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Notice

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3-Mini Disc Auto Changer PLL Frequency Synthesizer
Category: AM/FM-Stereo Receiver CD Auto Changer Control System Date: Nov. 1994

Model: MDR-300

Destination: U.S.A. REF:No. SM590384 Issue Number 1

DISASSEMBLY
DISASSEMBLY PROCEDURES OF MD MECHANISM
EXPLANATION OF MD MECHANISM OPERATION
BASIC SPECIFICATION AND FUNCTION OF PICKUP
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NOTES REGARDING HANDLING OF THE PICKUP
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EXPLANATION OF MINI-DISC
THE OUTLINE OF MINI-DISC
IC BLOCK DIAGRAM
EXPLANATION OF IC
EXPLANATION OF MD INITIALIZING OPERATION
TROUBLE SHOOTING

Prod. Code:147 592 02

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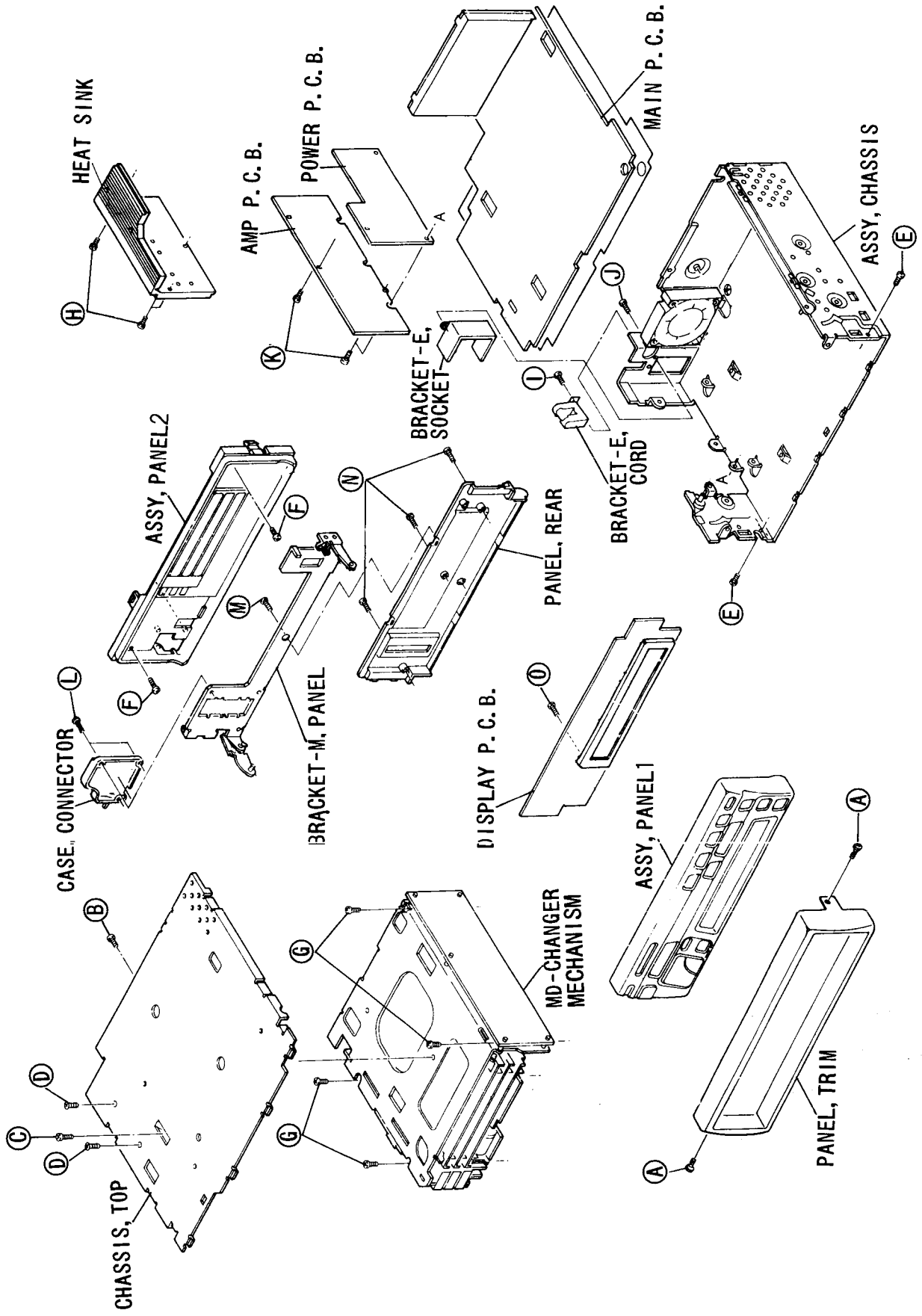

HEAT SINK
AMP P. C. B.
POWER P. C. B.
MAIN P. C. B.
ASSY, CHASSIS
BRACKET-E, SOCKET
BRACKET-E, CORD
ASSY, PANEL2
PANEL, REAR
CASE, CONNECTOR
BRACKET-M, PANEL
DISPLAY P. C. B.
ASSY, PANEL1
MD-CHANGER MECHANISM
CHASSIS, TOP
PANEL, TRIM

DISASSEMBLY

1. Remove the two screws Ⓐ which fix PANEL, TRIM. Then PANEL, TRIM can be disassembled.

2. Remove the screw Ⓑ, screw Ⓒ, and two screws Ⓓ which fix CHASSIS, TOP.
   Undo the two inlaid parts on the right side and one inlaid part in the rear with tweezers and the likes.
   Then CHASSIS, TOP can be disassembled.

3. Remove the two screws Ⓔ and two screws Ⓕ which fix ASSY, BRACKET-M (L) and (R).
   Remove the two sockets and one FPC.
   Remove one solder off lead wire.
   Undo the inlaid parts on the downside, and right and left side of ASSY, PANEL 2 with tweezers and the likes.
   Then ASSY, PANEL 2 can be disassembled.

4. Remove the four screws Ⓖ which fix MD-CHANGER MECHANISM.
   Then MD-CHANGER MECHANISM can be disassembled.

5. Remove the three screws Ⓗ which fix HEAT SINK.
   Then HEAT SINK can be disassembled.

6. Remove the screw Ⓘ which fixes BRACKET-E, CORD.
   BRACKET-E, CORD can be disassembled.

7. Remove the screw Ⓙ which fixes BRACKET-E, SOCKET.
   Then BRACKET-E, SOCKET can be disassembled.

8. Remove the three screws Ⓚ which fix AMP P.C.B. and POWER P.C.B.
   Then AMP P.C.B. and POWER P.C.B can be disassembled.

9. Straighten the seven clicks of MAIN P.C.B. with radio cutting pliers and the likes.
   Then MAIN P.C.B. can be disassembled.

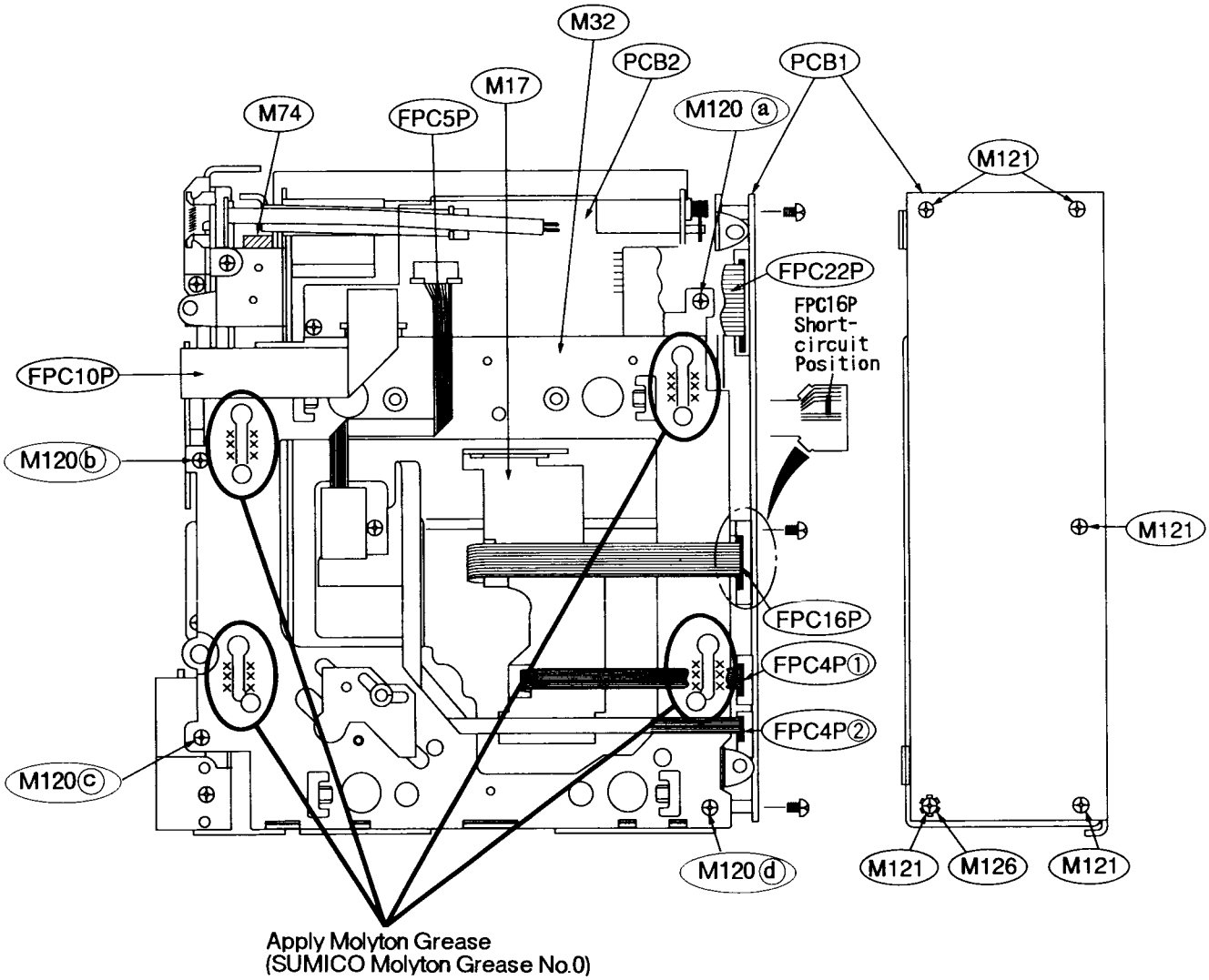
10. Remove the three screws Ⓛ which fix CASE, CONNECTOR.
    Then CASE, CONNECTOR can be disassembled.

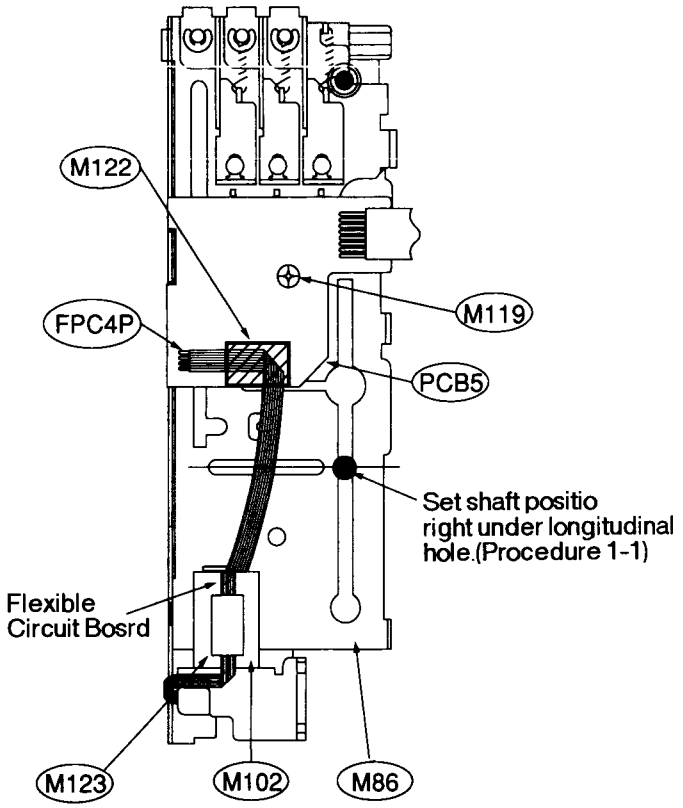
11. Remove the screw Ⓜ which fixes BRACKET-M, PANEL.
    Then BRACKET-M, PANEL can be disassembled.

12. Remove the three screws Ⓝ which fix PANEL, REAR.
    Undo the inlaid parts on the upside and downside, and right and left side of PANEL, REAR with tweezers and the likes.
    Then PANEL, REAR can be disassembled.

13. Remove the screw Ⓞ which fixes DISPLAY P.C.B.
    Then DISPLAY P.C.B. can be disassembled.

DISASSEMBLY PROCEDURES OF MD MECHA





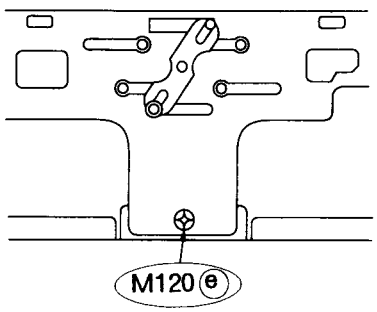


Fig. 1

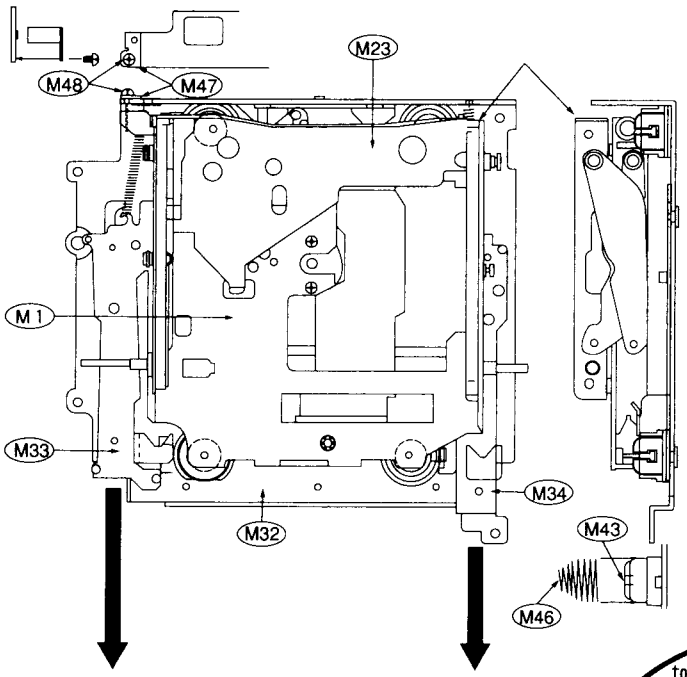
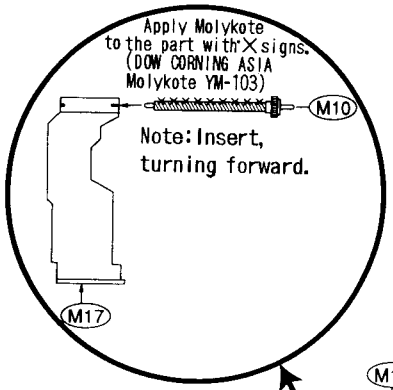


Fig. 2



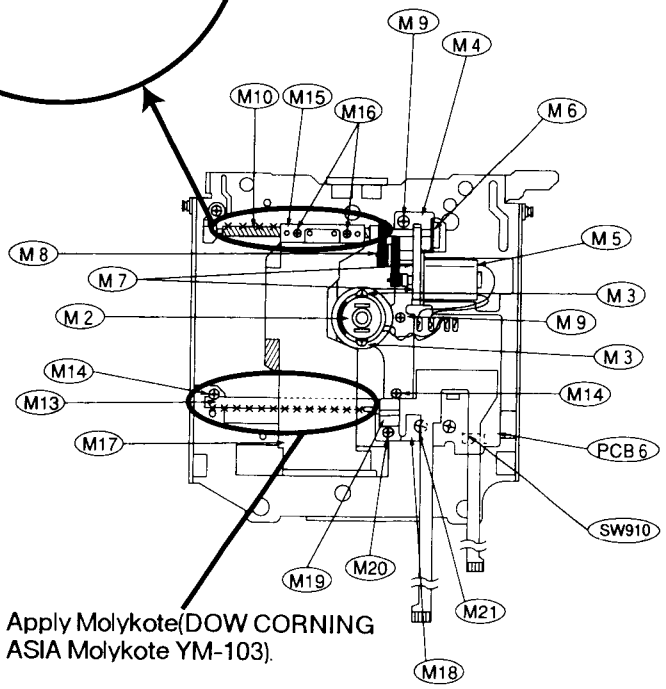


Fig. 3

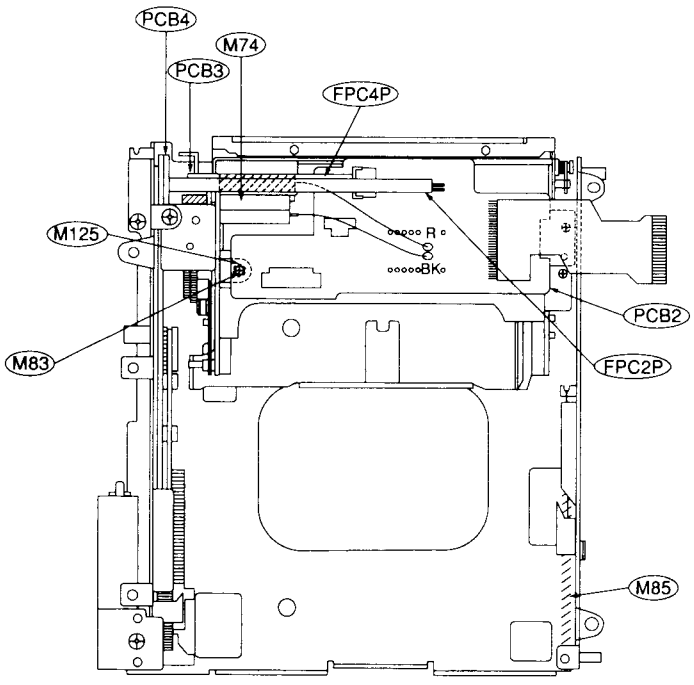


Fig. 4

DISASSEMBLY PROCEDURES OF MD MECHA

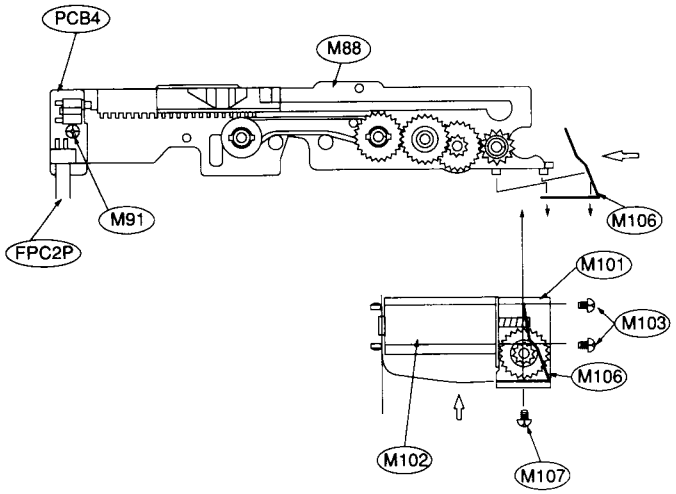


Fig. 5

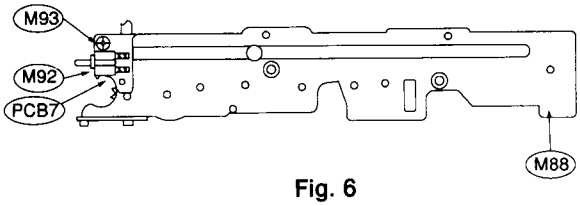


Fig. 6

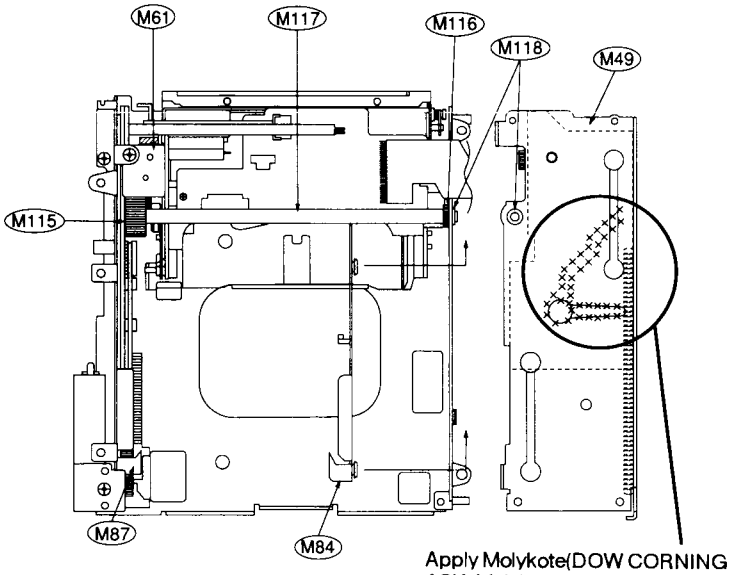


Fig. 7

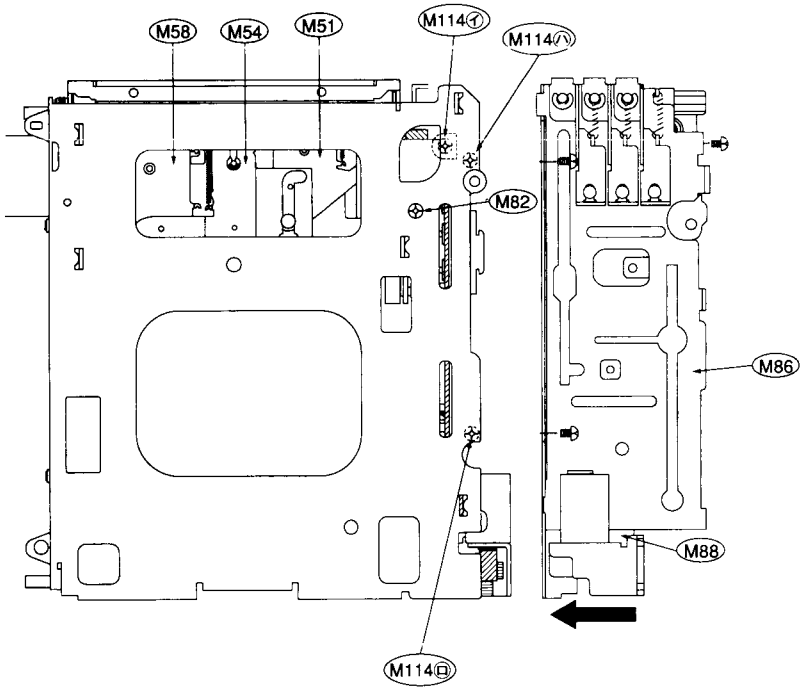


Fig. 8

DISASSEMBLY PROCEDURES OF MD MECHA

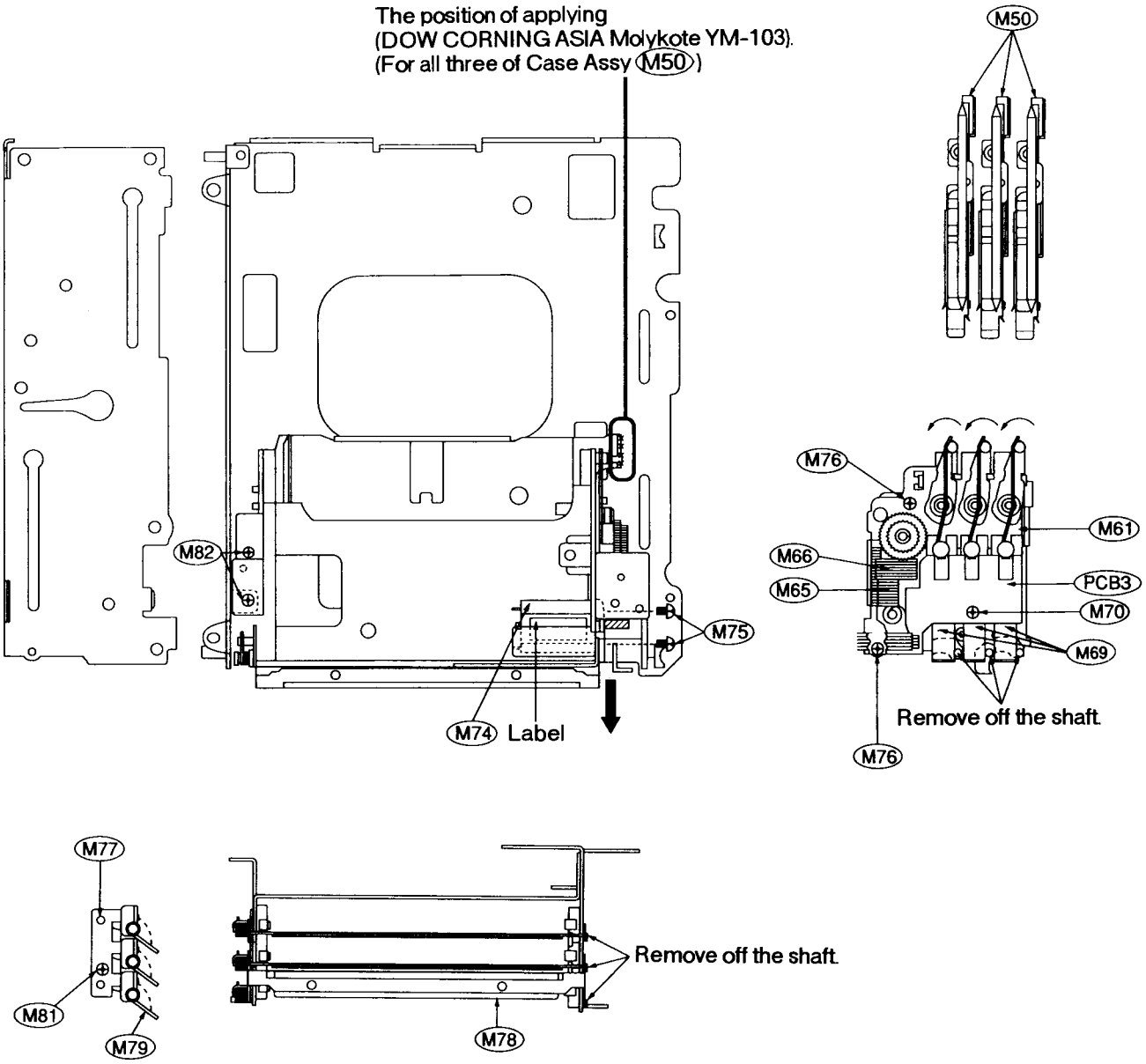


Fig. 9

DISASSEMBLY PROCEDURES OF MD MECHA

1.

