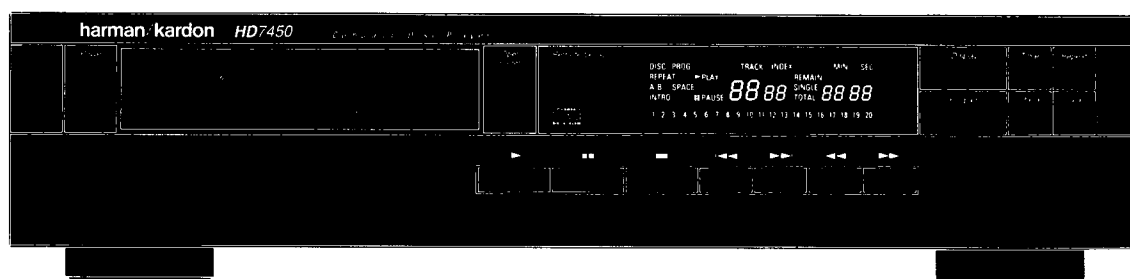


The Harman Kardon Model HD7450 COMPACT DISC PLAYER

Manual 160A

Technical Manual



The following marks found in the parts list of this manual identify the models as follows.

- BK : North America area model Black version
- I : International model
- IB : International model Black version
- BB : Australia model Black version
- WB : Asia / Oceania model Black version

harman/kardon

240 Crossways Park West, Woodbury, N. Y. 11797
1112-3152160A3 P-089008 2000 Printed in Japan

CLASS 1 LASER PRODUCT

Product complies with DHHS rules CFR subchapter J part 1040:10 at date of manufacture.

DANGER—invisible laser radiation when open and interlock failed or defeated. Avoid direct exposure to the beam.

CAUTION—use of all controls, adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.



Be Careful of the Laser Pickup

Although you cannot see it from the outside, a laser pickup is located under the disc tray and a precision lens is built in it.

Since the laser pickup, including the lens element, is especially sensitive to dust, keep the disc tray closed when not in use. Also do not put your hand inside the unit.

ADVARSEL:

Usynlig laserstråling ved åbning når sikkerhedsafbrydere er ude af funktion. Undgå udsættelse for stråling.

VAROITUS!

Laite sisältää laserdiodin, joka lähettää näkymätöntä silmille vaarallista lasersäteilyä.

SPECIFICATION

System : Compact Disc Digital Audio
 D/A Converter : Linear, Pulse Width Modulated Bit Stream, Clock Rate: 33.8688MHz (33,868.8KHz)
 Signal Detection : 3-Beam Semiconductor Optical Laser Pickup
 Error Correction : CIRC System
 Low Level Linearity : +/-1.0dB @-90dB
 Frequency Response : 4Hz to 20kHz +0dB/-1.5dB
 Total Harmonic Distortion (THD) : 0.003%
 Dynamic Range : 97dB
 Signal to Noise Ratio : 103dB
 Channel Separation : 93dB
 Line Output Level/Impedance : 2.0V @ 10kΩ

Power Supply
 U.S.A. and Canada models : AC120V, 60Hz
 International model : AC220/240V, 50/60Hz
 Japan model : AC100V, 50/60Hz
 Power Consumption : 15Watts
 Dimensions : 17-3/8" x 4" x 14"
 443mm x 103mm x 356 mm
 Weight : 11.5lbs./5.2kg

Specifications and components subject to change without notice. Overall performance will be maintained or improved.

Adjustment of this unit requires following measuring instruments and jigs.

- Oscilloscope (3 or more modes, 100MHz, input Select DC range) 1740A
- Test Disc: EIAJ CD-1

SAFETY PRECAUTIONS

Before returning an instrument to the customer, always make a safety check of the entire instrument, including, but not limited to, the following items:

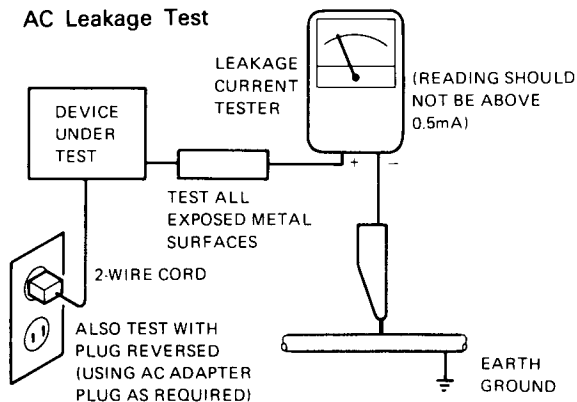
- a. Be sure that no built-in protective devices are defective and/or have been defeated during servicing.
 - (1) Protective shields are provided to protect both the technician and the customer. Correctly replace all missing protective shields, including any removed for servicing convenience.
 - (2) When reinstalling the chassis and/or other assembly in the cabinet, be sure to put back in place all protective devices, including, but not limited to, nonmetallic control knobs, insulating fishpapers, adjustment and compartment covers/shields, and isolation resistor/capacitor networks.

Do not operate this instrument or permit it to be operated without all protective devices correctly installed and functioning.

- b. Be sure that there are no cabinet openings through which an adult or child might be able to insert their fingers and contact a hazardous voltage. Such openings include, both are not limited to, excessively wide cabinet ventilation slots, and an improperly fitted and/or incorrectly secured cabinet back over.

- c. **Leakage Current Hot Check** — With the instrument completely reassembled, plug the AC line cord directly into a 120V AC outlet. (Do not use an isolation transformer during this test.) Use a leakage current tester or a metering system that complies with American National Standards Institute (ANSI) C101.1 "Leakage Current for Appliances" and Underwriters Laboratories (UL) 1270, (34.6). With the instrument AC switch first in the ON position and then in the OFF position, measure from a known earth ground (metal waterpipe, conduit, etc.) to all exposed metal parts of the instrument (antennas, handle bracket, metal cabinet, screwheads, metallic overlays, control shafts, etc.), especially any exposed metal parts that offer an electrical return path to the chassis. Any current measured must not exceed 0.5 milliamp. Reverse the instrument power cord plug in the outlet and repeat test. **ANY MEASUREMENTS NOT WITHIN THE LIMITS SPECIFIED HEREIN INDICATE A POTENTIAL SHOCK HAZARD THAT MUST BE ELIMINATED BEFORE RETURNING THE INSTRUMENT TO THE CUSTOMER.**

AC Leakage Test

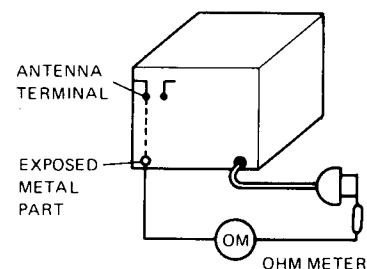


d. Insulation Resistance Test

- (1) Unplug the power supply cord and connect a jumper wire between the two prongs of the plug.
- (2) Turn on the power switch of the instrument.
- (3) Measure the resistance with an ohmmeter between the jumpered AC plug and each **exposed metallic** cabinet part on the instrument, such as screwheads, antenna, control shafts, handle brackets, etc. The reading should be as shown below. If it is not within the limits specified, there is the possibility of a shock hazard, and the instrument must be repaired and rechecked before it is returned to the customer.

e. Insulation Resistance Test Cold Check

- (1) Unplug the power supply cord and connect a jumper wire between the two prongs of the plug.
- (2) Turn on the power switch of the instrument.
- (3) Measure the resistance with an ohmmeter between the jumpered AC plug and each **exposed metallic** cabinet part on the instrument, such as screwheads, antenna, control shafts, handle brackets, etc. When the exposed metallic part has a return path to the chassis, the reading should be between 1 and 5.2 Megohm. When there is no return path to the chassis, the reading must be "infinite". If it is not within the limits specified, there is the possibility of a shock hazard, and the instrument must be repaired and rechecked before it is returned to the customer.



PRODUCT SAFETY NOTICE

Some electrical and mechanical parts have special safety related characteristics which are often not evident from visual inspection, nor can the protection they give necessarily be obtained by replacing them with components rated for higher voltage, wattage, etc. Parts that have special safety characteristics are identified by shading, by (△) on schematics and parts listed. Use of a substitute replacement that does not have the same safety characteristics as the recommended replacement part might create shock, fire, and/or other hazards. Products Safety is under review continuously and new instructions are issued whenever appropriate.

SERVICING PRECAUTIONS

CAUTION: Before servicing instruments covered by this manual and its supplements, read and follow the SAFETY PRECAUTIONS on this page.

NOTE: If unforeseen circumstances created conflict between the following servicing precautions and any of the safety precautions, **always follow the safety precautions.** Remember: Safety First.

General Servicing Precautions

- a. Always unplug the instrument AC power cord from the AC power source before:
 - (1) Removing or reinstalling any component, circuit board, module, or any other instrument assembly.
 - (2) Disconnecting or reconnecting any instrument electrical plug or other electrical connection.
 - (3) Connecting a test substitute in parallel with an electrolytic capacitor in the instrument.

Caution: A wrong part substitution or incorrect polarity installation of electrolytic capacitors may result in an explosion hazard.
- b. Do **not** defeat any plug/socket B+ voltage interlocks with which instruments covered by this manual might be equipped.
- c. Do **not** apply AC power to this instrument and/or any of its electrical assemblies unless all solid-state device heat sinks are correctly installed.
- d. Always connect a test instrument's ground lead to the instrument chassis ground before connecting the test instrument positive lead. Always remove the test instrument ground lead last.

NOTE: Refer to Safety Precautions on Page 3.

- (1) The service precautions are indicated or printed on the cabinet, chassis or components. When servicing, follow the printed or indicated service precautions and service materials.
- (2) The Components used in the unit has a specified flammability and dielectric strength. When replacing any components, use components which has the same ratings. Components marked (Δ) in the circuit diagram are important for safety or for the characteristics of the unit. Always replace with the appointed components.
- (3) An insulation tube or tape is sometimes used and some components are raised above the printed wiring board for safety. The internal wiring is sometimes clamped to prevent contact with heating components. Install them as they were.
- (4) After servicing, always check that the removed screws, components and wiring have been installed correctly and that the portion around the service part have not been damaged and so on. Further check the insulation between the blades of attachment plug and accessible conductive parts.

Insulation Checking Procedure

Disconnect the attachment plug from the AC outlet and turn the power on. Connect the insulation resistance meter (500V) to the blades of the attachment plug. The insulation resistance between the each blade of the attachment plug and accessible conductive parts (Note 1) should be more than 1M-ohm.

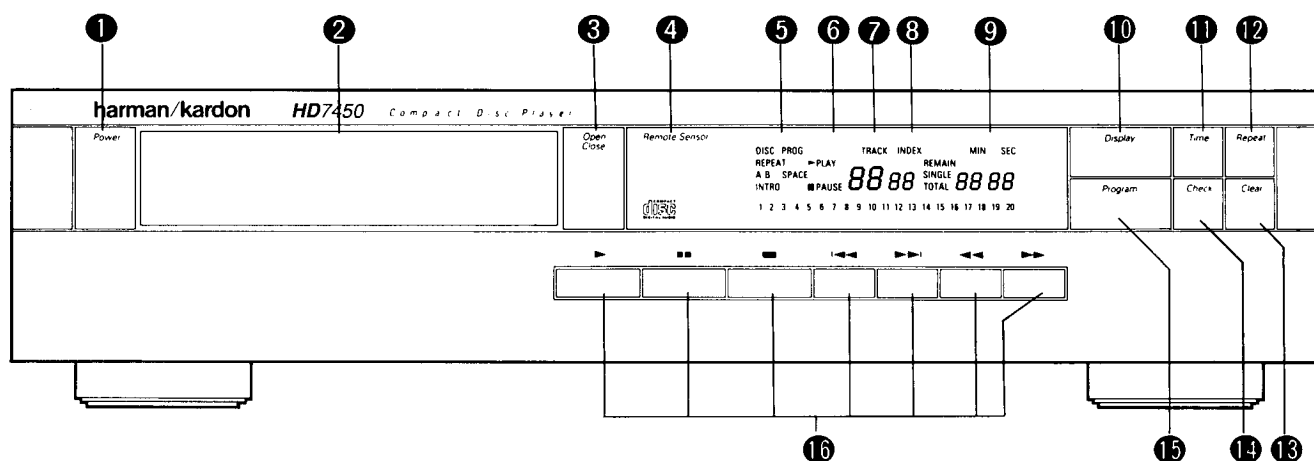
Note 1: Accessible Conductive Parts including Metal panels, Output jacks, etc.

ELECTROSTATICALLY SENSITIVE (ES) DEVICES

Some semiconductor (solid state) devices can be damaged easily by static electricity. Such components commonly are called Electrostatically Sensitive (ES) Devices. Examples of typical ES devices are integrated circuits and some fieldeffect transistors and semiconductor "chip" components. The following techniques should be used to help reduce the incidence of component damage caused by static electricity.

1. Immediately before handling any semiconductor component or semiconductor-equipped assembly, drain off any electrostatic charge on your body by touching a known earth ground. Alternatively, obtain and wear a commercially available discharging wrist strap device, which should be removed for potential shock reasons prior to applying power to the unit under test.
2. After removing an electrical assembly equipped with ES devices, place the assembly on a conductive surface such as aluminum foil, to prevent electrostatic charge buildup or exposure of the assembly.
3. Use only a grounded-tip soldering iron to solder or unsolder ES devices.
4. Use only an anti-static solder removal device. Some solder removal devices not classified as "anti-static" can generate electrical charges sufficient to damage ES devices.
5. Do not use freon-propelled chemicals. These can generate electrical charge sufficient to damage ES devices.
6. Do not remove a replacement ES device from its protective package until immediately before you are ready to install it. (Most replacement ES devices are packaged with leads electrically shorted together by conductive foam, aluminum foil or comparable conductive material).
7. Immediately before removing the protective material from the leads of a replacement ES device, touch the protective material to the chassis or circuit assembly into which the device will be installed.
CAUTION: Be sure no power is applied to the chassis or circuit, and observe all other safety precautions.
8. Minimize bodily motions when handling unpackaged replacement ES devices. (Otherwise harmless motion such as the brushing together of your clothes fabric or the lifting of your foot from a carpeted floor can generate static electricity sufficient to damage an ES device).

CONTROLS AND FUNCTIONS

**1 POWER switch**

The POWER switch turns the unit on and off.

2 Compact disc drawer

Load a disc (full-size or 3-inch) into your compact disc player by placing it in this drawer with the label side up. Open and close the drawer using the OPEN/CLOSE button (3).

3 OPEN/CLOSE button

Press this button to open or close the compact disc drawer. The drawer will also close if you press the play button or push the drawer gently toward the chassis of the player; however, we recommend that you do not push the drawer.

4 REMOTE SENSOR

This area receives the signal from the remote control unit. Make sure this area of the front panel is kept free from dirt or other obstructions that might prevent proper reception of the infrared signal from the remote control.

5 FUNCTION indicator

DISC - This indicator lights when the disc drawer is open, and when a disc is loaded. It does not light when there is no disc inside.

REPEAT - When this indicator is lit, the unit is in REPEAT mode and will continuously repeat either the entire disc or the programmed sequence.

A-B - When this indicator is lit steadily, the unit is set to repeat a specified section of the disc (from A to B). When repeat indicator is lit, you have already programmed the starting point (point A) of a section, and the unit is waiting for you to program the ending point of the section (point B).

INTRO - When this indicator is lit, the unit is in INTRO SCAN mode and will play only the first 15 seconds of each selection on the disc or in the selected program.

PROG - When this indicator is lit, the unit is in PROGRAM mode, in which you can program a sequence of tracks in the order you'd like to hear them, then play back your programmed sequence.

SPACE - When this indicator is lit, the unit is in SPACE mode and will insert 4 seconds of space between tracks.

6 PLAYBACK mode

PLAY - This indicator is lit when the unit is playing a track.

PAUSE - This indicator is lit when the unit is in PAUSE mode (i.e., you have pressed PAUSE to temporarily stop playback).

7 TRACK indicator

When a disc is loaded but not playing, the TRACK indicator displays the total number of tracks on that disc. During playback, the indicator displays the number of the track currently being played. During programming, it displays the number of the track most recently selected.

8 INDEX indicator

Some discs that contain very long tracks may have those tracks subdivided into shorter sections. For example, a long classical piece may be divided into movements, each of which may have an index number. The INDEX indicator displays the number of the subdivision of a track currently being played. If the track has no subdivisions, the INDEX indicator will display a 1 during playback. During programming, the INDEX light goes out and the indicator displays the total number of tracks selected in the programmed sequence.

9 TIME indicator

When a disc is loaded but not playing, the TIME indicator displays the total amount of playback time on that disc. During playback, depending on the state of the TIME button (9), the indicator displays one of the following

- The time that has elapsed since the beginning of the current track.
- The time that remains on the currently selected track. The words REMAIN SINGLE will be displayed if the indicator is in this mode.
- The time that remains on either the entire disc or on the programmed selections. The words REMAIN TOTAL will be displayed if the indicator is in this mode. Note that if you have programmed more than 99 minutes in your selection, only dashes will appear in this mode.

10 DISPLAY button

This button turns the display on and off. When you turn the display off in PLAY mode, the entire display goes off. In PAUSE mode, most of the display goes off, but the track number is still displayed. In STOP mode, most of the display goes off, but the total number of tracks on the disc is still displayed. In some systems, turning the fluorescent display off may provide the purest possible sound quality during playback.

11 TIME button

During playback or programming, this button cycles through the three TIME display modes

- The time that has elapsed since the beginning of the current track.
- The time that remains on the currently selected track.
- The time that remains on either the entire disc or the programmed sequence.

12 REPEAT button

This button puts your compact disc player in and out of REPEAT mode. In REPEAT mode, the unit will continually play back either the entire disc or the programmed sequence of tracks. Press the button once to turn on REPEAT mode; press again to turn off REPEAT mode. When the unit is in REPEAT mode, the FUNCTION indicator (5) will display the word REPEAT.

13 CLEAR button

The CLEAR button removes tracks from your programmed sequence one by one starting with the last track entered. Each time you clear a track from the programmed sequence, that track's time is deleted from the total time displayed. This button is used only in PROGRAM mode.

14 CHECK button

When a disc is loaded but not playing (STOP mode), you can press the CHECK button to see the playback time of each track on the disc. Each time you press the CHECK button, the next track is displayed along with its playback time. When you have stepped sequentially through all the tracks on the disc, another press of the CHECK button displays the total playback time of the entire disc. In PROGRAM mode, the CHECK button displays the cumulative time of the tracks in the programmed sequence. That is, the first press displays the time of the first programmed track, the second press displays the cumulative playback time of the first and second tracks, and so on.

15 PROGRAM button

This button puts your compact disc player in and out of PROGRAM mode. Press the button once to turn on PROGRAM mode; press again to turn it off. In PROGRAM mode, you can program a set of tracks to play in any sequence. (For instructions on programming a sequence of tracks, see the Operations section of this manual.) When the unit is in PROGRAM mode, the FUNCTION indicator (5) will display the word PROG in red.

16 Playback controls

PLAY - ► The PLAY button starts playback of a track.

PAUSE - ■■ Pressing the PAUSE button temporarily stops playback. Pressing the PAUSE button again, or pressing PLAY, resumes playback at the precise point where playback left off.

STOP - ■■■ The STOP button stops playback. When you press PLAY, playback will start either at the beginning of the disc or programmed sequence, or at any track you select.

SKIP BACK - ◀ Pressing this button once skips back to the beginning of the present track. If you are in PLAY mode, playback will resume. Holding the button down skips backward to the beginning of each preceding track until the first track on the disc is reached.

SKIP FORWARD - ▶ Pressing this button once skips forward to the beginning of the next track. If you are in PLAY mode, playback will resume. Holding the button down skips forward to the beginning of each subsequent track until the last track on the disc is reached.

SEARCH BACK - ◀◀ Holding down this button during playback reverses rapidly through the disc. This function is similar to the "Rewind" function on a tape deck.

SEARCH FORWARD - ▶▶ Holding down this button during playback speeds rapidly forward through the disc. This function is similar to the "Fast forward" function on a tape deck.

HD7450 Remote control

The remote control for the HD7450 provides the same functions found on the front panel of the compact disc player itself. In addition, the remote control provides some functions that are not found on the front panel.

The functions found on the remote control that are not found on the front panel are INTRO, A-B, INDEX, SPACE and the 1-10 and +10 keys. These five functions are described below (for other functions, see the descriptions above).

17 A-B button

This button puts your compact disc player in and out of A-B mode. In A-B mode, the unit will continually play back a "phrase" or section of your disc beginning at point A and ending at point B. (For instructions on repeating a section of a disc, see the Operations section of this manual.) When the unit is in A-B mode, the FUNCTION indicator (5) will display REPEAT A-B.

18 INTRO button

This button puts your compact disc player in and out of INTRO SCAN mode. When INTRO SCAN is on and you press PLAY, the unit plays only the first 15 seconds of each track before moving on to the next. Press the button once to turn on INTRO SCAN mode; press again to turn it off and stop the scanning. When the unit is in INTRO SCAN mode, the FUNCTION indicator (5) will display the word INTRO.

19 SPACE button

This button puts your compact disc player in and out of SPACE mode. Press the button once to turn on SPACE mode; press again to turn it off. In SPACE mode, the unit inserts 4 seconds of blank space between tracks. This is particularly useful if you are recording music from a compact disc onto a tape. Tape decks with a Music Search feature will be able to use the 4 seconds of space to correctly identify the beginning of each selection on the tape. When the unit is in SPACE mode, the FUNCTION indicator (5) will display the word SPACE.

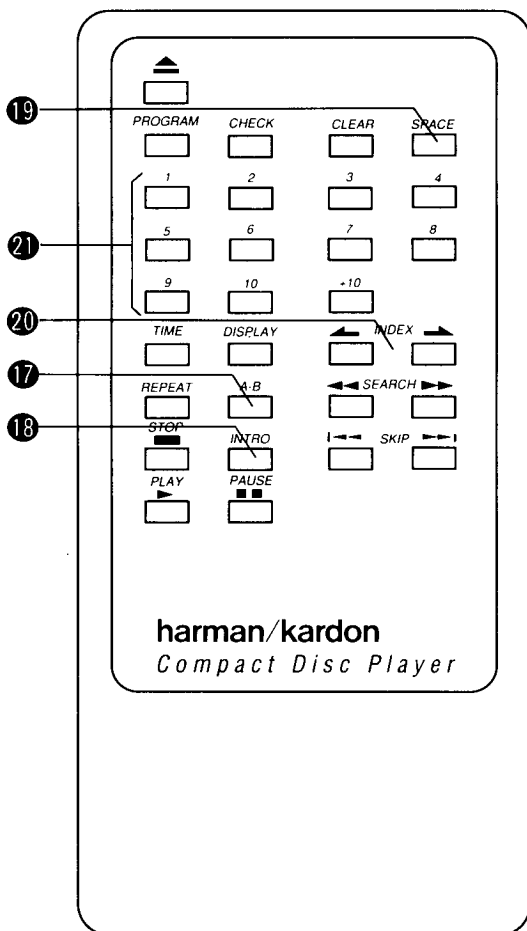
20 INDEX buttons

Some discs contain long selections that may be subdivided into shorter sections (for example, operas). Just as the tracks are marked by the track number, these shorter sections may be marked by index numbers. When you have started playback of the desired track, you can use the INDEX UP and INDEX DOWN buttons to jump to a desired index selection. Each time you press an INDEX button, the INDEX indicator displays the next higher or lower index number. If you continue pressing the button until the indicated index number is higher than the actual number of index selections on the disc, playback will start from the nearest index selection.

