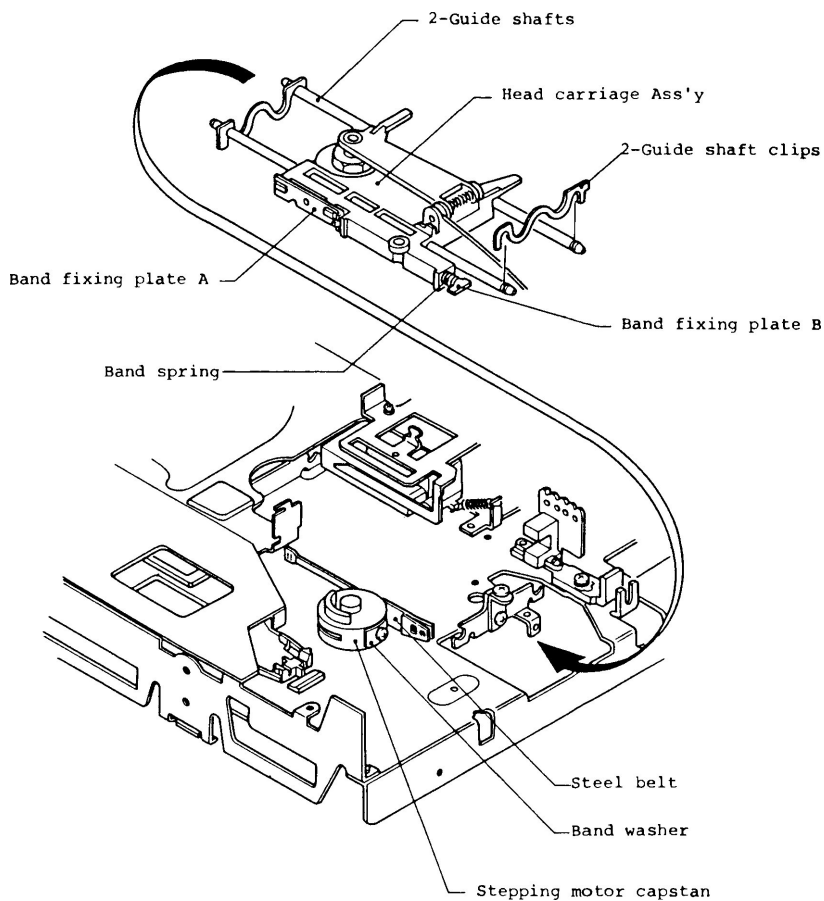
- (22) Connect the steel belt to the head carriage Ass'y using the band fixing plates A and B and band spring in the reverse order of items (9) through (11).
- (23) Tighten the fixing screw of the steel belt slightly to the stepping motor Ass'y.
- (24) After moving the head carriage several times manually, tighten the steel belt fixing screw carefully with the specified torque. At this time, be careful that the belt is tensioned straightly. Pay attention not to damage the surface of the belt or the capstan.
- (25) Form the head cable in the reverse order of items (4) and (6) through (8) and attach the PCBA MFD control. Refer to item 4-2-3 as to the details of the head cable treatment.
- (26) Loosen the fixing screw (Fig.505, S4) of the track 00 stopper (Fig.505, No.6) and shift the stopper toward the rear side of the FDD.
- (27) Attach the front lever temporarily for the following check and adjustment.
- (28) Make the head seek continuously between the track 00 and the innermost track and confirm that the steel belt does not meander nor undulate.

When the SKA is used, key in "C6" for this check and key in "F" for stop.

If the steel belt does meander or undulate, readjust the belt to run straightly by the screw in item (12). After the adjustment, tighten the screw carefully with the specified torque.

- (29) Check for the head touch according to item 4-4-6.
- (30) Check and adjust the asymmetry according to item 4-4-7. (Adjustment is applied only for the FDD with the variable resistor, R5 on the PCBA MFD control).
- (31) Adjust the track alignment according to item 4-4-10.
- (32) Adjust the track 00 sensor position according to item 4-4-11.
- (33) Adjust the track 00 stopper position according to item 4-4-12.
- (34) Check and adjust the index burst timing according to item 4-4-13.
- (35) Check for the read level according to item 4-4-8.
- (36) Check for the resolution according to item 4-4-9.
- (37) Attach the shield cover in the reverse order of item (5).
- (38) Remove the fixing screw of the front lever to remove the lever.
- (39) Attach the front bezel Ass'y and the front lever Ass'y in the reverse order of items (1) through (3).
- (40) Adjust the front lever position according to item 4-4-2.
- (41) It is recommended to connect the FDD to the system for overall test.

Refer to item 4-2-5 (1)).



(Fig.432) Replacement of head carriage Ass'y

4-5-2. Replacement of Stepping Motor Ass'y and Steel Belt

(A) Tools

- (1) Cross point screwdriver, M3
- (2) Cross point screwdriver, M2.6
- (3) Hexagon wrench key, 1.5mm
- (4) Box screwdriver for hexagon nut
- (5) A pair of tweezers
- (6) Alcohol and gauze
- (7) Locking paint
- (8) SKA or user's system

(B) Replacement procedure

- (1) Remove the shield cover (Fig.505, No.44) by removing the two fixing screws (Fig.505, S1).
- (2) Lift the PCBA MFD control (Fig.505, No.35) by removing the three fixing screws (Fig.505, No.37 and S1).
- (3) Disconnect all the connectors mounted on the PCBA MFD control and remove the PCBA.
- (4) Holding the top of the band fixing plate B (Fig.505, No.17) and the head carriage Ass'y with your fingers to release the hook of the steel belt (Fig.505, No.19) and the band fixing plate B.
- (5) Pull out the band fixing plate B and the band spring (Fig.505, No.18) at the same time from the head carriage Ass'y.
- (6) Separate the steel belt from the hook of the band fixing plate A (Fig.505, No.16) to remove the band fixing plate A from the head carriage Ass'y.

When removing the band fixing plate A from the head carriage, it will be removed easily if it is shifted toward the front bezel side and then drawn out in a right angle

- (7) Remove the belt fixing screw (Fig.505, S8) on the capstan of the stepping motor Ass'y (Fig.505, No.12) and then remove the band washer (Fig.505, No.20) and the steel belt.
- (8) Remove the stepping motor Ass'y by removing the fixing screws (Fig.505, S4).
- (9) Install a new stepping motor Ass'y as it was.
- (10) Fix a new α -shape steel belt temporarily to the capstan of the new stepping motor with the band washer and the screw in item (7).

Note: Fundamentally, the steel belt and the band spring should be replaced with the stepping motor. However, if there is no inferior points for these belt and spring, they may be used after cleaning the surface carefully with alcohol and gauze.