○ How to disassemble ASSY, PCB-ML, SERVO PCB1. (Procedure 2 ~ 4)
○ How to disassemble ASSY, MOTOR, SPINDLE M2. (Procedure 1 ~ 13)
○ How to disassemble ASSY, PCB-W, REFLECT, SWITCH PCB6. (Procedure 1 ~ 15)
○ How to disassemble ASSY, MOTOR, FEED M5. (Procedure 1 ~ 17)
○ How to disassemble PICKUP, LASER M17. (Procedure 1 ~ 20)

Procedure	Content	Illustration
1	Set the shaft position of ASSY, CHASSIS, 2 M86 on the left side as shown in Fig. 1 by operating the base part of warm gear of ASSY, MOTOR M74 (Elevator).	Fig. 1
2	Remove the five screws (SCR S-TPG BIN 2X4) M121 Which fix servo circuit board ASSY PCB1. Washer (WASHER OUT TW 2) M126 is fixed only at one position.	
3	Before removing pattern FPC 16P of PICKUP, LASER M17 off socket, be sure to cause short-circuit by soldering. (In assembling, remove solder off the short- circuit point after fitting FPC 16P into socket.)	
4	Remove FPC 22P, FPC 16P, FPC 4P①, FPC 4P② off socket of ASSY, PCB-ML, SERVO PCB1. Then ASSY, PCB-ML, SERVO PCB1 can be disassembled.	
5	Remove the double-sided adhesive tape which fixes FPC 4P② off two positions.	
6	Remove the double-sided adhesive tape which fixes FPC 5P off one position, and remove FPC 5P off socket of ASSY, PCB-W, DRIVER PCB2.	
7	Remove the double-sided adhesive tape which fixes FPC 10P off one position, and remove FPC 10P off socket of ASSY, PCB-W, DRIVER PCB2.	
8	Remove the five special screws M120 which fix ASSY, PLATE, BOTTOM M32. (In tightening screws, follow the order a ⇨ b ⇨ c ⇨ d ⇨ e. After tightening screws, apply molyton grease to the four groove parts (shown by × signs) of ASSY, PLATE, BOTTM M32.)	
9	Remove the right shaft of ASSY, BRACKET-M, ELEVATOR M23 by moving ASSY, PLATE, BOTTOM M32 to the left side. Then remove left shaft, too. Then ASSY, PLATE, BOTTOM M32 can be disassembled.	Fig. 2
	(In assembling, apply molykote YM-103 to the guide holes (the holes which shaft goes through) of ASSY, SLIDE, R M84 and ASSY, SLIDE, L M87. Assemble after setting shaft of ASSY, CHASSIS, 2 M86 at the right position by referring to 1.1.)	Fig. 1, 7
10	Remove BRACKET-M, LIMIT M47 by removing the one special screw M48.	Fig. 2
11	First pull ASSY, SLIDE, L, LOCK M33 and ASSY, SLIDE, R, LOCK M34 in the arrow direction. Keeping them as they are, Pull ASSY, CHASSIS, MD M1 upward. (In assembling, apply ethyl alcohol to the four parts of the middle groove of damper M34 in order to make insertion smooth. Insert springs (Damper) M46 into damper at four positions. In fixing ASSY, CHASSIS, MD M1 to bottom block, confirm that the four shafts are all certainly inserted into damper M43 by holding upward.)	

DISASSEMBLY PROCEDURES OF MD MECHA

Procedure	Content	Illustration
12	Remove solder off the lead wires (red and black) of ASSY, MOTOR, SPINDLE M2, and the lead wires (brown and orange) of ASSY, MOTOR, FEED M5.	Fig. 3
13	Remove the two screws (SCR PAN PCS 1.7X2) M3 which fix ASSY, MOTOR, SPINDLE M2. Then ASSY, MOTOR, SPINDLE M2 can be disassembled. (In assembling, apply three bond TB-1401B to the screw heads after tightening the two screws M3.)	
14	Remove special screws M20 which fix SWITCH, PUSH M19.	
15	Remove the one screw (SCR S-TPG BIN 2X3) M21 which fixes ASSY, PCB-W, REFLECT, SWITCH PCB6. Then ASSY, PCB-W, REFLECT, SWITCH PCB6 can be disassembled. (In assembling, confirm that the click of BRACKET-M, IN SIDE SWITCH M18 fits to the hole of the circuit board, and that the projecting part of MOUNT-M, FEED MOTOR M4 is inserted into the hole of circuit board. Form the lead wires (red and black) of ASSY, MOTOR, SPINDLE M2 into proper shape by twisting them severaltimes and putting them under circuit board.)	
16	Remove the two screws (SCR S-TPG BIN2X3) M9. Then MOUNT-M, FEED MOTOR M4 and ASSY, SHAFT, SCREW M10 can be disassembled.	
17	Remove the gear (Feed B) M8 which is inserted into MOUNT-M, FEED MOTOR M4. Remove the two screws (SCR PAN PCS 1.4X2) M7. Then ASSY, MOTOR, FEED M5 can be disassembled. (In assembling, apply screw lock(loctite601) to the screw heads after tightening the two screws M7.)	
18	Remove ASSY, SHAFT, SCREW M10 by turning it in the left direction. (In assembling, first apply molykote YM-103 to the ASSY, SHAFT, SCREW M10 (the part shown by X signs), and then insert it into PICKUP, LASER M17 by turning it in the right direction.)	
19	Remove the two screws (SCR FLT 2X4) M14. Then shaft can be disassembled. (In assembling, apply three bond TB1401B to the screw heads after tightening the two screws M14. Apply molykote YM-103 to shaft (PU) M13 (the part shown by X signs), and insert it into PICKUP, LASER M17.)	
20	Remove the two screws (SCR PAN PCS1.7X2) M16 Then ASSY, SPRING, PLATE, PU M15 can be disassembled, and PICKUP, LASER M17 becomes single unit. (In assembling, apply three bond TB1401B to the two screws M16 after tightening them. In case PICKUP, LASER M17 is replaced, it is necessary to make adjustment of ASSY, PCB-ML, SERVO PCB1.)	Fig. 1, 3

DISASSEMBLY PROCEDURES OF MD MECHA

2

○ How to disassemble ASSY, PCB-W, DRIVER PCB2. (Procedure 1 ~ 4)
○ How to disassemble ASSY, PCB-W, EJECT SWITCH PCB5. (Procedure 1 ~ 8)
○ How to disassemble ASSY, MOTOR M102 (LOAD). (Procedure 1 ~ 12)
○ How to disassemble PCB-W, LOAD IN SWITCH PCB7. (Procedure 1 ~ 15)
○ How to disassemble ASSY, PCB-W, LOAD OUT SWITCH PCB4. (Procedure 1 ~ 20)
○ How to disassemble ASSY, PCB-W, DISC SWITCH PCB3. (Procedure 1 ~ 21)
○ How to disassemble ASSY, MOTOR M74 (ELEVATOR). (Procedure 1 ~ 27)

Procedure	Content	Illustration
1	Practice MD mechanism disassembling procedures from 1.1 to 1.10.	Fig. 1, 2, 7
2	Remove the two lead wires (red and black) from ASSY, MOTOR M74(Elevator) which is soldered to ASSY, PCB-W, DRIVER PCB2, and then remove the double-sided adhesive tape off the two positions of FPC 2P which comes from ASSY, PCB-W, LOAD OUT SWITCH PCB4.	Fig. 4
3	Remove FPC 4P which comes from ASSY, PCB-W, DISC SWITCH PCB3 off ASSY, PCB-W, DRIVER PCB2. Remove the double-sided adhesive tape off one position.	
4	Remove washer (WASHER OUT TW2) M125 and the one special screw M83. Then ASSY, PCB-W, DRIVER PCB2 can be disassembled.	
5	Remove sheet M122 which fixes FPC 4P of ASSY, PCB-W, EJECT SWITCH PCB5.	Fig. 1
6	Remove solder off FPC 4P which is soldered to ASSY, PCB-W, EJECT SWITCH PCB5.	
7	Remove the double-sided adhesive tape which fixes FPC 4P. Then FPC 4P can be disassembled.	
8	Remove the special screw M119 which fixes ASSY, PCB-W, EJECT SWITCH PCB5. Then eject switch circuit board can be disassembled. (In fixing ASSY, PCB-W EJECT SWITCH PCB5 . confirm the projecting part of SW terminal doesn't get onto the slide.	
9	Remove sheet M123 (to prevent flexible circuit board from breaking) which fixes ASSY, MOTOR M102 (Load) to fiexible circuit board.	
10	Remove the double-sided adhesive tape which fixes ASSY, MOTOR M102 (Load) to flexible circuit board.	
11	Remove the solder off flexible circuit board which is soldered to ASSY, MOTOR M102 (Load).	
12	Remove the two screws (SCR PAN PCS 2X2.5) M103. Then ASSY, MOTOR M102 (Load) can be disassembled. (In assembling, apply three bond TB-1401B to the screw heads after tightening screws M103. Apply molykote YM-103 to warm gear position of motor ASSY M102 (Load).	Fig. 5
13	Remove the special screw M107 which fixes ASSY, BRACKET-M, LOAD MOTOR M101 to ASSY, SLIDE, ELEVATOR, L M88. (In assembling, fix ASSY, BRACKET-M, LOAD MOTOR M101 together with SPRING, PLATE, LOAD IN SW. M106 by using special screw M107.)	
14	Remove the one screw (SCR S-TPG PAN PCS 2X8) M93 with which PCB-W, LOAD IN SWITCH PCB7 and SWITCH, PUSH M92 are both fixed to ASSY, SLIDE, ELEVATOR, L M88.	Fig. 6

DISASSEMBLY PROCEDURES OF MD MECHA

Procedure	Content	Illustration
15	Remove solder off SWITCH, PUSH M92. (Soldering temperature should be 250°C, time within 3 seconds.) Remove the double-sided adhesive tape which fixes PCB-W, LOAD IN SWITCH PCB7 to flexible circuit board. Then load in circuit board can be disassembled.	Fig. 6
16	Remove SPRING, TENS, SLIDE, R M85.	Fig. 4
17	Remove MOUNT-M, SPECIAL WASHER M118 on ASSY, CHASSIS, 1 M49 side, and then remove shaft (Gear I) M117 by removing gear (J) M116. (In assembling, apply molykote YM-103 to the two holes which shaft (Gear I) M117 goes through (the holes of ASSY, CHASSIS, 1 M49 and of fixture ASSY, BRACKET-M, GUIDE L M61, and to gear (I) M115 and gear (J) M116.)	Fig. 7
18	Remove ASSY, SLIDE, R M84. (In assembling, let ASSY, SLIDE, R M84 slide as far as the nearest side (the side of MD inserting position), and then start assembling. Apply molykote YM-103 to ASSY, CHASSIS, 1 M49 and groove part of ASSY, SLIDE, R M84.)	
19	Remove the three special screws M114. Then ASSY, CHASSIS, 2 M86 can be disassembled. (In fixing, tighten the special screws M114 in the order of a ⇨b ⇨ c.)	Fig. 8
20	Remove the one special screw M91 which fixes ASSY, PCB-W, LOAD OUT SW. PCB4. Remove solder off FPC 2P, and ASSY, PCB-W, LOAD OUT SW. PCB4 can be disassembled.	Fig. 5
21	Remove the one screw (SCR PAN PCS 2×2.5) M70 which fixes ASSY, PCB-W, DISC SWITCH PCB3. Remove solder off FPC 4P, and ASSY, PCB-W, DISC SWITCH PCB3 can be disassembled. (In fixing, fit ASSY, PCB-W, DISC SWITCH PCB3 into the groove of shaft. Apply screw lock to the head (SCR PAN PCS 2×2.5) M70.)	Fig. 9
22	Fix dlive ASSY, SLIDE, ELEVATOR, L M88 of loading block by lowering as downward as possible in the ⇦ direction.	Fig. 8
23	Lower shaft of ASSY, BRACKET-M, GUIDE L M61 in the arrow direction, and slide and remove all three of ASSY, CASE M50. (In fixing, apply molykote YM-103 to all three of ASSY CASE M50.)	Fig. 9
24	Remove the three special screws M82. (In fixing, fit loading block into the square hole of chassis.)	Fig. 8, 9
25	Remove the special screw M81. Remove all three holes of LID, CASE M78 off the shaft. Then fixture ASSY (Guide L) can be disassembled. (In fixing, confirm the LID, CASE M78 certainly moves by hooking a bending end of torsion spring (LID, CASE)M79 on LID, CASE M78, and hooking the other end on fixture ASSY (LID, CASE M77).	Fig. 9
26	Remove the two special screws M76. (In fixing, apply molykote YM-103 to gear (F) M65 and gear(G) M66.)	
27	Remove the two special screws M76. Then ASSY, MOTOR M74 (Elevator) can be disassembled. (In fixing, put the labeled side of ASSY, MOTOR M74 (Elevator) at the position shown in Fig. 9, and practice fixing by drawing it in the arrow direction. Apply three bond TB1401B to the heads of screws (SCR PAN PCS 2×2.5) M75.	

EXPLANATION OF MD MECHANISM OPERATION(See Fig.1~Fig.9 in page3~6)

1. Cartridge Loading

○ Insert cartridge into charging position in the shown arrow direction. In the process of insertion, shutter lock is cancelled at the folded part of the case, and shutter opens. Further insertion causes slide ASSY (EJECT) M54 to go farther in and makes lever (DISC LOCK) M58 revolve, which leads to locking cartridge. At the same time lever ASSY (EJECT LOCK) M51 revolves and locks slide ASSY (EJECT) M54, which means completion of cartridge loading.

○ To bring cartridge in play condition, first chuck elevator block by elevator motor M74. Next raise it as high as cartridge position, and pull inward cartridge by motor ASSY (LOAD MOTOR) M102. Then lower elevator block as far as cucking position by elevator motor M74.

2. Cartridge Eject

To EJECT cartridge in play condition, raise elevator block as high as the position of cartridge you want to eject by elevator motor M74. Then bring forward cartridge by motor ASSY (LOAD MOTOR) M102, and then lower elevator block as far as DISC3 position by elevator motor M74. In this state push EJECT button, and slide (MANUAL SLIDE) M69 will slide and cause lever ASSY (EJECT LOCK) M51 to revolve and unlock slide ASSY (EJECT) M54, and cartridge is ejected by spring force of slide ASSY (EJECT) M54.

3. Pickup Feed Mechanism

Pickup Feed works as follows: rotation of motor ASSY (FEED) M5 is transferred to screw shaft ASSY M10 by way of [gear (FEED A) motor ASSY (FEED)], gear (FEED) M8, and [gear (FEED C) screw shaft ASSY], and screw shaft M10 rotates.

*On screw shaft ASSY M10, [fixture (FEED) plate spring ASSY (PU)], which is quipped on pickup M17, is pushed on this is precaution against the phenomenon of screw getting stuck, in case pickup M17 overruns the innermost or outermost track.

4. About Detction Sw

Micro switch (REFLECT) Sw910 detects sort of disc (high reflection disc or low reflection disc) contained in cartridge. Cartridge of low reflection disc (both for recording and playback) has a detection hole. Push switch (INSIDE SW) M19 is for detecting read-in position of pickup, and it operates inside the body of pickup.

Basic Specification

Semiconductor Lasar	Wavelength 790nm (Heat resistence grade)
Objective Lens	NA 0.47 WD = 1.43mm Non spherical plastic (Heat resistence grade)
Detecting Method	Focusing Non point aberration method Tracking 3 beam method
Optical Detector	8 division optical detector
Focusing Actuator	Movability ±0.5mm and more Coil direct current resistence 6.9Ω ± 20% Movable part weight 1.0g
Tracking Actuator	Movability ±0.4mm Coil direct current resistence 6.0Ω ± 20% Movable part weight 1.0g
Body Weight	23g
Operation Temperature	-10℃ ~ +60℃
Preservation Temperature	-40℃ ~ +85℃

Function

1 Standard Test Condition

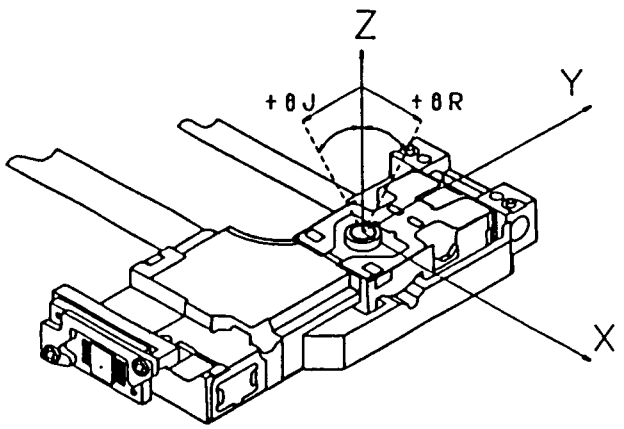
Usually test is supposed to be given in the atmosphere of normal temperature and normal humidity. When something wrong is suspected. test is supposed to be given in the atmosphere of temperature 20℃ ~ 25℃ and humidity 60 ± 5% (RH).

2 Standard Test Posture

Set -Z direction or -Y direction in gravity direction.

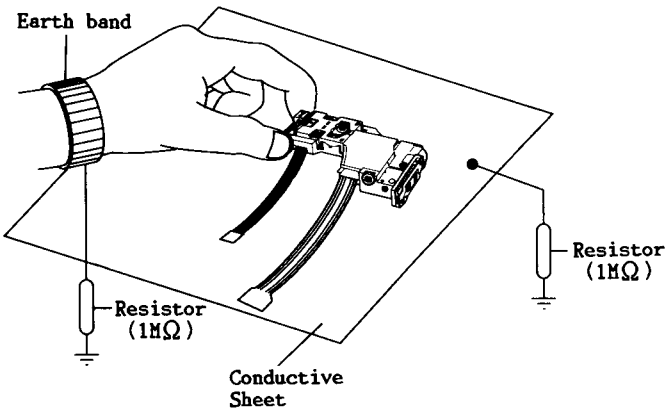
3 Standard Test Disc

SANYO MD disc (Recordable)



NOTES REGARDING MINI DISC REPAIRS

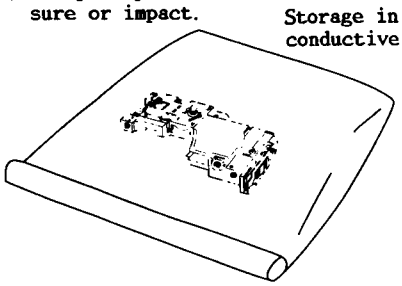
(1) Preparations
1) Compact disc players incorporate a great many ICs as well as the pickup (laser diode). These components are sensitive to, and easily affected by, static electricity. If such static electricity is high voltage, components can be damaged, and for that reason components should be handled with care.
2) The pickup is composed of many optical components and other high-precision components. Care must be taken, therefore, to avoid repair or storage where the temperature of humidity is high, where strong magnetism is present, or where there is excessive dust.

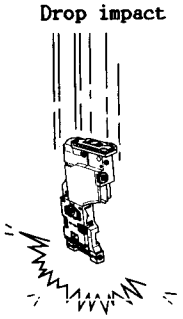


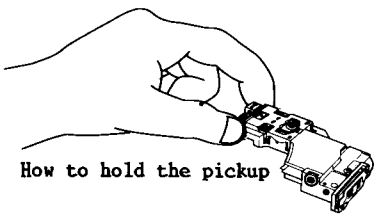
(2) Notes for repair
1) Before replacing a component part, first disconnect the power supply lead wire from the unit.
2) All equipment, measuring instruments and tools must be grounded.
3) The workbench should be covered with a conductive sheet and grounded.
When removing the laser pickup from its conductive bag, do not place the pickup on the bag. (This is because there is the possibility of damage by static electricity.)
4) To prevent AC leakage, the metal part of the soldering iron should be grounded.
5) Workers should be grounded by a earth band(1MΩ).
6) Care should be taken not to permit the laser pickup to come in contact with clothing, in order to prevent static electricity changes in the clothing to escape from the earth band.
7) The laser beam from the pickup should NEVER be directly facing the eyes or bare skin.

NOTES REGARDING HANDLING OF THE PICKUP

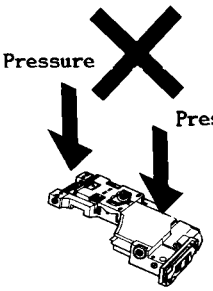
(1) Notes for transport and storage
1) The pickup should always be left in its conductive bag until immediately prior to use.
2) The pickup should never be subjected to external pressure or impact.

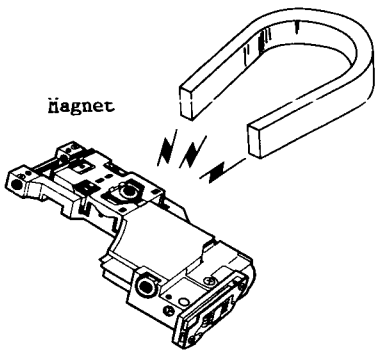




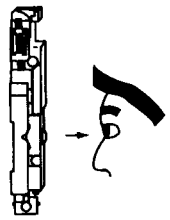


(2) Repair notes
1) The pickup incorporates a strong magnet, and so should never be brought close to magnetic materials.
2) The pickup should always be handled correctly and carefully, taking care to avoid external pressure and impact. If it is subjected to strong pressure or impact, the result may be an operational malfunction and/or damage to the printed circuit board.
3) Each and every pickup is already individually adjusted to a high degree of precision, and for that reason the adjustment point and installation screws should absolutely never be touched.
4) Laser beam may damage the eyes!
Absolutely never permit laser beams to enter the eyes!
Also NEVER switch ON the power to the laser output part(lens, etc.)of the pickup if it is damaged.