21 Track selection buttons

This set of buttons (numbered 1 through 10 and +10) enables you to directly select the track you want to play. To select a track with a number higher than 10, press the +10 button, then press the button that will add up to the number of the track you want. For example, to select track 14, press +10, then press 4. If you select a track number that does not exist on your disc, the TRACK indicator will continue to display the number of the last track on the disc. When PROGRAM mode is off, pressing a track button plays the track you select. When PROGRAM mode is on, pressing a track button programs that track into your sequence.

REMOTE CONTROL



The remote control operates within a 30° angle of the remote sensor on the front panel of the unit. Make sure that the remote's front projection "lens" as well as the REMOTE SENSOR area on the front panel of the unit are kept free from dirt to ensure proper transmission and reception of the infrared beam. Also make sure that no objects (e.g., stereo cabinet doors, end tables) block the path from the remote control to the REMOTE SENSOR area.

Avoid using the remote control near fluorescent lamps, as they may shorten its operating range.

DISASSEMBLY PROCEDURES (REFER TO PAGES 36, 38 AND 39)**[1] CABINET TOP (123) REMOVAL**

Remove 7 screws (A) and then remove the Cabinet Top (123).

[2] FRONT PANEL ASS'Y (AA) REMOVAL

1. Remove the Cabinet Top (123), referring to the previous step [1].
2. Disconnect the connectors with lead wires (LCN110, LCN111, LCN112, LCN116, LCN122 and LCN120) from connectors (CN109, CN110, CN111, CN112, CN116, CN122 and CN120) on the Main P. C. Board (PCB-1).
3. Remove 6 screws (B) and then remove the Front Panel Ass'y (AA) with the Front P. C. Board (PCB-2).
4. Remove 7 screws (C) and then remove the Front P. C. Board (PCB-2) from the Front Panel Ass'y (AA).

[3] MAIN P. C. BOARD (PCB-1) REMOVAL

1. Remove the Cabinet Top (123), referring to the previous step [1].
2. Disconnect the connector with lead wires (LCN110, LCN111, LCN112, LCN113, LCN114, LCN115, LCN116, LCN117, LCN120 and LCN122) from connectors (CN110, CN111, CN112, CN113, CN114, CN115, CN116, CN117, CN120 and CN122) on the Main P. C. Board (PCB-1).
3. Open the lid of connector (CN118) on the Main P. C. Board (PCB-1), then disconnect the jumper leads (JL1 and CN122).
4. Remove 8 screws (D) and then remove the Main P. C. Board (PCB-1).

[4] CD PLAYER MECHANICAL ASSEMBLY (120) REMOVAL

1. Remove the Cabinet Top (123), referring to the previous step [1].
2. Disconnect the connector with lead wires (LCN115, LCN114, LCN113 and LCN117) from connectors (CN115, CN114, CN113 and CN117) on the Main P. C. Board (PCB-1).
3. Remove 3 screws (E) and then remove the CD Player Mechanical Assembly (120) backward.

DISASSEMBLING THE CD PLAYER MECHANICAL ASSEMBLY**[5] DISC TRAY (16) REMOVAL**

1. Remove the Cabinet Top (123), referring to the previous step [1].
2. Connect the Power cord and turn on the power by pressing the Power switch.
3. Open the Disc Tray (16) by pressing the Open/Close button.
4. With the Disc Tray (16) opened as it is, pull out the power plug.
5. Push the Disc Tray (16) by hand to slide it in once.
6. Loosen the 2 screws (F) and then slide out the Disc Tray (16) by hand.

[6] OPTICAL PICK-UP (52) REMOVAL

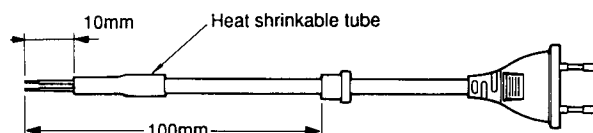
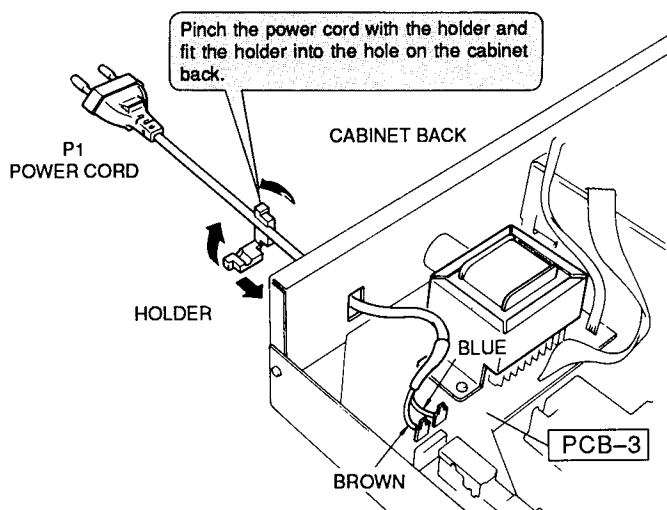
1. Remove the CD Player Mechanical Assembly (120), referring to the previous step [4].
2. Remove 4 screws (G) and then remove the Disc Motor Ass'y (63) with Pick-up, Slide Motor and etc.
3. Remove 2 screws (H) and then remove the Gears (59 and 60).
4. Remove the 2 screws (I) and then remove the Shaft Clamps (62), then remove the Pick-up (52) with shaft.

[7] SLIDE MOTOR (57) REMOVAL

1. Remove the Gears (59 and 60), referring to the previous step [6]-3.
2. Unsolder the terminal of Disc and Slide Motors, then remove the Motor P. C. Board (65).
3. Remove 2 screws (J) and then remove the Slide Motor (57).

POWER CORD REPLACEMENT (FOR SERVICE ENGINEERS OTHER THAN NORTH AMERICA)

In order to prevent fire or shock hazard when replacing the power cord, follow the procedure below to replace the part with the standard supply parts.



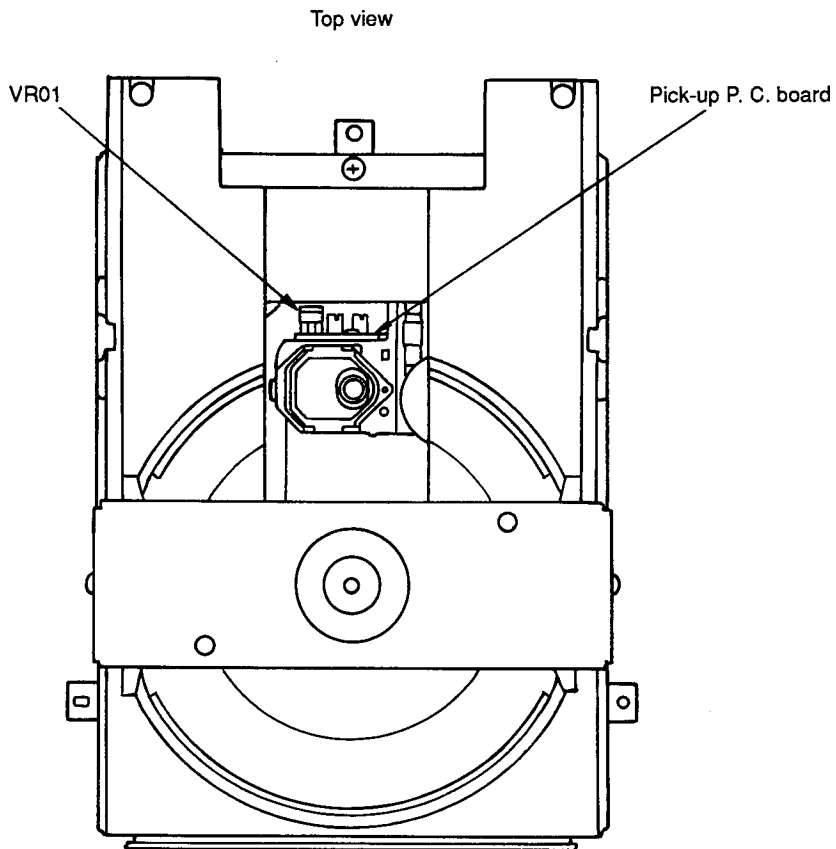
ADJUSTMENT PROCEDURE

1. Instruments required

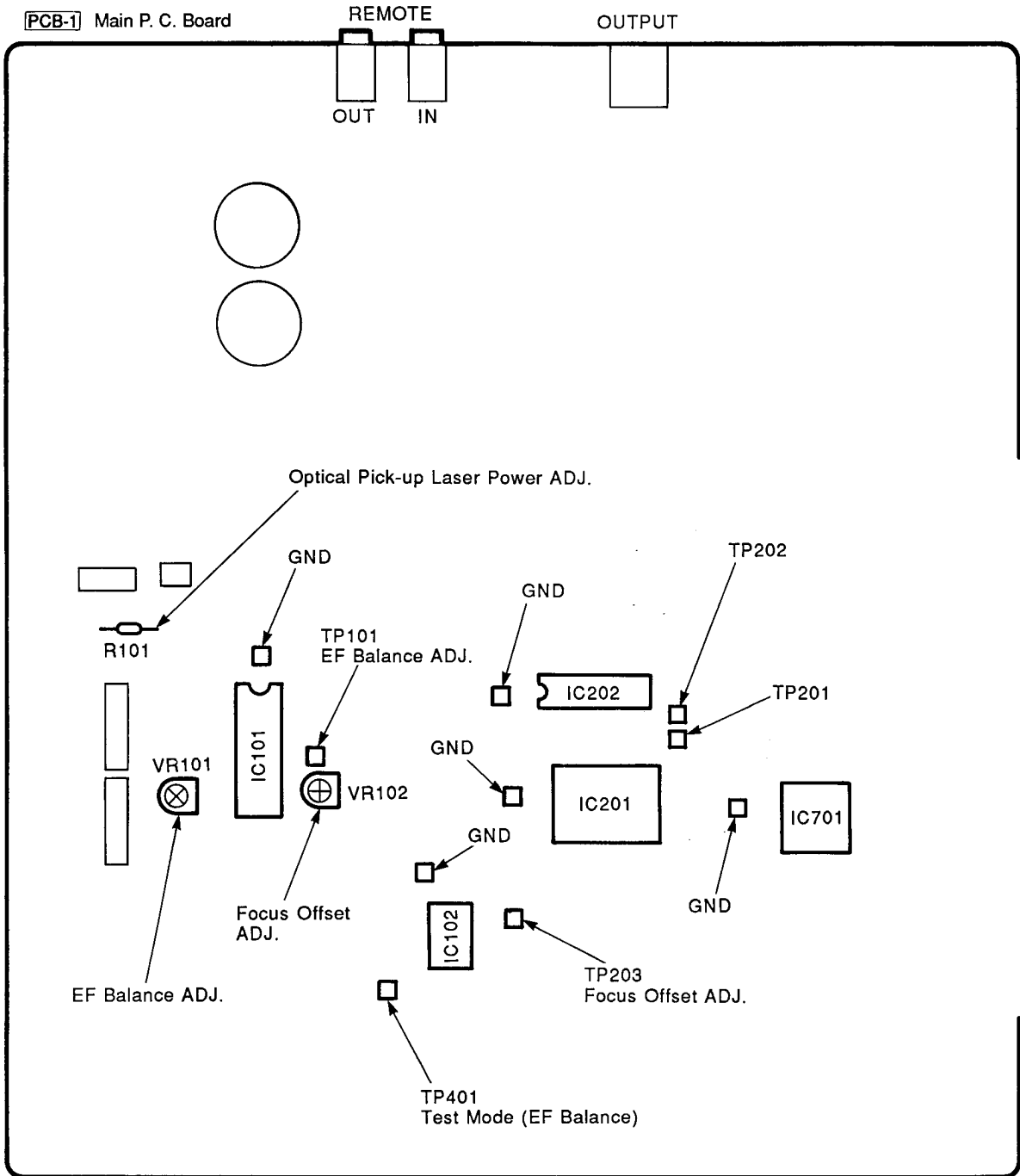
- DC voltmeter
- Oscilloscope (3 or more modes, 100 MHz, input select DC range)
- Jitter meter
- Test disc: EIAJ CD-1

2. Adjustment points

- 2-1 Adjusting screw layout for CD player mechanical assembly.



2-2 VR and test point layout for main P.C. board.



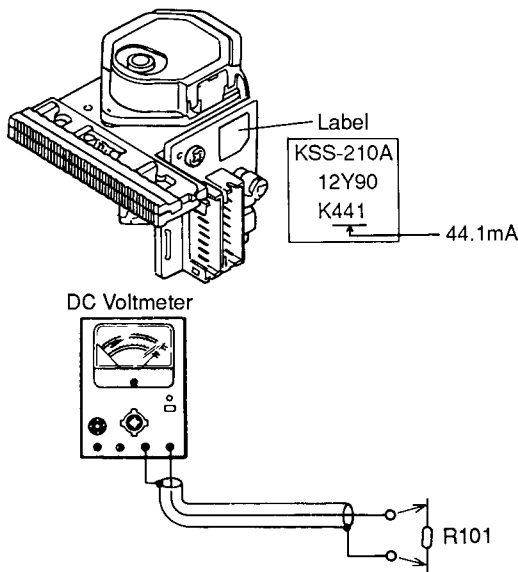
3. Optical Pick-up Laser Power Adjustment

The specified value for adjustment varies with the type of the pick-up in use. Obtain the voltage value according to the following procedure.

- (a) Read the current value on the label of the pick-up P.C.board.
- (b) Using the amperage of the current and the following equation, calculate the voltage value.

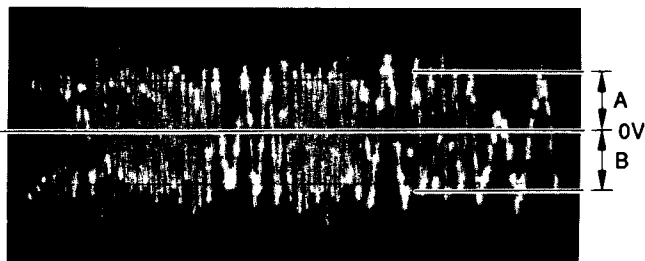
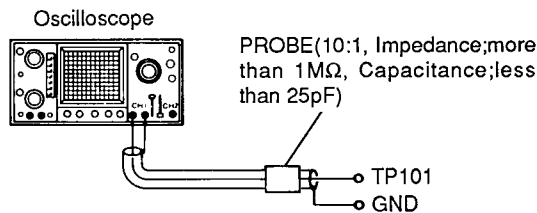
When the current is 44.1mA: $V=0.0441A \times 22=0.9702V$

- (1) Connect the DC voltmeter to both ends of R101.
- (2) Insert EIAJ CD-1 test disc and place the unit in the Play mode.
- (3) Adjust VR01 in the pick-up P.C.board to the voltage obtained in step (b) above.



4. EF Balance Adjustment

- (1) Connect the oscilloscope (0.5V/div, 5 msec./div, DC mode) to TP101 and GND. Short-circuit TP401 and GND.
- (2) Insert EIAJ CD-1 test disc and place the unit in the Play mode.
- (3) Adjust VR101 so that the amplitude above and below the zero DC line becomes equal. (Amplitude A = Amplitude B)

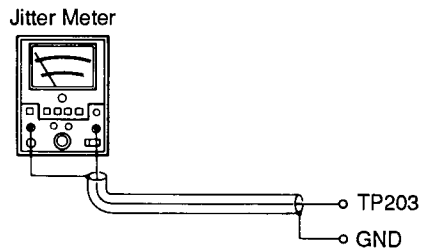


A=B

(approx. 1.5Vp-p)

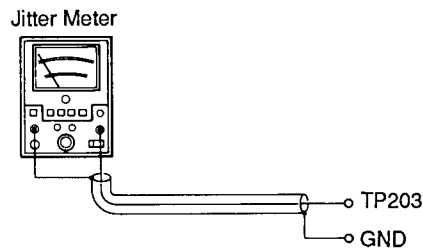
5. Focus Offset Adjustment

- (1) Connect the Jitter meter to TP203 and GND.
- (2) Insert EIAJ CD-1 test disc and place the unit in the play mode.
- (3) Adjust VR102 until the jitter for optimum sensitivity.



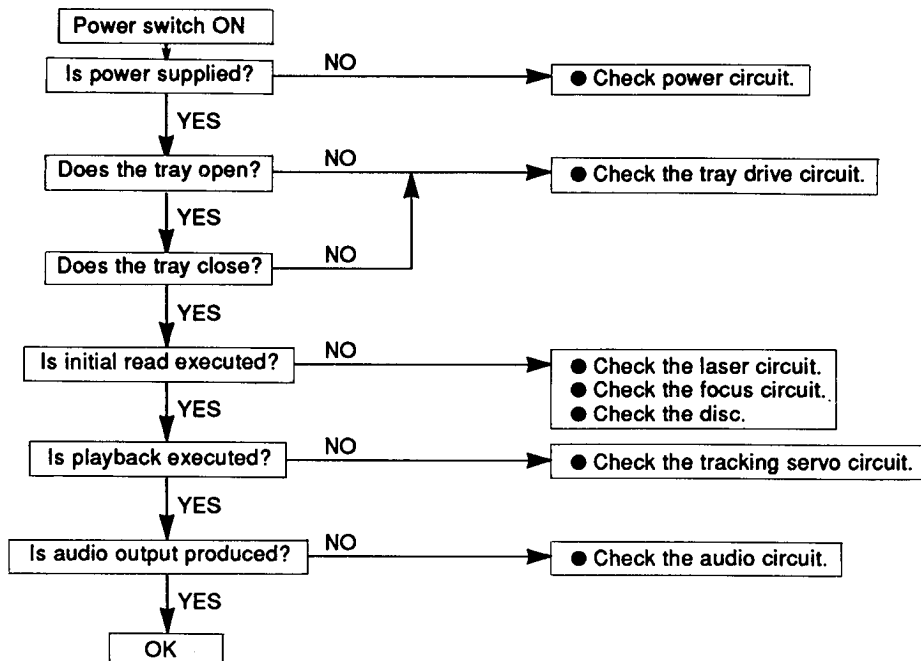
6. Jitter Inclination Confirmation

- (1) Connect the Jitter meter (sigma range) to TP203 and GND.
- (2) Insert EIAJ CD-1 test disc and place the unit in the Play mode.
- (3) Confirm the jitter meter reading is less than 30ns.

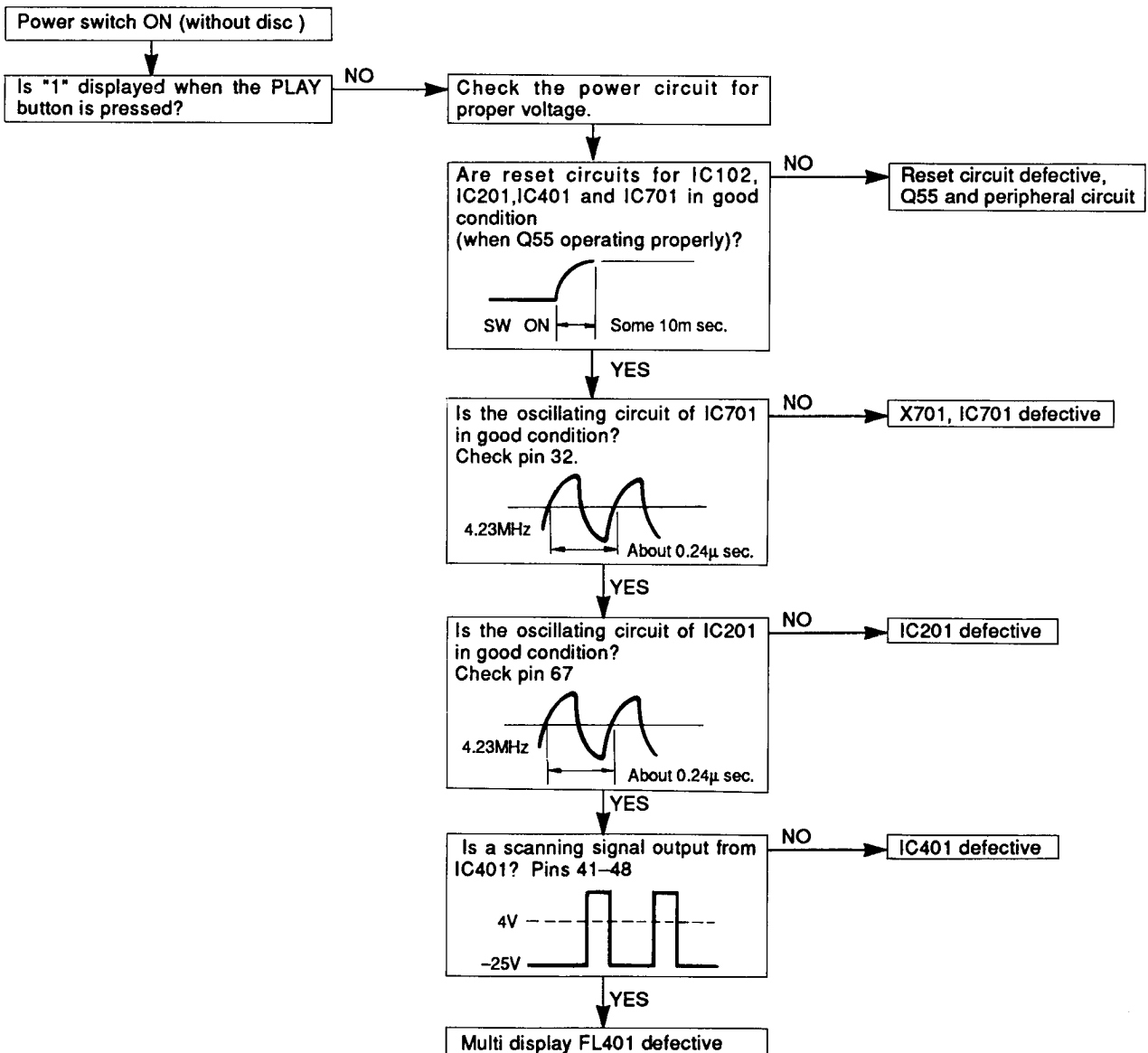


TROUBLE SHOOTING

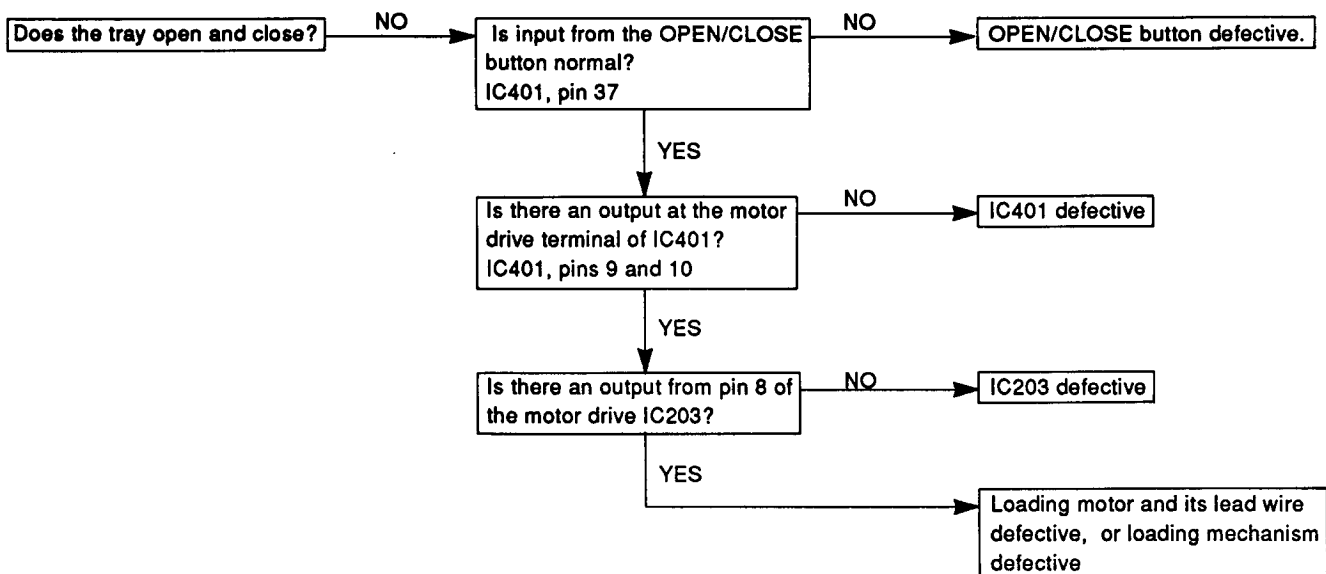
When a trouble has occurred, first check the pick-up lens for dirt and each connector for tight and secure connection. If the problem persists after checking both of these items, use the following check procedures.