- (11) Connect the steel belt and the head carriage using the band fixing plates A and B and band spring in the reverse order of items (4) through (6).
- (12) After moving the head carriage several times manually, tighten the steel belt fixing screw in item (10) carefully with the specified torque. At this time, be careful so that the belt is tensioned straightly. Pay attention not to damage the surface of the belt or the capstan.
- (13) Install the PCBA MFD control in the reverse order of items (2) and (3).
- (14) Loosen the fixing screw (Fig.505, S4) of the track 00 stopper (Fig.505, No.6) and shift the stopper toward the rear side of the FDD.

- (15) Make the head seek continuously between the track 00 and the innermost track and confirm that the steel belt does not meander nor undulate. When the SKA is used, key in "C6" for this check and key in "F" for stop the operation.

If the steel belt meanders or undulates, readjust the belt to run straightly by the screw in item (10). After the adjustment, tighten the screw carefully with the specified torque.

- (16) Execute the continuous seek operation for five minutes.

When the SKA is used, key in "C6" and key in "F" for stopping the operation.

- (17) Attach the shield cover with two fixing screws.

- (18) Adjust the track alignment according to item 4-4-10.

- (19) Adjust the track 00 sensor position according to item 4-4-11.

- (20) Adjust the track 00 stopper position according to item 4-4-12.

4-5-3. Replacement of DD Motor Ass'y (Spindle motor)

(A) Tools

- (1) Cross point screwdriver, M3
- (2) A pair of tweezers
- (3) Cutting pliers
- (4) SKA or user's system

(B) Replacement procedure

- (1) Remove the shield cover (Fig.505, No.44) by removing the two fixing screws (Fig.505, S1).
- (2) Disconnect the spindle motor connector (J7).
- (3) Cut and remove the cable tie (Fig.505, No.40) for binding the wiring. Throw away the removed cable tie.
- (4) Draw out the PCB holder (Fig.505, No.38) which holds the PCBA servo of the DD motor Ass'y (C) (Fig.505, No.7) from the chassis (Fig.505, No.1).
- (5) Remove three fixing screws (Fig.505, S2, S7) of the DD motor from the upper side of the FDD and remove the DD motor Ass'y from the lower side of the FDD.
- (6) Install a new DD motor Ass'y in the reverse order of items (2) through (5).

Notes: 1. The spindle area of the DD motor Ass'y (clamping cup of the disk) is precisely machined. For installing the motor to the frame, place the spindle in parallel to the frame and push into the frame slowly. Handle the spindle very carefully not to damage

the spindle surface.

2. Collar B (Fig.505, No.5) is attached to the screw of the disk insertion side. Confirm that the collar B is not taken out in the process of tightening the screw.

(7) Adjust the collet shaft plate (Fig.505, No.29) position according to item 4-4-1.

(8) Bind a new bundle of cables to the chassis made of DD motor cable, T00 sensor Ass'y cable, and front OPT Ass'y cable using a new cable tie.

(9) Check for the file protect sensor according to item 4-4-4.

(10) Check or adjust the disk rotation speed according to item 4-4-5.
(Adjustment is applied only for the motor with the variable resistor, R1 on the PCBA DD motor servo).

(11) Check and adjust the track alignment according to item 4-4-10.

(12) Check and adjust the index burst timing according to item 4-4-13.

(13) Attach the shield cover in the reverse order of item (1).

4-5-4. Replacement of Collet Ass'y

(A) Equipment

- (1) Cross point screwdriver, M3
- (2) A pair of tweezers
- (3) Locking paint
- (4) SKA or user's system

(B) Replacement procedure

- (1) Remove the shield cover (Fig.505, No.44) by removing the two fixing screws (Fig.505, S1).
- (2) Remove the collet shaft plate Ass'y (Fig.505, No.29 by removing two fixing screws (Fig.505, S3).

Note: For the drive with eject Ass'y (Option), remove the hooks of the eject spring A and eject spring B from the collet shaft plate.
Then remove the collet shaft plate Ass'y.

- (3) Pull out the collet Ass'y (Fig.505, No.30) from the U-groove of the clamp spring (Fig.505, No.27) to remove it.
- (4) Install a new collet Ass'y in the reverse order. For installation at this step screw the collet shaft plate Ass'y temporarily.
- (5) Adjust the collet shaft plate position according to item 4-4-1.
- (6) Check and adjust the track alignment according to item 4-4-10.
- (7) Attach the shield cover in the reverse order of item (1).

4-5-5. Replacement of PCBA T00 Sensor

(A) Tools

- (1) Cross point screwdriver, M3
- (2) Cross point screwdriver, M2
- (3) A pair of tweezers
- (4) Cutting pliers
- (5) Locking paint
- (6) SKA or user's system

(B) Replacement procedure

- (1) Disconnect the track 00 connector (J4).
- (2) Cut and remove the cable tie (Fig.505, No.40) for binding the wiring.
Throw away the removed tie.
- (3) Remove the PCBA T00 sensor (Fig.505, No.9) by removing the fixing screw (Fig.505, S10).
- (4) Install a new PCBA T00 sensor in the reverse order of item (1) through (3).
- (5) Loosen the fixing screw (Fig.505, S6) of the T00 bracket (Fig.505, No.8) and shift it toward the rear side of the FDD.
- (6) Loosen the fixing screw (Fig.505, S4) of the track 00 stopper (Fig.505, No.6) and shift it toward the rear side of the FDD.
- (7) Adjust the track 00 position sensor according to item 4-4-11.
- (8) Adjust the track 00 stopper position according to item 4-4-12.

4-5-6. Replacement of PCBA MFD Control (C)

(A) Tools

- (1) Cross point screwdriver, M3
- (2) Box screwdriver for hexagon nut, M3
- (3) SKA or user's system

(B) Replacement procedure

- (1) Remove the shield cover (Fig.505, No.44) by removing two fixing screws (Fig.505, S1).
- (2) Remove three fixing screws of the PCBA MFD control (Fig.505, No.35) and lift up the PCBA.
- (3) Disconnect all of the connectors mounted to the PCBA MFD control and remove the PCBA.
- (4) Install a new PCBA MFD control in the reverse order of items (2) and (3).
- (5) Set the straps as they were on the old PCBA.
- (6) Check and adjust the asymmetry according to item 4-4-7. (Adjustment is applied only for the PCBA MFD control with the variable resistor, R5.
- (7) Check for the read level according to item 4-4-8.
- (8) Check for the resolution according to item 4-4-9.
- (9) Check for the track 00 sensor according to item 4-4-11.
- (10) Attach the shield cover in the reverse order of item (1).

- (11) It is recommended to connect the FDD to the system for overall test.
(Refer to item 4-2-5, (1)).