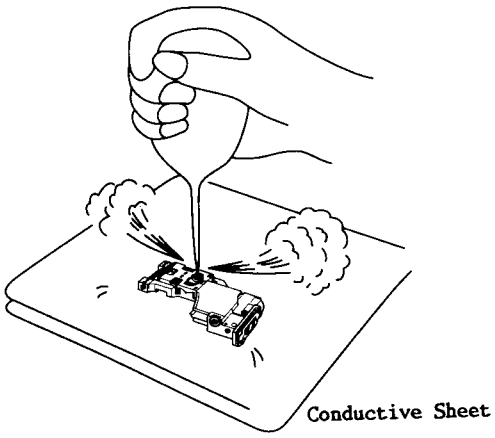




Laser Beam



NEVER look directly at the laser beam, and don't let contact fingers or other exposed skin.

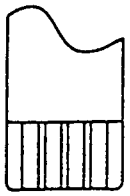


5) Cleaning the lens surfase
If there is dust on the lens surface, the dust should be cleaned away by using an air brush(such as used for camera lens). The lens is held by a delicate spring.
6) Never attempt to disassemble the pickup.

CONNECTION FIGURE OF CONNECTOR

FPC ACT

1	F −
2	T +
3	T −
4	F +

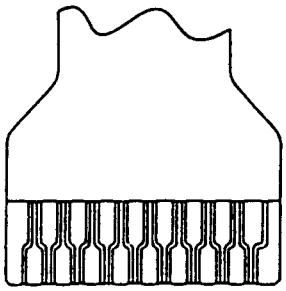


1 4

Copper-foiled side is Frontal side.

FPC LD PD

1	J
2	I
3	VC
4	VEE
5	VCC
6	F
7	E
8	C
9	D
10	A
11	B
12	NC
13	LD
14	GND
15	MD
16	VR
17	VRF
18	MDF



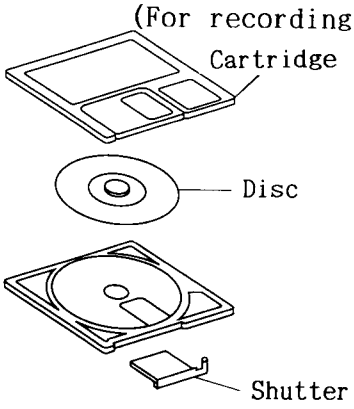
1 18

Copper-foiled side is Frontal side.

Explanation of Mini-disc

Mini-disc is a disc of 64mm in diameter contained in a cartridge, and is easier than CD to deal with, as it is not influenced by dust and protected against scars.
Both recording and playback can be operated by digital method, and its sound quality is no less high than that of CD.
Farthermore, it never gets entangled or stretched, so the sound quality never deteriorates, and the durability is great.

Structure of Mini-disc
(For recording)

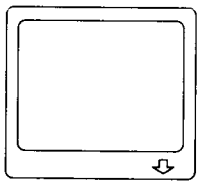


Types of disc

There are two types: one is for playback-only, and the other for recording.

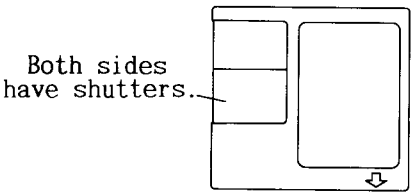
Playback only Mini-disc
Music soft on the market is this type, which is optical disc just like CD.
Playback is operated by means of optical pickup.

Mini-disc for recording
This is a raw disc which can also be used for recording by adopting optical-magnetic disc.
Recording is operated by means of lasar and magnet, and repeated recording is possible.



Sound Skip Guard Memory

This Mini-disc has made a great improvement in anti-vibration ability by adopting semiconductor memory, which has enabled disc to avoid sound skip caused by vibration which has been said to be a weak point of disc.
During playback, 11 seconds' worth of information is always accumulated in semiconductor memory. So even if pickup can't temporarily read information because of shock from outside, play condition is continued without any break of sound by sending accumulated information.



Adaptive Transform Acoustic Coding "A T R A C"

Owing to newly developed sound transformation technique "ATRAC", Adaptive TRansform Acoustic Coding, it has become possible to read at maximum 74 minutes of music, which is the same amount of CD, in Mini-disc of 64mm in diameter which is nearly half the size of compact disc.
This new technique ATRAC cuts off inaudible sound to a human ear, and compresses music data to nearly one fifth.
As data is sorted out based on auditory psychology, no audio quality is deteriorated.

Rapid Access

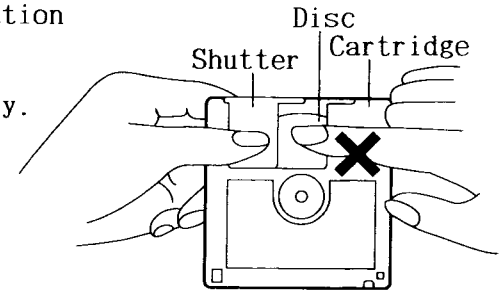
One of the features only disc has is rapid access to the requested tune.
Randam access, which means changing tune order, is another function only disc has.

This Mini-disc changer is only for playback.

- Playback-only Mini-disc (music soft on the market) and Mini-disc for recording which has already been used for recording with another machine can be used for playback.
- This product can display disc title or tune name in the course of playback of Mini-disc if it contains character information.

About How to Deal with Mini-disc

As disc itself is contained inside cartridge, it is easy to deal with, because there are rather few chances for dust, scars or fingerprints to damage it. Yet still be careful about one thing shown below, as sand dust coming in through slight opening of cartridge, stain on cartridge, or camber can cause operation failures.



- Don't touch Mini-disc directly!
  Don't open shutter or touch Mini-disc directly. If you forcedly try to open shutter, you will destroy it.

About Where to Put Cartridge

Don't leave cartridge where it is exposed to direct sunshine or where temperature is very high, for example in closed car, or where it is very humid. Besides, don't leave cartridge on the beach or sandy place where sand easily comes into cartridge.

Look after Cartridge Periodically

If you find dust or things like that on the surface of cartridge, wipe it off with a dry piece of cloth.

In Case You Suspect Failure

Some trifle wrong operation or wiring mistake can be suspected as failure. Please give another check before you ask for repair.

On Such an Occasion	Check This Point
Power can't be supplied.	○ Isn't extention code connected imperfectly? ○ Hasn't fuse blown?
No sound can be heard.	○ Isn't speaker code connected imperfectly? ○ Is volume high enough?
Neither front speaker nor rear speaker works.	○ Isn't FAD level deflected to either one side?
Radio doesn't speak.	○ Isn't antenna connected imperfectly?
Auto radio station selection doesn't work.	○ Is electric wave weak? Try manual station selection.
Radio sensitivity is bad.	○ Isn't power antenna or antenna booster connected imperfectly? ○ Has antenna extended to the full?
MD doesn't go in.	○ Isn't each slot occupied by another MD? ○ Isn't MD inserted in the wrong direction? Insert MD with the ↑ side upside and in the ↑ direction. ○ Aren't screws of the main body for transportation (two screws) remaining fixed?
Noise is mingled with MD playbacksound, or sound skips.	○ Isn't mounting angle of the main body more than 30°? ○ Is the main body mounted firmly with metal fittings and screws which are attachments to the main body?
Operation button doesn't work.	○ Is CD player on seperate sale in play mode? In case "AUX" display is lit, first turn off "AUX" display by pushing EJECT button or stand-by button of CD player, and then operate.

THE OUTLINE OF MINI-DISC

It's been ten years since CD appeared among the music media with records in center. Beautiful digital sound quality and convenient functin have attracted many people, and these days people take listening to music by CD for granted. And yet users still have various desires to enjoy digital sound more actively and more personally. Now here is the presentation of MD which meets all such desires.

This is a new medium which will surely change oncoming music world with casset-tape-like easy availability and pleasure of recording, in addition to high sound quality of CD and handling easiness.

Block Figure of Mini-disc System (Record/Playback Mechanism)

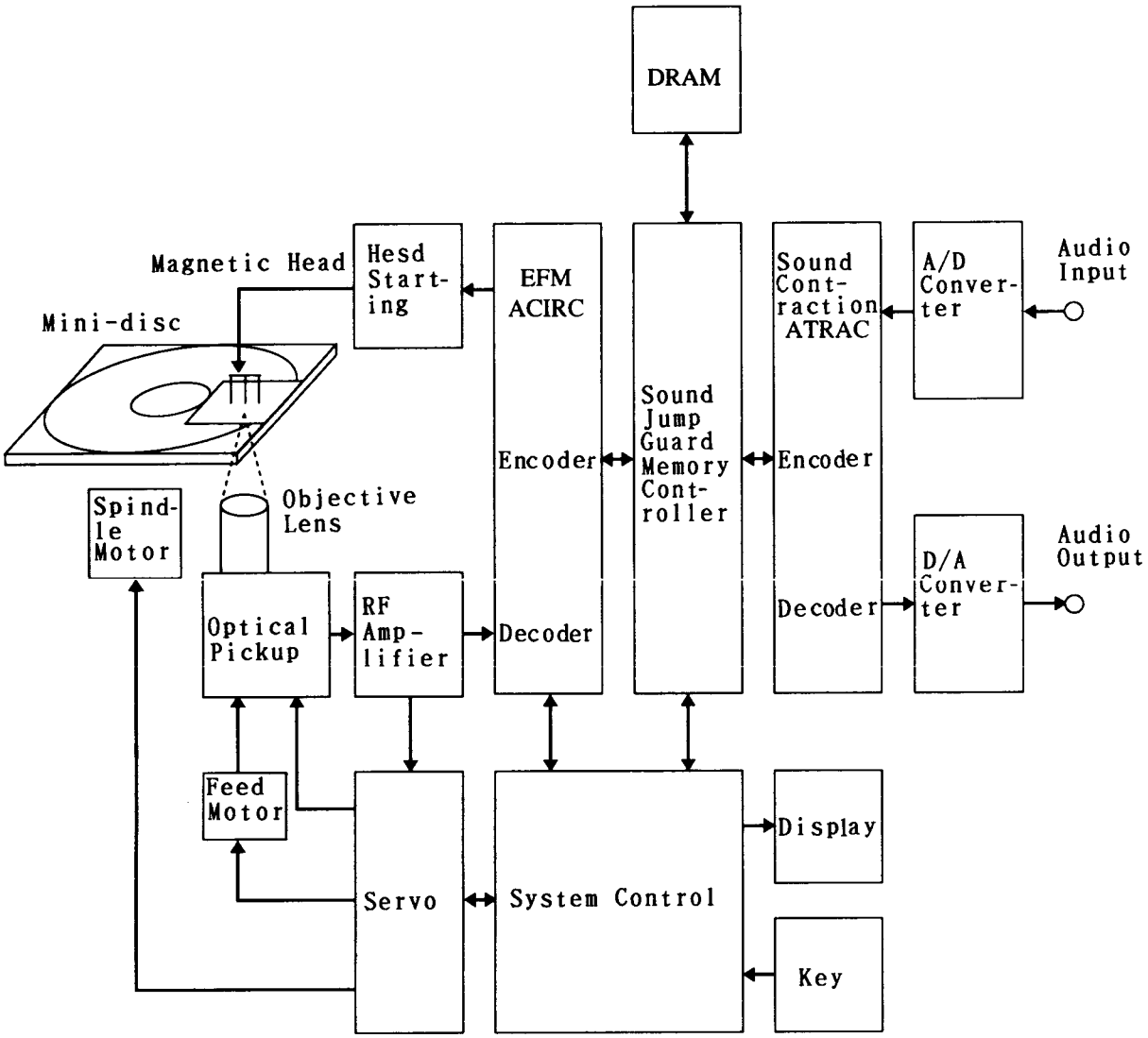


Fig. 1

Specification

Figure 1 shows system block illustration, and the table on the right shows MD specification. As you know from the table, modulation system of record signal and error correction system are almost the same as CD, so read out of playback-only disc is designed by making use of CD technique.

The data structure is almost like CD-ROM Mode 2, which makes contracted data of 424 byte one sound group, and arranges 11 sound groups in 2 sectors. 32 sectors of contracted data, with 2 sub-data sectors and 2 link sectors, which make 36 sectors in all, are called one cluster. Recording is always operated by the cluster. In terms of system, so far as encoder/ decoder of sound contraction (ATRAC) is equipped after EFM/ACIRC, namely encoder/decoder, digital sound contraction can be deal with. As contraction rate is about one-fifth, transmission read of data to ATRAC decoder is only 300kbit/s as against 1.4Mbit/s, actual read out rate from disc.
MD system has taken advantage of this, and succeeded in preventing sound from jumping By utilizing contraction technique, a small easy to-handledisc with 74 minute record/playback ability and quick random access system. The difference of transmission rates, which happens like this, is put to good use to overcome sound jumping problem, which used to be regarded as a weakpoint of a disc. We can say this is really "two birds with one stone".

ATRAC···Adaptive Transform Acoustic Coding
EFM·····Eight to Fourteen Modulation
ACIRC···Advanced Cross Interleave Reed-solomon Code

Main Specification	
Record Playback Time	74 minutes at a maximum
Cartridge Dimension	68X72X5mm
Disc Specification	
Diameter	64mm
Thickness	1.2mm
Hole Diameter	11mm
Diameter at the Beginning of Program Area	32mm
Diameter at the Beginning of Read-in Area	29mm
Track Pitch	1.6μm
Disc Linear Velocity	1.2 ~ 1.4m/second
Audio Function	
Channel Number	2 Channels (Stereo)
Frequency Range	5 ~ 20kHz
WOW Flutter	Crystal Oscillator Accuracy
Signal Format	
Specimen Frequency	44.1kHz
High Performance Code System	ATRAC
Modulation System	EFM
Error Correction System	ACIRC
Optical Parameter	
Laser Wavelength	Standard 780nm
Opening Number of Objective Lens	Standard 0.45
Recording Power	5mW at Maximum
Recording System	Magnetic Field Modulation system

Structure of Two Kinds of Disc

1. Cross Section of Disc Circuit Board

The cross section of disc circuit board contained inside cartridge presents the form as shown in Fig. 1. There is magnetic board in the center of polycarbonate circuit board, and there is no particular difference between playback-only optical disc and magneto-optical disc for recording. In fixing optical disc to drive assembly, sentering is necessary, and centering is to be operated based on inner track edge of polycarbonate circuit board just like CD.

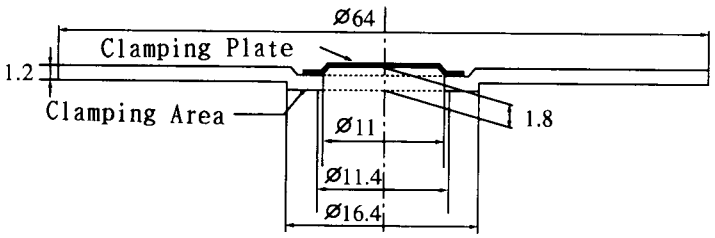


Fig. 1 Cross Section of Disc Circuit Board

MD is adsorbed to the magnet on the assembly side with magnetic board fixed in the center of disc circuit board. If it is to be fixed by being pinched from upside and downside, there should be a hole on the upside and downside of cartridge. This causes cartridge to have no space for printing label for music soft, which is avoided. As inner track edge of disc circuit board is referred to as basis, inner edge is as thick as 1.8mm. The thickness of disc is 1.2mm, which is the same as CD.

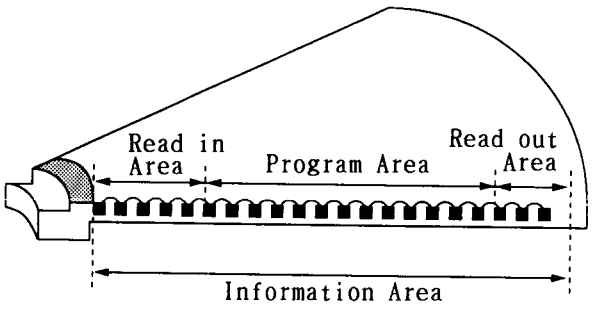


Fig. 2 Cross Section of Playback-only MD

2. Playback-only Optical Disc

Figure 2 shows the cross section of playback-only MD, which arranges read-in area in the inner track and read-out area in the outer track of information area of disc. Information is stamped in pit in the disc circuit board like CD. (FIG. 3) Discs can be produced in large quantities by using stampers and injection molding machines. There is a shutter window to read in laser beam only at the lower part of cartridge, and the upper part of cartridge is designed to bear a player's portrait or something like that sticked on.

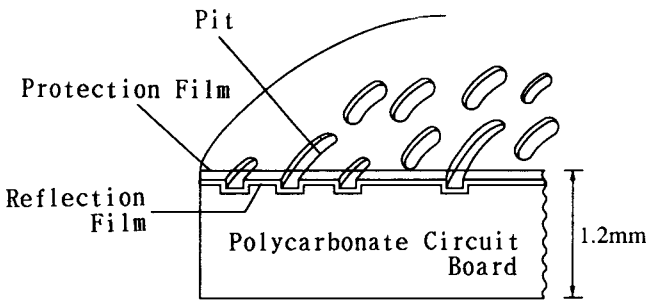


Fig. 3 Cross Section of Disc

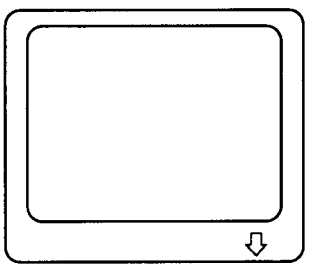


Fig. 4 Appearance of Playback-only MD

3. Magneto-optical Disc for Recording
Figure 5 shows the cross section of information area of magneto-optical disc. In recording, laser beam comes from the lower shell side of disc, so cartridge has a hole on both sides to impress magnetic field from upper shell side. (Fig. 8) Magneto-optical film is also designed to apply to the overwrite out of magnetic field modulation.

This excellent feature of magneto-optical disc, which enables rewriting more than one million times and stands long preservation, has been already proved as outer memory for computer.

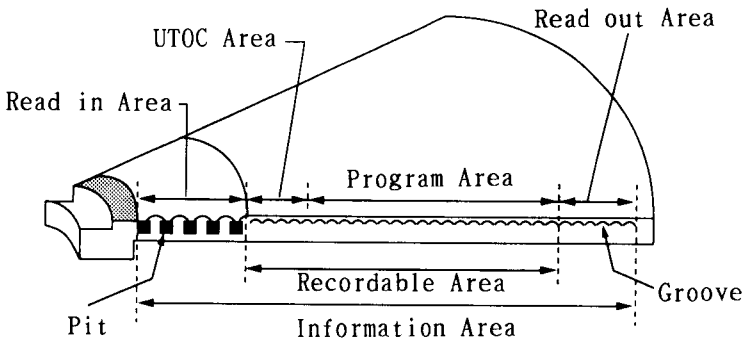


Fig. 5 Cross Section of Optical Magnetic Disc for Recording

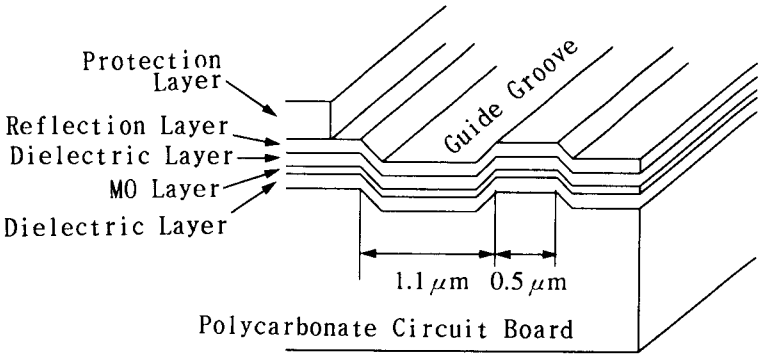


Fig. 6 Film Structure of Magneto-optical Disc for Recording

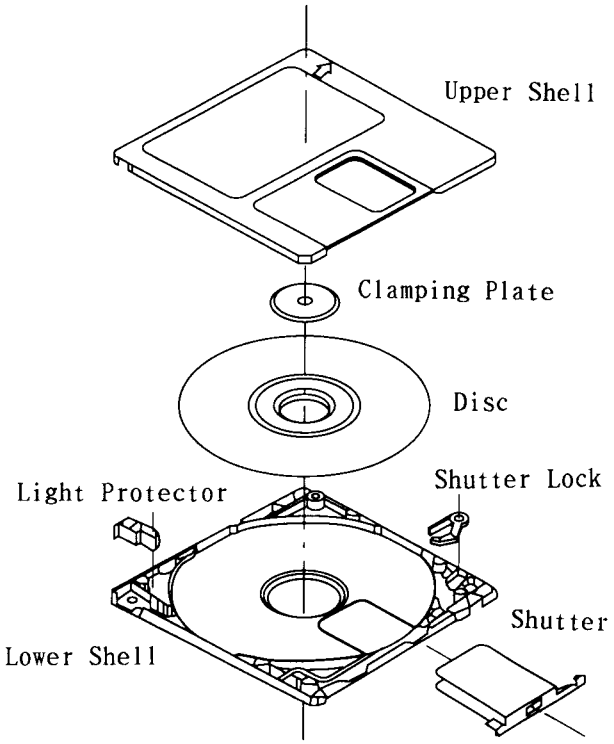


Fig. 8 Structure of Record/Playback MD

4. Hybrid Mini Disc (Option)
Mini disc has hybrid-typed format which forms information area as shown in Fig. 7. Users can't erase the programarea of inner track. So, for example, when used for the purpose of linguistic training, it is possible to record an instructor's voice in inner program area and a learner's voice in outer user's area, and afterward compare the pronunciation of the two areas. Please enjoy unique applications to your taste by taking advantage of the merit of this disc.

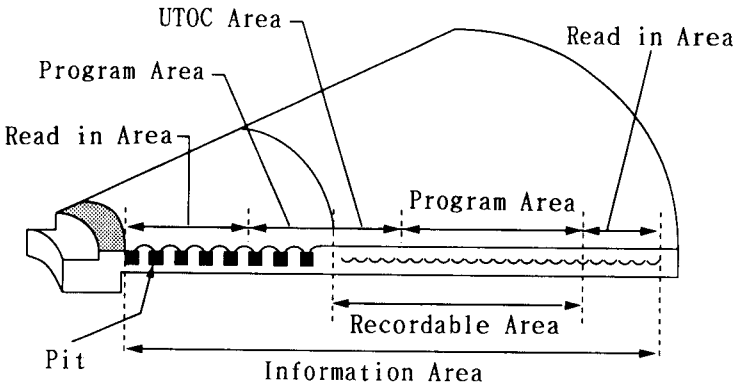


Fig. 7 Cross Section of Hybrid Mini Disc

Data Structure of Mini Disc

Characteristic

CD-ROM Mode 2 is adopted.
Playback-only disc has larger sub-data capacity than record/playback disc.
Mini disc adopts EFM (eight to fourteen modulation) as modulation system for write in into disc, and AIRC (advanced cross interleave Reed-Solomon code) as error correction code. Contracted audio data is recorded in this format.
Contracted data is recorded by the block. this is very similar to MOde 2 standard. (Fig.1)
CD-ROM makes 98 frames of CD 1 sector, and becomes 13.3ms when conversed into playback time. Interleave length of CIR is 108 frames (14.5ms), which is longer than 1 sector. This is because 3 sectors should be made "abandoned sectors" to record data by using error correction code of CIRC.
This abandoned sector area is called link area. Before beginning to write data, link area of more than 108 frames should be prepared. After finishing writing data, too, it is necessary to secure more than 108 frames (1 sector + α) area. otherwise, interleave of error correction can't be completed.
If it is made possible to choose random position for writing, disc areas will be scattered here and there inside disc, which will lead to reduced efficiency in using. So data is arranged to be written by the big mass to some extent.
In mini disc system, this recording unit is called "1 cluster". 1 cluster consists of 36 sectors, and transcription is always operated by the cluster multiplied by integral. Recorded data is first accumulated in RAM, and then written in into disc. This RAM is also used as sound skip guard memory in the course of playback.
As for magneto-optical disc for recording, the first 3 sectors are made link sector. The next 1 sector is reserved for sub-data, and contracted data is recorded in the rest 32 sectors. In recording data, recording starts halfway of the second link sector.
After finishing writing in the 36th sector, data for error correction should be written into the first link sector of the next cluster, and as far as halfway of the second sector.
Playback-only disc has no need to have the three sectors for link area, because data is written in with a single stroke. So by adding these three sectors, the first four sectors are allocated for sub-data. As this part can contain graphics data, it can be used, for example, for 'kalaoke'. In this way, mini disc has different sub-data capacity respectively with disc for recording and with playback-only disc, so this is the reason why it is impossible to copy data including sub-data completely from playback-only disc to disc for recording.