(1) When Multi Display fails to light properly

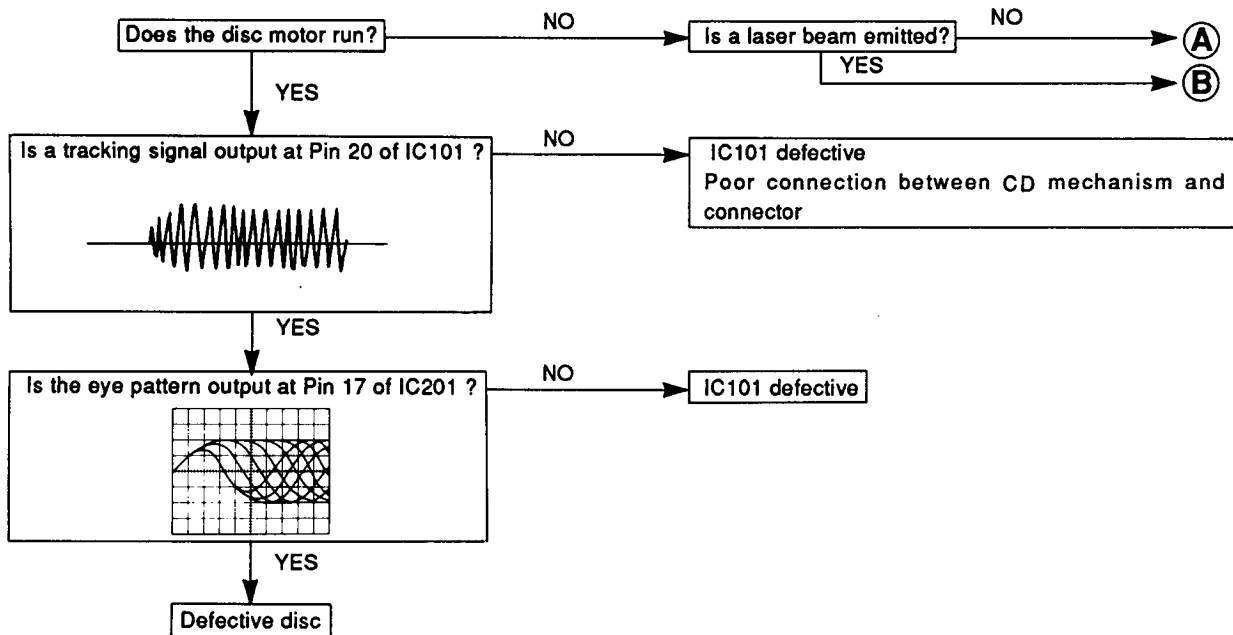


(2) When the tray fails to operate properly

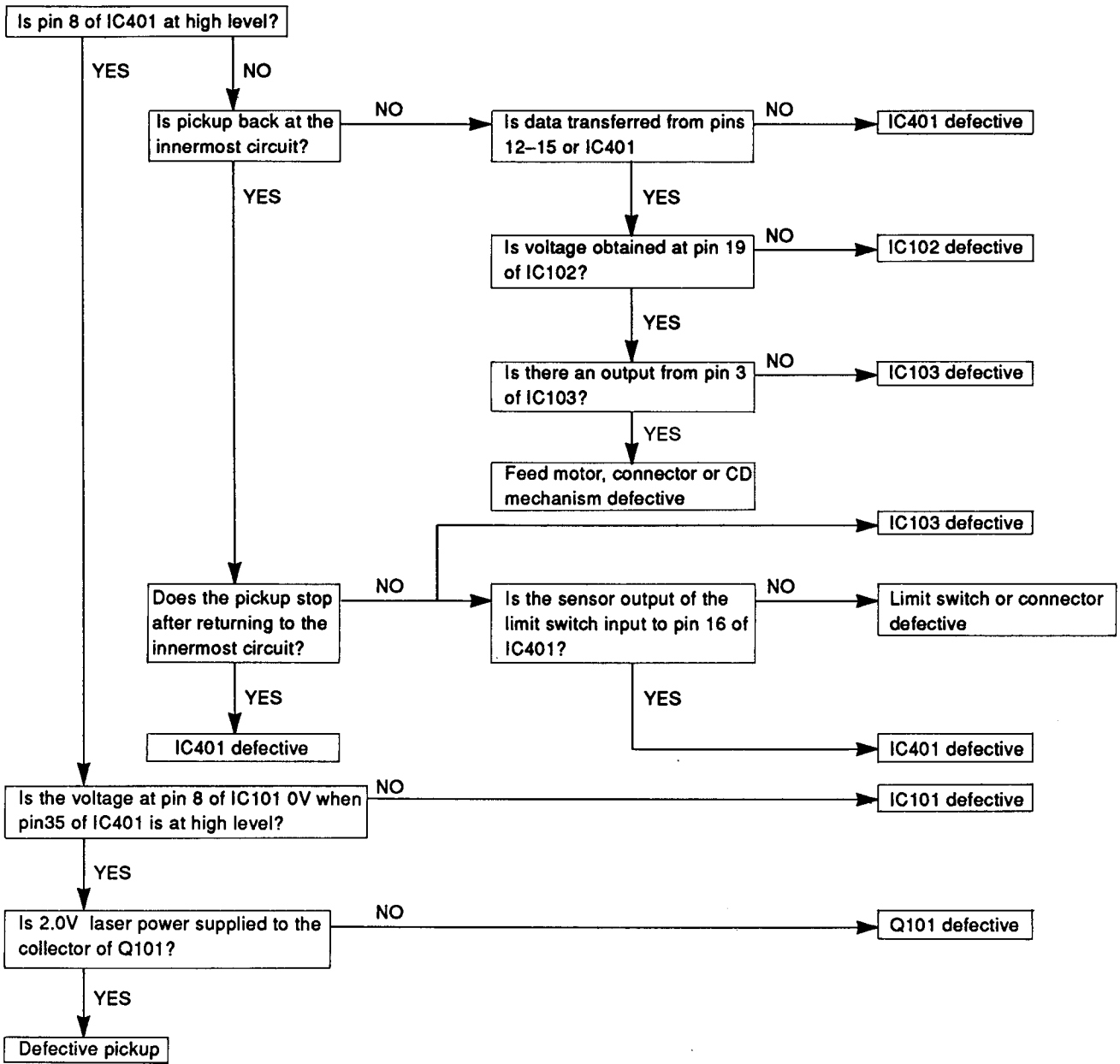


(3) When initial read cannot be executed

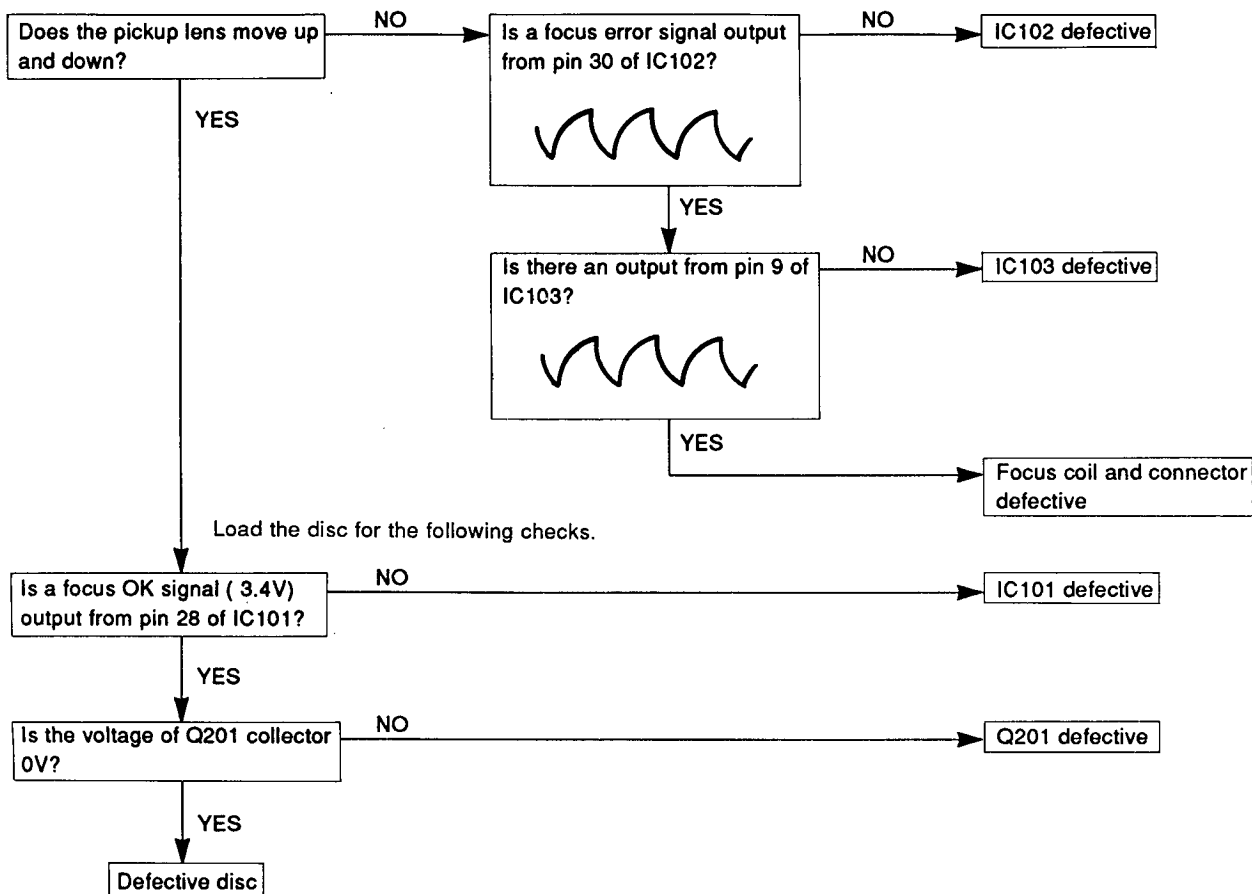
The following checks can be done without a disc loaded.



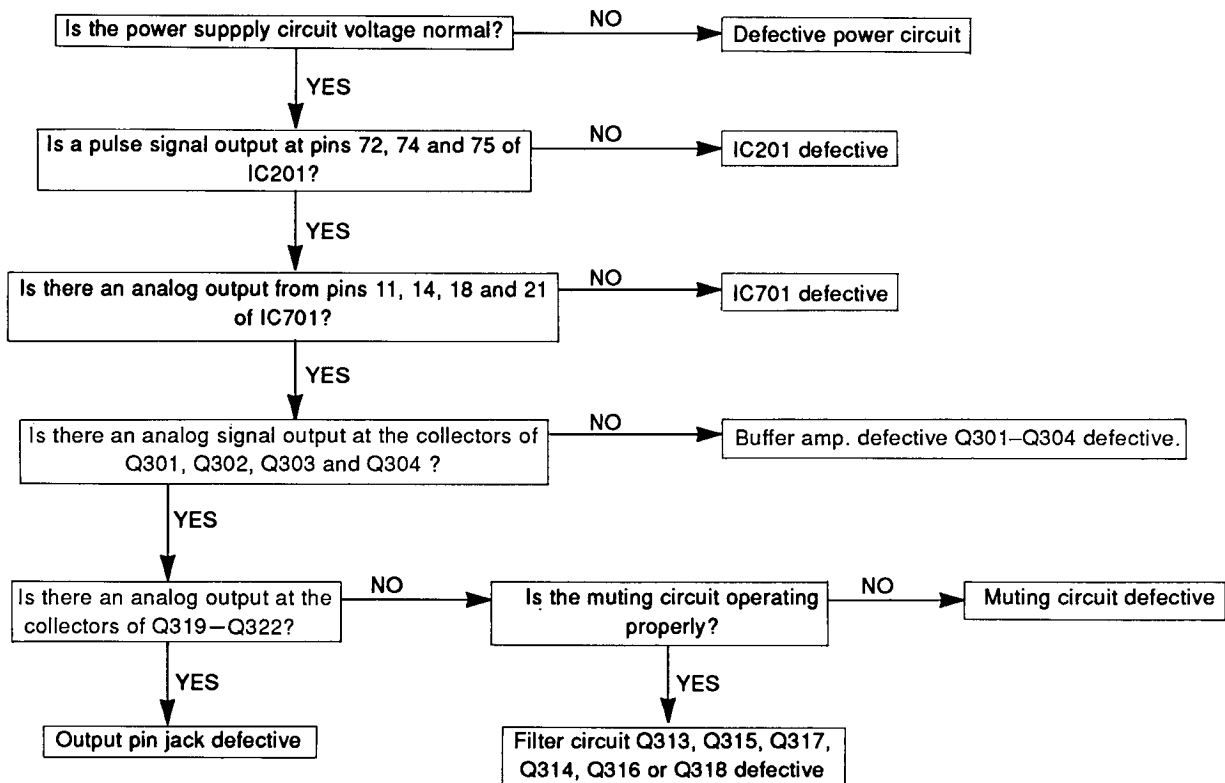
A When laser beam is not emitted



B When laser beam is emitted



When there is no audio output



IC TERMINAL FUNCTIONS

IC number	Terminal number	Port name	Terminal code	I/O	Outline of functions
IC101	1	RFI		I	RF summing amp. input terminal.
	2	RFO		O	RF summing amp. output terminal.
	3	RF-		I	RF summing amp. return input terminal.
	4	P/N		I	Laser diode P/N select terminal.
	5	LD		O	APC LD amp. output terminal.
	6	PD		I	APC PD amp. input terminal.
	7	PD1		I	RF I-V amp. (1) invert input terminal.
	8	PD2		I	RF I-V amp. (2) invert input terminal.
	9	VC		—	GND terminal.
	10	F		I	F I-V amp. invert input terminal.
	11	E		I	E I-V amp. invert input terminal.
	12	EO		O	E I-V amp. output terminal.
	13	EI		I	E I-V amp. return input terminal.
	14	VR		O	DC voltage output terminal.
	15	CC2		I	DEFECT signal input terminal.
	16	CC1		O	DEFECT signal output terminal.
	17	VEE		—	Negative power terminal.
	18	FE BIAS		I	Focus error amp. bias terminal.
	19	FE		O	Focus error amp. output terminal.
	20	TE		O	Tracking error amp. output terminal.
	21	DEFECT		O	DEFECT comparator output terminal.
	22	MIRR		O	MIRR comparator output terminal.
	23	CP		I	MIRR hold capacitor connect terminal.
	24	CB		I	DEFECT hold capacitor connect terminal.
	25	DGND		—	GND terminal.
	26	ASY		I	Auto asymmetry control input terminal.
	27	EFM		O	EFM comparator output terminal.
	28	FOK		O	Focus OK comparator output terminal.
	29	LD ON		I	Laser diode on/off select terminal.
	30	Vcc		—	Positive power terminal.

IC number	Terminal number	Port name	Terminal code	I/O	Outline of functions
IC102	1	TE IN	Pre amp. input	I	Tracking error signal input terminal.
	2	TC IN	Pre amp. input	I	Track cross signal input terminal.
	3	SHOCK IN	Pre amp. input	I	Shock detector signal input terminal.
	4	HF OK	Pre amp. input	I	HF OK signal input terminal.
	5	MR	Pre amp. input	I	Mirror detected signal input terminal.
	6	Jump Flag	Mi-com I/O	O	Outputs "H" under jump function.
	7	HFD	Mi-com I/O	O	"1" indicates that MR input is "1" and track servo loop is off (TS OFF, JF, JR).
	8	T•HLD	Track servo	I	Direct control terminal for TS1 switch. "1" indicates that TS1 switch is "b". "0" indicates that priority is given to controller command.
	9	DATA OUT	Mi-com I/O	O	Inner condition output changed by command modes.
	10	JP1	Mi-com I/O	I	1 track jump control signal. Usually "H".
	11	MSD	Mi-com I/O	I	Serial data input terminal (LSB first, 8-bit data).
	12	MLA	Mi-com I/O	I	Latch signal of serial data from mi-com to servo IC.
	13	MCK	Mi-com I/O	I	Clock signal of serial data from mi-com to servo IC. Receives data on leading edge.
	14	ACLR	Mi-com I/O	I	All clear input. (Clear inner registers and flip-flops by "L" signal.)
	15	Bias	Power supply	O	Vcc/2 bias power supply output when single-pole power supply is used.
	16	COM	Power supply	I	Common terminal. Connect to GND when double-pole power supply is used and to BIAS when single-pole power supply is used.
	17	GND	Power supply	I	GND terminal.
	18	VEE	Power supply	I	Negative power terminal. Connect to GND when single-pole power supply is used.
	19	SS OUT	Slide servo	O	Operation amplifier SS output.
	20	SS -	Slide servo	I	Operation amplifier SS reverse input.
	21	SS +	Slide servo	I	Operation amplifier SS non-reverse input.
	22	TS OUT	Track servo	O	Operation amplifier TA output.

IC number	Terminal number	Port name	Terminal code	I/O	Outline of functions
IC102	23	TS -	Track servo	I	Operation amplifier TA reverse input.
	24	TG2	Track servo	—	Track gain select switch TG2 output. Set to open or common level.
	25	TS +	Track servo	I	Operation amplifier TA non-reverse input.
	26	TG1	Track servo	—	Track gain select switch TG1 output. Set to open or common level.
	27	TE OUT	Track servo	O	Operation amplifier TE output.
	28	TE -	Track servo	I	Operation amplifier TE reverse input.
	29	FSR IN	Focus servo	I	Focus search voltage level detector input.
	30	FS OUT	Focus servo	O	Operation amplifier FA output.
	31	FS -	Focus servo	I	Operation amplifier FA reverse input.
	32	FS +	Focus servo	I	Operation amplifier FA non-reverse input.
	33	FG	Focus servo	—	Focus gain select switch FG output. Set to open or common level.
	34	C-FSR	Focus servo	—	Connect capacitor which determines time constant of focus search waveform.
	35	I-Ref	Power supply	I	Terminal for connecting resistor for setting current value of reference current source.
	36	Vcc	Power supply	I	Positive power terminal.
IC103	1	+VIN 1		I	Positive input terminal 1 for amp. 1.
	2	-VIN 1		I	Negative input terminal 1 for amp. 1.
	3	OUT 1		O	Output terminal 1.
	4	OUT 2		O	Output terminal 2.
	5	-VIN 2		I	Negative input terminal 2 for amp. 2.
	6	+VIN 2		I	Positive input terminal 2 for amp. 2.
	7	+VIN 3		I	Positive input terminal 3 for amp. 3.
	8	-VIN 3		I	Negative input terminal 3 for amp. 3.
	9	OUT 3		O	Output terminal 3.
	10	NC		—	

IC number	Terminal number	Port name	Terminal code	I/O	Outline of functions
IC103	11	NC		—	
	12	Vcc		—	Positive power supply.
IC201	1	EMP		O	Emphasis code output. Emphasis = "1"
	2	PWM1		O	Disc motor drive PWM output 1. -
	3	PWM2		O	Disc motor drive PWM output 2. +
	4	DOTX		O	Digital output.
	5	ACRCY		I	Channel status clock input.
	6	TEST1		I	Test mode select input.
	7	DOBSEL		I	Output data bit select.
	8	DASEL1		I	D/A converter interface select input 1.
	9	DASEL2		I	D/A converter interface select input 2.
	10	DASEL3		I	D/A converter interface select input 3.
	11	DASEL4		I	D/A converter interface select input 4.
	12	MSD		I	Microcomputer interface serial data input.
	13	MCK		I	Microcomputer interface shift clock input.
	14	MLA		I	Microcomputer interface data latch clock input
	15	ACLR		I	Microcomputer interface register clear input.
	16	HFD		I	Play signal absence signal input.
	17	HF		I	Play signal input.
	18	IREF		I	Detection/PLL circuit reference current input.
	19	TLC		O	Slice level control output.
	20	LPF		I/O	PLL loop filter connection terminal.
	21	LOCK/DRD		O	Synchronous/low disc rotate status output.
	22	SYCLK		O	Frame synchronous status output.
	23	Vdd2		I	5V power supply used for Detection/PLL circuit analog area only.
	24	DRD		O	Low disc rotate status output.
	25	EFFK		O	EFM frame clock output.
	26	SCINT		O	Subcode Q interrupted signal output.
	27	SQRO		O	Subcode Q register output.
	28	SQRCK		I	Subcode Q register data shift clock input.
	29	SCOR		O	Subcode synchronous signal output.