4-5-7. Replacement of Front OPT Ass'y

(A) Tools

- (1) Cross point screwdriver, M3
- (2) Hexagon wrench key, 1.5mm
- (3) Box screwdriver for hexagon nut, M3
- (4) Cutting pliers
- (5) Locking paint
- (6) SKA or user's system

(B) Replacement procedure

- (1) Turn the front lever (Fig.505, No.42) to close position and remove the fixing screw (Fig.505, S11).
- (2) Turn the front lever to open position and draw out the front lever Ass'y.
- (3) Remove the front bezel Ass'y (Fig.505, No.41) by removing two fixing screws (Fig.505, S5).
- (4) Remove the shield cover (Fig.505, No.44) by removing two fixing screws (Fig.505, S5).
- (5) Cut and remove the cable tie (Fig.505, No.40) for binding the wiring. Throw away the removed tie.
- (6) Disconnect the front OPT connector (J5).
- (7) Draw out the cable from the space between the chassis (Fig.505, No.1) and the PCBA DD motor servo and then draw it out from the U-groove of the disk guide (Fig.505, No.3).
- (8) Remove two separate fixing screws (Fig.505, S1 and S5) of the front OPT

Ass'y (Fig.505, No.34) to remove the Ass'y.

- (9) Install a new front OPT Ass'y in the reverse order of item (6) through (8).
- (10) Check for the file protect sensor according to item 4-4-4.
- (11) Adjust the index burst timing according to item 4-4-13.
- (12) Form the cables as they were using a new cable tie.
- (13) Attach the shield cover in the reverse order of item (4).
- (14) Attach the front bezel Ass'y and the front lever Ass'y in the reverse order of items (1) through (3).
- (15) Adjust the front lever position according to item 4-4-2.

4-5-8. Replacement of Head Pad (Single sided only)

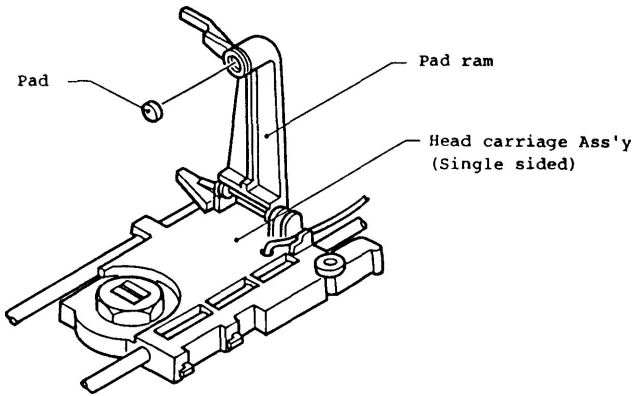
This item applies only to the single sided FDD.

(A) Tools

- (1) A pair of tweezers
- (2) Alcohol and gauze

(B) Replacement procedure

- (1) Remove the shield cover (Fig.505, No.44) by removing two fixing screws (Fig.505, S5).
- (2) Lift up the pad arm manually and peel the pad carefully with a pair of tweezers. (See Fig.433).
- (3) Apply a new pad to the initial position. Be careful not to press the pad surface strongly.
- (4) Clean the magnetic head surface according to item 4-3-2.
- (5) Adjust the head pad position according to item 4-4-6.
- (6) Check for the read level according to item 4-4-8.
- (7) Check for the resolution according to item 4-4-9.
- (8) Attach the shield cover in the reverse order of item (1).



(Fig.433) Replacement of head pad

4-5-9. Replacement of Front Bezel Ass'y

(A) Tools

- (1) Cross point screwdriver, M3
- (2) Hexagon wrench key, 1.5mm

(B) Replacement procedure

- (1) Turn the front lever (Fig.505, No.42) to close position and remove a fixing screw (Fig.505, S11).
- (2) Turn the front lever to open position and draw out the front lever Ass'y.
- (3) Remove the fixing screws (Fig.505, S5) of the front bezel Ass'y (Fig. 505, No.41) and draw out the front bezel.
- (4) Install a new front bezel Ass'y in the reverse order of item (2) and (3).

Note: For the installation of the front bezel, be sure to hold the four installation and support arms of the upper and the lower chassis (Fig.505, No.1 and No.21) and press the longitudinal sides of the bezel against the chassis and tighten the fixing screws with the specified torque.

- (5) Adjust the front lever position according to item 4-4-2.

4-5-10. Replacement of Front Lever Ass'y

(A) Tools

- (1) Hexagon wrench key, 1.5mm

(B) Replacement procedure

- (1) Turn the front lever (Fig.505, No.42) to close position and remove a fixing screw (Fig.505, S11).
- (2) Turn the front lever to open position and draw out the front lever Ass'y.
- (3) Install a new front lever Ass'y in the reverse order.

Note: For installation of the front lever Ass'y, match the slot of the lever to the pin of the lever shaft.

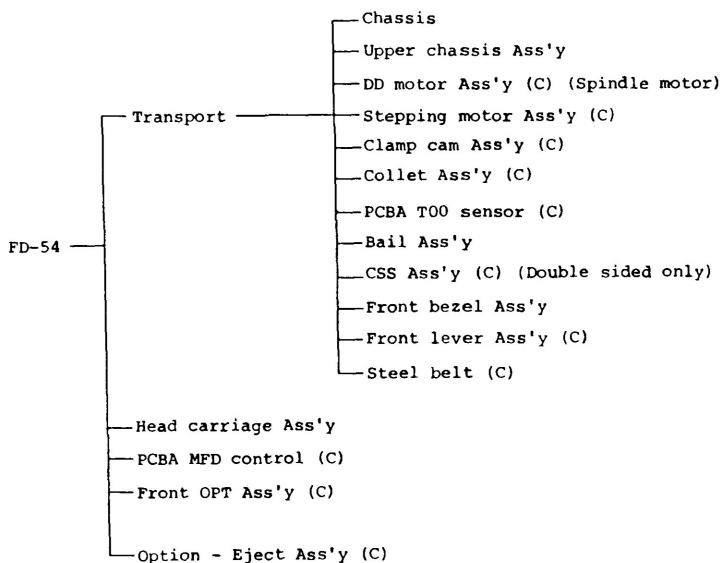
- (4) Adjust the front lever position according to item 4-4-2.