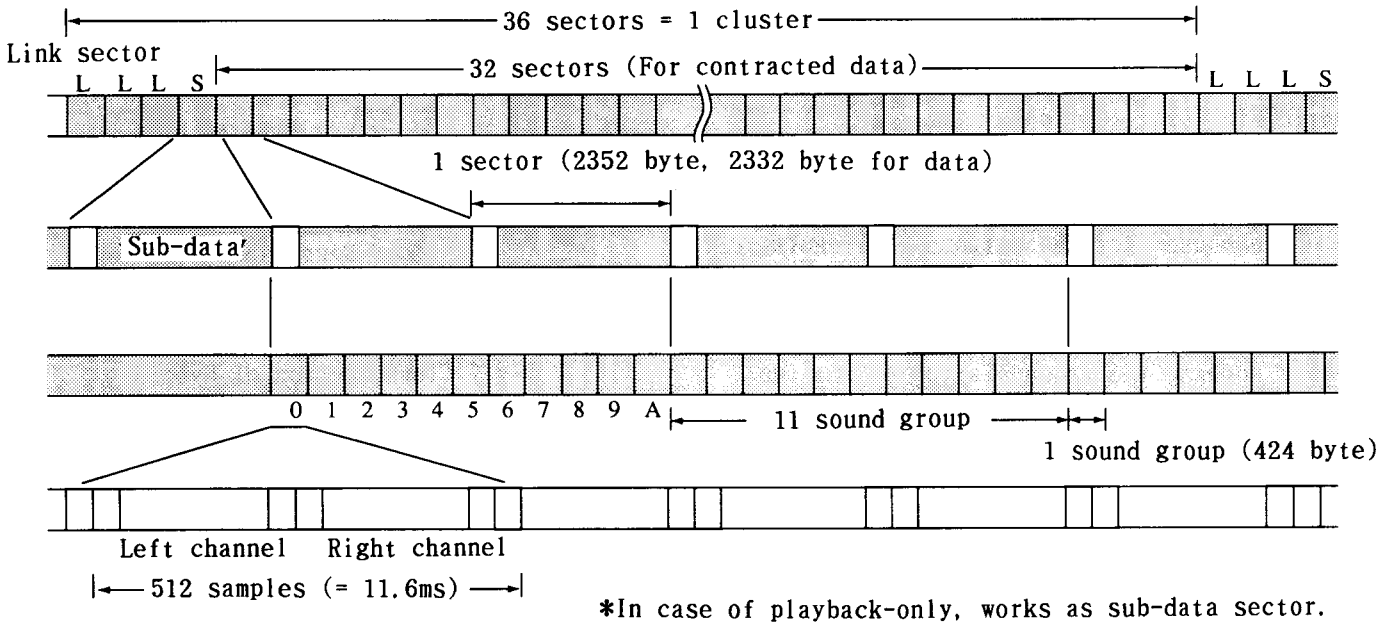


Fig.1 Structure of MD Data

Audio Contracted Data

In case of audio contracted data recorded in 1 sector of mini disc, 424 byte of contracted data is dealt with as 1 unit, which is called "sound group". 212 byte are allocated respectively to right channel and left channel. This contracted data, stretched and put back into time axis information, is equal to 512 samples of right and left channel (512X16X2/8=2048 byte), which means the data is contracted to one-fifth. It takes 11.6ms to playback 1 sound group. Contracted data keeps coordination with sector by arranging 11 sound groups with 424 byte as 1 unit each into 2 sectors. 5 groups from right and left channel and 1 group from left channel are recorded in the first sector (424X5+212X1=2332 byte). In the second sector, 1 group from right channel and 5 groups from right channel are recorded (212X1+424X5=2332 byte). In this way, 2 sectors have 11 groups written in. Through the above procedures, contracted data is recorded in 32 sectors inside 1 cluster.

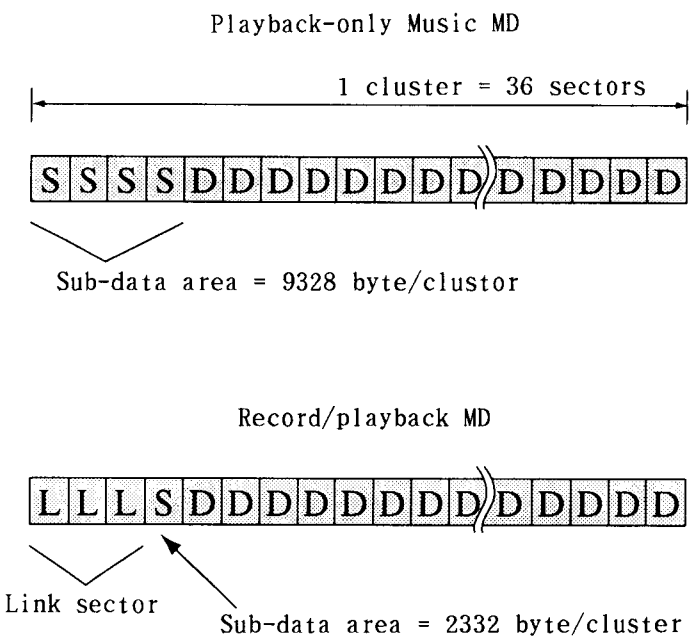


Fig. 2

Merits of Playback-only Music Mini Disc

(1) As data is physically stamped in pit, the data can never be erased so far as disc is not destroyed.
(2) Label area is larger than record/playback MD, and the whole one side can be used.
(3) Sub-data capacity is big.

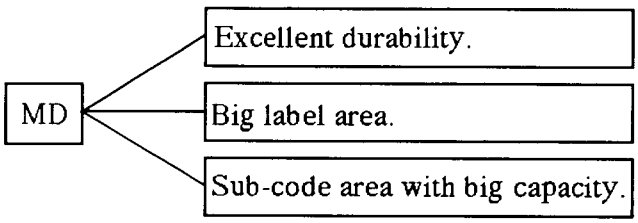


Fig. 3

MiNi Disc System and New Technique

Newly Developed Sound Contraction Technique "ATRAC"

Mini disc is made as small as 64mm in diameter to make it suitable for personal audio use. When it comes to recording the same amount of digital signal in this mini disc as that of CD, the time for record or playback will be only 10 minutes or so.
So the method to enable record or playback time to be as long as 74 minutes at maximum like CD was searched for. At that stage of time, the conclusion was that adopting the technique of digital contraction is better than trying to raise record density of disc five times as high as that of CD. In coding CD, when analog signal is transformed into digital signal, the information amount of 2chx16bitx44.1kHz=1.4Mbit/s is necessary regardless of presence or loudness of music signal. So, to make recording for 74 minutes possible, it is necessary to contract the amount of information and make it as small as nearly to one-fifth, 300kbit/s. Newly developed audio contraction technique ATRAC (Adaptive Transform Acoustic Coding) has succeeded in cutting out audio data after AD transformation using time frame of 11.6ms at maximum, and resolve it into frequency element by means of Modified Discrete Cosine Transform operation. (Fig.1)
Then frequency area is divided into three in advance. The purpose of dividing area is raising function and reducing cost.
As for function, pre-echo, which often occurs through MDCT operation, can be avoided. As for cost, hardware size can be made small by selectively valueing the level below medium area to which human ear is very sensitive.
After being transformed into frequency axis through modified DCT, data is thinned down by making use of human aural characteristics. As noise or small signal near big music signal frequency elements can be made inaudible by using aural mask, audible elements are reserved and unnecessary inaudible elements are discarded. Such technique based on aural psychology has realized this high quality sound with one-fifth worth of information quantity. Contracted data is first collected by the sound group, and then recorded in disc by the cluster. In case of playback, contracted data recorded in disc is stretched by means of decoder, and put back to audio data with specimen frequency 44.1kHz, MD resolusion power 16 bit.
Figure 3 is block illustration of decoder. Data of high area and medium area is put back to time axis information by practicing inverse modified DCT operation, and then medium area and low area are synthesized. Finally high area is synthesized by synchronizing timing through delay circuit, and is transferred to D/A transducer.

Pre-echo
A kind of noise which occurs when audio data is put back to time axis information by practicing MDCT operation.
This is the phenomenon in which specific noise overlaps before real sound is audible.
This noise is conspicuous against sharp sounds such as clapping of castanets.

Sound Waveshape and Each Frequency Element

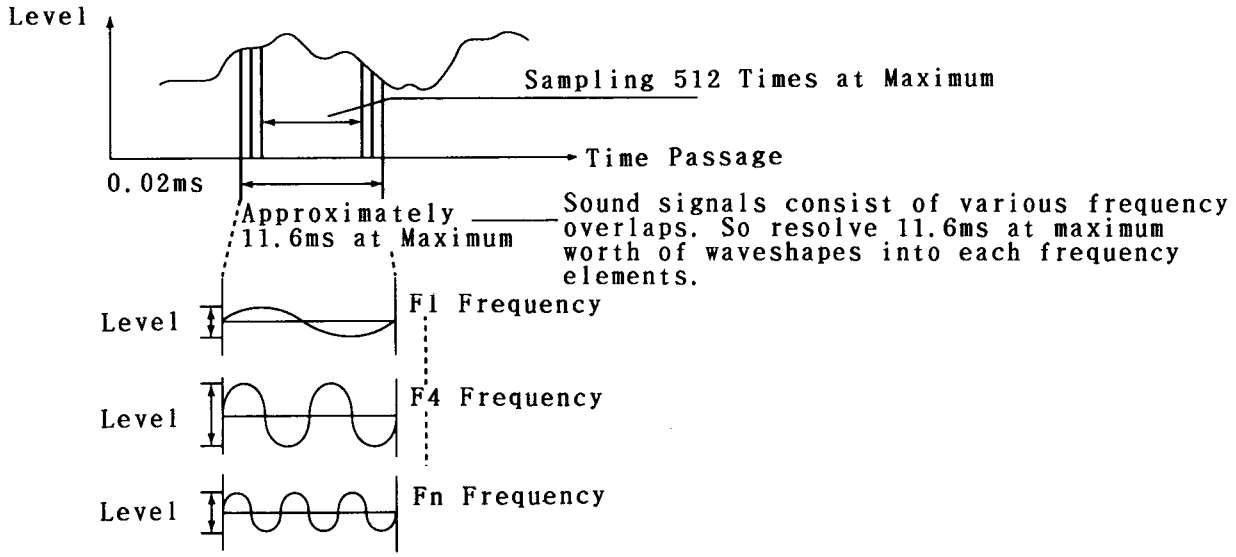


Fig.1 Principle of ATRAC

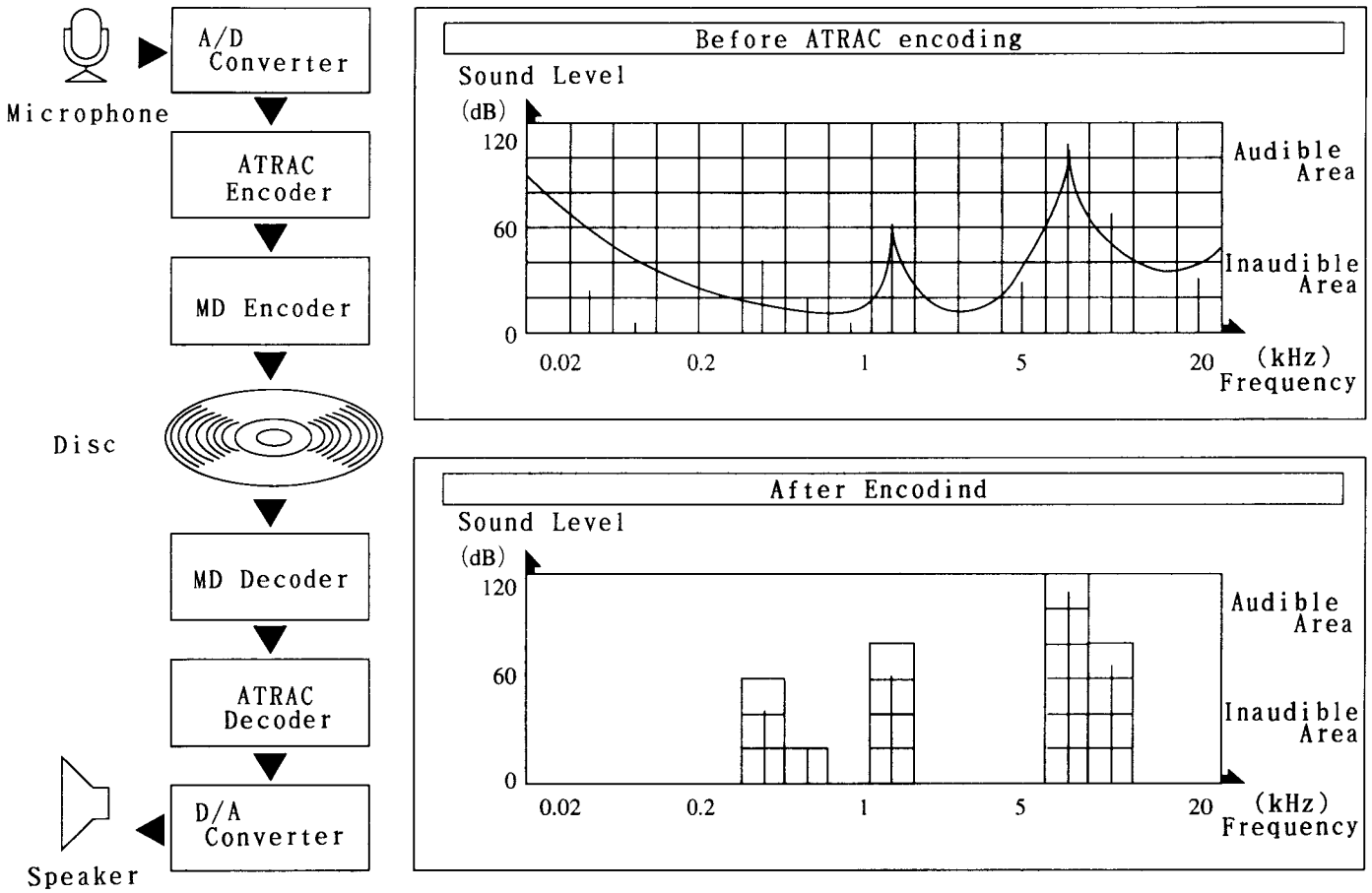


Fig. 2 Masking Effect

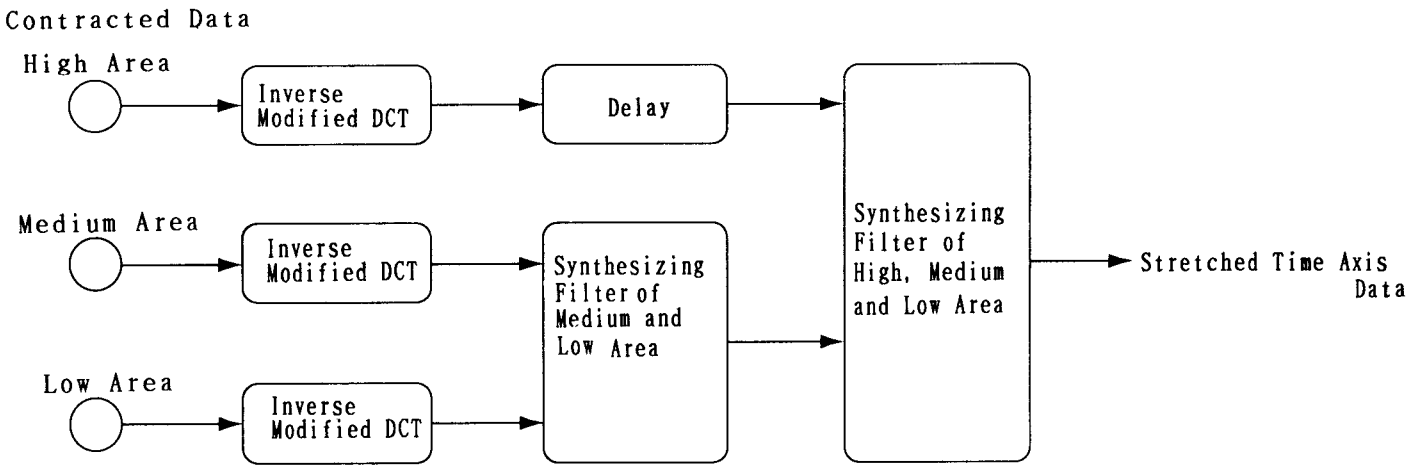


Fig. 3 Block Figure of Sound Contraction Decoder

Sound Jump Guard Memory

Occasional jumps from vibration used to be the greatest problem in using optical /magneto-optical disc outdoors. Mini disc system has succeeded in raising anti-vibration ability remarkably by adopting semi-conductor memory. This new technique is named "Sound Jump Guard Memory". In the course of mini disc playback, optical pickup reads in digital signals on disc by 1.4Mbit/s. On the other hand, "ATRAC" decoder, which is given 300Kbit/s data, makes it possible to resolve "ATRAC" contraction and output music signals through A/D converter without any break. Semiconductor memory is inserted as data buffer between optical pickups (to be more accurate, between EFM and CIRC decoder). (Refer to Fig.4, Block Figure of Mini Disc System, on page 17.)

When DRAM of 1Mbit is used for this semiconductor, RAM becomes full of digital signals only in 0.9 second during playback of music. Even if a big vibration occurs and reading digital signals on disc becomes impossible, RAM can keep transferring digital signals to "ATRAC" decoder. In other words, optical pickup gains access to the original position on disc within 3 seconds, and resumes reading signal, so what is called sound jump can never occur. Besides as the position of optical pickup is always monitored by address recorded by forming all around disc, sound jump position can be instantly recognized.

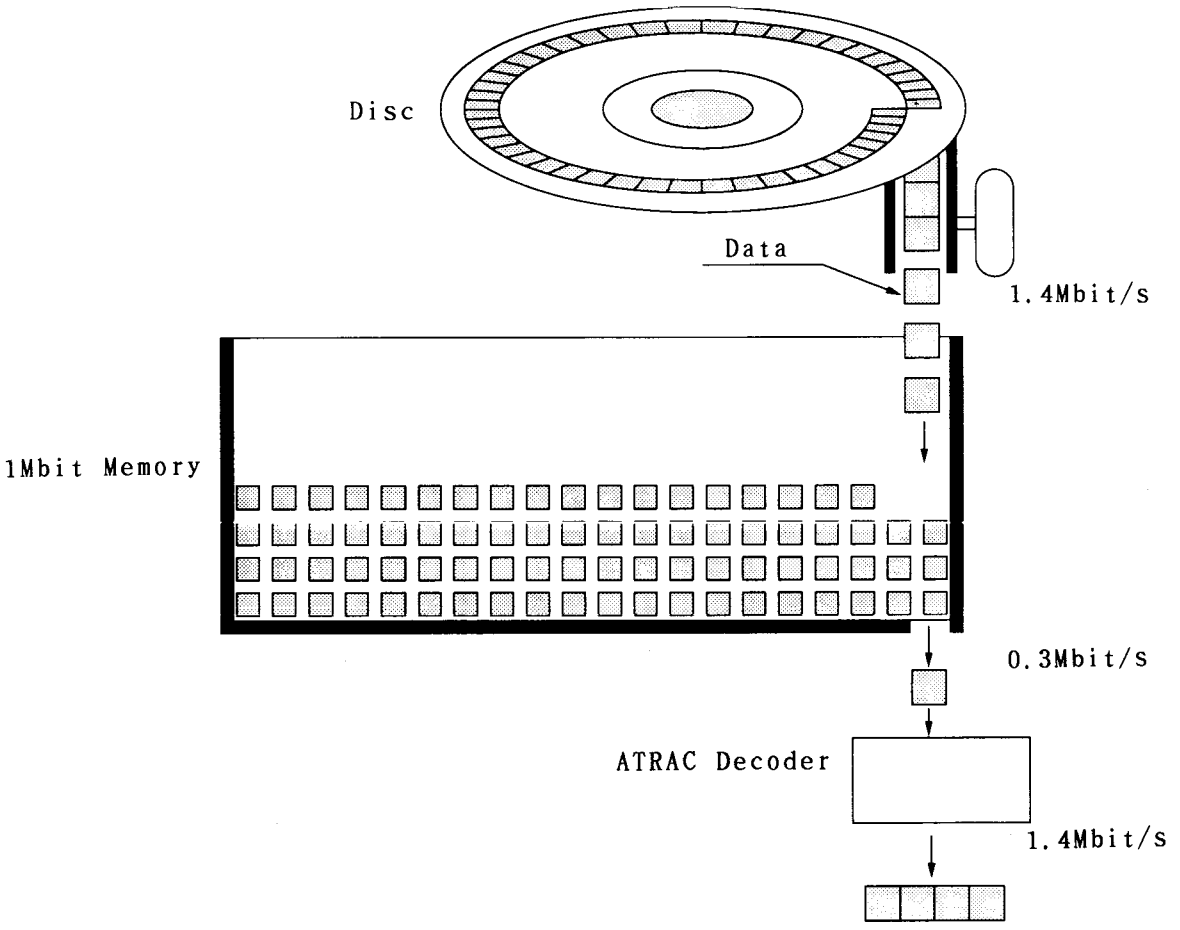


Fig.4 Sound Jump Guard Memory

Intermittent Read-out of Mini Disc

Figure 5 shows the difference of read-out from disc between CD and mini disc. CD should constantly transfer 1.4Mbit/s signals into D/A converter, while mini disc needs only 0.3Mbit/s, because as the signal which is read out by 1.4Mbit/s is contracted signal, it takes only 0.3Mbit/s flow to decode it. It follows that, as shown in the figure, disc signal is intermittently read out. Read-out amount and standby time interval can be selected depending on system design. Figure 6 shows the condition of data accumulation of sound jump memory. In stable condition without any shock, as shown on the left side of the figure, data read out from disc begins at a certain amount, and memory is always kept in full condition. When a shock is given, as shown in the center of the figure, read out amount becomes bigger than usual by the time for searching sound jump position.