IC number	Terminal number	Port name	Terminal code	I/O	Outline of functions
IC201	30	CRCF		O	Subcode Q CRC check result output.
	31	SCCK		I	Shift clock input for serial subcode data output.
	32	Vss2		I	GND terminal.
	33	SCOE2		I	Subcode parallel output channel P to S enable input.
	34	SCOE1		I	Subcode parallel output channel T to W enable input.
	35	SBCW		O	Subcode channel W output.
	36	SBCV		O	Subcode channel V output.
	37	SBCU		O	Subcode channel U output.
	38	SBCT		O	Subcode channel T output.
	39	SBCS		O	Subcode channel S output.
	40	SBCR		O	Subcode channel R output.
	41	SBCQ		O	Subcode channel Q output.
	42	SBCP		O	Subcode channel P output.
	43	RAS		O	Row address strobe signal output.
	44	NC		—	
	45	RDB2		I/O	External memory data I/O 2.
	46	NC		—	
	47	RDB1		I/O	External memory data I/O 1.
	48	RDB4		I/O	External memory data I/O 4.
	49	CAS		O	Column address strobe signal output.
	50	RDB3		I/O	External memory data I/O 3.
	51	WE		O	Write enable signal output.
	52	NC		—	
	53	RAD1		O	External memory address output 1.
	54	RAD2		O	External memory address output 2.
	55	RAD3		O	External memory address output 3.
	56	RAD7		O	External memory address output 7.
	57	RAD4		O	External memory address output 4.
58	RAD5		O	External memory address output 5.	
59	RAD6		O	External memory address output 6.	

IC number	Terminal number	Port name	Terminal code	I/O	Outline of functions
IC201	60	RAD0		O	External memory address output 0.
	61	EST2		O	Error status 2.
	62	EST1		O	Error status 1.
	63	Vdd1		I	5V power supply.
	64	DOFK		O	OSC frame clock output.
	65	FSCK		O	Clock output. 44.1kHz
	66	C846		O	Clock output. 8.4672MHz
	67	C423		O	Clock output. 4.2336MHz
	68	C16MI		I	1/2 divider input.
	69	C8MO		O	1/2 divider output.
	70	XI		I	Crystal oscillator input.
	71	XO		O	Crystal oscillator output.
	72	DO1		O	D/A converter serial data output.
	73	Vss1		I	GND terminal.
	74	DSCK		O	D/A converter data shift clock output.
	75	LRCK		O	D/A converter left/right clock output.
	76	DO2		O	Dual D/A converter serial data output.
	77	WDCK		O	D/A converter word clock.
	78	DLRCK		O	D/A converter left/right clock output.
	79	APTL		O	D/A converter deglitch clock L.
80	APTR		O	D/A converter deglitch clock R.	
IC202	1	OE		I	Output enable input.
	2	DQ1		I/O	Data I/O.
	3	DQ2		I/O	Data I/O.
	4	W		I	Write control input.
	5	RAS		I	Row address strobe input.
	6	A6		I	Address input.
	7	A5		I	Address input.
	8	A4		I	Address input.
	9	Vcc		—	Power supply (5V).
	10	A7		I	Address input (row address only).

IC number	Terminal number	Port name	Terminal code	I/O	Outline of functions
IC202	11	A3		I	Address input.
	12	A2		I	Address input.
	13	A1		I	Address input.
	14	A0		I	Address input (row address only)
	15	DQ3		I/O	Data I/O.
	16	CAS		I	Column address strobe input.
	17	DQ4		I/O	Data I/O.
	18	V _{ss}		—	Power supply (0V).
IC203	1	VSENCE1			
	2	OUT1		O	Output terminal 1.
	3	-VIN1		I	Negative power supply.
	4	+VIN1		I	Positive input 2.
	5	VEE			Negative input 2.
	6	+VIN2		I	Positive power supply.
	7	-VIN2		I	Negative input 2.
	8	OUT2		O	Output terminal 2.
	9	VSENCE2			
	10	V _{cc}			Positive power supply.
IC401	1	V _{cc}			Positive power supply.
	2	P65		I/O	
	3	P64		I/O	
	4	P63		I/O	
	5	P62		I/O	
	6	P61		I/O	
	7	P60		I/O	
	8	P27	I/O port	I/O	Disc tray open direction driving output.
	9	P26	I/O port	I/O	Disc tray close direction driving output.
	10	P25	I/O port	I/O	
	11	P24	I/O port	I/O	Serial data output.
	12	P23	I/O port	I/O	Serial data output.
	13	P22	I/O port	I/O	Data latch clock output.

IC number	Terminal number	Port name	Terminal code	I/O	Outline of functions
IC401	14	P21	I/O port	I/O	
	15	P20	I/O port	I/O	
	16	P37	OUT PORT	O	Display output i.
	17	P36	OUT PORT	O	Display output g.
	18	P35	OUT PORT	O	Display output f.
	19	P34	OUT PORT	O	Display output e.
	20	P33	OUT PORT	O	Display output d.
	21	P32	OUT PORT	O	Display output c.
	22	P31	OUT PORT	O	Display output b.
	23	P30	OUT PORT	O	Display output a.
	24	P53			
	25	P52			
	26	CNVss			Usually connected to Vss.
	27	RESET		I	Reset input.
	28	XIN	CLOCK IN	I	Clock input.
	29	XOUT	CLOCK OUT	O	Clock output.
	30	XCIN	CLOCK IN	I	Serial data input.
	31	XCOU	CLOCK OUT	O	Clock output.
	32	Vss			Power Supply.
	33	Ø		O	Timing output.
	34	P57			
	35	P56			
	36	P55			
	37	P54			
	38	VP		I	Pull down voltage input.
	39	P51			
	40	P50			
	41	P17	OUT PORT	O	Laser diode control output.
	42	P16	OUT PORT	O	Display output 7.
	43	P15	OUT PORT	O	Display output 6.
44	P14	OUT PORT	O	Display output 5.	

IC number	Terminal number	Port name	Terminal code	I/O	Outline of functions
IC401	45	P13	OUT PORT	O	Display output 4.
	46	P12	OUT PORT	O	Display output 3.
	47	P11	OUT PORT	O	Display output 2.
	48	P10	OUT PORT	O	Display output 1.
	49	P07	I/O port	I/O	Serial data input.
	50	P06	I/O port	I/O	Frame synchronous state output.
	51	P05	I/O port	I/O	Low disc rotate state output.
	52	P04	I/O port	I/O	Sub-code synchronous signal output.
	53	P03	I/O port	I/O	Sub-code Q check.
	54	P02	I/O port	I/O	Sub-code channel Q output.
	55	P01	I/O port	I/O	Interrupt input.
	56	P00	I/O port	I/O	
	57	P47			
	58	P46			
	59	P45			
	60	P44			
	61	P43			
	62	P42			
	63	P41			
64	P40				
IC701	1	MLD		I	Mi-com command load input terminal. Low level=load
	2	RSTB			Reset terminal. Low level=active
	3	IE		I	Low level=LSI format. High level=I2S format.
	4	TP1		O	Digital filter test output terminal 1.
	5	TP2		O	Digital filter test output terminal 2.
	6	TEST 1		I	Digital filter test signal input terminal 1. Nominal=Low level
	7	TEST 2		I	Digital filter test signal input terminal 2. Nominal=Low level
	8	NC			
	9	NC			
	10	AVDD 4			Analog power supply terminal 4. (+5V)
	11	OUTL(-)		O	L ch. negative PWM output terminal.

IC number	Terminal number	Port name	Terminal code	I/O	Outline of functions
IC701	12	AVSS 4			Analog ground terminal 4.
	13	AVSS 3			Analog ground terminal 3.
	14	OUTL(+)		O	L ch. positive PWM output terminal.
	15	AVDD 3			Analog power supply terminal 3. (+5V)
	16	NC			
	17	AVDD 2			Analog power supply terminal 2. (+5V)
	18	OUTR(+)		O	R ch. positive PWM output terminal.
	19	AVSS 2			Analog ground terminal 2.
	20	AVSS 1			Analog ground terminal 1.
	21	OUTR(-)		O	R ch. negative PWM output terminal.
	22	AVDD 1			Analog power supply terminal 1. (+5V)
	23	DVDD 1			Digital power supply terminal 1 for oscillator. (+5V)
	24	DVSS 1			Digital ground terminal 1 for oscillator.
	25	X2			Crystal oscillator.
	26	X1			Crystal oscillator (external clock input terminal).
	27	NC			
	28	DVDD 2			Digital power supply terminal 2. (+5V)
	29	DVSS 2			Digital ground terminal 2.
	30	NSUB			Connect to the D-VDD terminal.
	31	ZFLGB		O	Zero signal detect output terminal.
	32	192FS		O	Clock output. 8.4672MHz
	33	LRPOL			Polarity (L ch. and R ch.) select terminal. L level=R H level=L
	34	LRCLK		I	LRCLK input terminal.
	35	BCLK		I	Serial input bit clock.
	36	SRDATA		I	Serial data input terminal.
	37	DVSS 3			Digital ground terminal 3.
	38	DVDD			Digital power supply terminal. (+5V)
	39	384FS		O	Clock output. 16.9344MHz
	40	PD			Power down terminal. High level=active
	41	MDATA		I	Mi-com command data input terminal.
	42	MCLK		I	Clock input terminal for mi-com command.

CIRCUIT DESCRIPTION

1. APC CIRCUIT

A semiconductor laser is used as the light source for the optical pickup. As the output from the semiconductor laser changes radically with changes in temperature, a circuit must be provided to stabilize this output. For this purpose, a monitor diode which detects the optical output of the laser diode is used in the semiconductor laser.

As the laser diode emits light from its bonded surface, light is emitted both in front and behind. The light emitted behind is monitored with the monitor diode installed on its rear surface, and the optical output is thus controlled. The light emitted in front becomes the light source for the pickup.

Fig. 1 shows the APC circuit.

When the temperature rises and the optical output decreases, the monitor diode current (I_s) decreases, the electric potential of IC101 pin 5 rises, the base current of the driving transistor increases, and the laser diode current increases. This causes the reduced optical output to return to its former level.

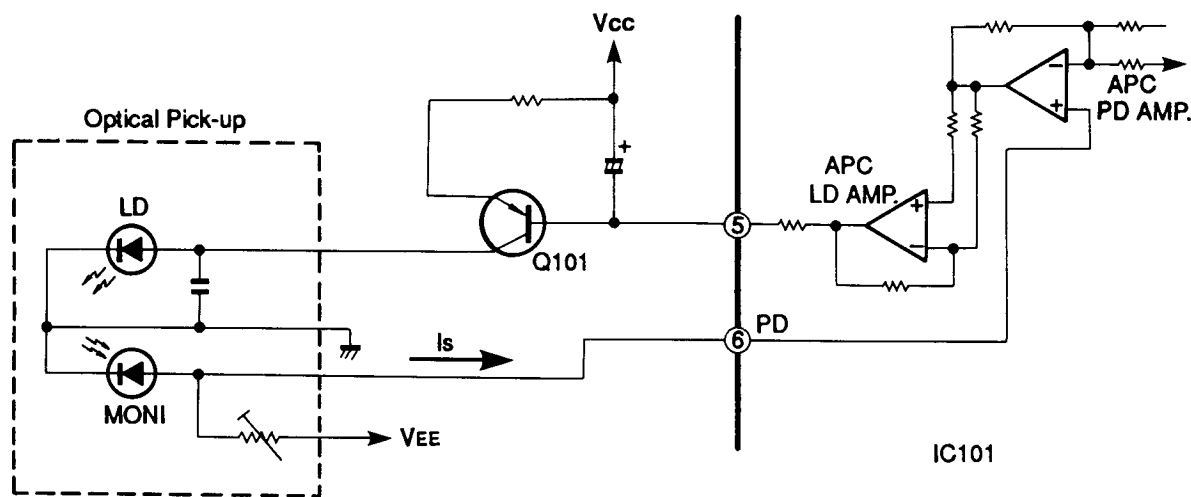


Fig. 1

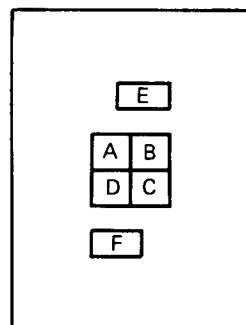
2. FOCUS SERVO

2-1. Optical pickup

This set employs a three-beam optical pickup comprised of six division photodiodes, A through F as shown in Fig. 2. The four photodiodes (A through D) at the center provide focus error detection by using their property to allow the beam to focus into a round image only at a certain point.

The sums of outputs from diagonal two elements of four division photodiodes (A+C and B+D) are compared by the differential amplifier in IC101 to detect the shape of the beam image.

The remaining two diodes (E and F) provide tracking error detection by means of sub-beam spots.



Three spotted (six-division) photo diodes

Fig. 2

2-2. Focus error detecting operation

The reflected laser beam from a disc is polarized 90° with the beam-splitter and sent to the cylindrical lens. The beam passed through this cylindrical lens is then sent to the four division photodiodes and focuses into an image whose shape varies with the distance between the disc and the objective lens. Such change in the beam shape causes the current flowing from the photodiodes to vary.

Shown in Fig. 3 is the principle of the focus error detection.

The currents from the photodiodes (A+C and B+D) are applied to pins 7 and 8 of IC101 and converted to voltage by RF I-V amplifiers (1) and (2) included in IC101.

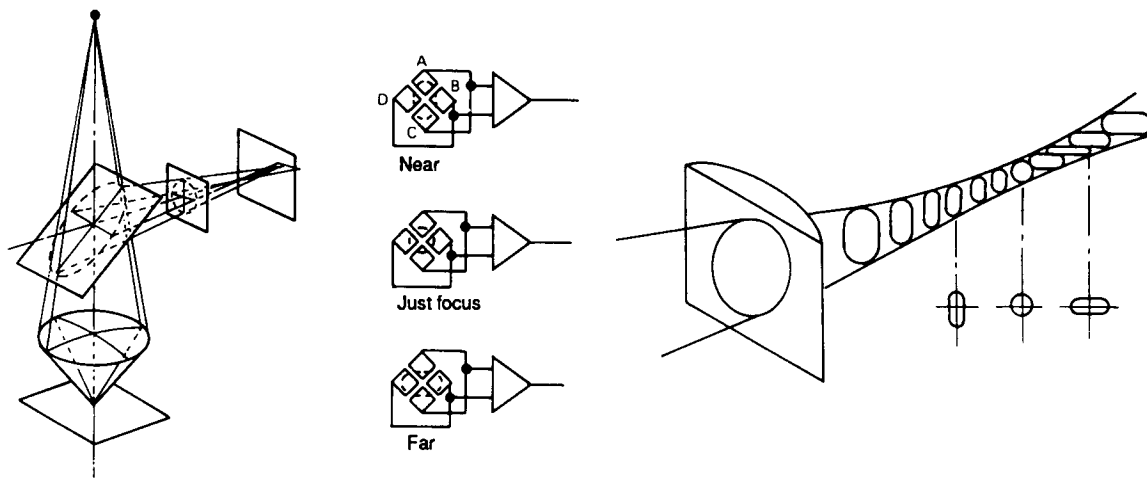


Fig.3

2-3. Focus servo control operation

The focus error signal, after begin converted to voltage by the RF I-V amplifier, is transmitted to the operation amplifier in the IC and output from pin 19.

When the disc to objective lens distance is in just focus, the beam forms a true round. In this state, the beams applied to four elements of four division photodiodes become equal and thus the output provided then is 0(zero). When the disc to objective lens distance is too close (near focus), the beam is reflected divergently to form an oval in crosswise direction. In this state, the outputs provided from photodiodes A and C are higher than those from B and D, resulting in negative (-) output voltage. On the other hand, when the distance is too far (far focus), the beam is reflectd convergently to form an oval in longitudinal direction. Then the outputs from photodiodes B and D are higher, resulting in positive (+) output.

The output voltage(focus error signal) from pin 19 of IC101 passes through IC102 , in from pin 32 and out from pin 30, and IC103, in from pin 7 out from pin 9 as shown in Fig. 4. It is amplified in each IC and fed to the focus coil which then drives the objective lens of the pickup.

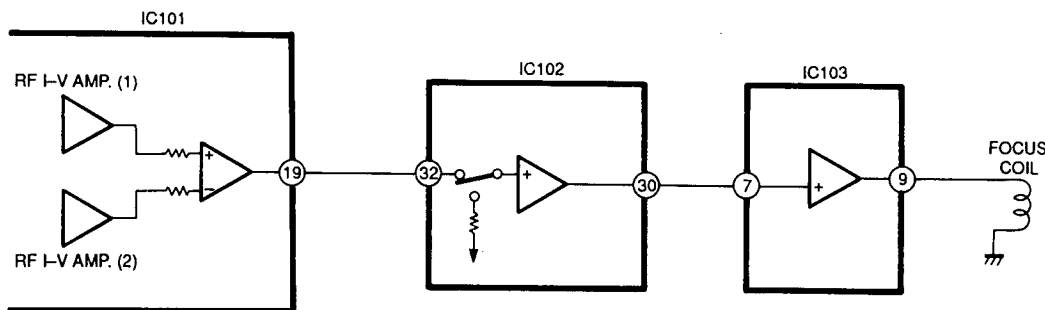


Fig. 4

2-4. Tracking error detection system

Fig. 5 shows the principle of the tracking error detection system which employs the three beam system.

The laser beam is divided into the main beam and two sub-beams by diffraction grating and they are arranged on one line. The center line connecting these three beams has a slight offset angle against the main beam. The main beam is received by photodiodes A, B, C and D and two sub-beams by E and F respectively.

Fig. 5-A shows the on-track state. As both auxiliary beams 1 and 2 are slightly on the track in this state, the outputs of photodiodes E and F are equal and the tracking signal is 0(zero). When the track is shifted to the left (Fig. 5-B), the auxiliary beam 1 is off the pit. This allows more light to be received by the photodiode E, resulting in positive (+) tracking signal output. On the other hand, when the track is shifted to the right (Fig. 5-C), the amount of light received by the photodiode F increases, resulting in negative (-) tracking signal output. And these extreme signals are detected as tracking error signals.

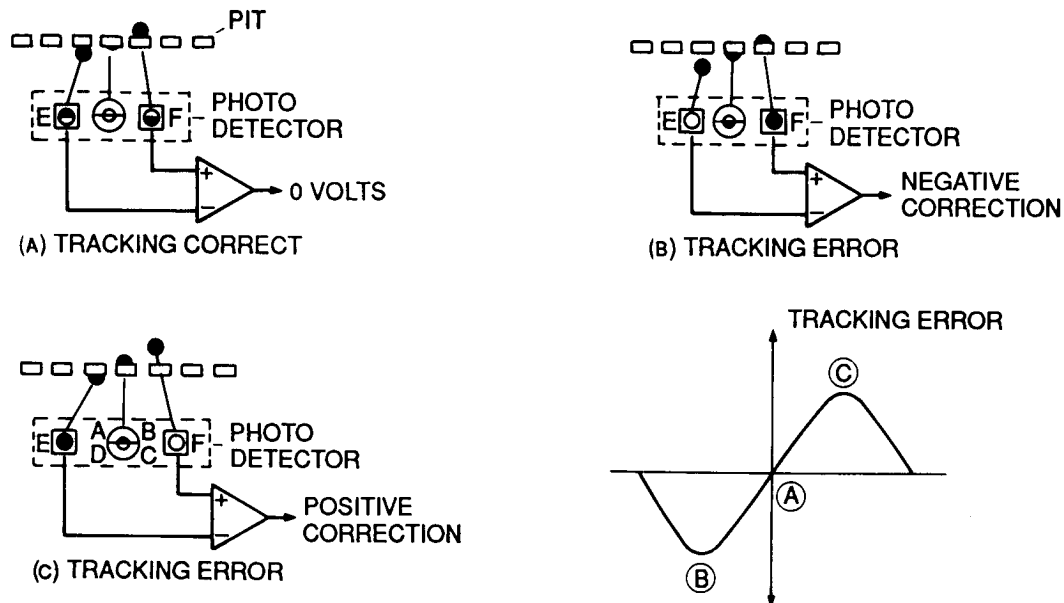


Fig. 5

2-5. Tracking servo control operation

When a tracking error signal is detected by photodiodes E and F, it is fed to pins 11 and 10 of IC101 respectively as shown in Fig. 6. In IC101, the signal is converted into voltage by the E I-V amplifier and F I-V amplifier, transmitted to the tracking error amplifier and output through pin 20. While it passes through IC102, in from pin 1 and out from pin 22, and IC103, in from pin 6 and out from 4, it is amplified in each IC and sent to the tracking coil to adjust pickup so that the amount of track shift is reduced as closely to none as possible.

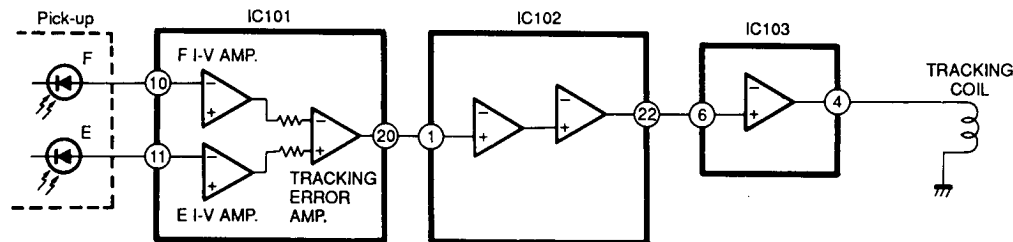


Fig. 6

3. Regenerative Circuit

3-1. RF circuit

The currents from photodiodes (a, b, c and d) are fed to IC101 through pins 7 and 8 and converted to voltage by RF I-V amplifiers (1) and (2) respectively there, added by the RF summing amplifier and output from pin 2 as a signal. As it is sent to pin 7 of IC201, it can be checked at the test point (TP201) provided on its way by means of the eye pattern check.

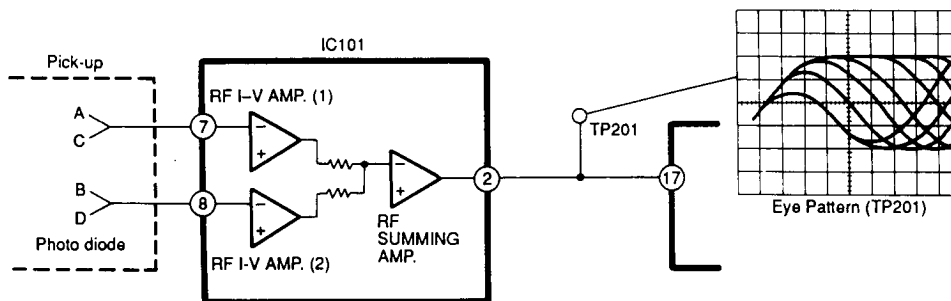


Fig. 7

3-2. EFM demodulation, error correction, serial/parallel conversion

EFM demodulation, error correction and serial/parallel conversion are performed by the internal circuitry of IC201. The eye-pattern signals from pin 2 of IC101 are sent to pin 17 of IC201, then demodulated from 14 bits to 8 bits by EFM readjustment. At the same time any error, if found, is corrected (CIRC) and the signals are sent to the D/A converter interface. After that, they are output as 18-bit digital signals from pins 72, 74 and 75 of IC201 and fed to the D/A converter of IC701.