SECTION 5

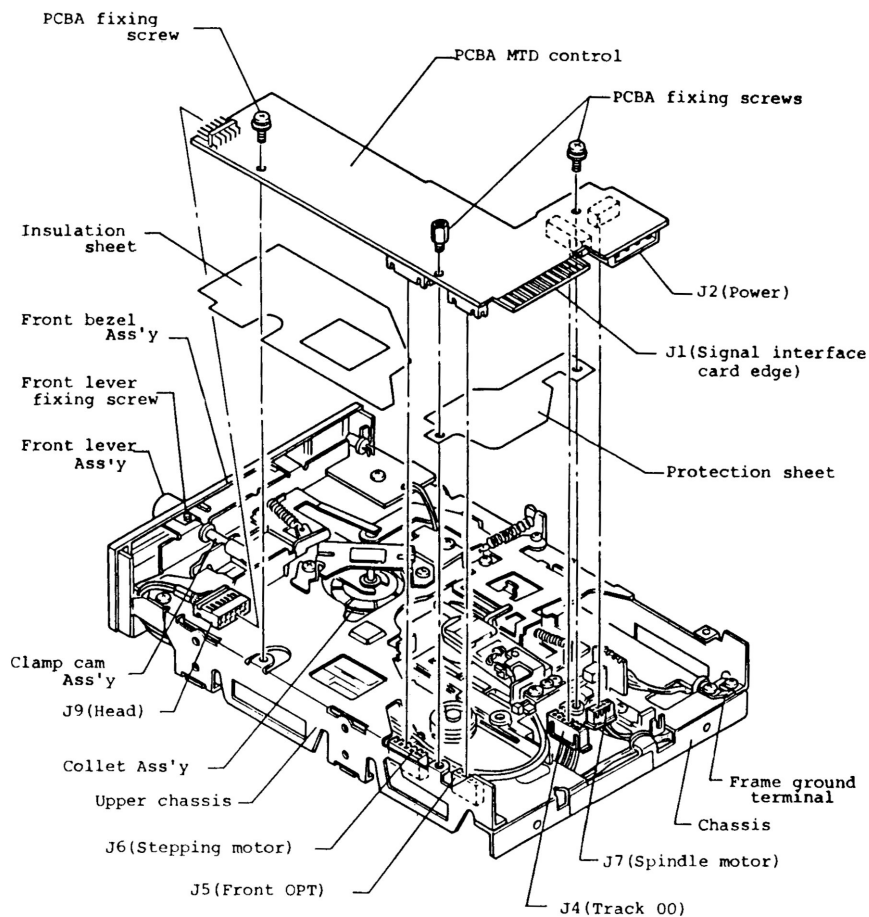
DRAWINGS & PARTS LIST

5-1. CONFIGURATION

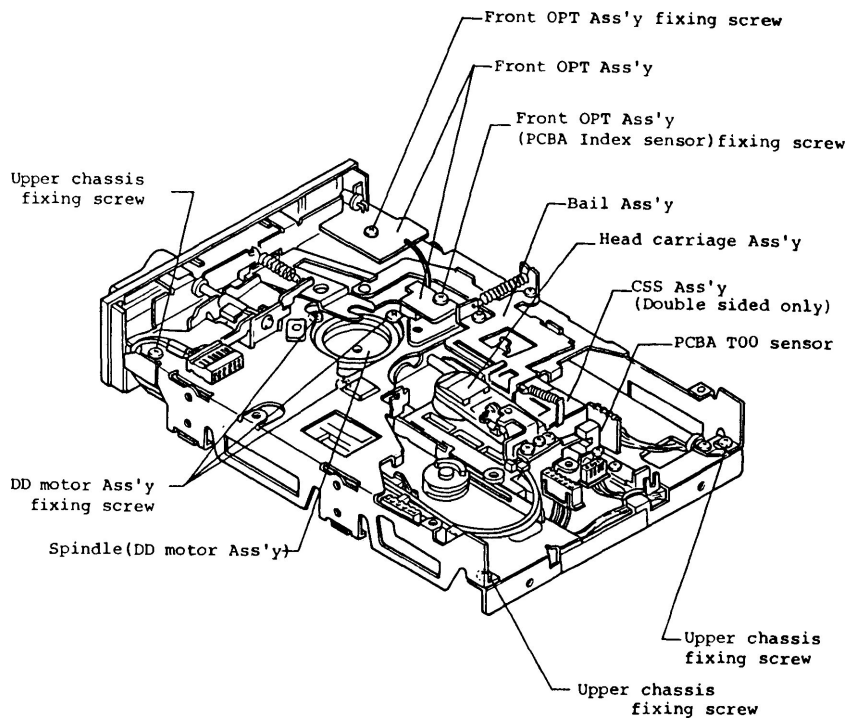
Following shows the configuration of the main parts of FD-54. (Refer to Fig.501 Fig.504). Refer to items 5-2 and 5-3 as to detailed break-downs.



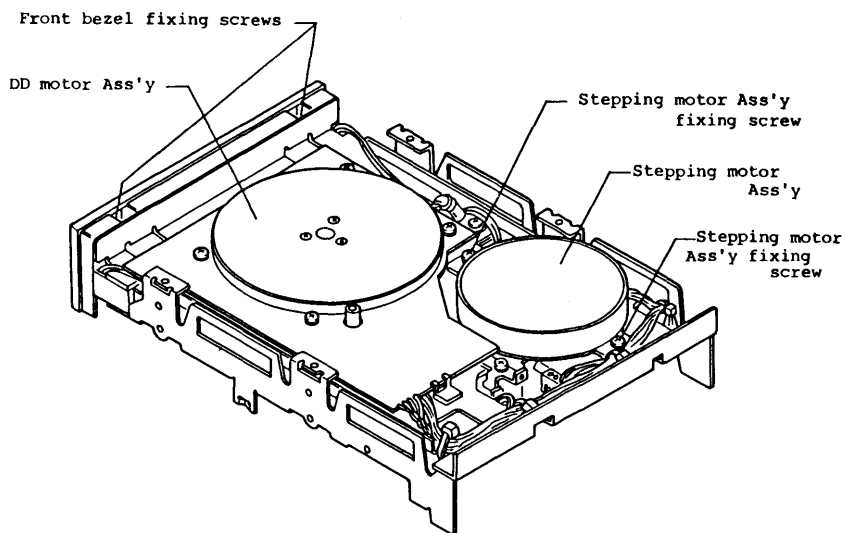
(Table 501) Main parts configuration of FD-54



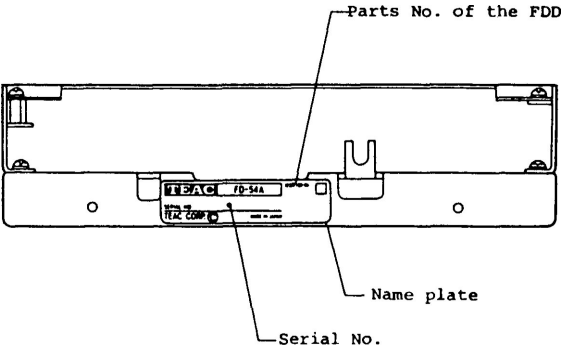
(Fig.501) External view (No.1)



(Fig.502) External view (No.2)



(Fig.503) External view (No.3)



(Fig.504) External view (No.4)

5-2. MECHANICAL BREAK-DOWN AND PARTS LIST

5-2-1. FDD (Refer to Fig.505)