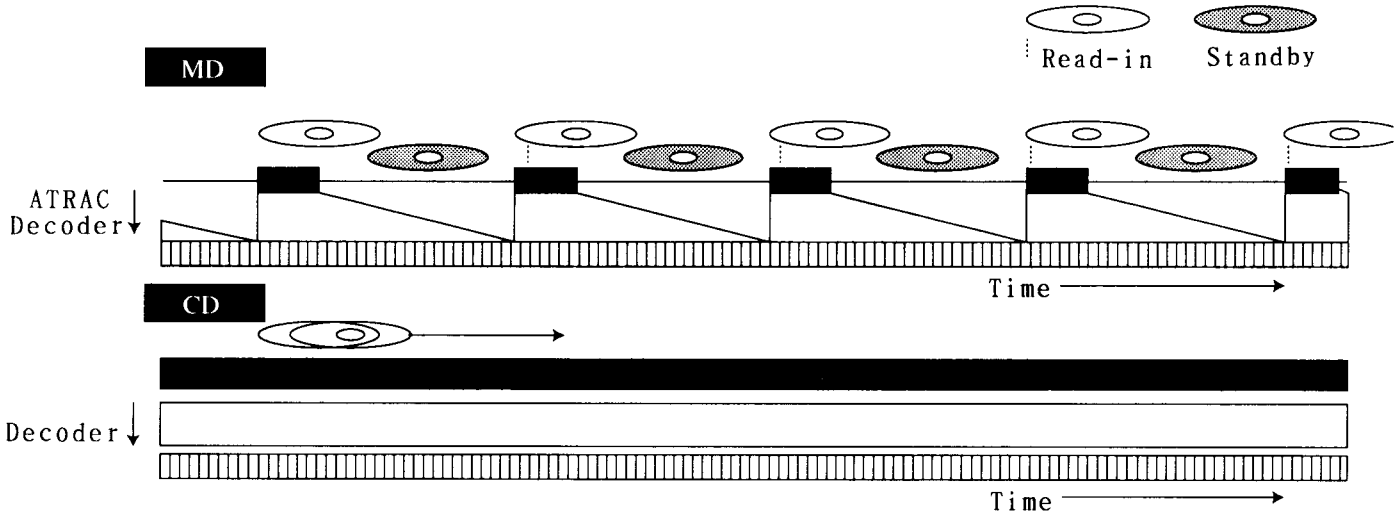


Fig.5 Intermittent Read out of Mini Disc

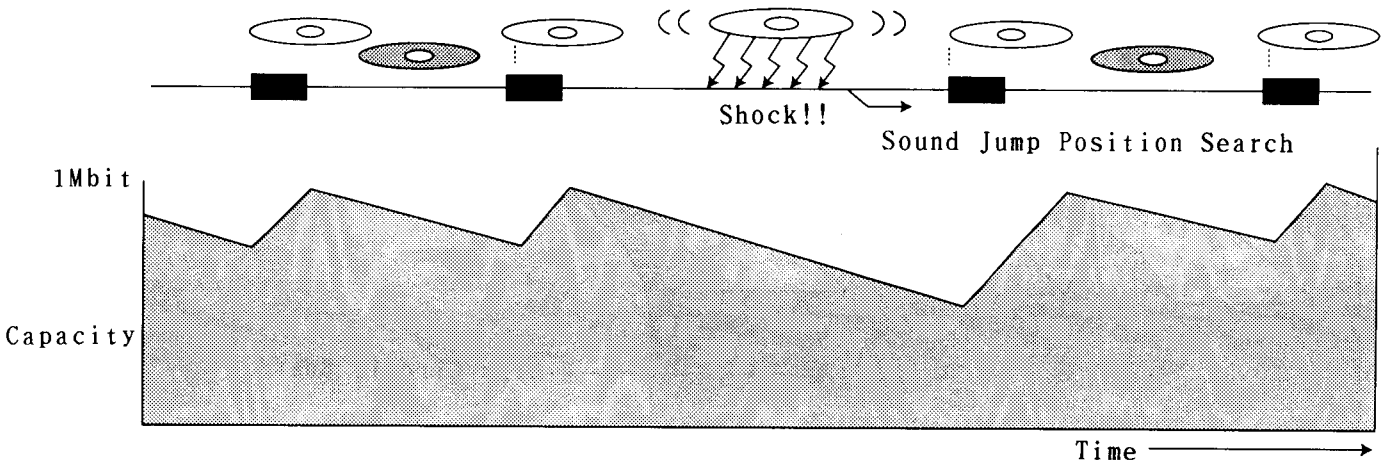


Fig.6 Codition of Sound Jump Guard Memory

High Speed Random Access Function

Mini disc has system format which takes full advantage of random access function, which is the greatest feature of mini disc.

1. High speed access to the requested tune is made possible within a few seconds by using special group.
2. Editing tune order is made possible within a few seconds by using user TOC area.

It is high speed random access function that using disc has made possible. Now people are used to gaining easy access to the requested tune with CD player within a few seconds, so it is irritating for them to spend 1 minute or so at longest to gain access to the requested tune with compact cassette, which never fits for the feeling of contemporary people. Here mini disc system has developed high speed random access, not only with playback-only music MD, but with record/playback MD. Record/playback MD has grooves called pre-group formed all around disc, in the process of injection forming of polycarbonate circuit board during disc production. Tracking servo and spindle servo are controlled by the grooves in the course of recording and playing.

In addition, with the technique of making this pre-group wind its way only a little, address is formed every 13.3ms. (Fig.7) This enables address to be stamped all around even in the unrecorded condition, and not only remarkably stable high speed random access is made possible, but tune editing can be practiced very easily. For example, if you record a certain tune by time division in the same area as music data, and want to change the tune order, you will have to wait for the real performance time of the tune whose order you want to change. But mini disc system can finish this just in a few seconds. This is because tune information is controlled only in "User TOC Area", which is set in inner track of disc. (Fig.8)

This is the same function as directory of floppy disc. As starting address and ending address of each tune are recorded in this area, tune editing requires only rewriting of the address.

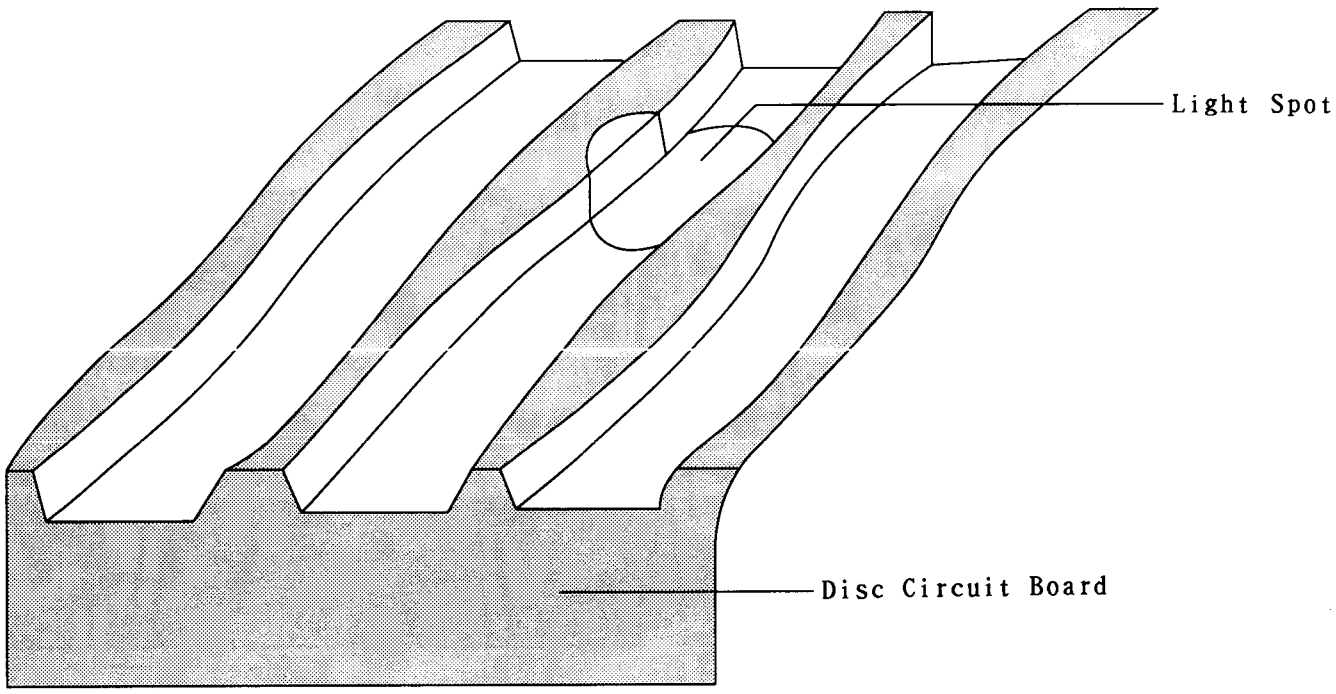
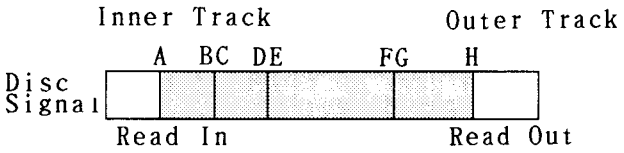


Fig.7 Guide Groove for Record/Playback MD

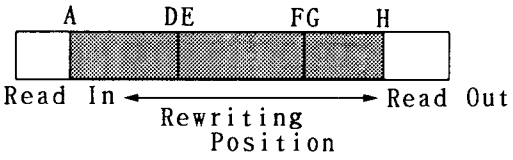
1 Ordinary Method

ⓐ Before Editing

Write In Music Data and Tune Number by Time Division

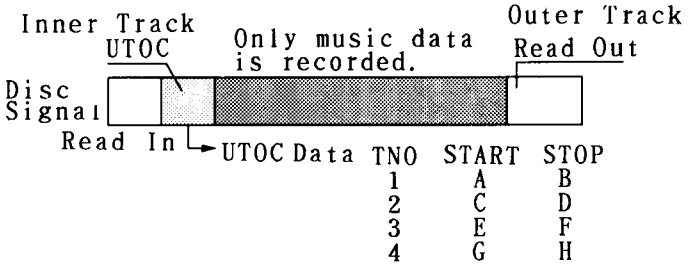


ⓑ After Editing



2 Mini Disc

There is address all around disc, and music data and tune number are written in by area division.



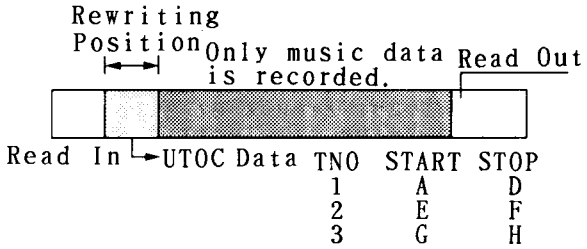


Fig. 8 Tune Number Editing

Pickup

As described above, mini disc system adopts 2 kinds of discs as media, which are playback-only optical disc and magneto-optical recording disc. So pickup of mini disc player should read out increase and decrease of light amount, and in playback of magneto-optical disc, it should read out polorization of light. Our company has developed a small-sized pickup which has ability to practice reading out both discs, and yet can be produced in large quantities. Newly developed MD pickup is the improved pickup with ordinary CD player pickup as basis, and is equipped with polorized beam splitter for detecting magneto-optical signal and 2 shoto diodes. (Fig.9, Fig.10)

About Playback-only MD

When laser of about 0.2mW is irradiated to the pit on disc, reflected light increases or decreases according to the presence or absence of pit, which is the same as ordinary CD. If there is no pit on aluminum reflection surface, and the surface is flat, reflected laser beam light returns to photo diode without any change, while if there is a pit inside laser spot, laser beam light is diffracted by pit, and light amount returning to photo diode decreases. This increase or decrease is detected, and displayed as 1 or 0 according to the sum total of light amount of 2 photo diodes, that is, by the increase or decrease of the added value of electric signals of 2 photo diodes. (Fig.9)

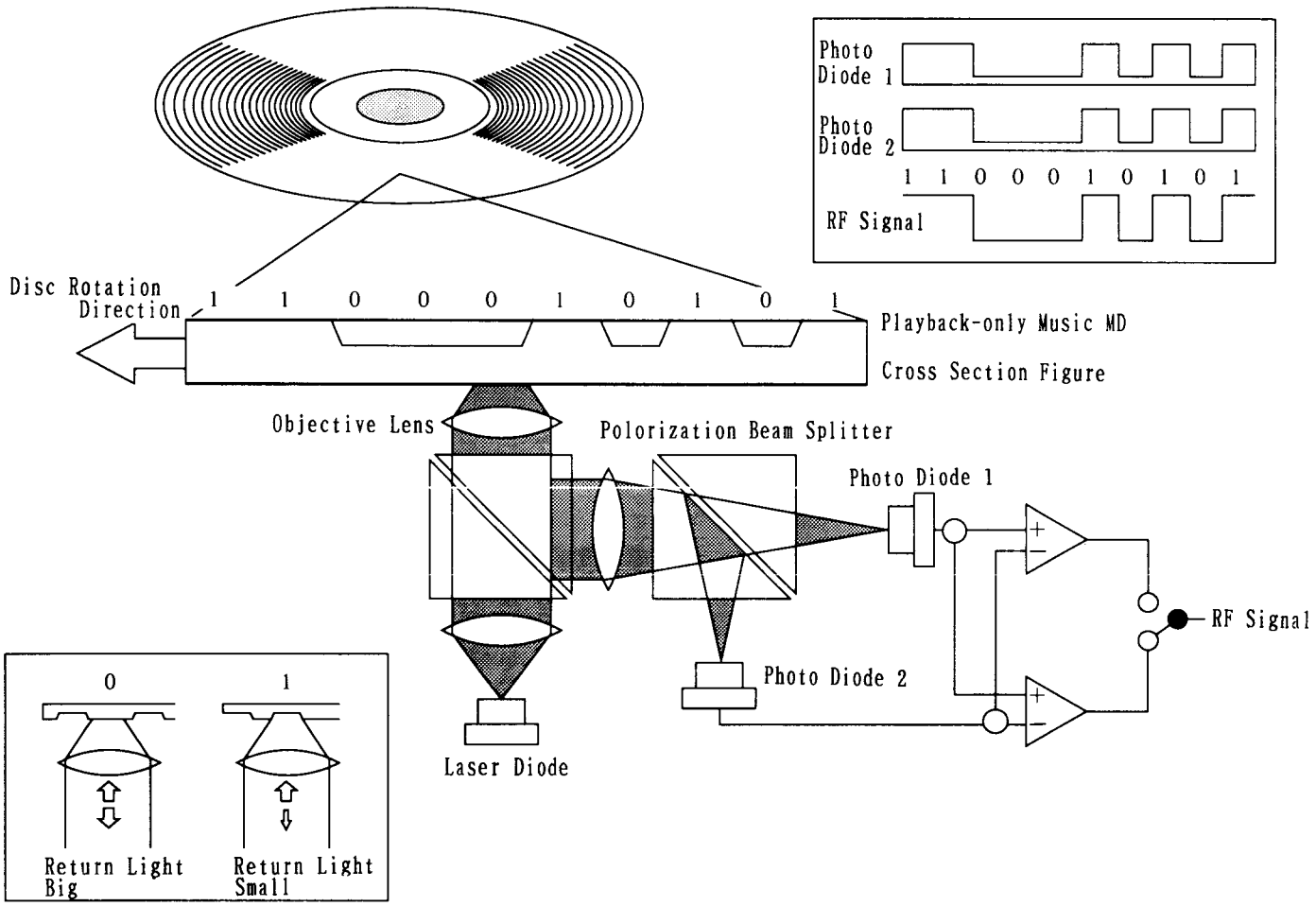


Fig.9 Signal Read Out Method of Playback-only Optical Disc

About Record/Playback MD

When laser of about 0.8mW is irradiated to magnetic signal in 1 or 0 direction recorded on disc, the direction of polorization surface of reflected laser beam light turns a little toward the regular direction or the reversed direction according to the direction of magnetic signal. (Keer Effect) Polorization splitter changes distribution rate to 2 photo diodes according to the polorization direction of the return laser light. In other words, when one incident light turns in the regular direction, more light is distributed to the phote diode, and when it turns in the reversed direction, more light is distributed to the other photo diode. the 2 photo diodes transform the distributed light into electric signal level in comparison with each light amount. So it is possible to calculate the difference of electric signal level and read 1 or 0 according to the answer, plus (+) or minus (-). (Fig.10) Optically, this is the form which adds polorization beam splitter and photo diode to CD light pickup.

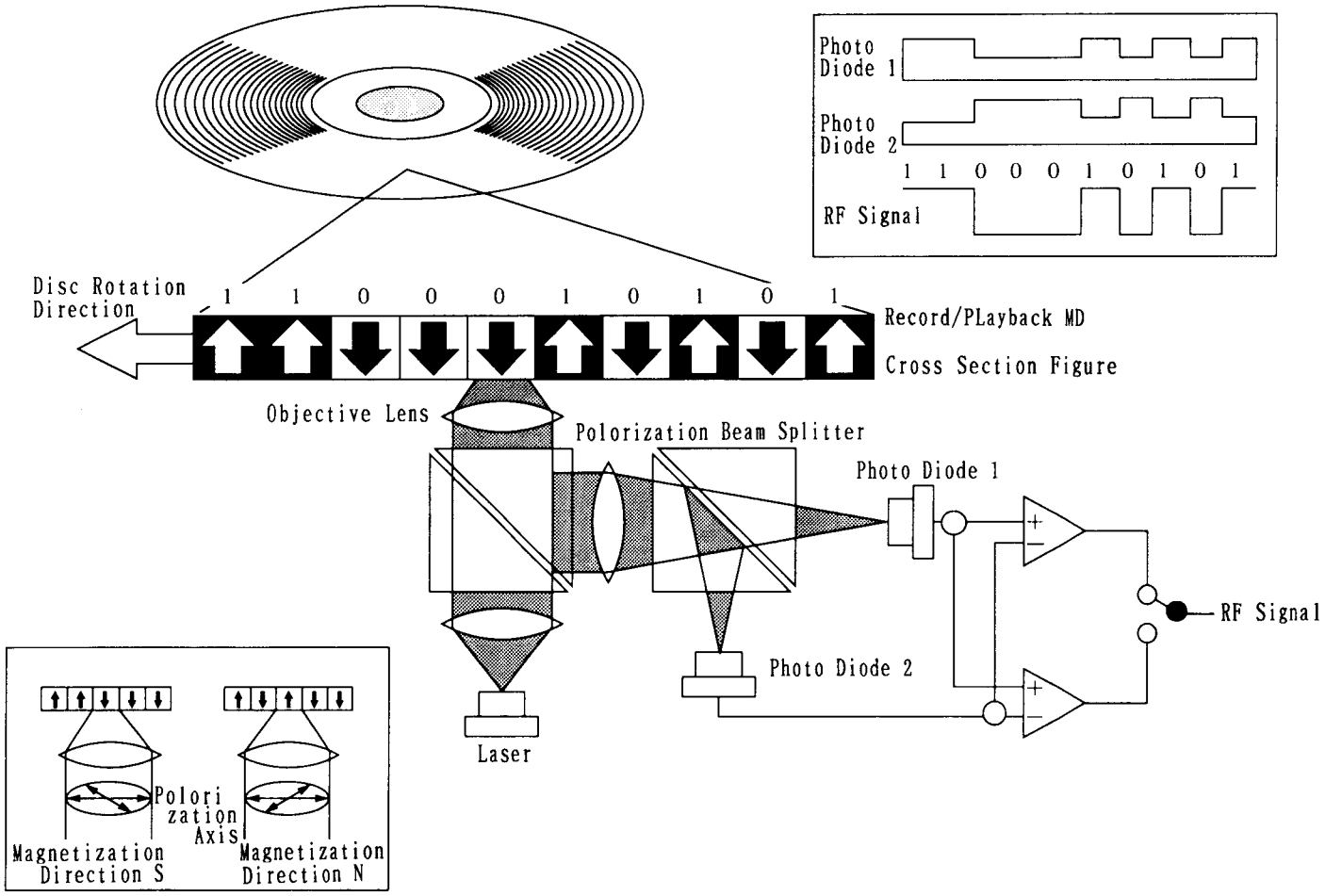


Fig.10 Signal Read Out Method of Magneto-optical Disc for Recording

MD System Control

1. Difference from CD System
MD system has completely similar digital audio disc system as CD, and its basic servo technique is common with CD. But in order to realize its features, which are "small sized", "has ability to record and edit" and "strong against shock", MD system has the following unique points;

①Disc bears contracted music data redorded in it.
②Music data is recorded by being divided by the sector.
③Division or number of track is controlled with TOC information.
④There are two sorts of discs. One of them is record/playback disc which can be ued for recording.

2. About System Control
According to the difference shown above, the following controls are necessary;

① Intermittent Playback from Disc and Intermittent Record
In playing, the data read out from disc is once stored in memory disc and then output through stretching process. The disc contains recorded data contracted to about one-fifth. So if if reads out with the same speed as CD, the memory will soon be full. If so, there is no choice but to suspend read out from disc. A little later, before the memory becomes empty, read out should be resumed. But, actually, by making use of a little space to secure shock-proof system, data read out from disc can be instantly resumed, and memory is always kept full. In recording, music data contracted to about one-fifth is once recorded and stored in memory. As shown above, if data is recorded in disc with the same speed as CD, memory will soon become empty. So when music data is stored in memory to some extent, it is necessary to record the data in disc, and pause before memory becomes empty.

② Sector Address Search, Playing Time Conversion
Music data is divided by the sector, and each of the data is given its own address number.
But as track number or performance time is not recorded, the starting address of the track recorded in TOC information should be searched for and the data should be read out to bring the requested track in playing condition. To display time passage of performance, it is necessary to practice conversion from address into time.

③ Content of TOC Information
Compared with CD, MD TOC information contains much more data.
Main data as follows;
○ Sort of disc. (Playback-only/ Record)
○ Starting address of read out area.
○ Starting address of user TOC area. (Only for record/playback disc)
○ Starting and finishing address of each track.
○ Emphasis of each track, monoral/stereo, copy prohibition, rewrite prohibition. (Only for record/playback disc)
○ Tune name of each track, album name. (Option)
○ The date of each recording. (Option)
Track control is operated with TOC information like this, it is possible to erase specific track or change track number by operating TOC information. On the other hand, if TOC information is not read in, it is impossible to gain normal performance.
Playback-only disc records information in innermost read in area like CD. So playing is started after reading out the information in read in area.
Record/playback disc has two sorts of TOC information in read in area and near starting point of recordable area a little outside the read in area. Sorts of disc or read out, and starting address of user TOC are recorded in the read in area of these two. This information cannot be rewritten. In the other area called user TOC, information about each track is recorded, and this information can be rewritten by users. In playing or recording, first read in TOC is read out, next user TOC is read out, and then operation starts.

THE OUTLINE OF MINI-DISC

④ About Control of Record/Playback Disc

MD disc has two types of recording methods. One is recording method in pit, which is the same method as CD, and the other is recording method in groove by magneto-optical effect. There are two kinds of reflection rates. Playback-only disc has high reflection rate, and all information is recorded in pit, while record/playback disc has low reflection rate, and read in TOC data is recorded in pit, but other data, which is user TOC data and music data, is recorded in groove. This means that, in case of record/playback disc, it is necessary to switch in one disc to make it possible to read in user TOC and music data in groove after reading in information in pit in the read in area beforehand. The difference of control methods between pit area and groove area is as follows;

- ○ Polarity of tracking error signal is reversed against each other.
- ○ In pit area sub-code signal is used for address read in, which is the same as CD, and in groove area ADIP signal is used.
- ○ EFM signal is used for spindle servo in pit area, which is the same as CD, and ADIP signal is used in groove area.
- ○ Strength or weakness of reflection light is used for data read out in pit area, and magneto-optical effect is used in groove area.

As reflection rate is differs between playback-only disc and record/playback disc, some procedure , for example changing laser power, is necessary. Actual control of record/playback disc after reading in two TOC informations, is as follows;

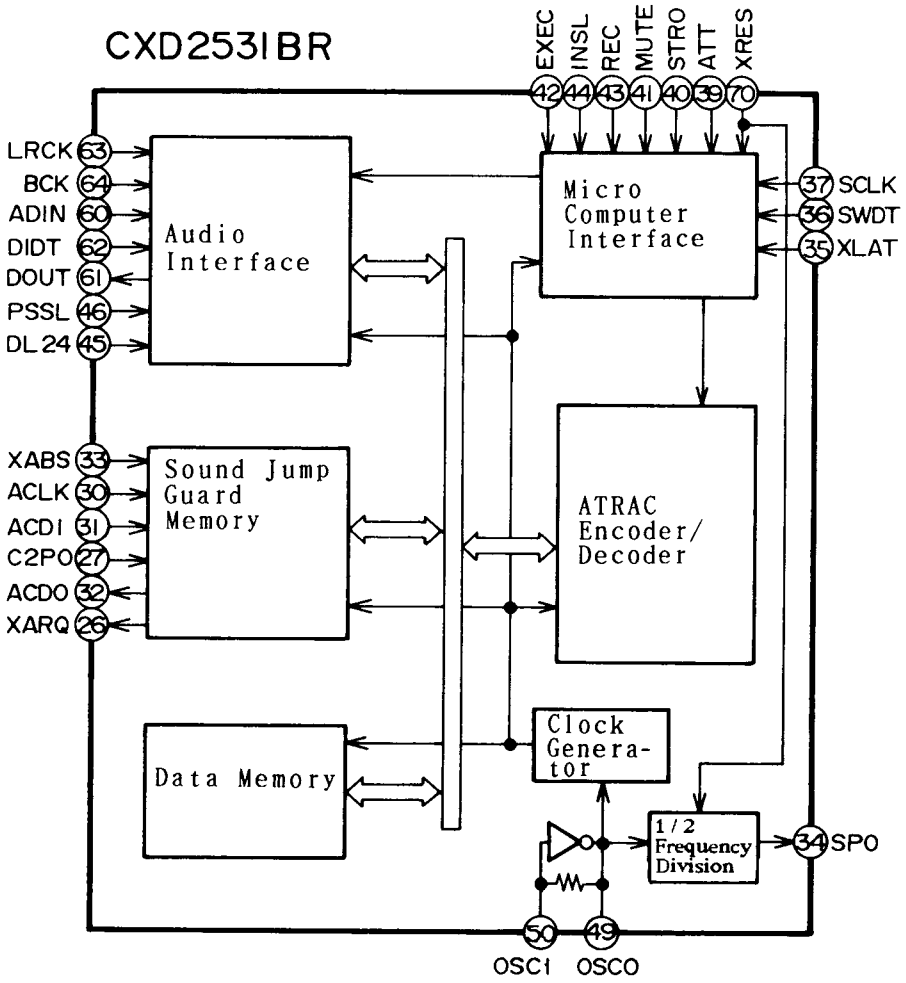
In Case of Playing

- ○ Spindle motor is operated by means of ADIP signal.
- ○ The targeted track position is searched for by reading ADIP.
- ○ EFM signal is read out by means of magneto-optical effect.