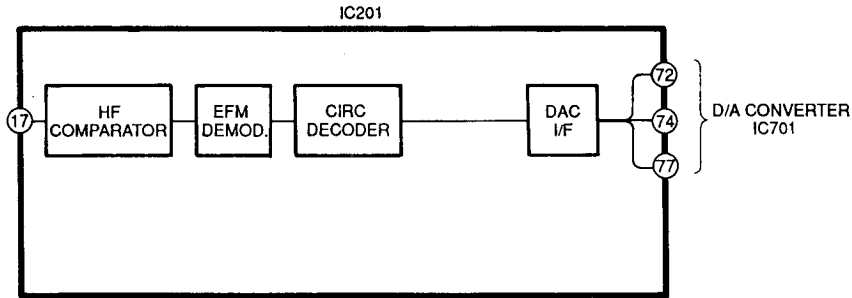


Fig. 8

4. 1-bit D/A Converter

Conventionally, high-precision D/A conversion was mainly carried out using resistor ladder systems. There was, however, one main drawback with these systems, which was that zero cross distortion was likely to be generated. To achieve production of a high-precision D/A converter with a minimum amount of zero cross distortion, it would be necessary to carry out complicated and bothersome processes such as laser trimming processing. In addition, use of such D/A converter would require a sampling-and-hold circuits(or de-glitcher circuit) and an intricate analog filter with special characteristics when mounting it.

To solve these difficulties, we used a 1-bit D/A converter with 3rd order noise shaping technology (IC701: MN 6471M).

4-1. Features and Configuration of MN6471M

- Features
1. No zero cross distortion
 2. No non linear distortion
 3. Built-in 4 times oversampling digital filter
 4. 2 channels (left and right) built in
 5. 4DAC configuration possible
 6. Single 5V power supply operation

The block diagram is shown in Fig. 9. The MN6471M is configured of a digital filter, a 3rd order noise shaping circuit, and a PWM.

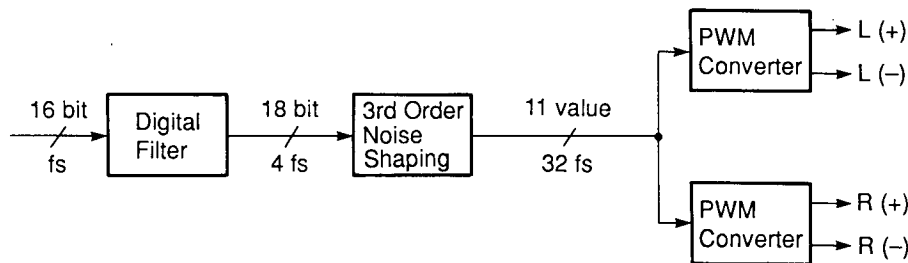


Fig. 9

4-2. Configuration of MN6471M

Fig. 10 shows the configuration of the MN6471M. The sampling frequency of the input data is expressed in fs, so the 3rd order noise shaping circuit operates at 32fs. This means that a 32-times oversampling filter is required. In this LSI, however, oversampling is carried out first at 4fs in the first digital filter, and following that, a 0 order hold takes place in the 3rd order noise shaping circuit. This enables conversion of the 4fs signal to a 32fs signal.

The digital filter, using 384fs as clock signals, and the noise shaping section, uses 64fs, carry out time division processing on the data for the left and right channels. The PWM section, using 768fs as a clock signal, carries out signal processing for the left and right channels independently.

In the noise shaping section, the 19-bit 32fs signal is converted to 11 values and pulse width modulation (PWM) is carried out on these signals in the PWM section. D/A conversion is carried out in this way. Following are the descriptions of the various blocks.

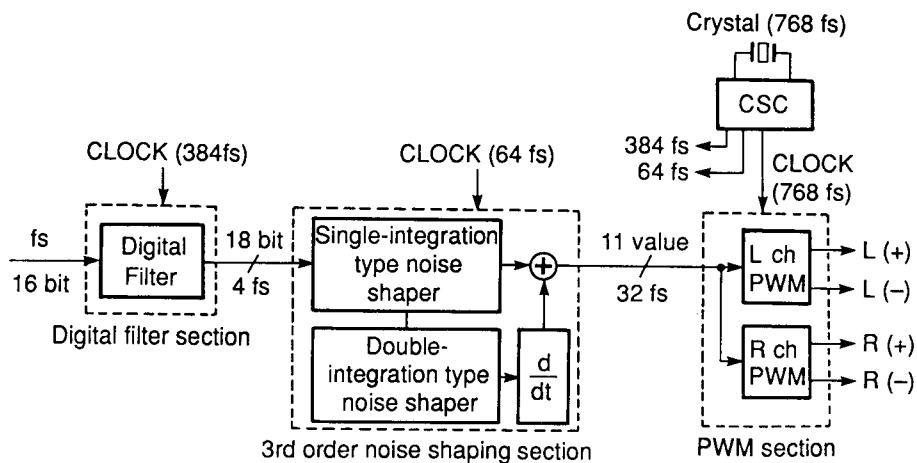


Fig. 10

5. Digital filter

Fig. 11 shows the signal data of an audio signal up to 20kHz that has been digitalized, along with the frequency distribution of the signal data. The graphs show the conditions for a sampling frequency of 44.1kHz, plus its doubled frequency, 88.2kHz, and its quadrupled frequency, 176.4kHz.

As the figure shows, for the same signal up to 20kHz, the noise portion of the digitalized signal component tends to shift toward the higher range of the signal if the sampling frequency is increased. However, at any sampling frequency, the volume of necessary audio signal information remains constant up to 20kHz. This allows certain important results to be derived; that is, if the information represented in section (a) is obtained, then it should be possible to create a signal in the form shown in (b) or (c).

When the noise caused by sampling shifts to the higher frequency range, as shown in (b) or (c), the low pass filter characteristic to eliminate noise during re-conversion to an audio signal need not be steep but can be rather gradual as shown. It is comparatively simple to provide a high audio quality low pass filter of such characteristic with little phase fluctuation or distortion.

The question now becomes how to make a signal sampled at 44.1kHz resemble one sampled at a much higher frequency. Fig. 12 shows the signal sequence sampled at the same 44.1kHz as in Fig. 11 and its frequency distribution.

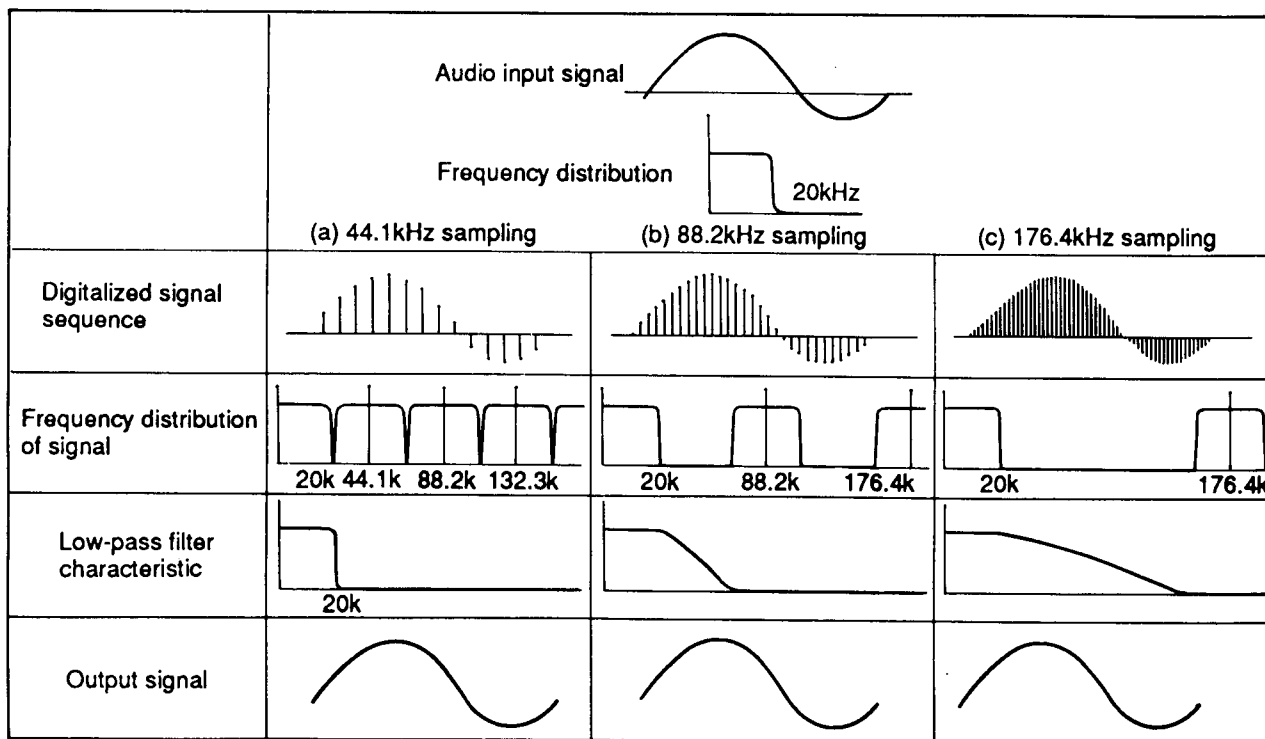


Fig. 11

If the frequency is to be doubled as the first step in increasing the sampling frequency of the signal, zero-level data is added between the data marked with X in Fig. 12(b). In the original signal sequence sampled at 44.1kHz, there are data only at the points of the sampling timing, while the intervals between those points have all been made zero-level. Introducing zero data in these intervals does not change the original data in any way, nor is the frequency distribution altered. Only the sampling frequency is doubled.

Passing this data in its modified form through a digital filter with the characteristic shown in Fig.12(c) causes the portion corresponding to N1 to be eliminated, resulting in a signal sequence with the frequency distribution shown in (d). This signal sequence possesses exactly the same shape as that obtained for the signal in Fig. 11(b), sampled at 88.2kHz.

In other words, this method enables the sampling frequency to be doubled.

The digital filter used in this unit is a Finite Impulse Response type. Its circuit diagram is shown in Fig. 13.

The sampling frequency of this unit has been quadrupled, and the phase characteristic has been improved by using a softer analog low-pass filter.

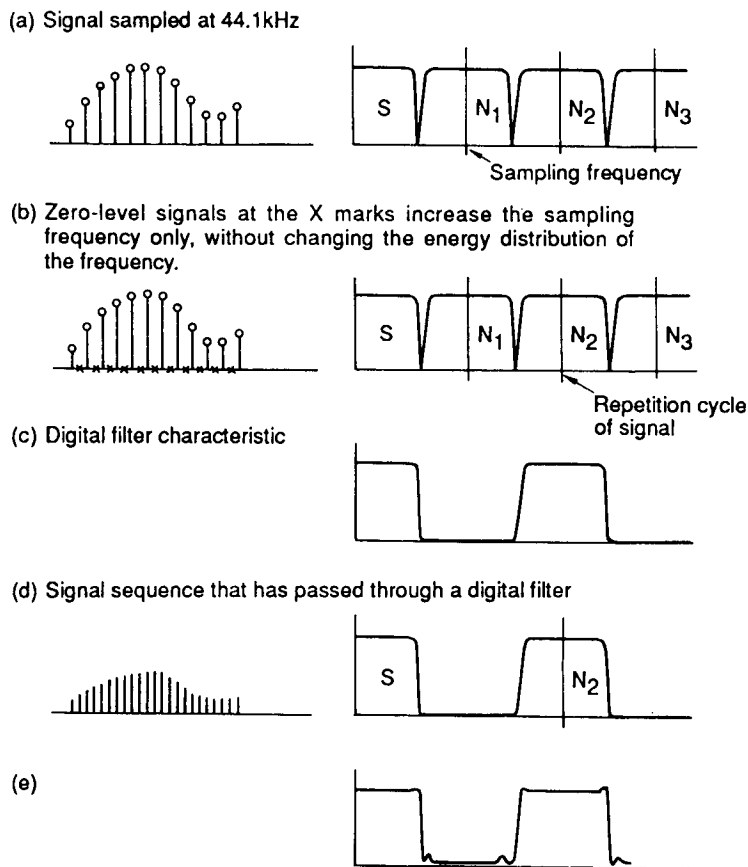
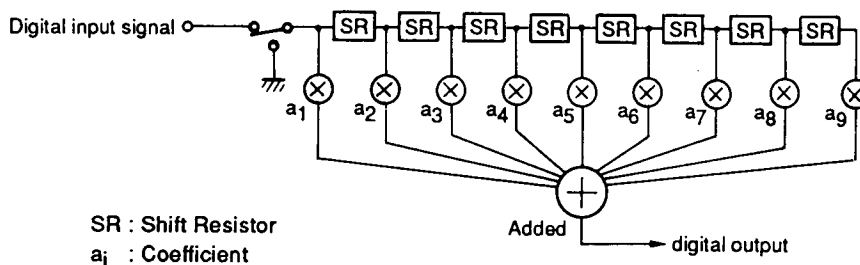


Fig. 12



SR : Shift Resistor
 a_i : Coefficient

Fig. 13

6. Noise shaper

a) Single-integration noise shaper

The block diagram is shown in Fig. 14.

According to the figure, the relation between input X and output Y is as follows:

$$Y = X + (1 - Z^{-1}) Vq \dots\dots\dots (1)$$

The quantization error Vq is a random value, and (1-Z⁻¹) expresses the differential characteristic. Thus, according to equation (1), the spectrum of the quantization error Vq for the single-integration noise shaper has a characteristic of 6dB/oct, and the lower the frequency is, the greater the attenuation becomes. (This is because the noise distribution can be changed by the noise shaper).

b) Double-integration noise shaper

The block diagram is shown in Fig. 15.

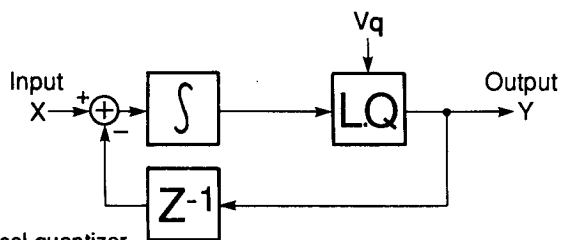


Fig. 14

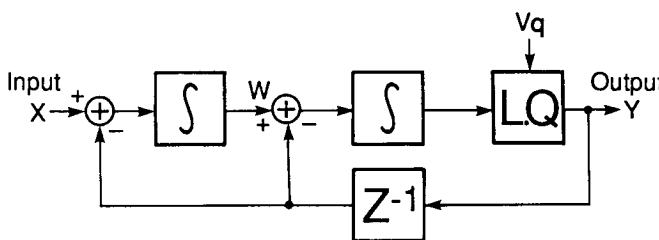


Fig. 15

LQ : Local quantizer
 Z⁻¹ : Delay
 Vq : Quantization error
 ∫ : Integrator

In Fig. 15, the path to the output seen from W has a configuration identical to that of the single-integration noise shaper, so that relation between W and Y is:

$$Y = W + (1 - Z^{-1}) Vq \dots\dots\dots (2)$$

The relation between X and Y is:

$$W = \frac{1}{1 - Z^{-1}} (X - Z^{-1}Y) \dots\dots\dots (3)$$

And the result obtained from above equations (2) and (3) is:

$$Y = X + (1 - Z^{-1})^2 Vq \dots\dots\dots (4)$$

Comparison with equation (1) shows that the term (1 - Z⁻¹) is a square of itself. In other words, with the double-integration noise shaper, the spectrum of the quantization error Vq is attenuated at a slope of 12dB/oct.

Fig. 16 shows the output spectrum of the noise shaper.

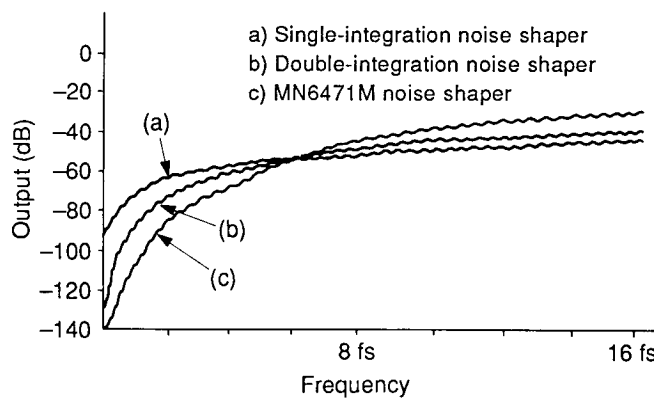


Fig. 16

6-2. 3rd order noise shaper

The block diagram of the 3rd order noise shaper is shown in Fig. 17.

This configuration shows that the first stage uses a single-integration noise shaper and the following stage uses a double-integration noise shaper. The quantization error of the first stage is input at the second stage.

In this configuration, single-integration and double-integration noise shapers are connected at several stages, and the quantization error of the previous stage is quantified again at the following stage, so that the quantization error included in the output of the previous stage is negated. In this way, compensation is carried out.

In this noise shaping circuit, the input is expressed as X, the output as Y, and the re-quantized error as Vq, and their relation for

each order is shown in the following equations.

(1st order) $Y = X + (1 - Z^{-1}) Vq$

(2nd order) $Y = X + (1 - Z^{-1})^2 Vq$

(3rd order) $Y = X + (1 - Z^{-1})^3 Vq$

In noise shaping, as the order of the transfer coefficient called $(1 - Z^{-1})$ becomes larger, the noise in the 1/2 fs audio band moves higher in the frequency range. The result is that, within a narrow audio band, an 18-bit performance can be obtained even from a 1-bit DAC.

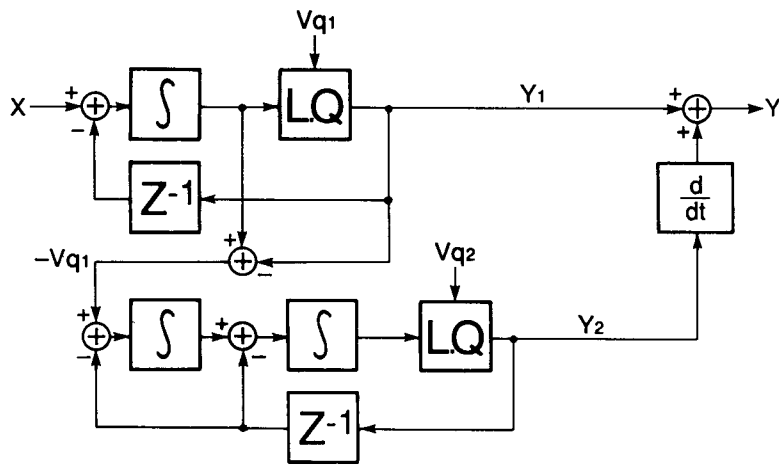


Fig. 17

$Y_1 = X + (1 - Z^{-1}) Vq_1$ (5)

$Y_2 = -Vq_1 + (1 - Z^{-1})^2 Vq_2$ (6)

$Y = Y_1 + (1 - Z^{-1}) Y_2$ (7)

The result obtained from above equations (5) ~ (7) is:

$Y = X + (1 - Z^{-1})^3 Vq_2$ (8)

7. PWM Output Section

In the output from the MN6471M noise shaper, the 11 value data of the 32fs is output. In the PWM section, pulse width modulation (PWM) is carried out on that signal, enabling D/A conversion.

Fig. 18 shows the PWM section of the MN6471M.

The 11 value digital data output from the noise shaper is converted (1-bit data stream) to pulse signal with 11 pulse widths precisely controlled by the crystal OSC and output as an analog signal. In the PWM output section, signals from both left and right channels are output as differential output so that the synchronous-phase noise is eliminated and the 2nd order high-frequency distortion is reduced.

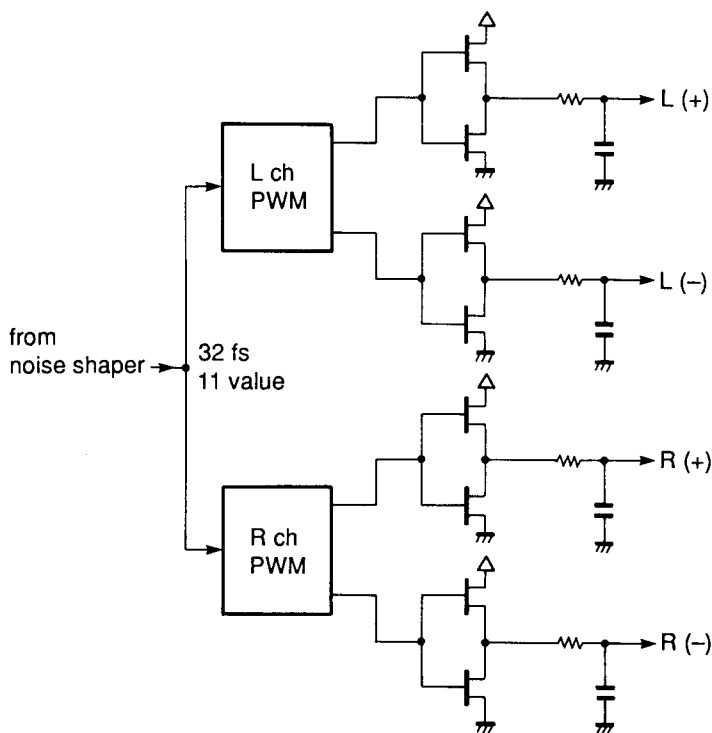


Fig. 18

8. Audio Circuit

Fig. 19 shows a block diagram of the audio circuit.

The outputs from Pin 14 (OUT L (+)) and Pin 11 OUT (-) pass through the 2-step LPF which consists of C601, R601 and R603 for one and C603, and R607 for the other, and the high frequency component of the PWM output from DAC is removed. Then the (+) side component of the PWM is inputted directly, and its (-) side componenty through the inverted darlington circuit consisting of Q301 and Q303 to the discrete circuit amplifier cossisting of Q305, Q307, Q309 and Q311, where they are synthesized into an approximately 2V signal voltage which is then output to the LPF circuit of the next stage.