Nos.	Parts Nos.	Parts name	Q'ty	Description
1	16152892-00	Chassis	1	
2	16802621-00	PCB fixing plate	1	
3	16787144-00	Disk guide	1	
4	16730435-00	Collar	2	
5	16730433-00	Collar B	1	
6	16802622-00	T00 stopper	1	
7	14733780-00	DD motor Ass'y(C) (Spindle motor)	1	
8	16757130-00	T00 bracket	1	
9	15532004-00	PCBA T00 sensor(C)	1	
10	17966927-00	CSS Ass'y(C)	1	FD-54B
11	13189135	Terminal	1	
12	14733770-00	Stepping motor Ass'y(C)	1	
13	17966912-00	Head carriage Ass'y(C)	1	FD-54A
	17966863-00	Head carriage Ass'y(C)		FD-54B
14	16766631-XX	Guide shaft(C)	2	Note 4
15	16766638-00	Guide shaft clip	2	
16	16802624-00	Band fixing plate A	1	
17	16802623-00	Band fixing plate B	1	
18	16385130-00	Band spring	1	
19	16792300-00	Steel belt (C)	1	
20	16766636-00	Band washer	1	

(Table 502) FDD parts list (1/3)

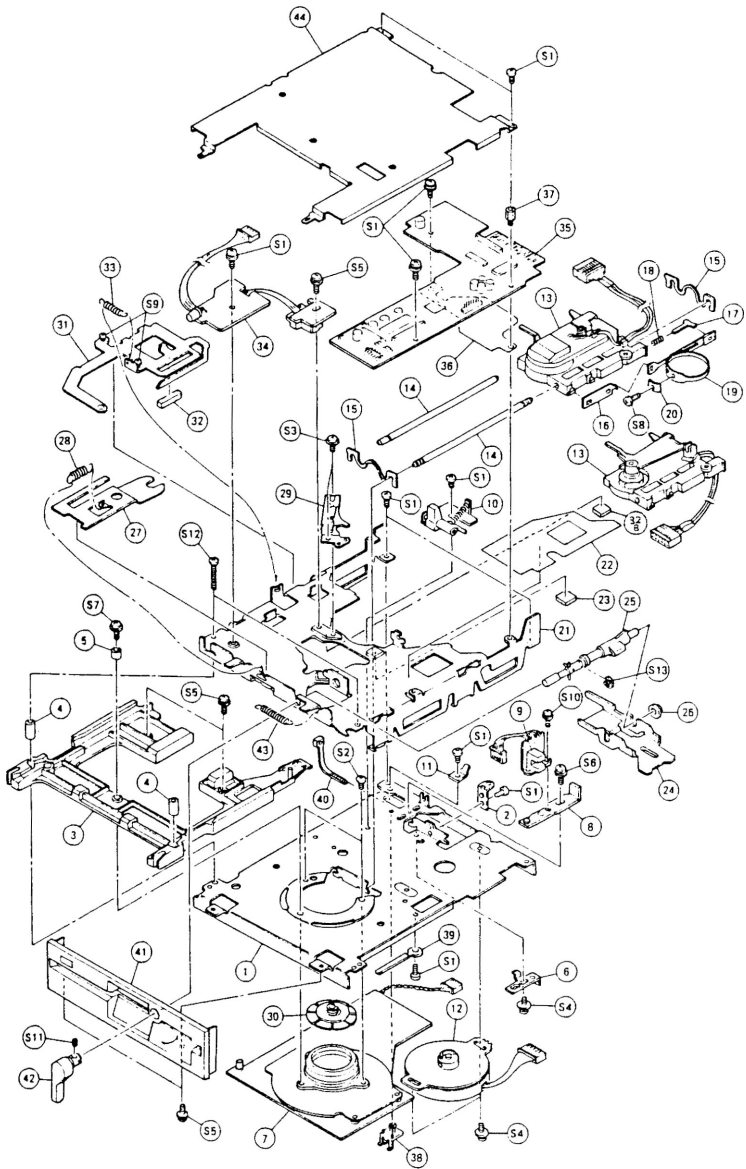
Nos.	Parts Nos.	Parts name	Q'ty	Description
21	16152891-00	Upper chassis	1	
22	16787150-00	Insulation sheet	1	
23	16787151-00	Disk pad B	1	Note 3
24	16802616-00	Set arm	1	
25	17966929-00	Clamp cam Ass'y(C)	1	
26	16787148-00	Clamp shaft holder	1	
27	16392019-00	Clamp spring	1	
28	16381104-00	Clamp return spring	1	
29	17966933-00	Collet shaft plate Ass'y	1	
30	17966923-00	Collet Ass'y(C)	1	
31	17966935-00	Bail Ass'y(A)	} *1	FD-54A
	17966936-00	Bail Ass'y(B)		FD-54B
32	16787157-00	Disk pad A-2	1	Note 3
32B		Disk pad	1	Note 3
33	16381106-00	Disk pad lever spring	1	
34	15090730-00	Front OPT Ass'y(C)	1	
35	15532006-XX	PCBA MFD control(C)	1	Note 5
36	16787152-00	Protection sheet	1	
37	16730434-00	Fixing shaft	1	
38	16787149-00	PCB holder	1	
39	16322054-00	Cord clamper	1	
40	16362418-00	Cable tie	4	

(Table 502) FDD parts list (2/3)

Nos.	Parts Nos.	Parts name	Q'ty	Description
41	17966807-50	Front bezel Ass'y	1	Note 6
42	17966924-00	Front lever Ass'y(C)	1	Note 6
43	16381109-00	Front lever spring	1	
44	17966937-00	Shield cover Ass'y	1	

(Table 502) FDD parts list (3/3)

- Notes:
1. As to the parts with an asterisk in the Q'ty column, select appropriate one for the model.
 2. As to the parts with model name of FD-54 in the Description column, the parts is used only for the model.
 3. Disk pads are included in the Ass'y No.21 and No.31.
 4. Guide shafts are always used in combination with the head carriage Ass'y due to make the corresponding diameter match with the hole of the head carriage. When you replace the head carriage Ass'y, be sure to replace the guide shafts together.
 5. The parts number versions of the PCBA MFD control (C) are different depending on each model. Refer to the name plate on the actual PCBA installed to designate the same version.
 6. The parts numbers of the front bezel Ass'y and the front lever Ass'y are those of FD-54, standard color, black.



(Fig.505) Mechanical section break-down

5-2-2. Screw, Washer

Nos.	Parts Nos.	Parts name	Description
S1	16410304	Screw,bind,3x4,S,ZMC	
S2	16411304	Screw,bind,3x4, B,BNM	
S3	16400304	Screw,pan,three pieces,3x4,S,ZMC	
S4	16498647	Screw,pan,three pieces,3x5,S,ZMC	
S5	16410306	Screw,bind,3x6,S,ZMC	
S6	16498579	Screw,pan,three pieces,3x6,S,ZMC	
S7	16476308	Screw,pan,flat,flat washer,3x8,B,BNM	
S8	16470004	Screw,pan,sems,2.6x4,S,ZMC	
S9	16400004	Screw,pan,2.6x4,S,ZMC	
S10	16400204	Screw,bind,2x4,S,ZMC	
S11	16498260-00	Set screw,3x3	
S12	16410316	Screw,bind,3x16,S,ZMC	
S13	16351140	E-ring,3J	

(Table 503) Parts list of screw & washer

5-3. PCBA PARTS LIST

Following shows all the parts mounted on the PCBAs of FD-54 series.