In Case of Recording

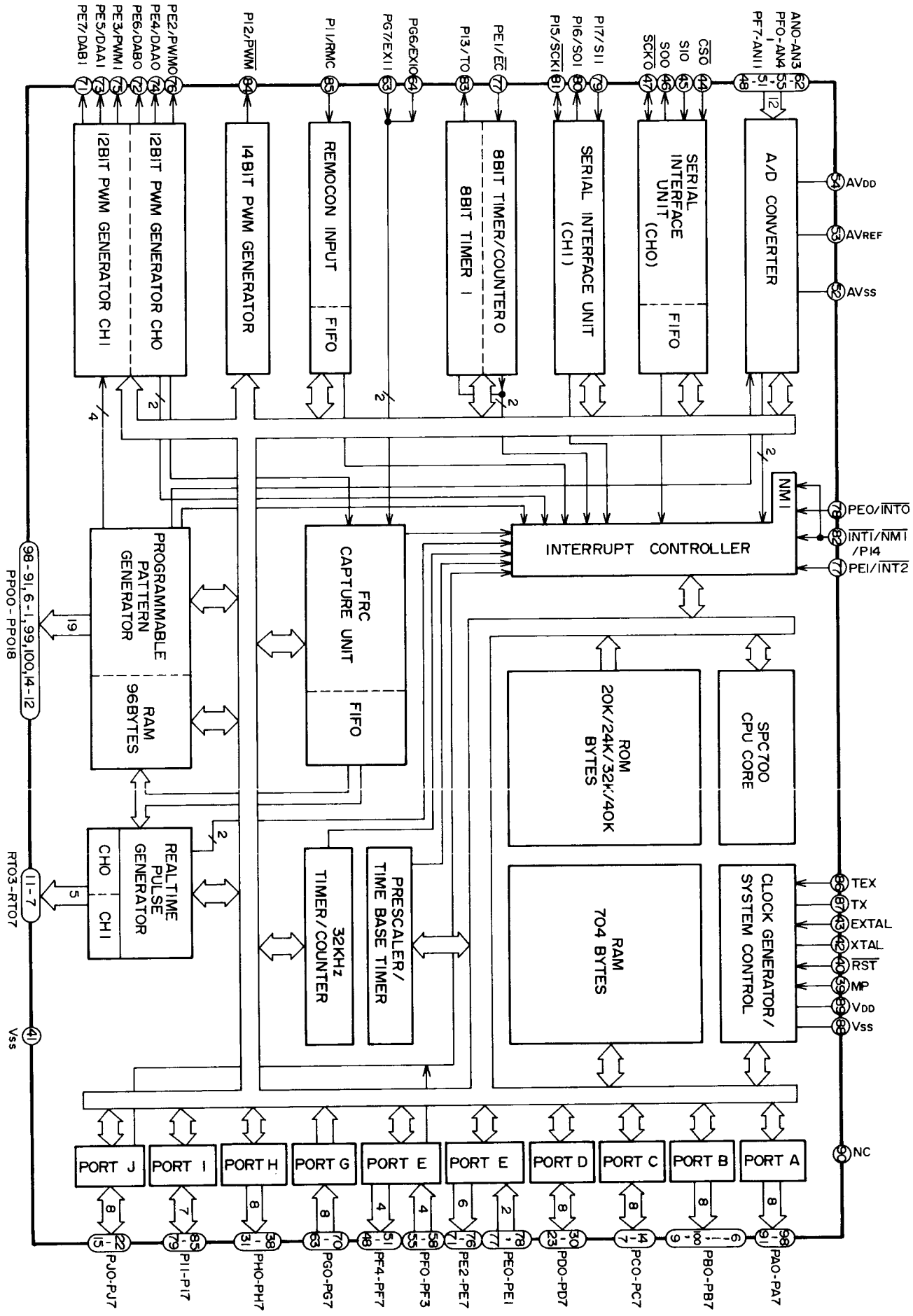
- ○ Servo of spindle motor is operated by means of ADIP signal.
- ○ The targeted track position is searched for by reading ADIP signal.
- ○ On reaching the targeted position, laser power is raised, and electric current is sent to magnetic head for recording.
- ○ After finishing recording, user TOC is rewritten.

IC BLOCK DIAGRAM



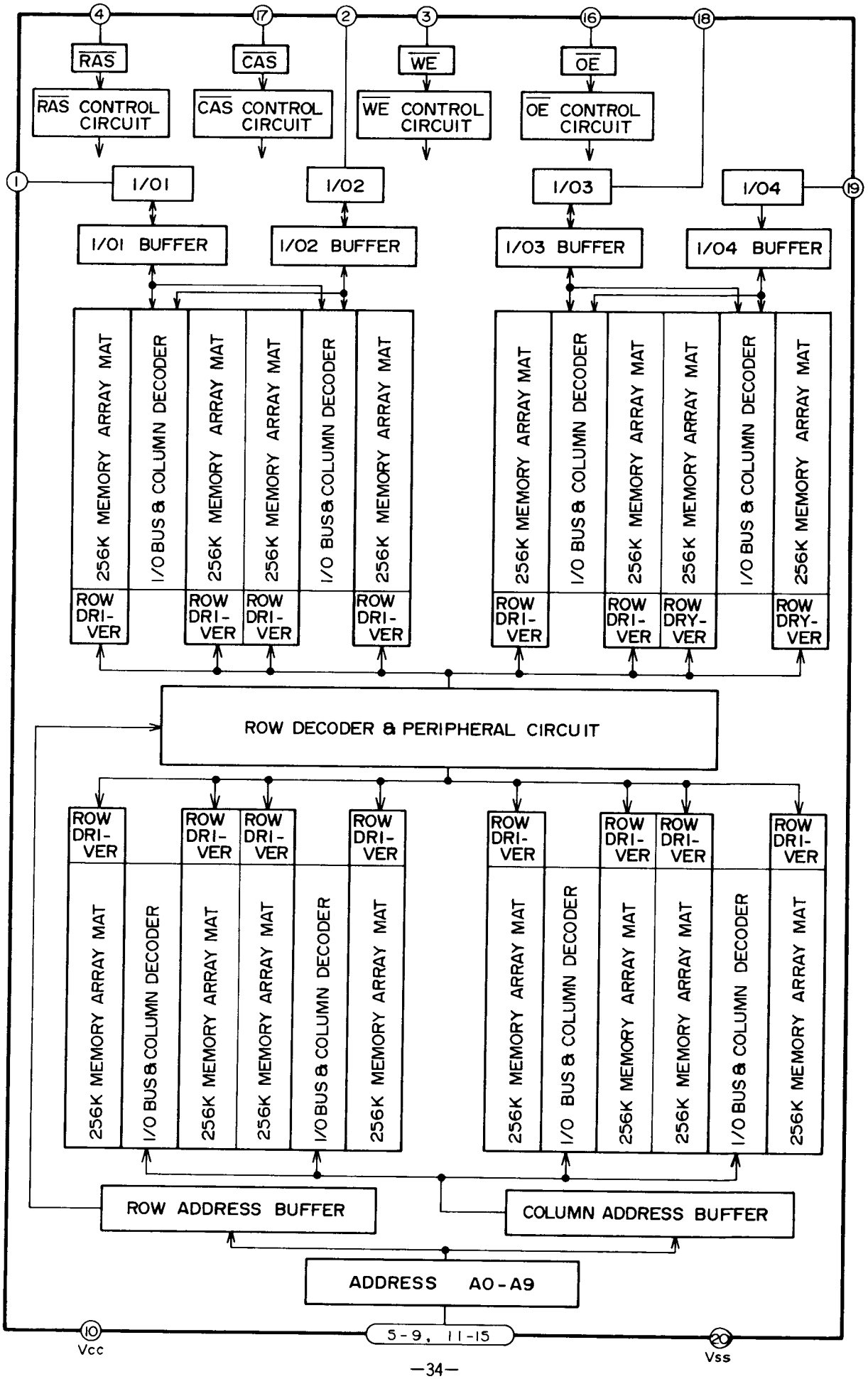
IC BLOCK DIAGRAM

CXP817P24Q-001-2



IC BLOCK DIAGRAM

HM514400BTT-8



EXPLANATION OF IC

SIC701 Control Micro Computer μPD78P014YGC-001

No	PORT	I/O	Explanation of Function
1	P30	O	Display Color Switch Initial Period: HIGH
2	P31	I	GND
3	P32	I	GND
4	P33	I	KEY Selection 1 Combination Selection(1 ~ 6 In a row: Low, 2 rows: HIGH) (+5V)
5	P34	I/O	Liquid Crystal Driver Communication RESET
6	P35	O	Oscillation Frequency Confirmation Output (Liquid Crystal Driver Communication CLOCK) *For Clock Adjustment (For Frequency Confirmation) Output
7	P36	O	BEEP Output Output to warning tone when effective key is input. One output in case of MODE switch or short push of key; two outputs in case of long push of key. One output is 40msec ON; two outputs 40msec ON-80m sec OFF-40msec ON. Output 4kHz oscillation waveshape. Warning tone outputs two outputs three times at 1sec intervals.
8	P37	I	RADIO SLCT HIGH: RADIO absent. LOW: RADIO present. (+5V)
9	VSS		GND
10	P40	I	Destination SLCT A1 Domestic A2 A1 0 A2 0 A3 0
11	P41	I	
12	P42	I	
13	P43	I	TEST MODE; LOW ; ON (+5V)
14	P44	I	TEST STEP; LOW ; ON (+5V)
15	P45	I	CLK SLCT 1 (Clock presence or absence preset terminal) In case of clock presence, LOW. (+5V)
16	P46	I	GND
17	P47	I	GND
18	P50	I	LOUD/BASS X SLCT LOW; Display; LOUDNESS electronic VR; (LOUD ON) (Display, electronic VR) HIGH; Display; BASS X, electronic VR; (LOUD + center 4dB UP) (GND)
19	P51	I	PHONE MUTE IN When LOW, ON. Outputs AF MUTE HIGH, displays "MUTE", makes MUTE display flash. (Make CD/MD operation pause.) (+5V)
20	P52	O	N·C
21	P53	O	N·C
22	P54	O	STBY 2 OUTPUT
23	P55	O	(+5V)
24	VSS		GND
25	P56	O	N·C
26	P57	O	(+5V)
27	P60	O	(+5V)
28	P61	O	AF MUTE
29	P62	O	N·C
30	P63	O	BUS for Changer Communication Periodically confirm changer output. When error is found, correct to this micro computer. In case of RESET from RAM rupture, make adjustment to communication.

EXPLANATION OF IC

No	PORT	I/O	Explanation of Function
31	P64	O	MODE 1 Mode switc by sound switch or combination MODE 2
32	P65	I	
33	P66	O	(+5V)
34	P67	I	(+5V)
35	$\overline{\text{RESET}}$	I	Terminal for RESET
36	INTP0	I	Remote control input.
37	INTP1	I	BUS for changer communication
38	INTP2	I	CE LOW; watch MODE, HIGH; standby MODE or operation MODE
39	P03	I	Latch for display input (communication) from MD
40	VDD		VDD
41	X2	I	Outer oscillation circuit connection
42	X1	I/O	
43	IC	I	GND
44	XT2	O	OPEN
45	XT1	I	GND
46	AVSS		GND
47	ANI0	I	GND
48	ANI1	I	GND
49	ANI2		GND
50	ANI3		GND
51	P14	I	GND
52	P15	I	(+5V)
53	P16	O	N·C
54	P17	O	N·C
55	AVDD		VDD
56	AVref		CE or VDD
57	SI1	I	Input terminal for KEY input prohibition. Usually, LOW; Input, HIGH; KEY input prohibition. In case of change from HIGH to LOW, input prohibition for 1sec after change.
58	SO1		Crystal liquid driver communication. SI
59	$\overline{\text{SCK1}}$		Crystal liquid driver communication. SCK
60	P23		Crystal liquid driver communication. C/D
61	P24		Crystal liquid driver communication. BUSY
62	SI0	I	Display communication data from MD IN.
63	SO0		N·C
64	SCK0	O	Clock for display communication from MD.

	CHANGER	MD	RADIO	AUX
MODE1	0	0	1	0
MODE2	0	1	0	0

EXPLANATION OF IC

IC801 MD Changer Controller CXP817P24Q

NO	I/O	TERMINAL NAME	NAME	FUNCTION	MD+B (LOW)	STOP
1	O	PB5	SBMN	Sub-data Write-in Switch Terminal H:Sub-data Write-in.	L	L
2	O	PB4	WRMN	Light, Monitor MODE Switch Terminal H:Light MODE, L:Monitor MODE	L	L
3	O	PB3	RFSW0	Disc MODE Switch Terminal H:High Reflection Rate L:Low Reflection Rate	L	L
4	O	PB2	RFSW1	Disc MODE Switch Terminal H:Pit, L:Groove	L	L
5		PB1	AGCTC	During Focus Search, Gain Control H:During Search(high sensitivity)	L	L
6	O	PB0	NC		L	L
7	O	PC7	BUS 8	LCD Data Output BUS 8 (For Debug)	L	L
8	O	PC6	BUS 7	LCD Data Output BUS 7 (For Debug)	L	L
9	O	PC5	BUS 6	LCD Data Output BUS 6 (For Debug)	L	L
10	O	PC4	BUS 5	LCD Data Output BUS 5 (For Debug)	L	L
11	O	PC3	LODMF	Cartridge Loading Motor Control Output H:Forward Side (IN)		L
12	O	PC2	LODMR	Cartridge Loading Motor Control Output H:REVERSE Side (OUT)		L
13	O	PC1	ELVMF	Elevator Motor Control Output H:Forward Side (UP)		L
14	O	PC0	ELVMR	Elevator Motor Control Output H:REVERSE Side (DOWN)		L
15	I	PJ7	DISC3	DISC Switch3 Condition Detection Terminal L:STBY Position, H:Other		
16	I	PJ6	DISC2	DISC Switch2 Condition Detection Terminal L:STBY Position, H:Other		
17	I	PJ5	DISC1	DISC Switch1 Condition Detection Terminal L:STBY Position, H:Other		
18	I	PJ4	EJCT3	Cartridge Eject Switch3 Terminal H:OFF, L:ON		
19	I	PJ3	EJCT2	Cartridge Eject Switch2 Terminal H:OFF, L:ON		
20	I	PJ2	EJCT1	Cartridge Eject Switch1 Terminal H:OFF, L:ON		
21	I	PJ1	LOAD1	Cartridge Load Completion Detect Terminal H:Load Completed, L:Not Completed		
22	I	PJ0	LOAD0	Cartridge Eject Completion Detect Terminal H:Not Completed, L:Eject Completed		
23	I	PD7	CHACK	Cartridge Chucking Completion Detect Terminal H:Not Completed, L:Completed		
24	I	PD6	RFLCT	Disc Reflection Rate Detect Terminal H:High Reflection, L:Low Reflection		
25	I	PD5	LMTSW	Pickup Innermost Track Detect Terminal H:Outer Track, L:Innermost Track		
26	I	PD4	TEMP	Temperature Abnomality Detect Terminal L:Normal, L:Abnormal		
27	I	PD3	ELVS	Elevator Position Detect Terminal Count Method		
28	I/O	PD2	NC		Input Specified	
29	I	PD1	DEVICE 0	Device Code Preset Terminal H:Integrated System MODE		
30	I/O	PD0	NC		Input Specified	
31	O	PH7	BUS 4	LCD Data Output BUS 4 (For Debug)	L	L

NO	I/O	TERMINAL NAME	NAME	FUNCTION	MD+B (LOW)	STOP
32	O	PH6	BUS 3	LCD Data Output BUS 3 (For Debug)	L	L
33	O	PH6	BUS 2	LCD Data Output BUS 2 (For Debug)	L	L
34	O	PH5	BUS 1	LCD Data Output BUS 1 (For Debug)	L	L
35	O	PH3	E	LCD Driver Control signal (For Debug)	L	L
36	O	PH2	R/W	LCD Driver Control signal (For Debug)	L	L
37	O	PH1	RS	LCD Driver Control signal (For Debug)	L	L
38	O	PH0	CMDO	Serial Communication BUS Data Output Terminal		Pull Up
39	I	MP	MP	To GND		
40	I	XRST	XRESET	Micro Computer Reset Input Terminal		
41		VSS	VSS	Grand Terminal		
42		XTAL	XTAL	Crystal Connection Terminal :12MHz		
43	I	EXTAL	EXTAL	Crystal Connection Terminal :12MHz		
44	I	XCSO	SRDT	SONY IC Serial Command Data IN Terminal (Level Detection)		
45	I	SIO	SRDT	SONY IC Serial Command Data IN Terminal		
46	O	SOO	SWDT	SONY IC Serial Command Data OUT Terminal	L	L
47	I/O	XSCKO	SCLK	SONY IC Serial Command Shift Lock Terminal	L	L
48	O	PF7	XRST	SONY IC Serial Command Reset Terminal	L	L
49	O	PF6	XLT	SONY IC Serial Command Latch Signal Terminal	L	L
50	O	PF5	DIRC	Direct Control Terminal in Case of 1 Jump	L	L
51	I/O	PF4	NC		Input Specified	
52		AVSS		Grand Terminal		
53		AVREF	AVREF	D+5V Terminal		
54		AVDD	AVDD	D+5V Terminal		
55	I	PF3	NC			
56	I	PF2	NC			
57	I	PF1	XBATT	Monitoring Terminal for Backup +B Power Supply Voltage Monitor H:Compulsory STOP		
58	I	PF0	XCE	STOP MODE Detect Terminal H:STOP		
59	I	AN3	KEY3	TEST KEY3 for Debug		
60	I	AN2	KEY2	TEST KEY2 for Debug		
61	I	AN1	KEY1	TEST KEY1 for Debug		
62	I	AN0	KEY0	TEST KEY0 for Debug		
63	I	EXI1	CIN	Pulse Width from Track Jump Measurement Input Terminal		
64	I	EXI0	BATT	Monitoring Terminal for Backup +B Power Supply Voltage L:Compulsory STOP		
65	I	PG5	XMICON	TEST MODE Selection Terminal 1 H:TEST MODE, L:Usual		
66	I	PG4	DEVICE 1	DEVICE ID Selection Terminal H:MD1, L:MD2		
67	I	PG3	LOCK	Spindle Servo Lock Condition Detect Terminal H:Locked		
68	I	PG2	GFS	Frame Sink Lock Condition Detect Terminal H:Locked		

EXPLANATION OF IC

NO	I/O	TERMINAL NAME	NAME	FUNCTION	MD+B (LOW)	STOP
69	I	PG1	FOK	Focus Lock Condition Detect Terminal H:Locked		
70	I	PG0	SENS	SENSE Signal Input Terminal (CXD2525Q)		
71	0	PE7	NC		L	L
72	0	PE6	NC		L	L
73	0	PE5	LD ON	Laser Power Control Terminal L:Laser ON	L	L
74	0	PE4	XRMPH	Emphasis ON/OFF Switch Terminal L:Emphasis ON	L	L
75	0	PWM1	NC		L	L
76	0	PWM0	NC		L	L
77	I	XINT2	AD/SQ	ADSY/SQSY Interruption Selection Terminal		
78	I	XINT0	CMDI	Serial Communication BUS Data Input Terminal		
79	0	P17	LAT	Serial Data Communication Latch Enable Output (Used When Connected to Outer Micro Computer)	L	L
80	0	SO1	DATA	Serial Data Communication Output Terminal (TOC Information)	L	L
81	0	XSCK1	SCK	Serial Data Communication Clock Output Terminal (TOC Information)	L	L
82	I	XINT1	CE	$\overline{\text{STOP}}$ MODE Detect Terminal L:STOP MODE		
83	I	P13	PITGRV	PIT/GRV Switch Terminal	L	L
84	I/O	P12	NC		Input Specified	
85	I	P11	XINT	XINT Interruption Demand Signal Input Terminal (SONY IC)		
86	I	TEX				
87		TX	NC			
88		VSS	VSS	Grand Terminal		
89		VDD	VDD	D+5V Terminal		
90		NC	NC	To D+5V Terminal (VER2 Change)		
91	0	PA7	NC		L	L
92	0	PA6	MECHA+B	Mechanism System Power Supply Control Terminal H:Power Supply ON		L
93	0	PA5	MD+B	Signal Treatment System Power Supply Control Terminal H:Power Supply ON		L
94	0	PA4	MUTE	Digital, Analog MUTE Output Terminal H:MUTE ON	L	L
95	0	PA3	NC		L	L
96	0	PA2	NC		L	L
97	0	PA1	NC		L	L
98	0	PA0	NC		L	L
99	0	PB7	FWOB	Focus Wobble Switch Terminal L:OFF (During focus search)	L	L
00	0	PB6	XRSTA	Expand LSI Reset Output Terminal L:RESET	L	L

EXPLANATION OF MD INITIALIZING OPERATION

Explanation of the regular operations from ACC power supply ON to MD play starting.

(1) ACC Power Supply ON
When ACC power supply becomes ON, the set comes into waiting condition for bus communication command with controller IC.
By back-up request command, back-up information is returned to control micro computer.
After that, play command is transmitted from controller, and playing operation starts.

(2) In case no DISC is inserted in stand-by position, "NO-DISC" sign is displayed in waiting condition.
When DISC is already chucked, operation advances to (4).
When DISC is in stand-by position, the first disc has the priority to start loading operation to chucking position.

(3) From DISC Loading to Chucking completion
"H" output from IC801 11pin enables DISC in stand-by position to start loading, and when 21pin becomes "H", 11pin becomes "L" and operation stops.
In succession, "H" output from IC801 13pin lowers elevator. When 23pin becomes "H", 13pin becomes "L" and operation stops. In this way DISC chucking is completed.

* In case each terminal of 21pin and 23pin doesn't become "H" more than 4Sec after each output has set motor operating, try again. If another trial can't initiate the above operations, stop output as mechanism error.

(4) Shift pickup to innermost track.
Shift pickup toward inner track by means of "H" pulse from IC661 6pin.
Keep shifting till pickup limit SW (IC801 25pin) becomes "L".
* In case 25pin doesn't become "L" more than 4Sec after operating sled motor toward inner track, try again. If the above operations are still impossible, stop output as mechanism error.

(5) Start Focus Servo (Operate Focus Search).
a) Laser ON.
Set IC801 73pin "L", and pickup laser power supply ON.
b) Communicate from IC801 46pin, 47pin and 49pin to servo IC (IC631), and set up items in the following procedures:
Focus OFF Command. (Communication Data $00)
Charge focus search condenser (7pin).
c) Set up focus search height at ±3.
· Focus search height ±3 (Communication Data $38)
· Sled kick height ±1 (Communication Data $38)
d) Focus up (Communication Data $02)
Shift pickup lens near DISC surface.
e) Upward driving time 100mSec
f) Set up focus search height at NORMAL.
Focus search height ±1 (Communication Data $30)
Sled kick height ±1 (Communication Data $30)
g) Set up servo IC in auto-focus mode. (Communication Data $47)
Servo IC automatically adjusts the focus of DISC surface and lens by focus down (by lowering lens).
h) Downward driving time 800mSec
i) Focus ON CHECK
When during the above 800mSec IC801 69pin (FOK terminal) changes into "H" and remains "H" for 100mSec in a row, you can judge FOCUS ON, which means completion of focus search.