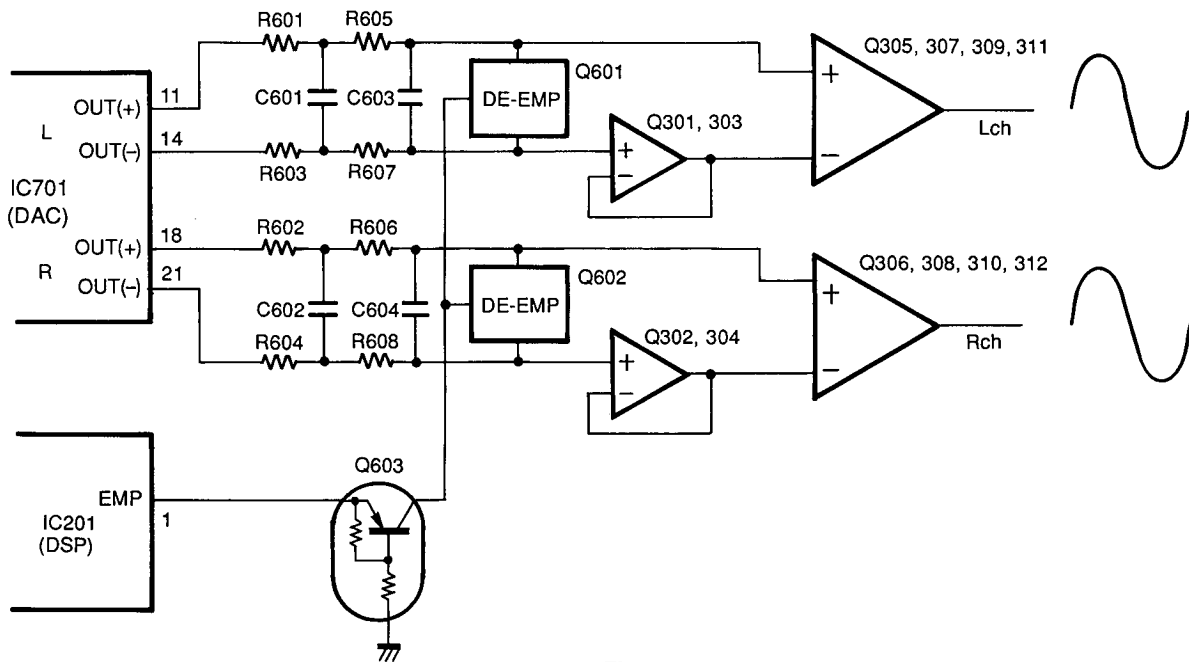


Fig 19

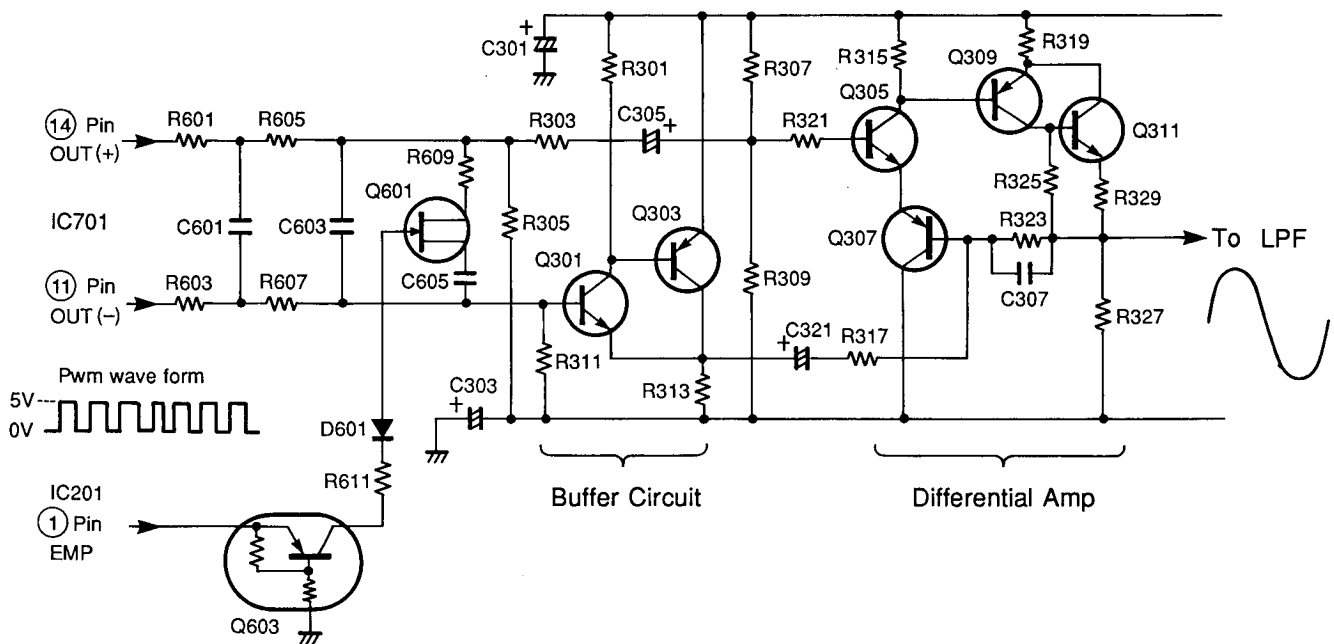


Fig. 20

The emphasis data from the disc is output through the terminal (Pin 1) of IC201. When a disc to which emphasis is applied is play back, this terminal is set high and Q603 turns ON. Following this, Q601 are also turned ON. Then connected C605 and R609 provides the DE-Emphasis characteristics. Fig. 20 shows the buffer circuit and the differential amplifier. (Light channel only)

9. Low-pass filter

Fig. 21 shows a final-stage circuit which includes a low-pass filter and other elements.

The portion of Fig. 21 enclosed by the broken line is 3rd-order active LPF. This LPF causes noise in the high range to be cut. Q313 and Q315 (Left channel) and Q314 and Q316 (Right channel) are buffer circuit of inverted darlington configuration. Q317 and Q318 are FET controlled constant current circuits. Q51, Q319, Q320, Q321 and Q322 are power muting circuit.

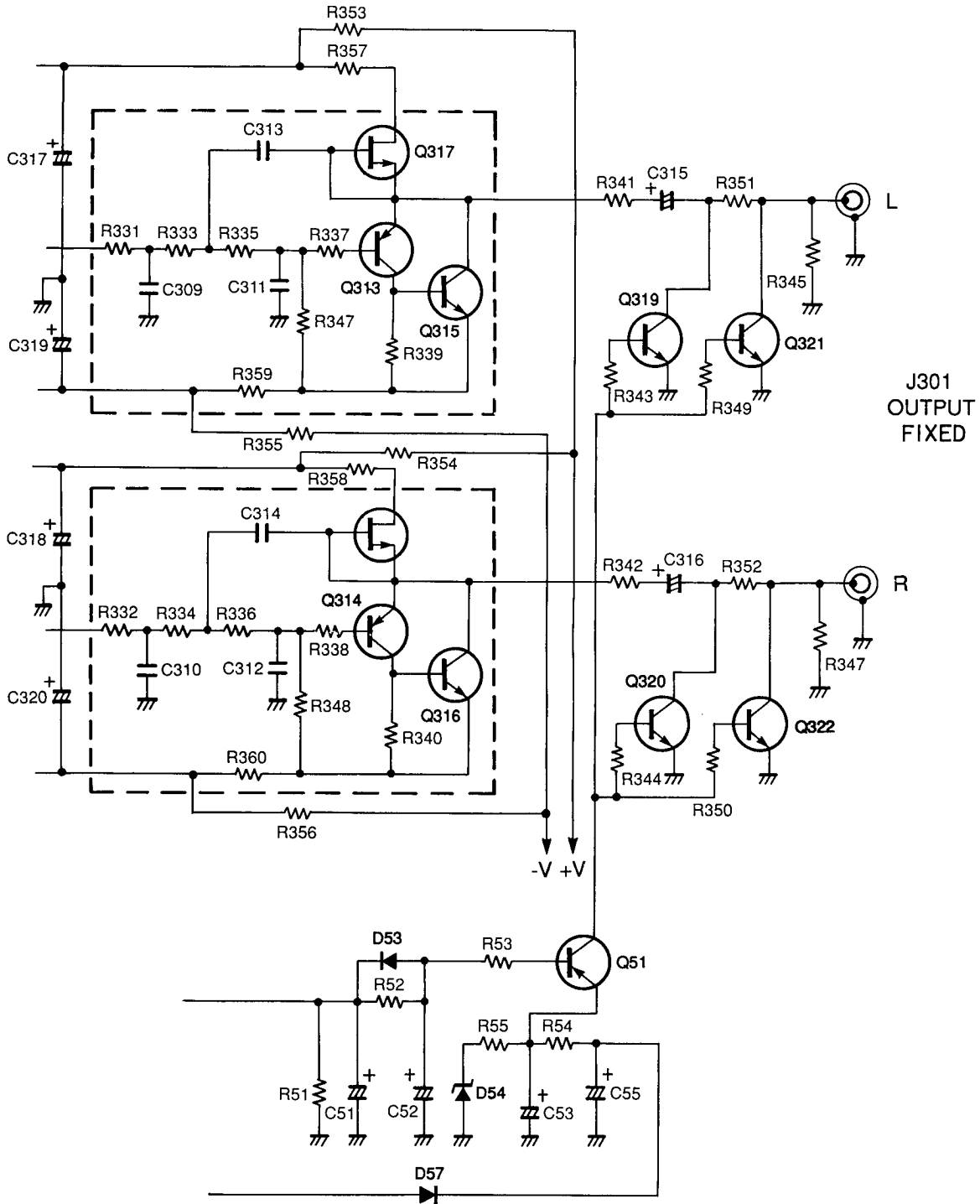
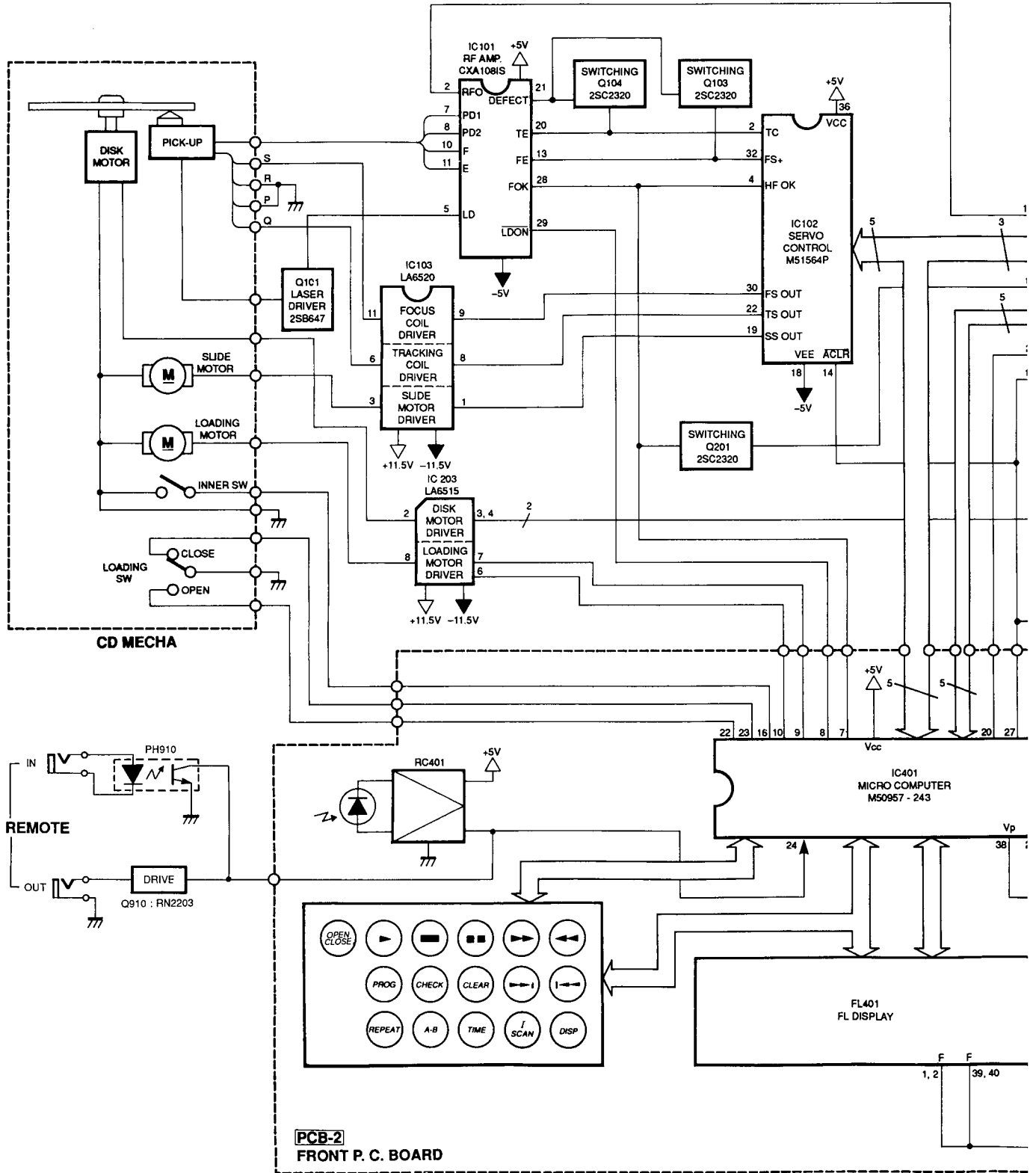
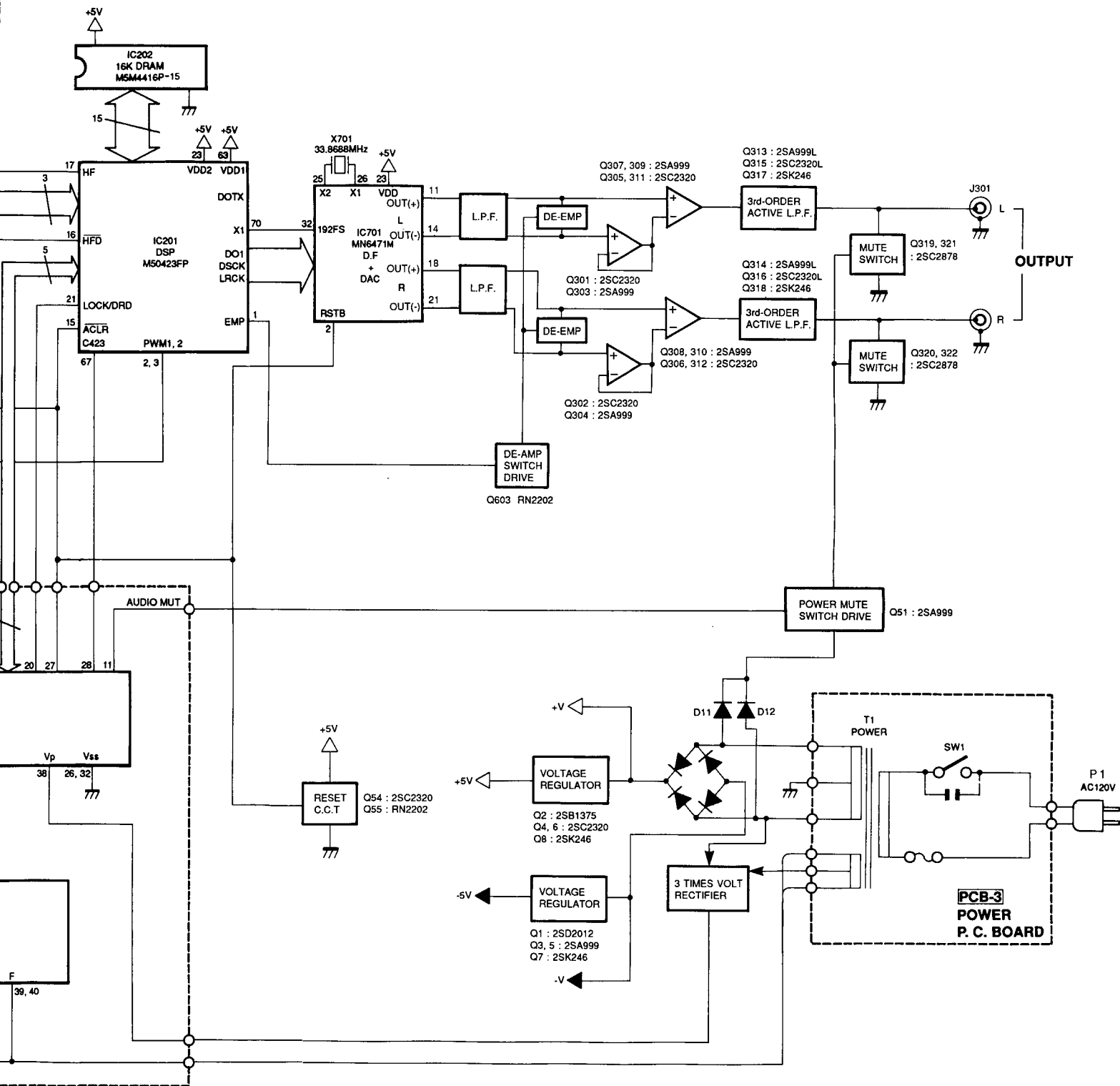


Fig. 21

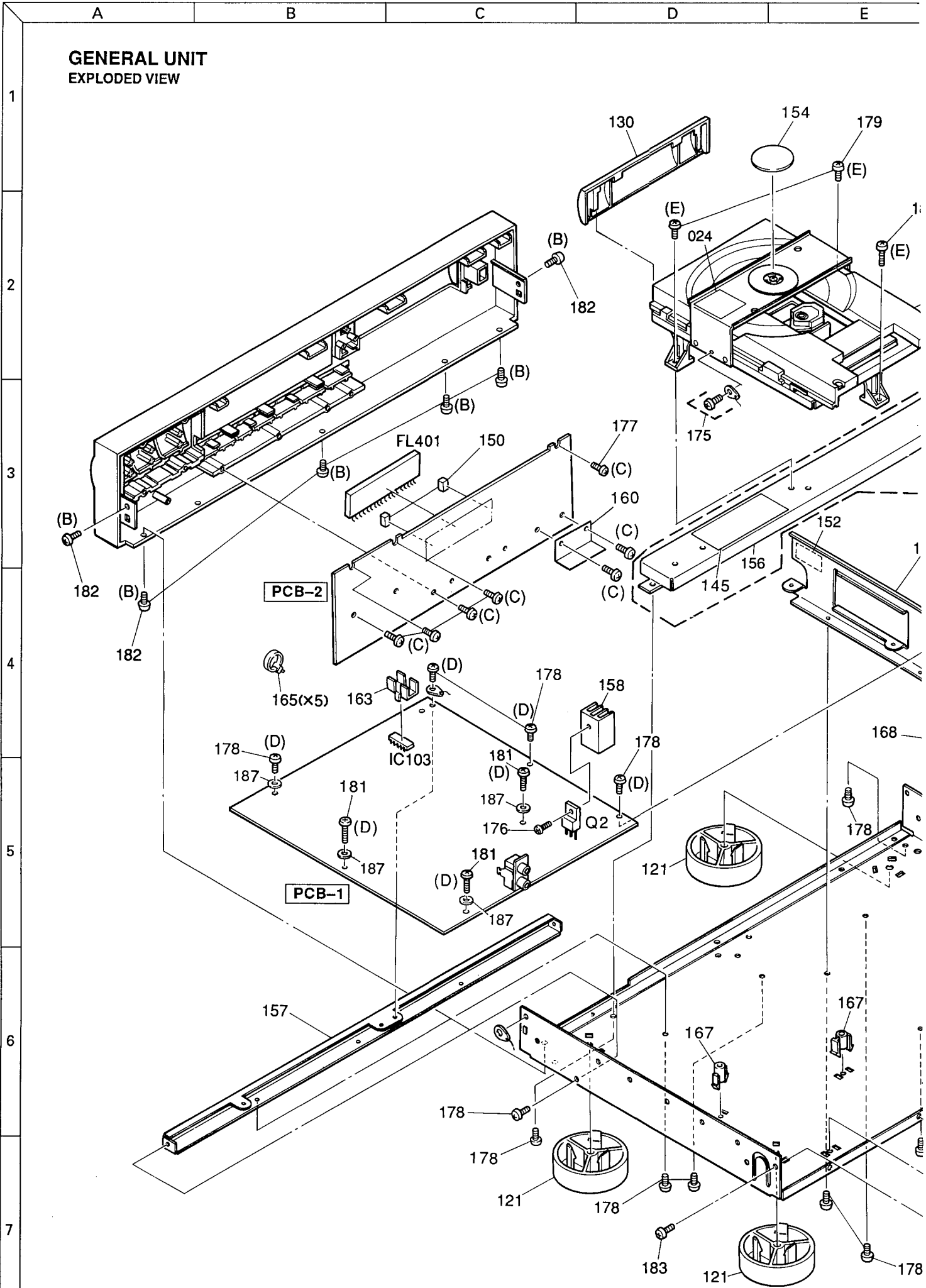
BLOCK DIAGRAM



E F G H I J



**GENERAL UNIT
EXPLODED VIEW**



A

B

C

D

E

EXPLODED VIEW

1

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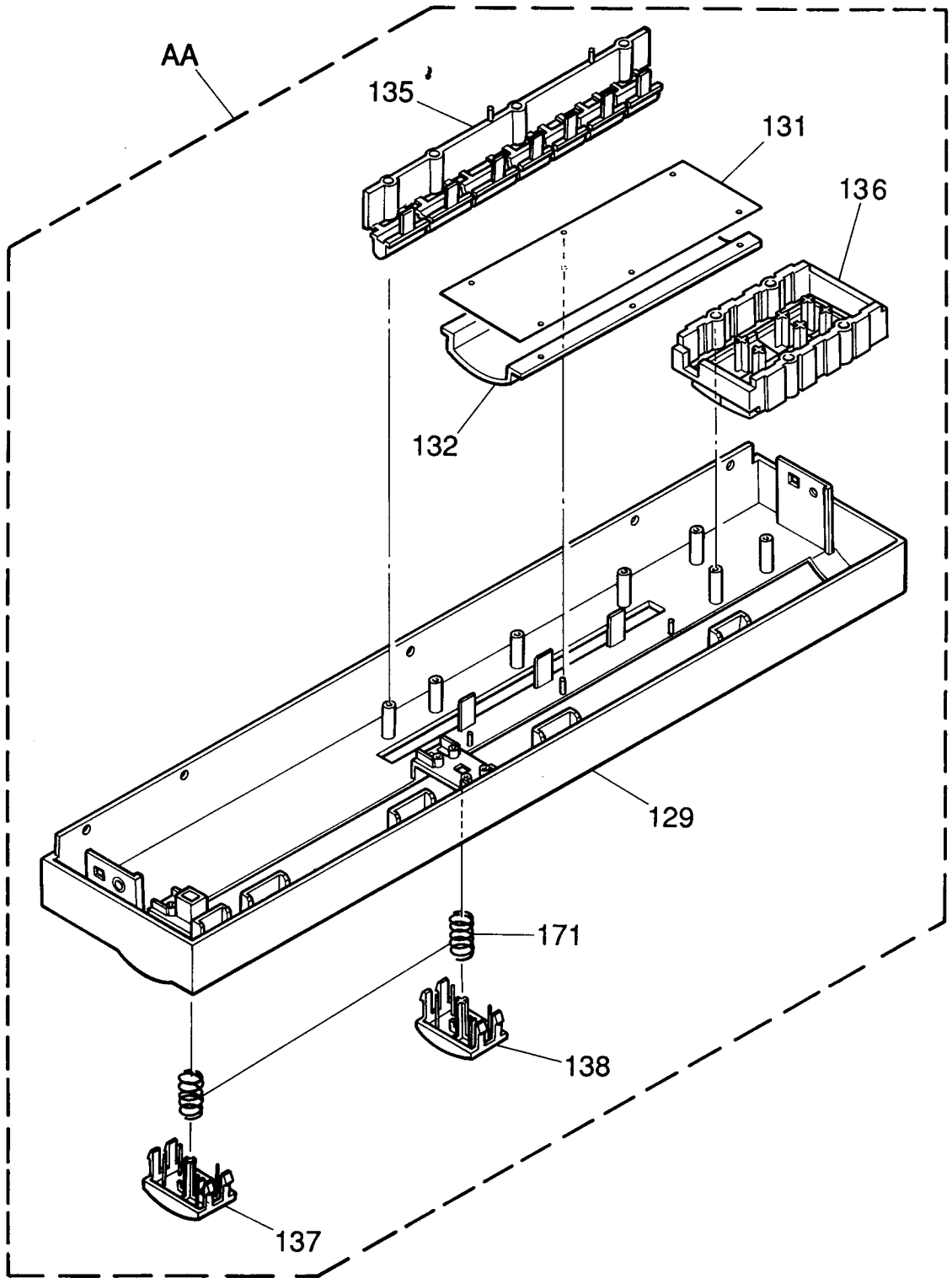
3