5-3-1. PCBA MFD Control (C)

Parts Nos.	Parts name & rating	Location
13447358-00	LSI TEAC 7358-00	U1
13441922-00	LSI TEAC 1922-00	U2
13441983	TTL IC 74LS368A	U3
13441235	TTL IC 74LS04	U4
13428139	Transistor array,M54578P	U5
13424286	Transistor,2SC2021R	Q3,Q4
13421211	Transistor,2SA881 Q-R	Q1
13411378	Diode,pair,MA154WA	CRA1,CRA2,CRA5,CRA6, **CRA3,**CRA4
13411406	Diode,pair,MA154WK	CRA7
13411243	Diode,1S954	CR1,CR4~CR8
13411339	Diode,DS442X	CR8
13415408	Diode,zener,RD6.8EN2	CR2
13497262	Resistor array,SA 9-1K Ω ,J	RA1
13497310	Resistor array,SA 5-15K Ω ,J	RA3

(Table 504) PCBA MFD control (C) parts list (1/4)

Parts Nos.	Parts name & rating	Location
13497266	Resistor array, SA 3-4.7K Ω , J	RA4
13497286	Resistor array, SC 4-2.2K Ω , J	RA2
13497228-00	Resistor array, T-7228	RA5
13497227-00	Resistor array, T-7227	RA7
13497229-00	Resistor array, T-7229	RA6
11187105	Resistor, RD, 1/6W, 1M Ω , J	R16
11187473	Resistor, RD, 1/6W, 47K Ω , J	**R15, R18
11187682	Resistor, RD, 1/6W, 6.8K Ω , J	R17
11187222	Resistor, RD, 1/6W, 2.2K Ω , J	R20
11198104	Resistor, RD, 1/4W, 100K Ω , J	R10
11198497	Resistor, RN, 1/4W, 1.24K Ω , F	R19
11051121	Resistor, RN, 1W, 120 Ω , J	R21
11051390	Resistor, RN, 1W, 39 Ω , J	R13, R14
13040341	Jumping wire	**S1
12903343	Capacitor, CE, 10V, 100 μ F, M	C2
12903353	Capacitor, CE, 25V, 47 μ F, M	C24
12903345	Capacitor, CE, 16V, 22 μ F, M	C6, C8
12903227	Capacitor, CS, 20V, 15 μ F, M	C7, C9
12903154	Capacitor, CS, 16V, 47 μ F, M	**C33, C34
12903152	Capacitor, CS, 16V, 2.2 μ F, K	C36
12903178	Capacitor, CS, 35V, 0.22 μ F, K	C13, C14
12903177	Capacitor, CS, 35V, 0.15 μ F, M	C11, C12
12903375	Capacitor, CS, 16V, 1 μ F, M	C17

(Table 504) PCBA MFD control (C) parts list (2/4)

Parts Nos.	Parts name & rating	Location
12903372	Capacitor,CS,16V,0.33 μ F,M	C5
12903080	Capacitor,CC,25V,YU,0.1 μ F,M	C26,C28
12903335	Capacitor,CC,25V,X,0.022 μ F,Z	C3,C4,C10,C15,C16,C20 C27,C31,C32
12902530	Capacitor,CC,500V,F,0.01 μ F,Z	C1
12901421	Capacitor,CC,50V,B,2200PF,K	C25
12901417	Capacitor,CC,50V,B,1000PF,K	C29
12900771	Capacitor,CC,50V,SL,180PF,J	C18,C19
12902588	Capacitor,CC,50V,CH,56PF,J	C22
12902578	Capacitor,CC,50V,CH,22PF,J	C23
12454222	Capacitor,CQ,100V,2200PF,G	C30
12454152	Capacitor,CQ,100V,1500PF,G	C35
12454101	Capacitor,CQ,100V,100PF,G	C21
13295084-00	Ceramic oscillator,480KHz	Y1
14723507	Coil,chalk,330 μ H,J	L1 \sim L3
13121234	Connector,S6P,polarizing	*J9
13121152	Connector,W12P,polarizing	
13121361	Connector,S5P	TF7 \sim 10,G
13121363	Connector,S7P	TFI \sim 6,G
13121332	Connector,W14P	HS \sim 1U

(Table 504) PCMB MFD control (C) parts list (3/4)

Parts No.s	Parts name & rating	Location
13121109	Connector,4P	J2
16322368	Connector,clamp	for J2 installation
13121175	Connector,4P	J7
13121176	Connector,5P	J5
13121177	Connector,6P	J4,J6
13121149	Short bar	HSM,HL,IU,HS,DS0v3,HM straps
16271169-XX	Name plate	

(Table 504) PCBA MFD control (C) parts list (4/4)

- Notes:
1. Parts with an asterisk are different depending on the PCBA versions. Select either of them.
 2. Parts with a double asterisks are not used in some PCBA versions.
 3. Refer to the schematic diagram of the PCBA as to the details of the parts with asterisks.
 4. Name plate version is different depending on the PCBA version used.

Parts No.s	Parts name & rating	Location
13121109	Connector,4P	J2
16322368	Connector,clamp	for J2 installation
13121175	Connector,4P	J7
13121176	Connector,5P	J5
13121177	Connector,6P	J4,J6
13121149	Short bar	HSM,HL,IU,HS,DS0V3,HM straps
16271169-XX	Name plate	

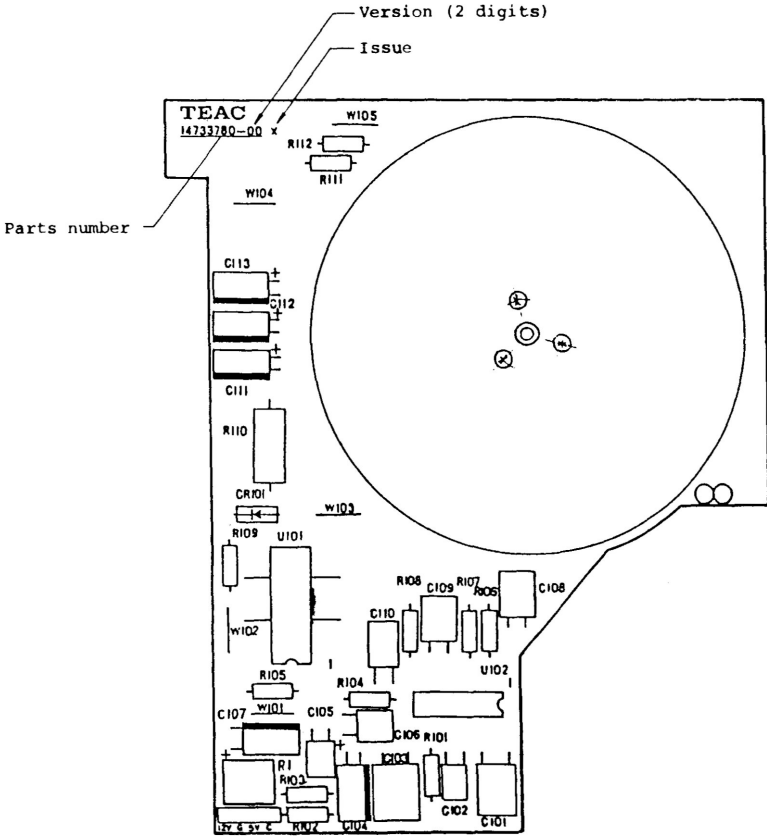
(Table 504) PCBA MFD control (C) parts list (4/4)