* In case focus search operation IC801 69pin doesn't change into "H" in spite of focus search operation, repeat procedures from b) 10 times at a maximum. If FOK doesn't still change into "H", exchange the given DISC for the next one, judging as focus error. (E-07 Display)

(6) Set spindle motor KICK (rotating).
Communicate from IC801 46pin, 47pin and 49pin to signal processor IC (IC671).
· CLV KICK Command. (Communication Data $83)
· KICK duration 80mSec

EXPLANATION OF MD INITIALIZING OPERATION

(7) Set tracking servo and sled servo ON. (Communication Data $25)
·Set tracking gain and others just in advance. (Communication Data $17)
Anti-shock circuit OFF, brake circuit ON and TG gain UP. (1, 1)

(8) Set spindle servo ON. (Communication Data $60)
·Set EFM in auto mode. Gain is -6db.
·Detect spindle LOCK.
Wait for IC801 67pin to become "H".
·Set tracking gain NORMAL. (Communication Data $18)
Anti-shock circuit ON, brake circuit OFF and TG gain NORMAL. (0, 0)

* In case spindle doesn't become LOCK (IC801 67pin doesn't become "H") within 1000mSec, or address data can't be normally read within 2000mSec after LOCK, temporarily stop allthe servos, and try processes from (4) item 5 times at a maximum. If the data still can't be read, exchange the given DISC for the next one as TOC reading error. (E-07 Display)

(9) Read read-in TOC information.
·Gain access to designated read-in territory.

* In case access can't be gained within 15Sec, stop all the servos and try processes from (4) item. If reading is still impossible, exchange the given DISC for the next one as TOC reading error. (E-07 Display)

·After read-in TOC finishes reading, playback only DISC advances to (12), and record/playback DISC advances to (10), because user TOC has to be read.

(10) Gain access to user TOC territory.
·Gain access to user TOCstart address recorded in read-in TOC information.

* Read-in territory is recorded in pit; user territory in group.

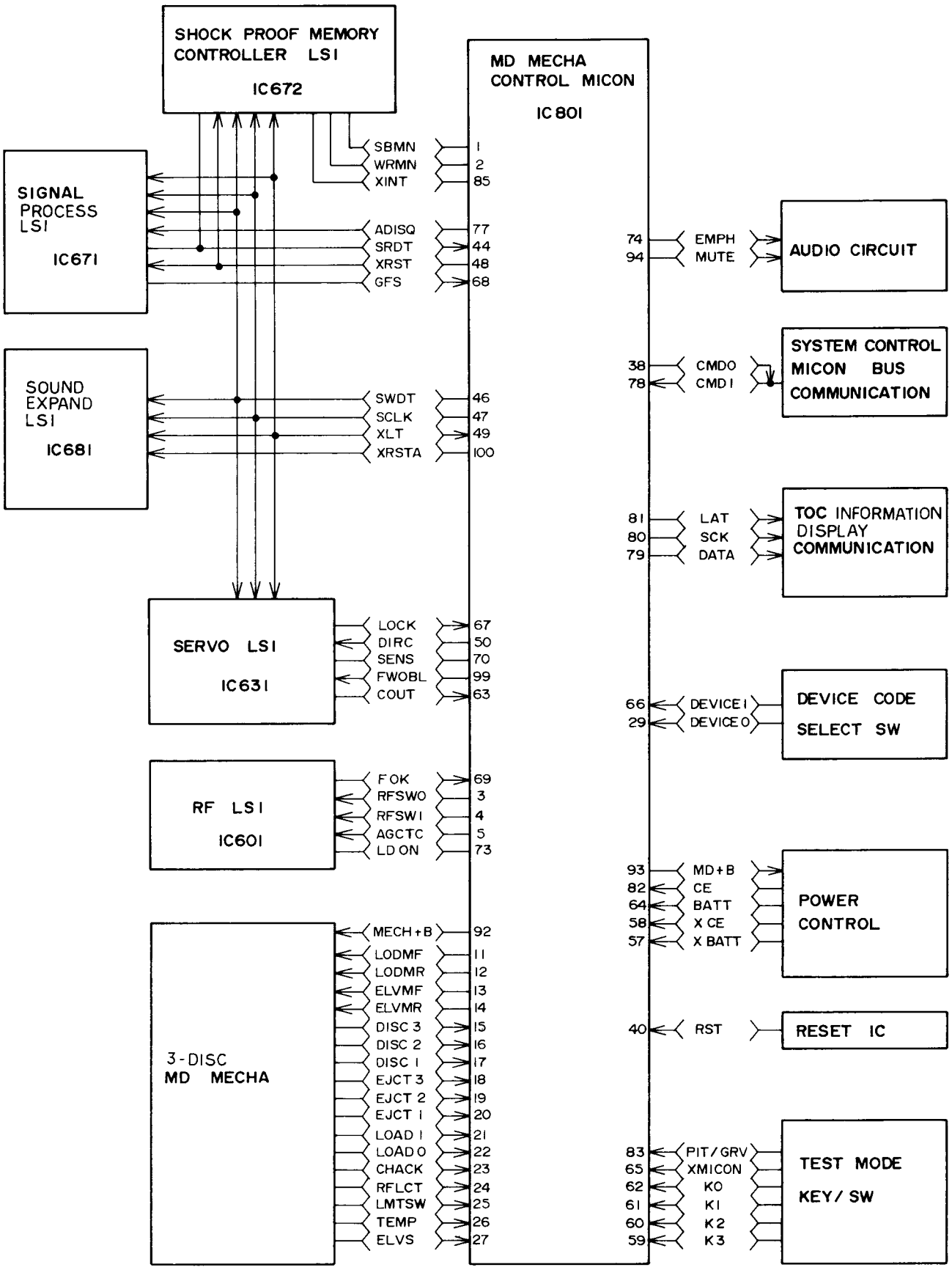
·After getting transferred to user territory, record/playback DISC has different data read-out setting from the setting in pit.
Laser power setting and CLV mode setting are changed during transfer to user territory.

* In case access can't be gained within 15Sec, stop all the servos and try processes from (4) item. If reading is still impossible, exchange the given DISC for the next one as DISC reading error. (E-07 Display)

(11) Read user TOC information.
·In case information can't be correctly read within 15Sec, exchange the given DISC for the next one as DISC error. On this occasion, the given DISC is judged as raw DISC. (E-08 Display)

(12) Search for head track number.
·Play is started after gaining access to head track number recorded in user TOC information and read-in TOC information.
·When track is designated, the designated track is searched for.
·When ACC becomes OFF halfway during the previous play, the playing position ia memorized by IC801, and when ACC becomes ON, play starts from that position by means of reflection in back-up content.

MD BLOCK SYSTEM STRUCTURE FIGURE



EXPLANATION OF IC801(MECHANISM CONTROL MICRO COMPUTOR)

1. Outline

This LSI is micro computer which controls 3-mini disc changer mechanism, signal process LSI, sound expand LSI, servo LSI, bus communication and the whole system in vehicle-mount three-mini disc consecutive play MD changer.

2. Characteristics

This LSI has the following functions in combination with peripheral system.

1) Power supply ON/OFF function
2) DISC change function
3) PLAY/PAUSE function
4) STOP function
5) Repeat playback (TRACK/DISC) function
6) Scan playback (TRACK/DISC) function
7) Shuffle playback (TRACK/DISC) function
8) MD title display (DISC Name/Track Name/Time Counter)
9) Title scrawl display function
10) KEY/REMOTE CONTROL interface
11) Audio output control function
12) Test mode function
13) Shock proof function

3. Summary of Micro Computor Specification

·8bit CPU micro computer
·ROM 24K byte, RAM 800 byte
·Minimum time for carrying out command 333nS/12MHz
·100pin plastic QFP package

4. Operating Condition

·Source (supply) voltage 4.5V ~ 5.5V
·Clock frequency 12MHz

5. Principal Control Item

·Command reception and status return by means of bus communication
·MD title information sending to system control micro computer
·Content reading by means of KEY and switch input from port
·3-mini disc changer mechanism control
·Pickup/Servo circuit control
·ATRAC signal process circuit control
·Decoder signal process circuit control
·Audio circuit control
·Player power supply ON/OFF control
·Momentary electric breakdown detection control.

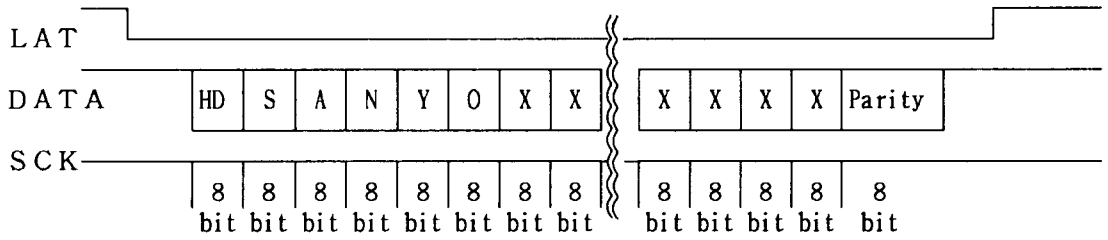
6. Explanation of MD Block Diagram Signal

(1) Command reception and status return by means of bus communication
This bus doesn't use special communication IC, but micro computer directly controls communication line.
Units connected with system are connected by bus line which is one communication line, and controls system by means of data on the bus.

78pin: CMDI: serial communication bus input
38pin: CMDO: serial communication bus output

(2) MD Title (TOC) Information Sending to System Control Micro Computer

Send MD DISC name,TRACK name, time count data from mechanism control micro computer to system control micro computer.



79pin: LAT : TOC information serial communication latch output
80pin: DATA: TOC information serial communication data output
81pin: SCK : TOC information serial communication clock output

Character data content: ASCII-CODE (8 bit per character)
Parity data content : exclusive-or

(3) Device Code Select Process

29pin: DEVICE0 : Device code setting switch 0
66pin: DEVICE1 : Device code setting switch 1

Mechanism Type Mode	DEVICE 0	DEVICE 1
MD Changer (1)	L	L
MD Changer (2)	L	H
Integrated Type (This one)	H	Arbitrary

* Device code of this type is always supposed to be "H" "H" (integrated type).

(4) 3-mini Disc Changer Mechanism Control

92pin: MECHA+B: Mechanism block power supply control terminal. "H" shows power being supplied.
11pin: LODMF : Loading motor forward rotation output. "H" causes DISC lead-in operation.
12pin: LODMR : Loading motor reversed rotation output. "H" causes DISC release operation.
13pin: ELVMF : Elevator motor forward rotation output. "H" causes elevator raising operation.
14pin: ELVMR : Elevator motor reversed rotation output. "H" causes elevator lowering operation.
15pin: DISC3 : The third DISC presence detection SW. "L" shows DISC presence.
16pin: DISC2 : The second DISC presence detection SW. "L" shows DISC presence.
17pin: DISC1 : The first DISC presence detection SW. "L" shows DISC presence.
18pin: EJCT3 : The third DISC eject SW. "L" causes eject ON.
19pin: EJCT2 : The second DISC eject SW. "L" causes eject ON.
20pin: EJCT1 : The first DISC eject SW. "L" causes eject ON.
21pin: LOADI : Loading completion detection terminal. "H" shows DISC loading completion.
22pin: LOADO : Load-out completion detection terminal. "L" shows DISC load-out completion.
23pin: CHACK : DISC chuck completion detection terminal. "L" shows DISC chuck completion.
24pin: PFLCT : DISC reflection ratio detection terminal. "H" shows high reflection DISC.
25pin: LMTSW : Pickup innermost track detection terminal. "L" shows pickup innermost track position.
26pin: TEMP : Temperature abnormality detection terminal. "L" shows temperature abnormality.
27pin: ELVS : Elevator position detection terminal. "L" shows having detected floor position.

* DISC presence detection SW is effective only when DISC is in stand-by position.
* Just before DISC change operation, transfer pickup to inner track side for a certain period of time (100mSec).
  However, when innermost track detection SW is "L", this operation is not necessary.
* Even when ACC power supply is OFF, DISC in chuck position can be released to stand-by position by means of eject switch.

(5) Pickup/Servo Circuit Control

3pin: RFSW0: DISC mode changeover terminal 0. "H" shows high reflection ratio DISC ; "L" low.
4pin: RFSW1: DISC mode changeover terminal 1. "H" shows pit DISC; "L" group DISC.
5pin: AGCTC: Gain control terminal during focus search. "H" shows 'in search' (raises sensitivity).
50pin: DIRC : Direct control terminal in case of 1 track jump.
63pin: COUT : Signal input for counting track jump number.
67pin: LOCK : CLV LOCK monitor input. "H" shows 'under LOCK'.
69pin: FOK : Focus OK monitor input. "H" shows focus OK.
70pin: SENS : Sense input terminal.
73pin: LD ON: Laser power control terminal. "L" causes laser power ON.
99pin: FWOBL: Focus wobble terminal. "L" shows 'in focus search'.

* In case of track jump, jump distance is controlled by COUT input.
* Playback only DISC, which has as high reflection ratio as CD, lessens laser power.
  As Record/Playback DISC has low reflection ratio, it raises laser power.
* Playback only DISC signal is recorded in pit in all territory like CD.
  Record/Playback DISC signl is recorded in pit in read-in territory, in group in music territory.
* In case of track jump, track jump is carried out by using DIRC terminal.

(6) Signal Proess Circuit

1pin: SBMN : Sub-data writing changeover terminal. "H" shows 'in sub-data writing'.
2pin: WRMN : Light mode and monitor mode changeover terminal. "H" shows 'in light mode.
44pin: SRDT : Serial command data input with SPP LSI and signal process LSI.
46pin: SWDT : Serial command data output with each LSI.
47pin: SCLK : Serial command shift lock (input and output).
48pin: XRST : Serial command reset output.
49pin: XLT : Serial command latch output.
68pin: GFS : Frame sink lock condition detection output and input terminal.
77pin: AD/SQ: ADSY/SQSY interception selection changeover terminal. "H" causes ADSY interception selection.
85pin: XINT : XINT interception command signal input terminal. "L" shows interception command presence.
100pin: XRSTA: System reset output to expand LSI. "L" causes reset.

* To reset each LSI, first initialize expand LSI (IC681) after power is supplied, then, 100mSec later, initialize each LSI. This is because master clock is formated in expand LSI, and then provided for other LSIs.
* Signal processing LSI (IC671) is operated by command from micro computer as follows;
  - Spindle motor control
  - EFM decode
  - ACIRC decode
  - ADIP decode
* SPP (Shop Group Processor) LSI (IC672)has the following functions by command from micro computer;
  - Data C2PO FIFO function
  - Sub-data buffering function
  - TOC data buffering function
  - RAM data reading/writng function
  - DRAM refresh function

* Sound expand LSI (IC681) is operated by receiving indication from micro computer as follows;
·ATRAC decode processing. Stretch and restore data which has been read from DISC.
·Output sound muffling and attenuating control
·Playback data error processing
·Interface with DAC

(7) Audio Circuit Control

74pin: EMPH: Emphasis control terminal. "L" causes emphasis ON.
94pin: MUTE: Analogue mute control terminal. "H" causes mute ON.

Sound muting is mainly operated through sound stretch LSI control, yet mute circuit is outequipped in order to prevent pop sound caused by power supply ON and OFF.

(8) Player Power Supply ON/OFF Control

57pin: XBATT: Momentary electric breakdown detection terminal. "H" stops operation.
58pin: XCB : STOP mode control terminal. "H" processes STOP mode.
64pin: BATT : Momentary electric breakdown detection terminal. "L" stops operation.
82pin: CE : STOP mode control terminal. "L" processes STOP mode.
93pin: ND+B : Control terminal of power supply to MD block. "H" causes power supply ON.

XCE terminal is directly connected with system control micro computer, and when MD is operating, the system control micro computer sends "H".
System control micro computer controls this terminal by monitoring ACC and processing KEY.
XBATT terminal, whose electric breakdown is directly detected by mechanism micro computer through battery voltage monitor circuit, and on detecting "L", forces all operations to stop, memorizes operation mode, and enters STOP mode. On detecting "H", operations are resumed and continued.

(9) Test Mode Processing

This is used in case of TEST mode.

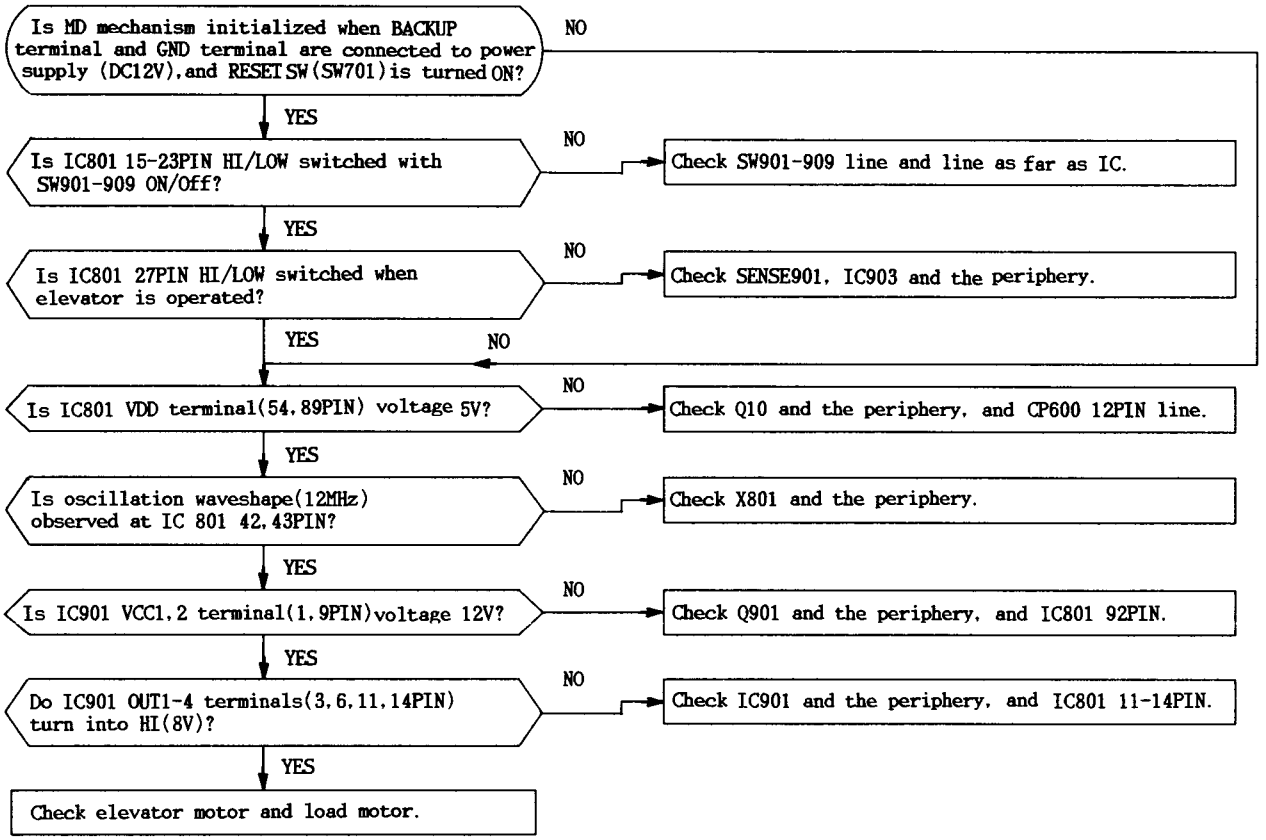
65pin: XMICON : Regular mode/TEST mode selection port. "H" TEST mode.
83pin: PIT/GRV: In case of PII DISC, "H".
62pin: K0 : TEST KEY 0
61pin: K1 : TEST KEY 1
60pin: K2 : TEST KEY 2
59pin: K3 : TEST KEY 3

7. Error Display and List of the Content

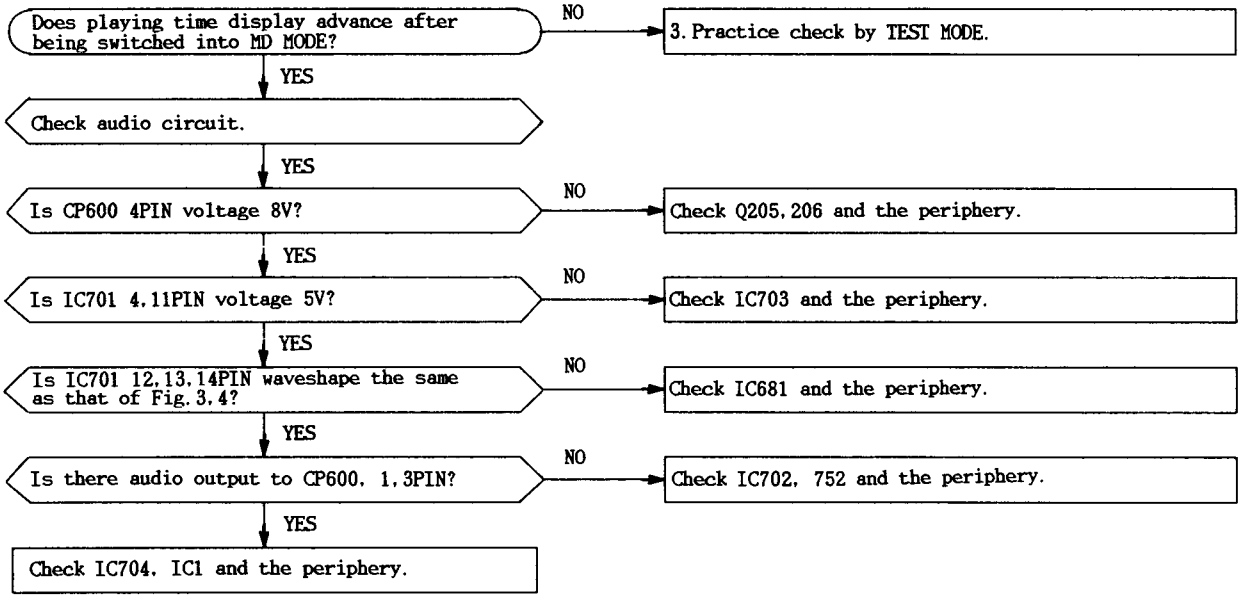
Character Display	Error Content
NO DISC	No MD DISC is set.
ERROR-01	Deficiency with regard to mechanism. Pickup inner track can't be detected. DISC change abnormality.
ERROR-07	Focus ON impossible. Read-in TOC information can't be read.
ERROR-08	Unrecorded DISC display. (Including the case in which read-in TOC can be read, but user TOC can't be correctly read.)
ERROR-30	Temperature abnormality detection circuit is operating.

TROUBLE SHOOTING

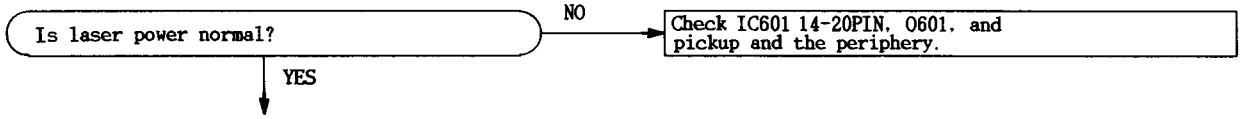
1. In case chucking does not work even if disc is inserted.