4

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6

7



AA

135

131

136

132

129

171

138

137

F

G

H

I

J

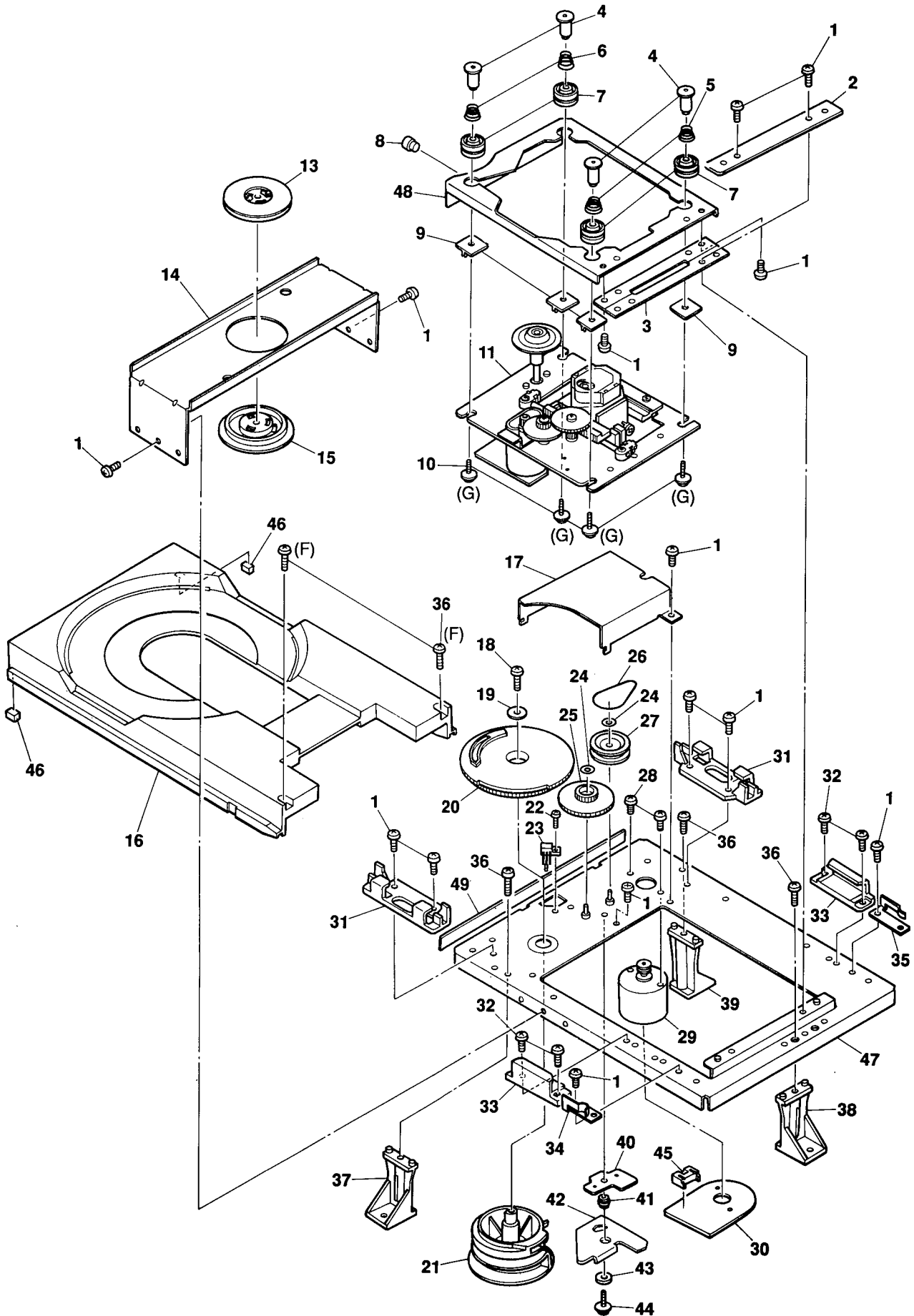
PARTS LIST (GENERAL UNIT)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
AA	A442-HD7450IA	PANEL, FRONT ASSY I	146	1756-CSA	LABEL BK
AA	A442-HD7450IB	PANEL, FRONT ASSY BK IB BB WB	147	1756-11604	LABEL, DHHS CARD BK
AB	A424-HD7450IA	CABI BACK, REAR BK	149	1756-11801	LABEL, LASER WARNING
AB	A424-HD7450IB	CABI BACK, REAR I IB BB	150	2114-86143	BUSHING FL REAR
AB	A424-HD7450NB	CABI BACK, REAR WB	151	2111-11769	FELT, TOP COVER
AC	B219-HD7450IA	METAL FITTG, MECHA BK	152	2111-1197	FELT
AC	B219-HD7450IB	METAL FITTG, MECHA I IB BB WB	154	2111-1422	FELT, CD MECHA TOP
AD	A414-HD7450IA	CABINET, TOP	155	2219-8260	METAL FITTG, TRANS
024	1756-11802	LABEL I IB BB WB	156	2219-8290	METAL FITTG, MECHA
109	1117-78	SERIAL LABEL	157	2219-8275	METAL FITTG
120	3119-01204	CD MECHA	158	2222-7217	HEAT SINK, TR
121	1319-03301	LEG	159	2219-8264	METAL FITTG
123	1414-14601EXP	CABINET, TOP	160	2216-7194	SHIELD PLATE, FRONT PCB
125	1424-33003	CABI BACK, REAR BK	161	1223-00207018	SOFT SHEET
125	1424-33004	CABI BACK, REAR I IB BB	163	2222-7264	HEAT SINK
125	1424-33020	CABI BACK, REAR WB	164	2240-364	HOLDER, AC CORD
126	1424-29601	CABI BACK, BOTTOM	165	2240-R0101	HOLDER, WIRING
129	1442-25501	PANEL, FRONT I	167	2360-7021	BOSS, SPE (x3)
129	1442-25502	PANEL, FRONT BK IB BB WB	168	2360-7018	BOSS, SPE
130	1452-08302	LID, MECHA I	169	2601-7187	SHAFT, POWER SWITCH
130	1452-08301	LID, MECHA BK IB BB WB	171	2651-2101732	SPRING, PUSH BUTTON
131	1511-19803	PLATE, FL FILTER	176	2327-R0130082	SCREW, BND+ (3x8mm)
132	1532-17502	WINDOW, FRONT	177	2347-R0126082	SCREW, BND T+ (2.6x8mm) (x7)
135	1662-52103	PUSH BUTTON, PLAY, STOP I	178	2347-R0130062	SCREW, BND T+ (3x6mm) (x14)
135	1662-52101	PUSH BUTTON, PLAY, STOP BK IB BB WB	179	2347-R0130082	SCREW, BND T+ (3x8mm) (x10)
136	1662-52202	PUSH BUTTON, FUNCTION I	180	2347-R0130162	SCREW, BND T+ (3x16mm)
136	1662-52201	PUSH BUTTON, FUNCTION BK IB BB WB	181	2347-R0130202	SCREW, BND T+ (3x20mm) (x3)
137	1662-52003	PUSH BUTTON, POWER I	182	2347-R0130084	SCREW, BND T+ (3x8mm) (x7)
137	1662-52001	PUSH BUTTON, POWER BK IB BB WB	183	2347-R0130084	SCREW, BND T+ (3x8mm) (x10)
138	1662-52004	PUSH BUTTON, OPEN/CLOSE I	184	2347-R0140064	SCREW, BND T+ (4x6mm) (x4)
138	1662-52002	PUSH BUTTON, OPEN/CLOSE BK IB BB WB	185	2347-R0130104	SCREW, BND T+ (3x10mm)
141	1751-20304	LABEL, REMOCON	187	2401-035	WASHER, METAL (x9)
142	1751-03709	LABEL	△ P1	4161-03601202	CORD W/PLUG BK
143	1341-568	NAME PLATE BK	△ P1	4161-03701220	CORD W/PLUG I IB BB
144	1756-03305	LABEL, LASER CAUTION	△ P1	4161-7256	CORD W/PLUG WB
145	1756-09602	LABEL, LASER CAUTION BK	△ T1	5584-S8801	XFORMER, POWER BK
145	1756-12101	LABEL, LASER CAUTION I IB BB WB	△ T1	5584-S8802	XFORMER, POWER I IB BB WB

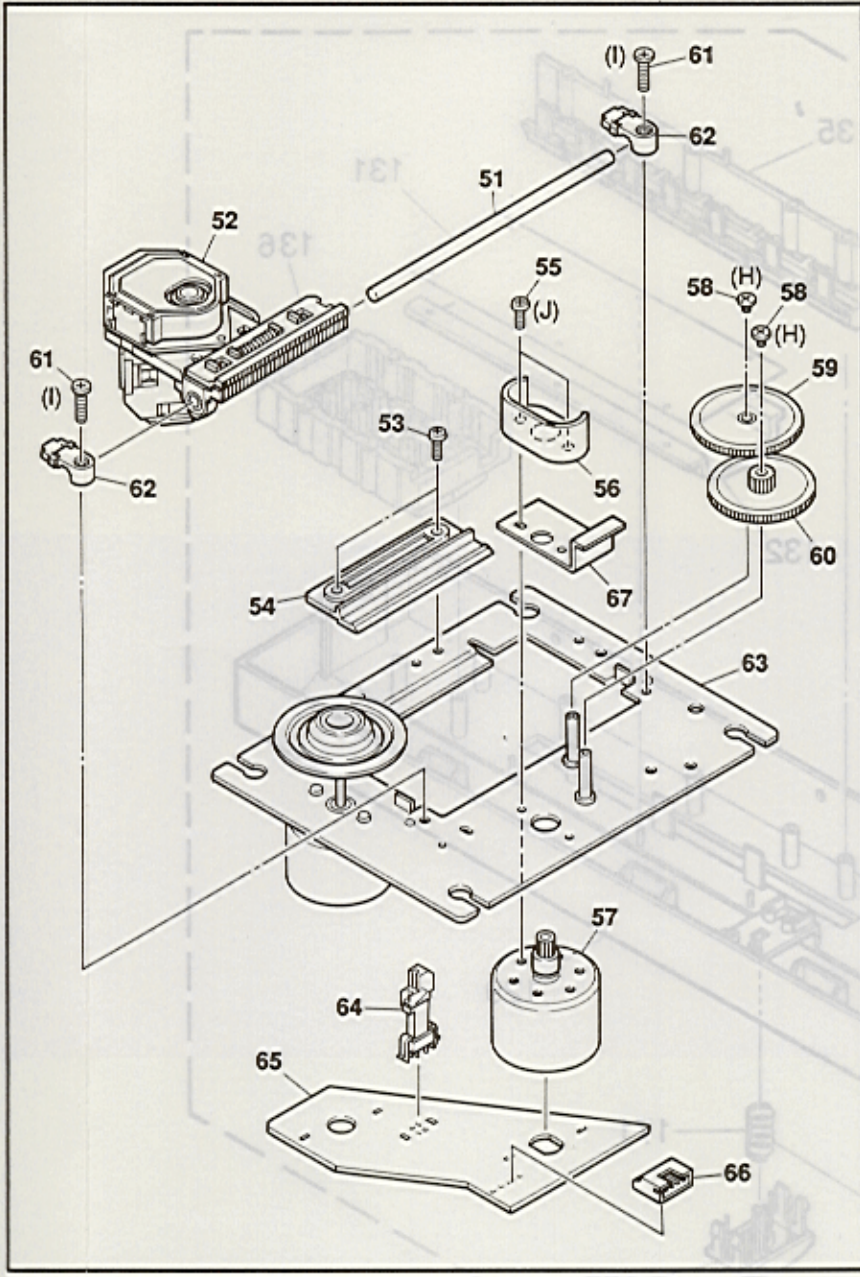
A B C D E

CD MECHANISM
EXPLODED VIEW

1
2
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5
6
7



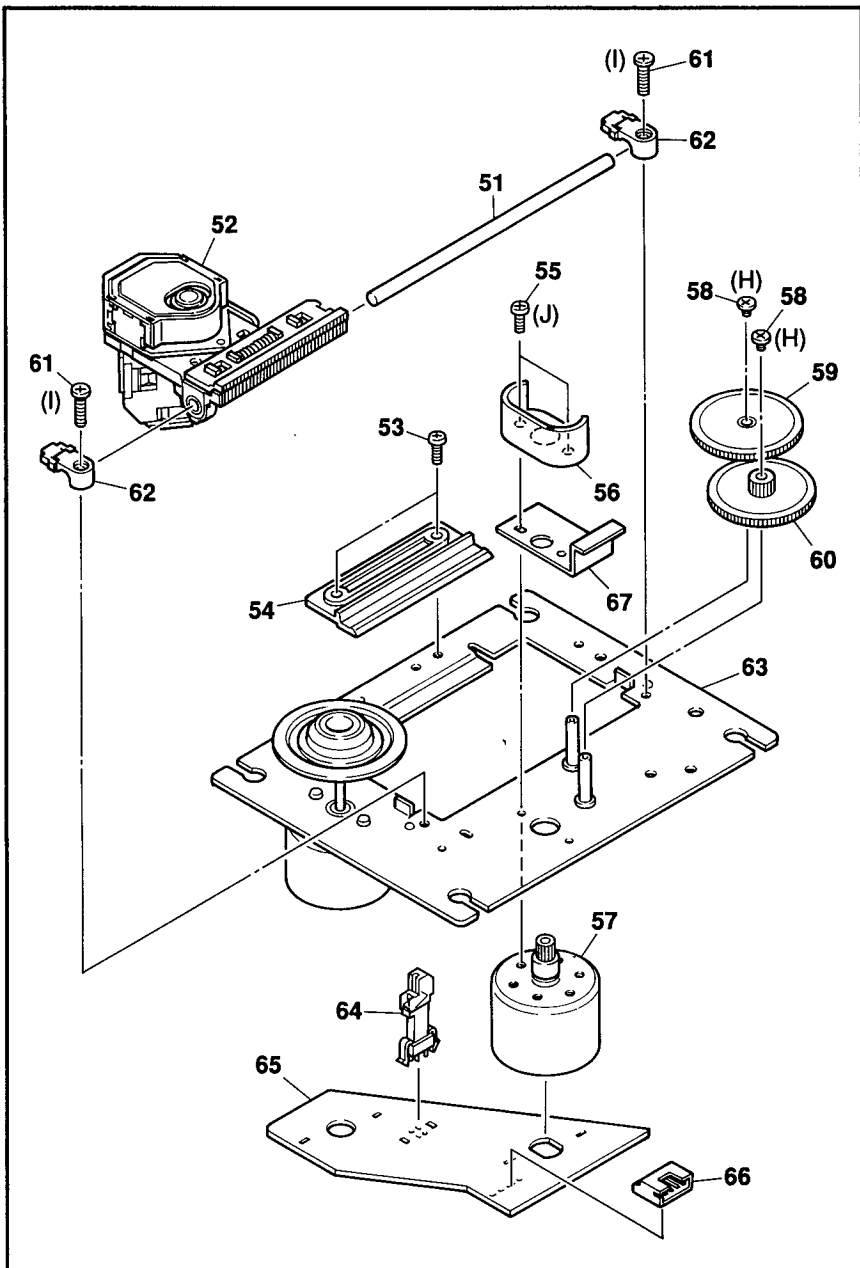
PARTS LIST



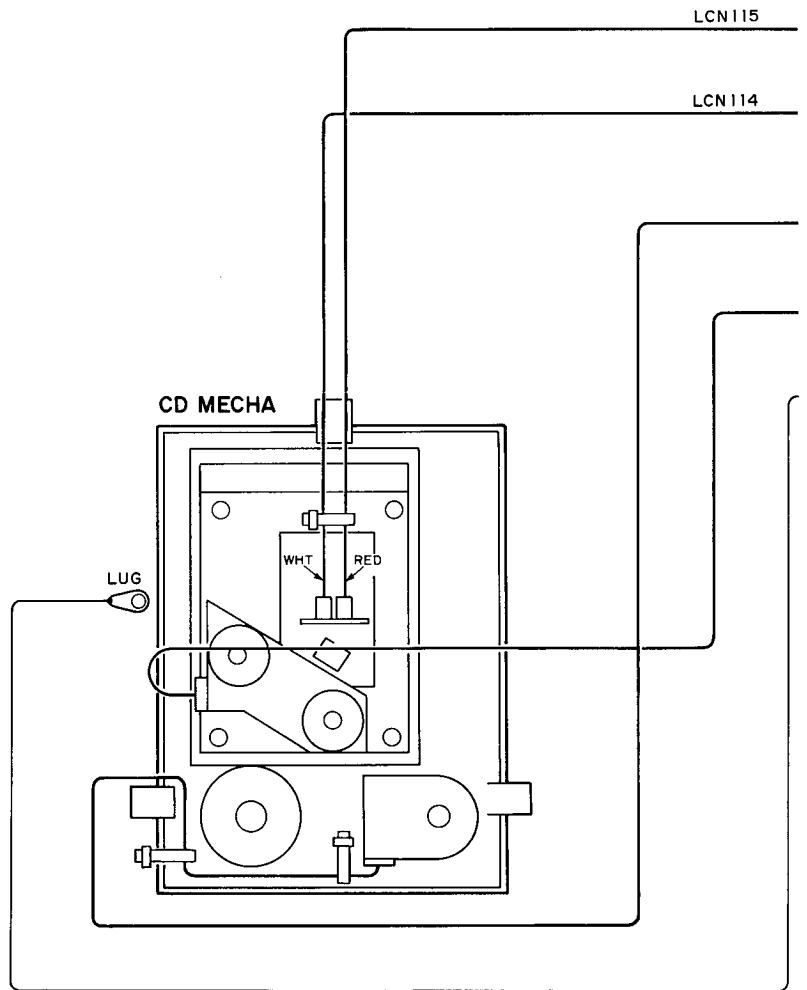
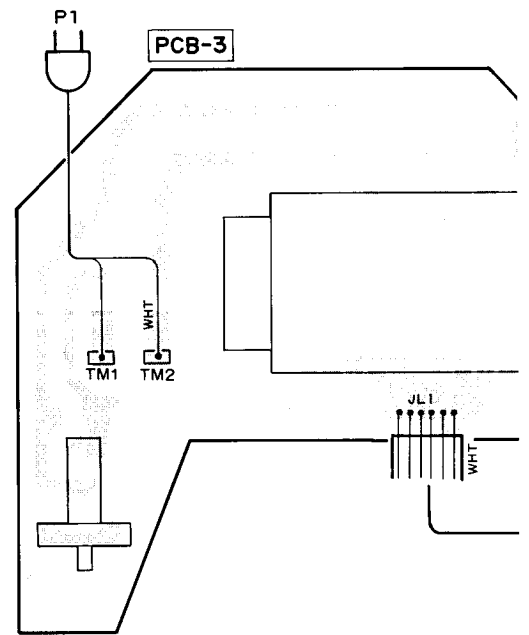
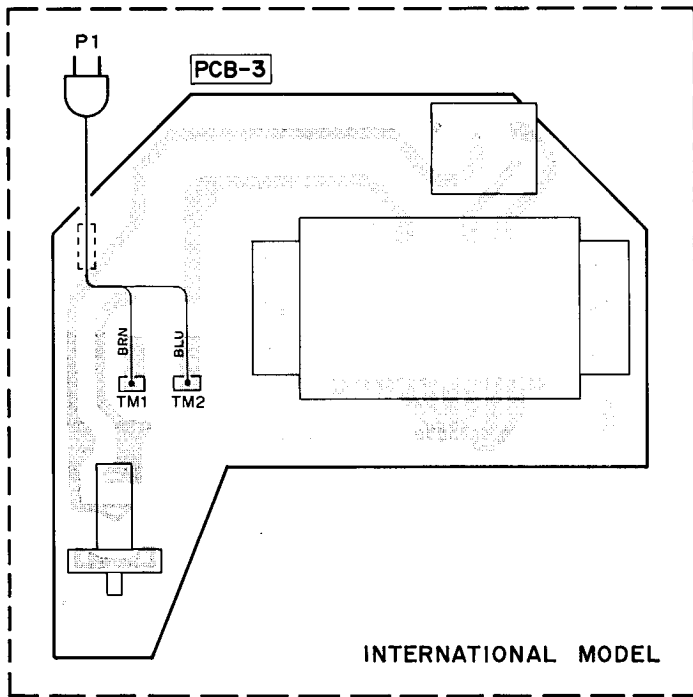
Ref. No.	Part No.	Description
1	7-685-862-(01)	SCREW (+)(2.6x8mm)
2	2-642-170-(01)	HINGE HOLDER
3	2-642-164-(01)	HINGE
4	2-642-160-(01)	SHAFT
5	2-642-137-(02)	COIL SPRING (B)
6	2-642-139-(02)	COIL SPRING (A)
7	2-642-158-(01)	INSULATOR (C)
8	2-642-169-(02)	ROLLER
9	2-642-159-(01)	PLATE (T)
10	2-642-142-(01)	SCREW
11	8-848-184-(01)	CD PLAYER SUB UNIT ASS'Y
13	X-2642-108-(1)	MAGNET ASS'Y
14	2-642-165-(01)	CHUCK CHASSIS
15	2-642-181-(01)	CHUCKING PULLEY
16	2-642-156-(02)	TRAY
17	2-642-149-(02)	GEAR COVER
18	7-685-535-(19)	SCREW (+)(2.6x10mm)
19	4-812-554-(01)	WASHER
20	2-642-154-(03)	DRIVE GEAR
21	2-642-153-(01)	CONTROL CAM
22	7-685-851-(01)	SCREW (+)(2x4mm)
23	1-572-052-(11)	LEAF SWITCH
24	3-558-708-(21)	LOCK WASHER
25	2-642-148-(01)	CENTER GEAR
26	3-653-387-(01)	LM BELT
27	4-913-731-(01)	LOADING PULLEY
28	7-621-775-(00)	SCREW (+)(2.6x3mm)
29	X-2641-336-(1)	MOTOR ASS'Y
30	1-624-793-(21)	MOTOR P. C. BOARD
31	2-642-161-(01)	TRAY HOLDER, FRONT
32	7-685-781-(01)	SCREW (+)(2x4mm)
33	2-642-162-(03)	TRAY HOLDER, REAR
34	2-642-146-(02)	TRAY GUIDE, RIGHT
35	2-642-147-(02)	TRAY GUIDE, LEFT
36	7-685-547-(19)	SCREW (+)(3x10mm)
37	2-642-510-(01)	HOLDER, RIGHT
38	2-642-512-(01)	HOLDER, REAR
39	2-642-511-(01)	HOLDER, LEFT
40	2-642-173-(01)	LINK PLATE
41	2-642-133-(02)	BOSS
42	X-2642-109-(1)	STOPPER LINK ASS'Y
43	2-642-172-(01)	SPACER
44	7-682-902-(31)	SCREW (+)(2.6x8mm)
45	1-564-721-(11)	CONNECTOR, 5 PIN
46	2-642-125-(01)	DAMPER
47	X-2642-106-(2)	MAIN CHASSIS ASS'Y
48	X-2642-105-(2)	SUB CHASSIS ASS'Y
49	2-642-157-(03)	FRONT TAPE
51	4-910-431-(02)	SLIDE SHAFT
52	8-848-127-(31)	PICK-UP ASS'Y
53	2-641-386-(01)	SPECIAL SCREW (2x5mm)
54	2-641-443-(02)	SLIDE HOLDER
55	7-621-255-(35)	SCREW (+)(2x5mm)
56	2-641-434-(01)	GEAR COVER
57	X-2641-358-(1)	SLIDE MOTOR ASS'Y
58	3-303-809-(31)	SPECIAL SCREW (M1.7x3mm)
59	2-641-404-(02)	GEAR (A)
60	2-641-403-(06)	GEAR (B)
61	2-641-447-(01)	SCREW (+)(2.6x8mm)
62	2-641-448-(02)	SHAFT CLAMP
63	X-2641-356-(1)	DISC MOTOR ASS'Y
64	1-570-053-(12)	LEAF SWITCH
65	1-628-263-(11)	MOTOR P. C. BOARD
66	1-564-720-(11)	CONNECTOR, 4 PIN
67	2-641-371-(01)	STOPPER