- Notes:
1. Parts with an asterisk are different depending on the PCBA versions. Select either of them.
 2. Parts with a double asterisks are not used in some PCBA versions.
 3. Refer to the schematic diagram of the PCBA as to the details of the parts with asterisks.
 4. Name plate version is different depending on the PCBA version used.

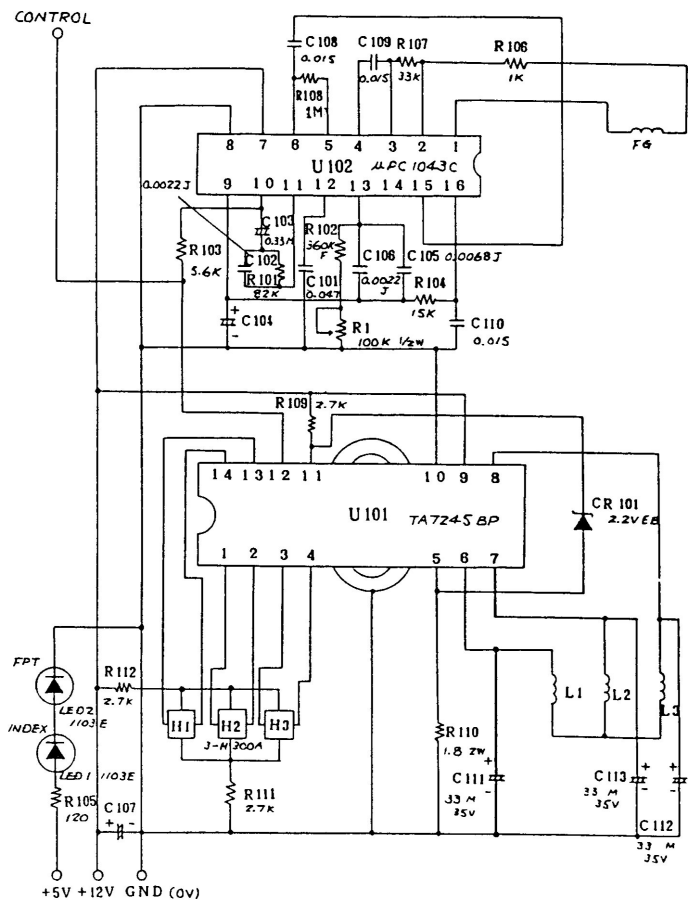
5-4. SCHEAMTIC DIAGRAMS AND PARTS LOCATION

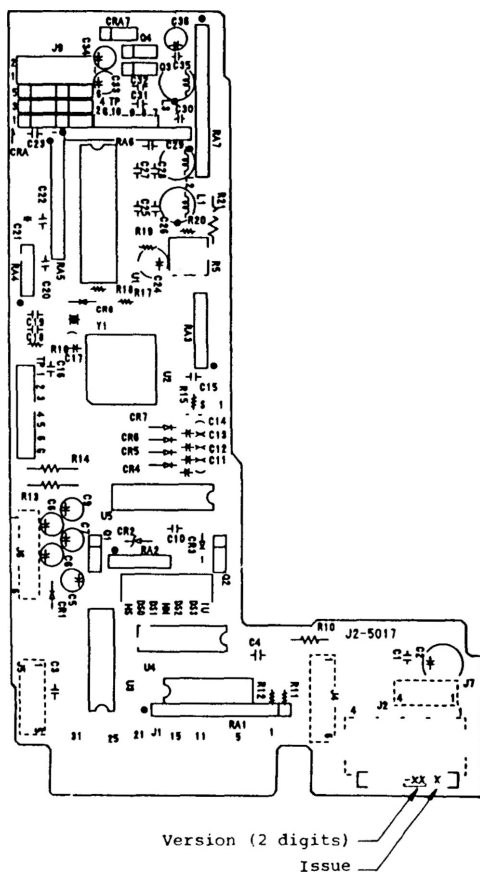
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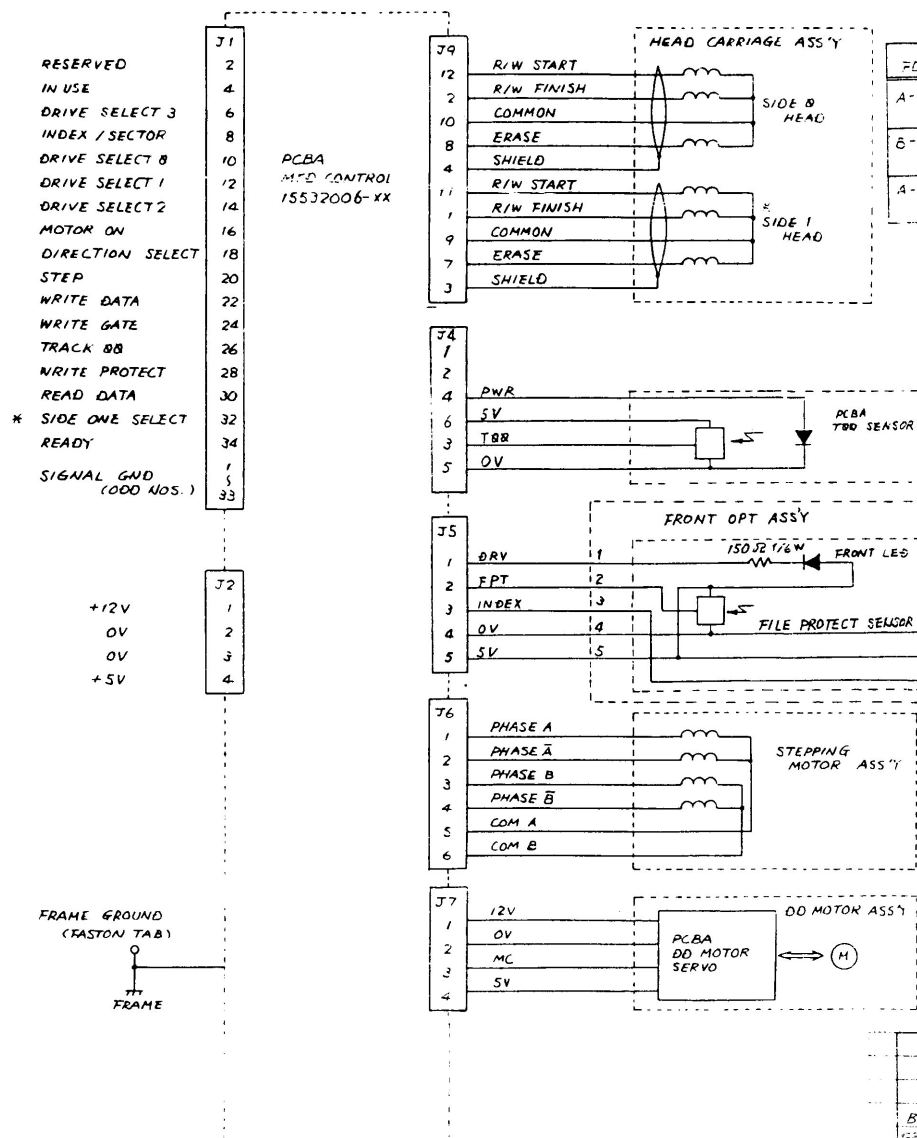