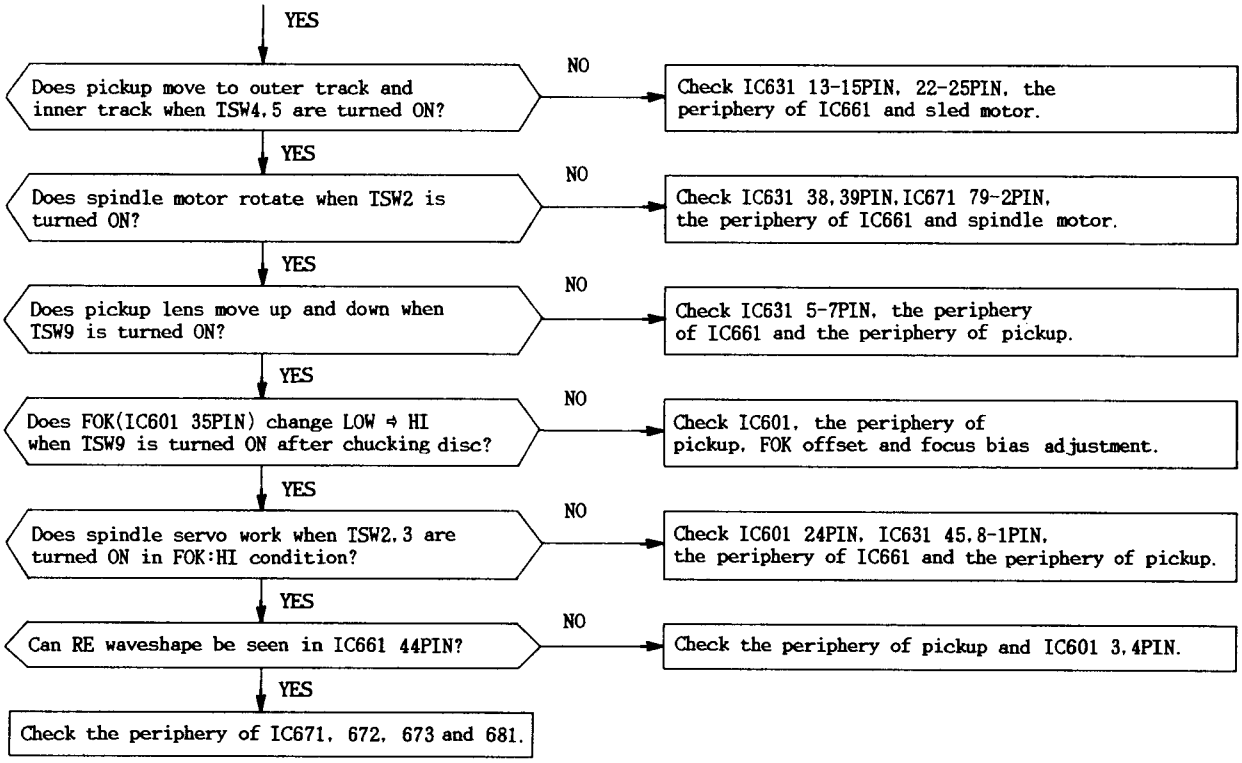


2. In case MD MODE doesn't bring playing condition.

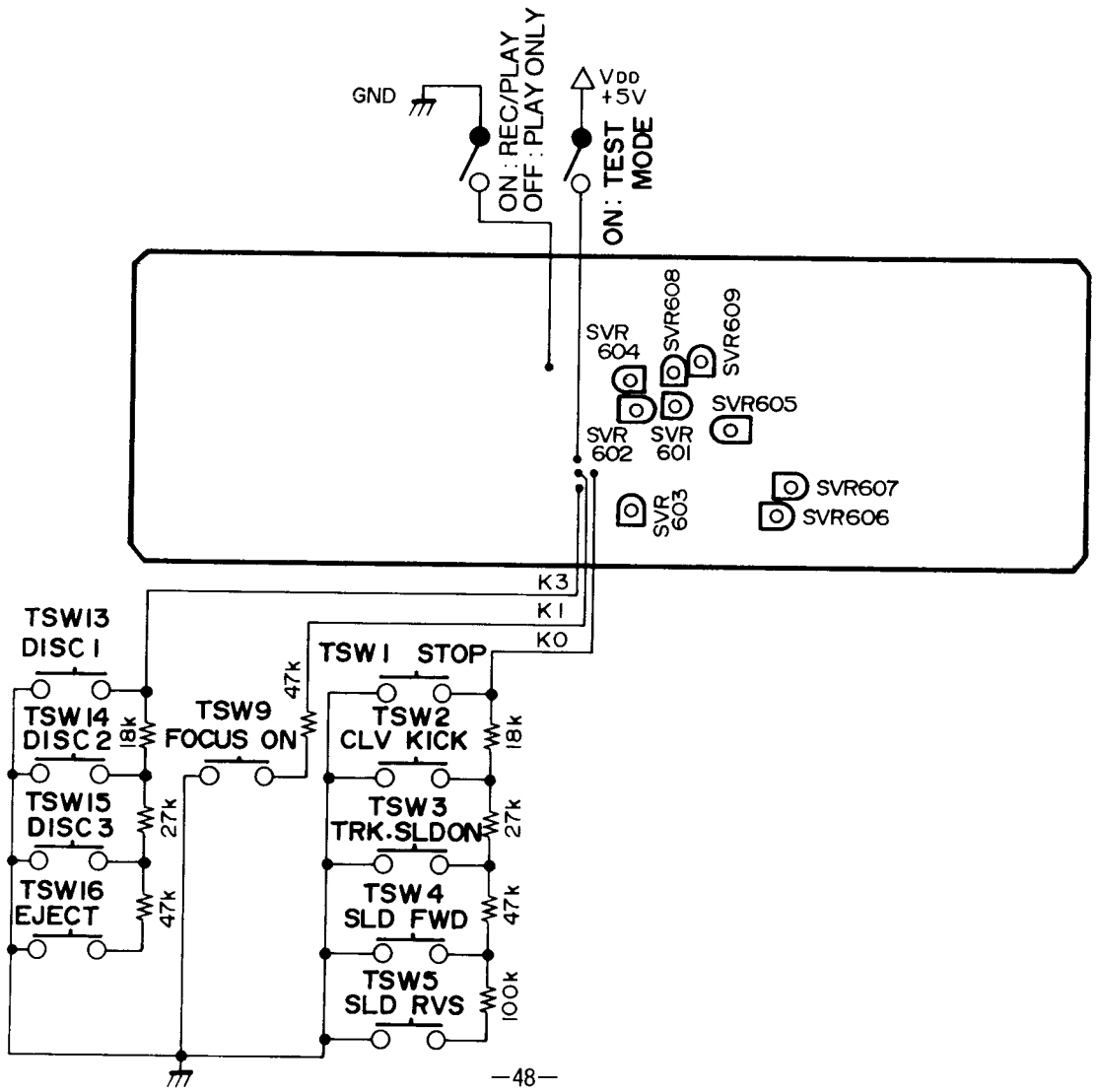


3. Check by TEST MODE.
   Supply power, and switch into TEST MODE.
   (There are the following two ways to bring TEST MODE.)
   - After supplying power, and connecting IC801 65PIN(XMICON) with VDD, turn ON RST KEY.
   - Supply power with IC801 65PIN(XMICON) connected with VDD.

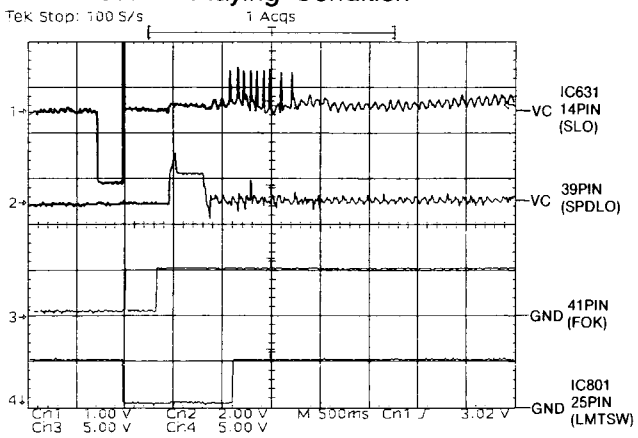




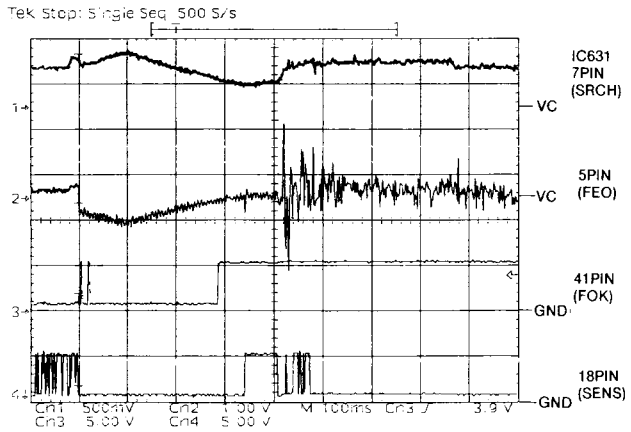
TEST KEY Wiring in Checking by TEST MODE



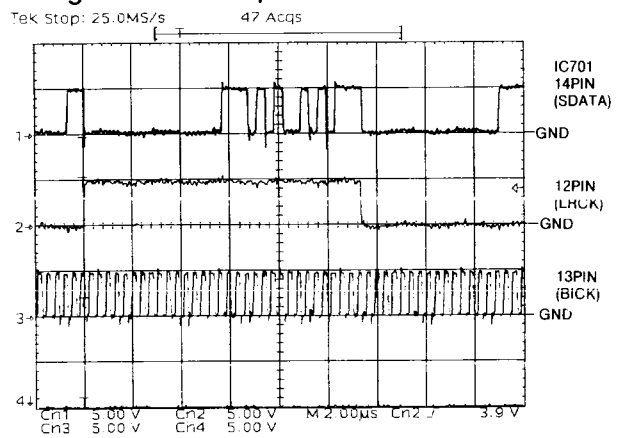
1. MD ON → Playing Condition



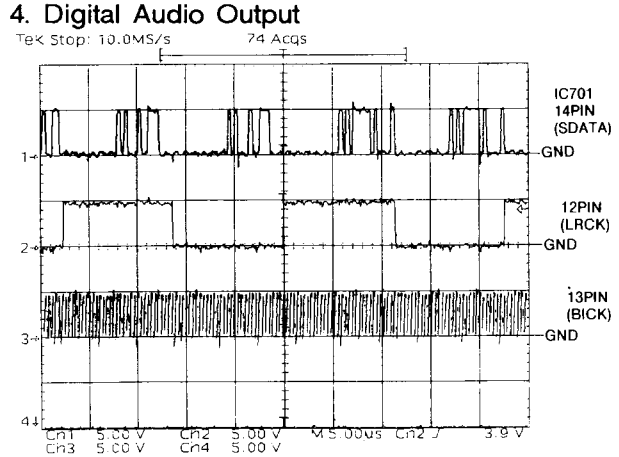
2. Focus Search



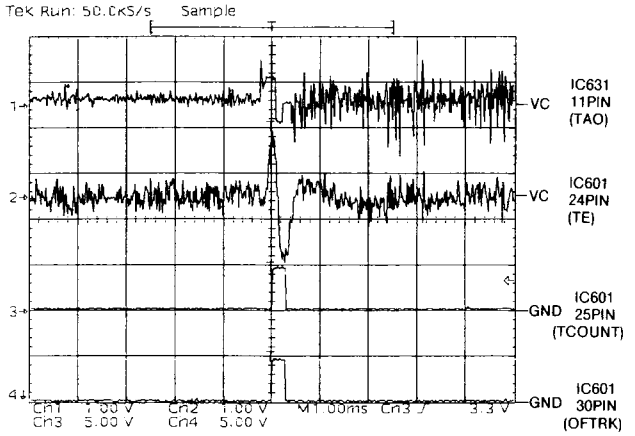
3. Digital Audio Output



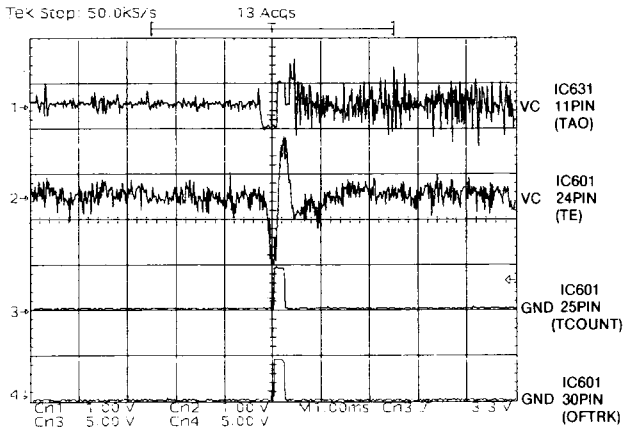
4. Digital Audio Output



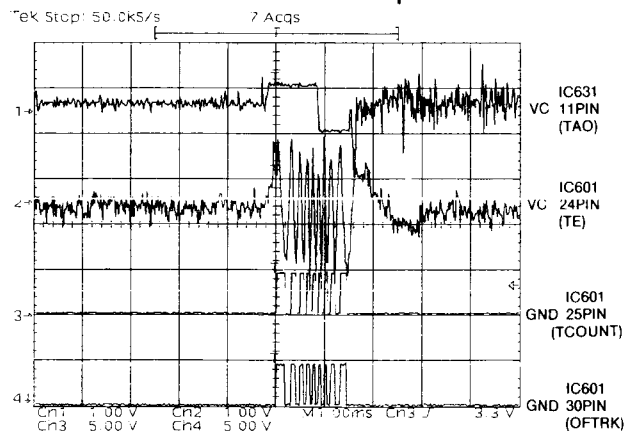
5. Pit Forward 1 Track Jump



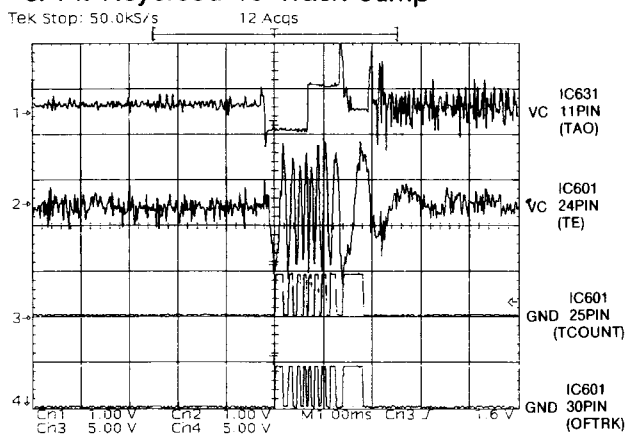
6. Pit Reversed 1 Track Jump



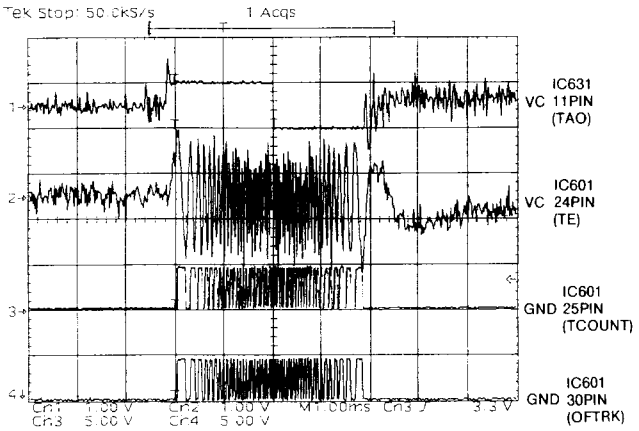
7. Pit Forward 10 Track Jump



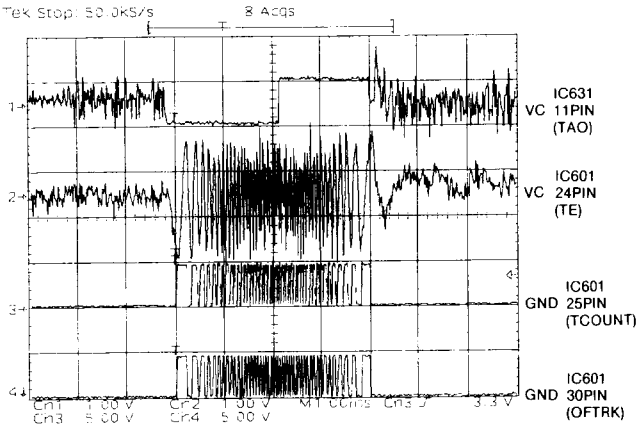
8. Pit Reyersed 10 Track Jump



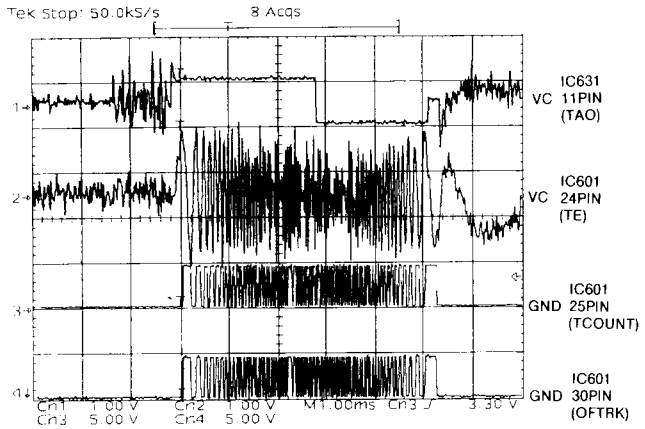
9. Pit Forward 50 Track Jump



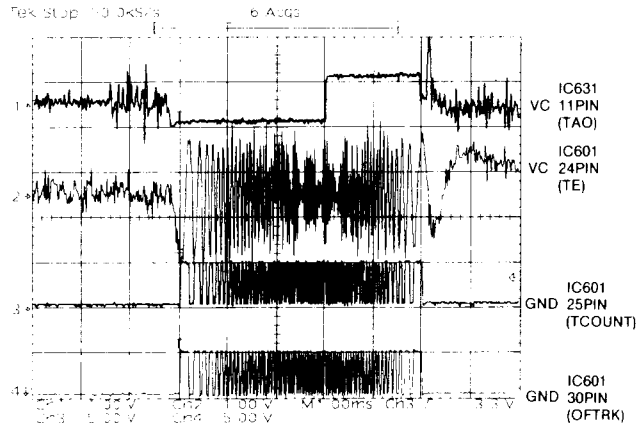
10. Pit Reversed 50 Track Jump



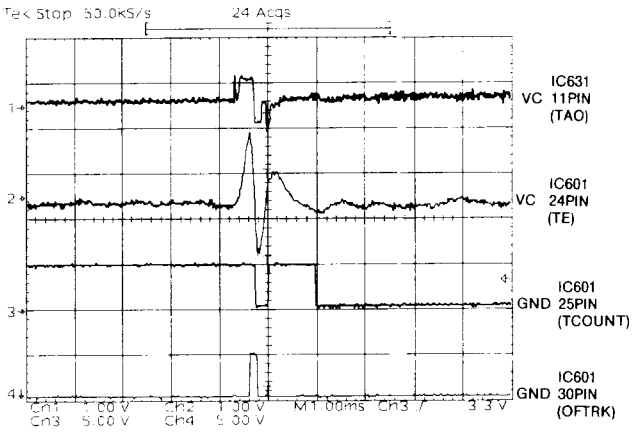
11. Pit Forward 100 Track Jump



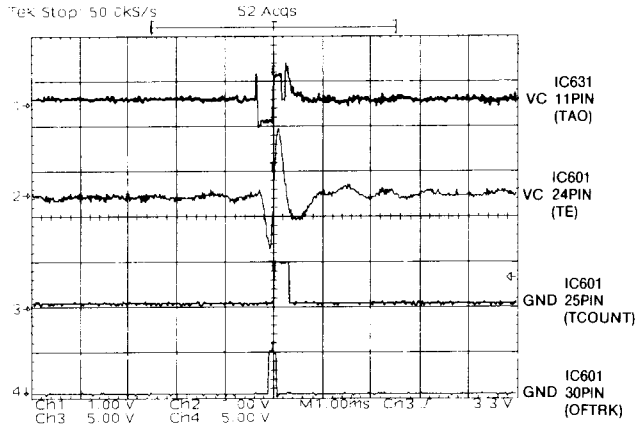
12. Pit Reversed 100 Track Jump



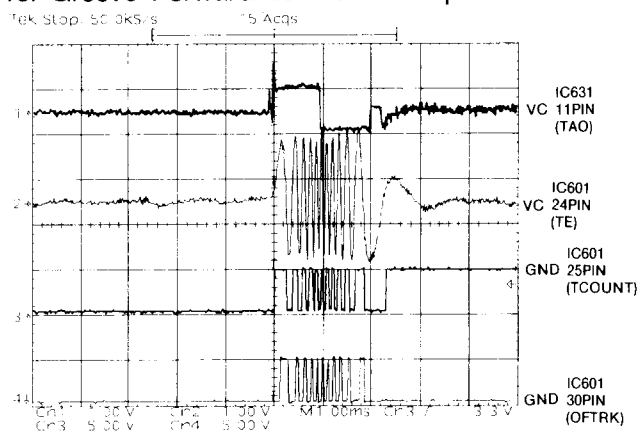
13. Groove Forward 1 Track Jump



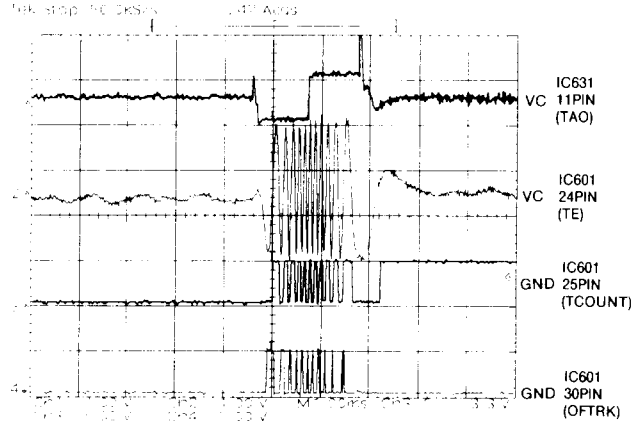
14. Groove Reversed 1 Track Jump



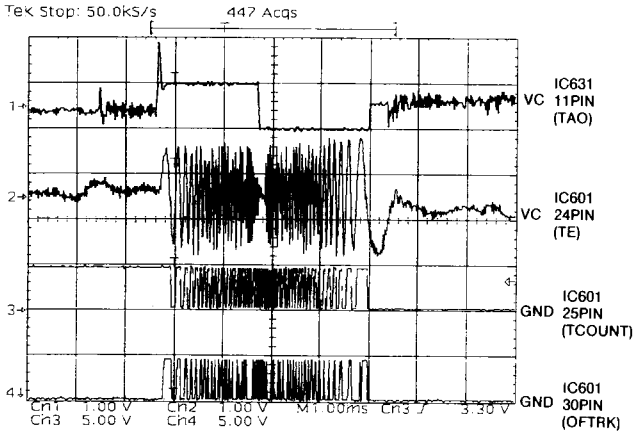
15. Groove Forward 10 Track Jump



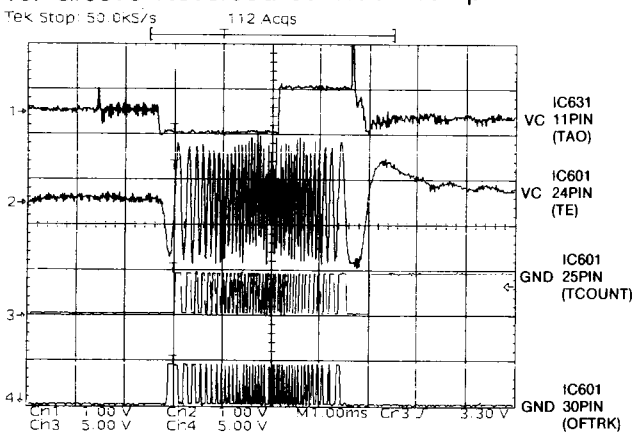
16. Groove Reversed 10 Track Jump



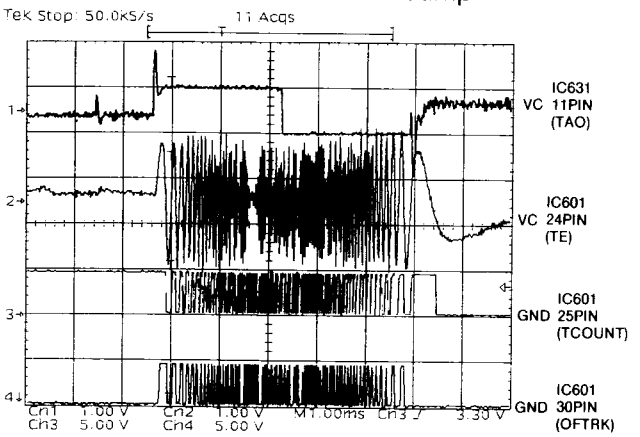
17. Groove Forward 50 Track Jump



18. Groove Reversed 50 Track Jump



19. Groove Forward 100 Track Jump



20. Groove Reversed 100 Track Jump