PCBA DD MOTOR SERVO (Type C)
PARTS LOCATION

PCBA DD MOTOR SERVO (Type C)
SCHEMATIC DIAGRAM



PCBA MTD CONTROL, PARTS LOCATION



VERSION TABLE

FDD VERSION	MAIN SPEC	* PARTS & SIGNALS	NOTE
A-00	S SIDE		
B-02	D SIDE	S1 HEAD SIDE ONE SELECT	
A-04	S SIDE	MECHANISM ONLY (WITHOUT PCBA MFD CONTROL & T88 SENSOR)	

2. ABBREVIATED NAMES ARE AS FOLLOWS

S SIDE : SINGLE SIDE

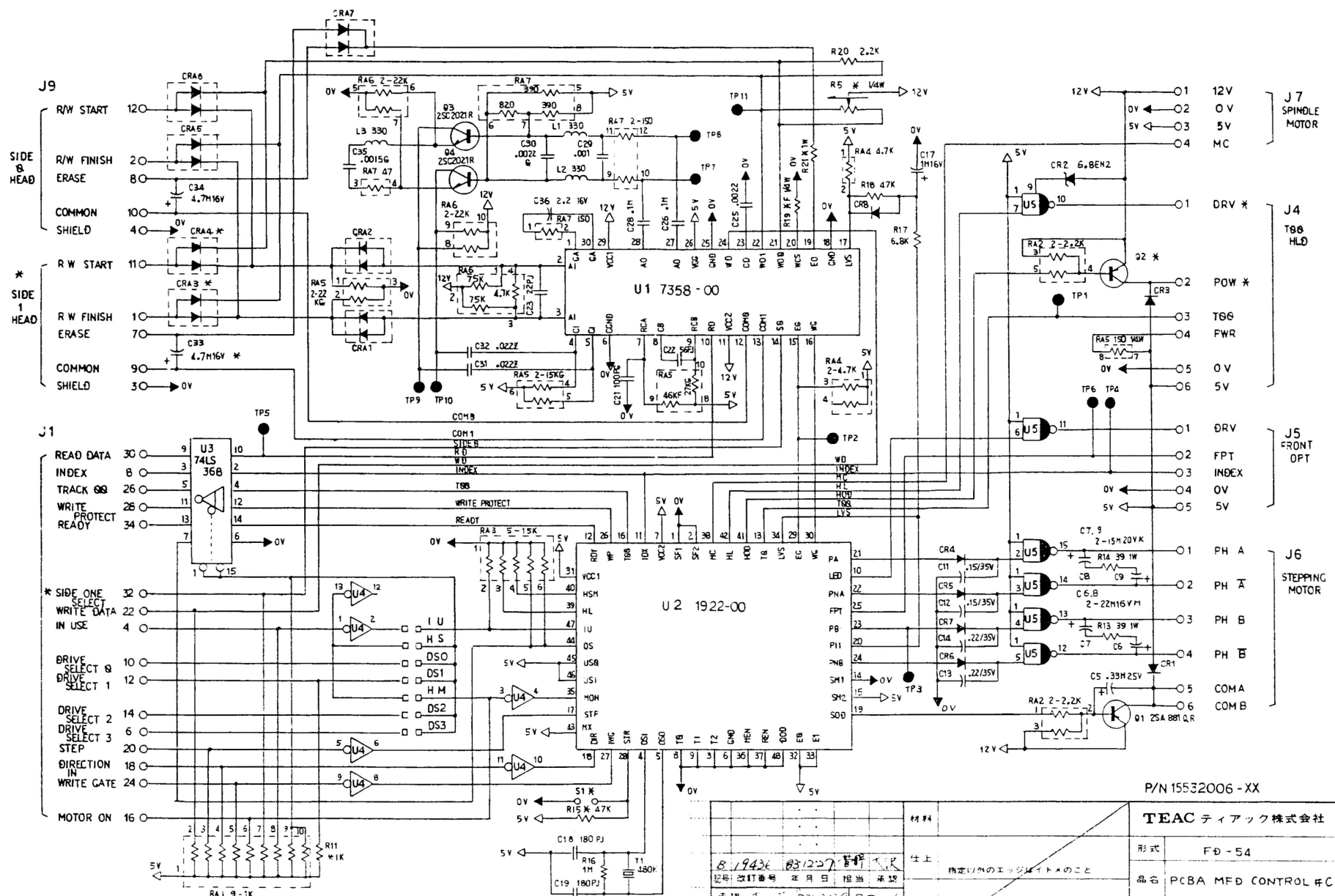
D SIDE : DOUBLE SIDE

S1 HEAD : SIDE ONE HEAD

NOTE 1. PARTS AND SIGNALS WITH AN ASTERISK (*) ARE USED
ONLY FOR THE DOUBLE SIDED MODEL.

P/N 19307120-XX

材料				TEAC ティアック株式会社	
B-1836 8/12/26 5P 1P				形式	
仕様 改訂 年月日 担当者 承認				品名	FD-54
作成 1/18 3/12/26 尺理				図名	TOTAL DIAGRAM
検印 1/18 3/12/26				図番	10409304
設計 (6/18) 1/18 3/12/26 第三角法					
承認 1/18 3/12/26 検印					



P/N 15532006 - XX

TEAC ティアック株式会社

形式	FD-54
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品名	PCBA MFD CONTROL #C
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圖名	SCHEMATIC
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10409305