PARTS LIST

Ref. No.	Part No.	Description
1	7-685-862-(01)	SCREW (+)(2.6x6mm)
2	2-642-170-(01)	HINGE HOLDER
3	2-642-164-(01)	HINGE
4	2-642-160-(01)	SHAFT
5	2-642-137-(02)	COIL SPRING (B)
6	2-642-139-(02)	COIL SPRING (A)
7	2-642-158-(01)	INSULATOR (C)
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26	3-653-387-(01)	LM BELT
27	4-913-731-(01)	LOADING PULLEY
28	7-621-775-(00)	SCREW (+)(2.6x3mm)
29	X-2641-336-(1)	MOTOR ASS'Y
30	1-624-793-(21)	MOTOR P. C. BOARD
31	2-642-161-(01)	TRAY HOLDER, FRONT
32	7-685-781-(01)	SCREW (+)(2x4mm)
33	2-642-162-(03)	TRAY HOLDER, REAR
34	2-642-146-(02)	TRAY GUIDE, RIGHT
35	2-642-147-(02)	TRAY GUIDE, LEFT
36	7-685-547-(19)	SCREW (+)(3x10mm)
37	2-642-510-(01)	HOLDER, RIGHT
38	2-642-512-(01)	HOLDER, REAR
39	2-642-511-(01)	HOLDER, LEFT
40	2-642-173-(01)	LINK PLATE
41	2-642-133-(02)	BOSS
42	X-2642-109-(1)	STOPPER LINK ASS'Y
43	2-642-172-(01)	SPACER
44	7-682-902-(31)	SCREW (+)(2.6x8mm)
45	1-564-721-(11)	CONNECTOR, 5 PIN
46	2-642-125-(01)	DAMPER
47	X-2642-106-(2)	MAIN CHASSIS ASS'Y
48	X-2642-105-(2)	SUB CHASSIS ASS'Y
49	2-642-157-(03)	FRONT TAPE
51	4-910-431-(02)	SLIDE SHAFT
52	8-848-127-(31)	PICK-UP ASS'Y
53	2-641-386-(01)	SPECIAL SCREW (2x5mm)
54	2-641-443-(02)	SLIDE HOLDER
55	7-621-255-(35)	SCREW (+)(2x5mm)
56	2-641-434-(01)	GEAR COVER
57	X-2641-358-(1)	SLIDE MOTOR ASS'Y
58	3-303-809-(31)	SPECIAL SCREW (M1.7x3mm)
59	2-641-404-(02)	GEAR (A)
60	2-641-403-(06)	GEAR (B)
61	2-641-447-(01)	SCREW (+)(2.6x8mm)
62	2-641-448-(02)	SHAFT CLAMP
63	X-2641-356-(1)	DISC MOTOR ASS'Y
64	1-570-053-(12)	LEAF SWITCH
65	1-628-263-(11)	MOTOR P. C. BOARD
66	1-564-720-(11)	CONNECTOR, 4 PIN
67	2-641-371-(01)	STOPPER



WIRING DIAGRAM



WIRE COLOR ABBREVIATIONS

RED : Red	YEL : Yellow
ORG : Orange	PUP : Purple
BLU : Blue	OIK : Pink
WHT : White	GRY : Gray
BLK : Black	BRN : Brown

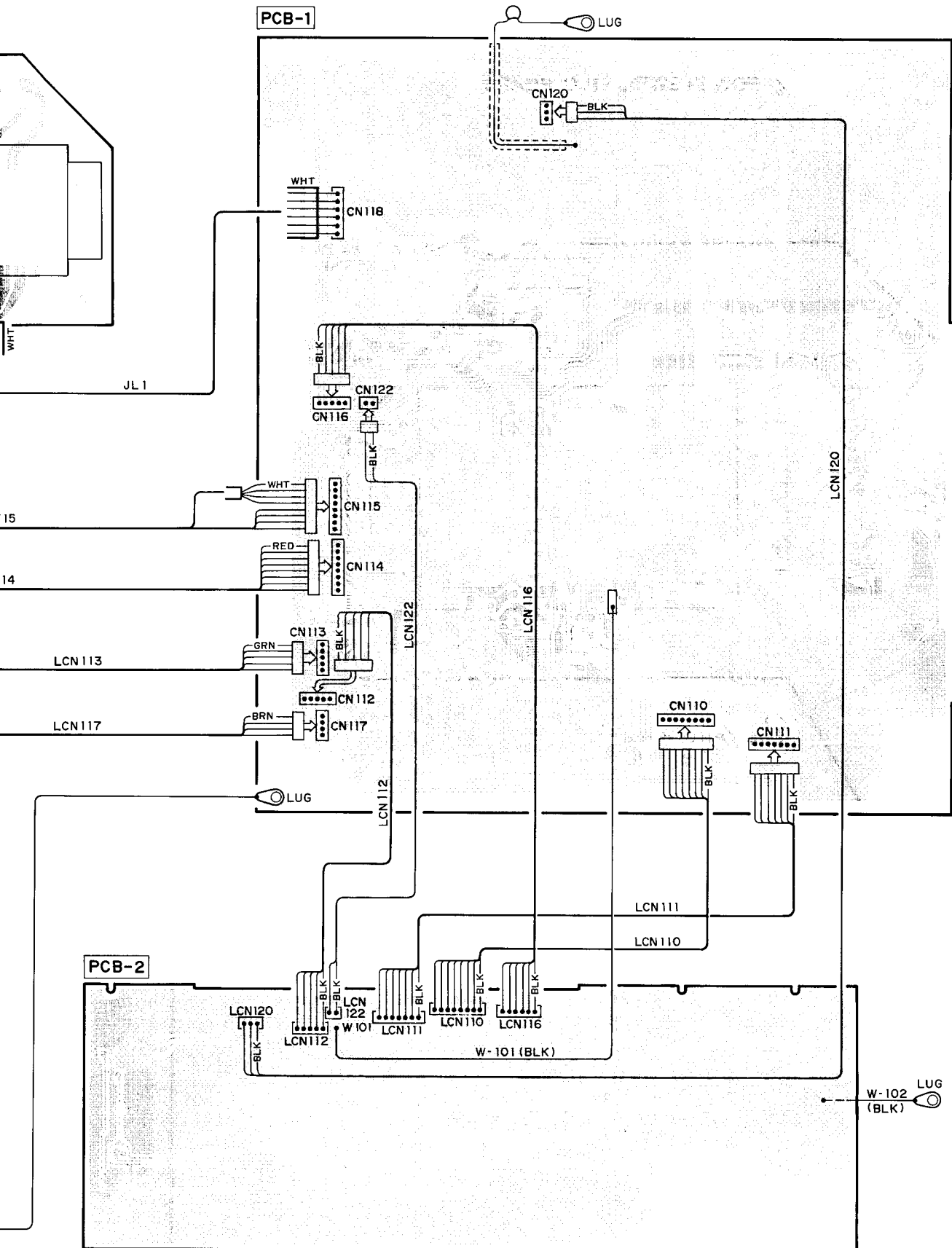
F

G

H

I

J



P. C. BOARDS

PCB-3 POWER SWITCH P. C. BOARD

1

2

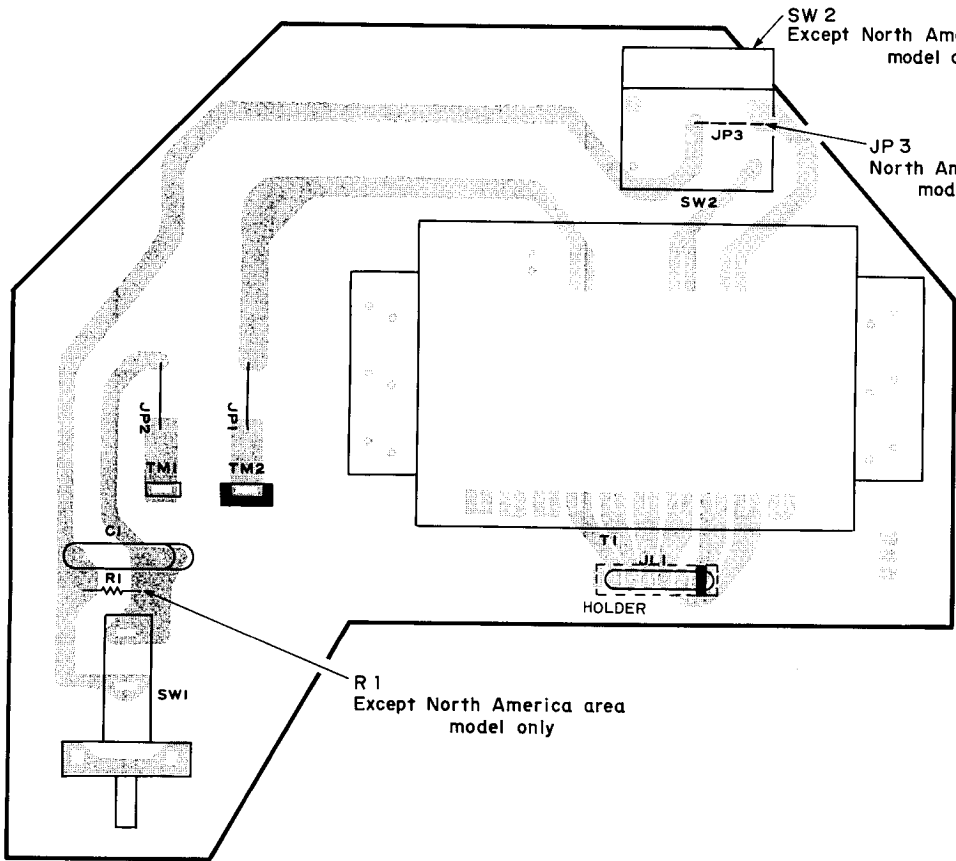
3

4

5

6

7



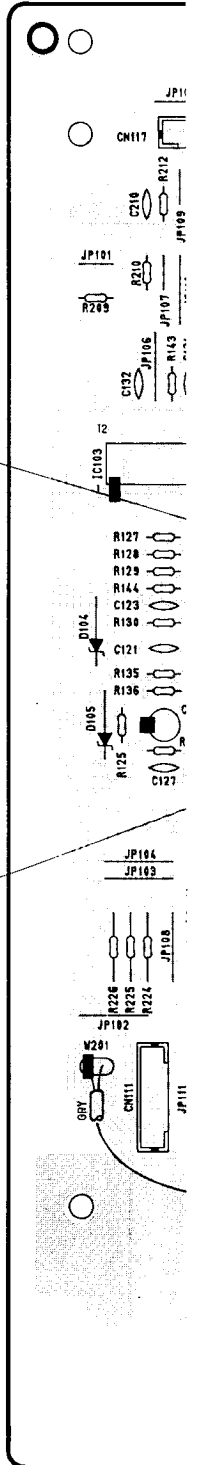
SW 2
Except North America area
model only

JP 3
North America area
model only

R 1
Except North America area
model only

TP401

TP203

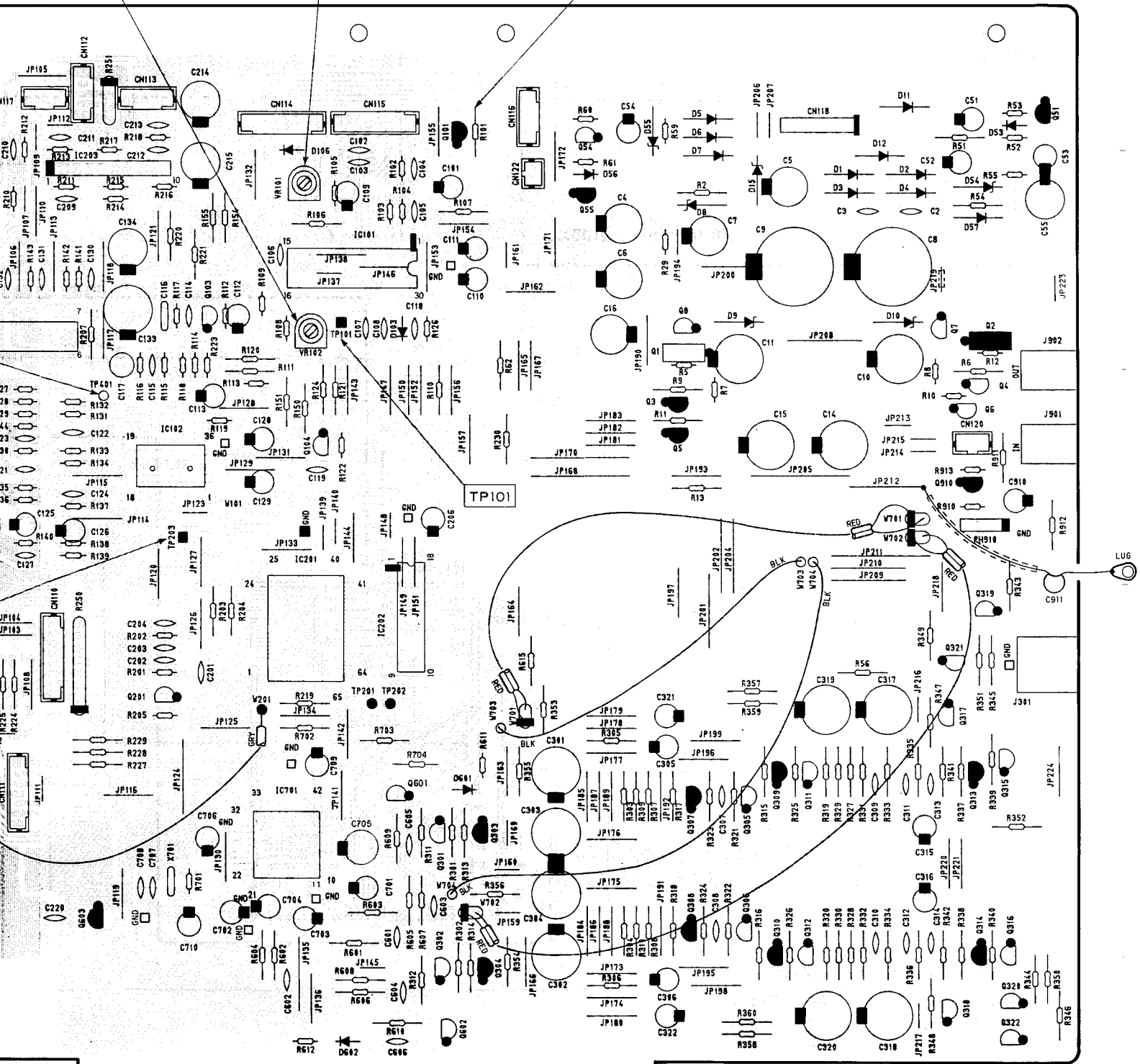


PCB-1 MAIN P. C. BOARD

FOCUS OFFSET
ADJ.

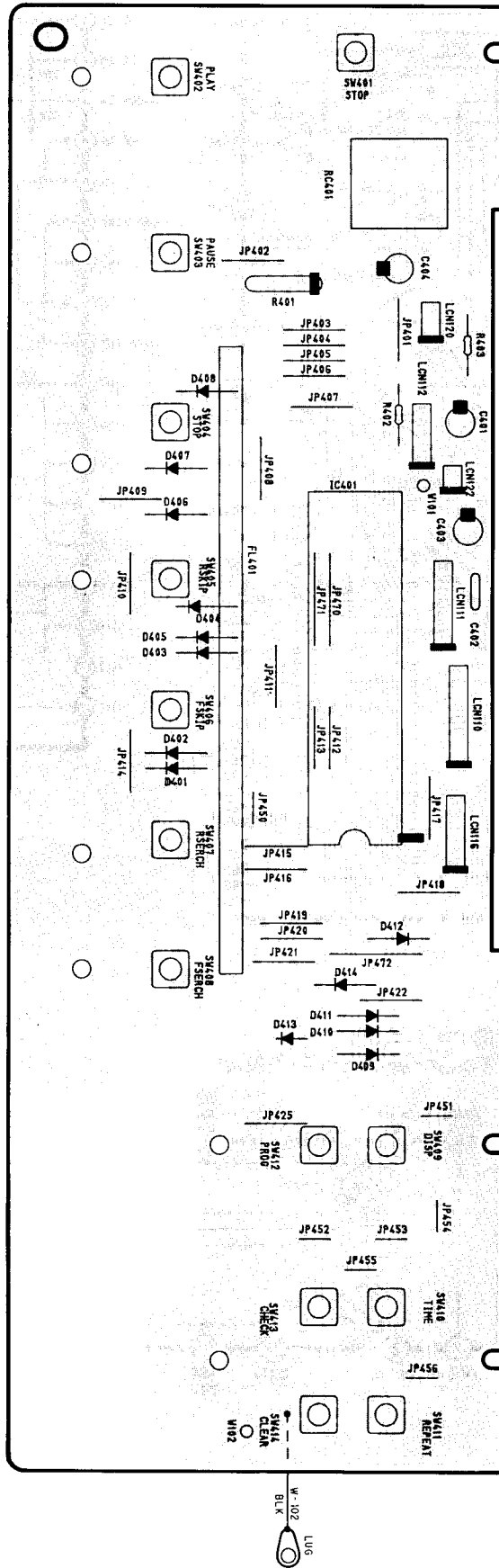
EF BALANCE
ADJ.

OPTICAL PICK-UP LASER POWER
ADJUSTMENT



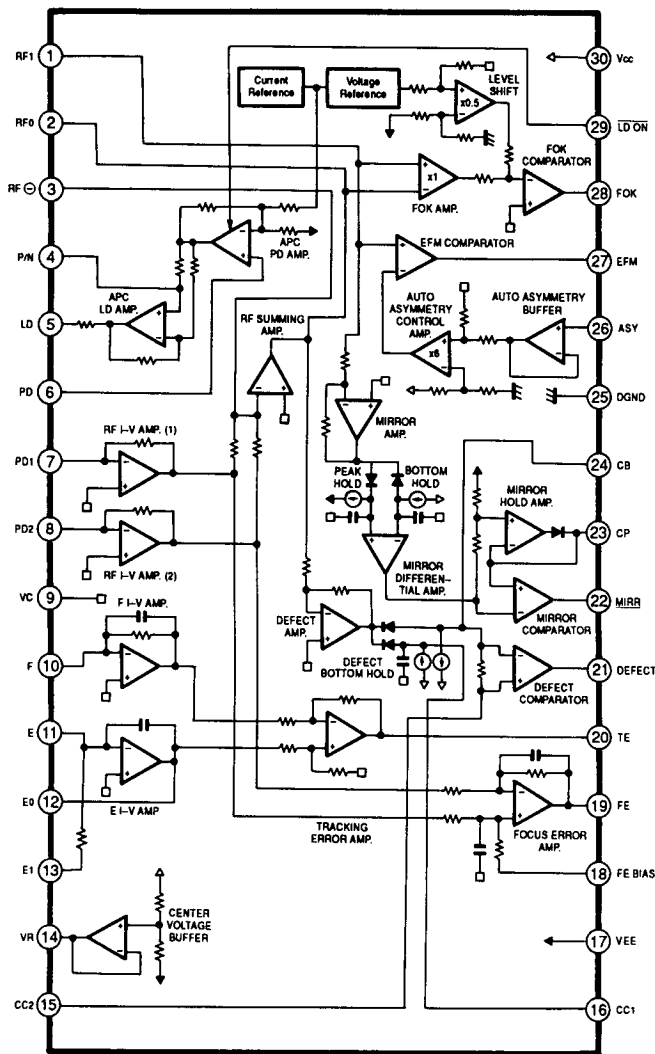
P. C. BOARDS

PCB-2 FRONT P. C. BOARD

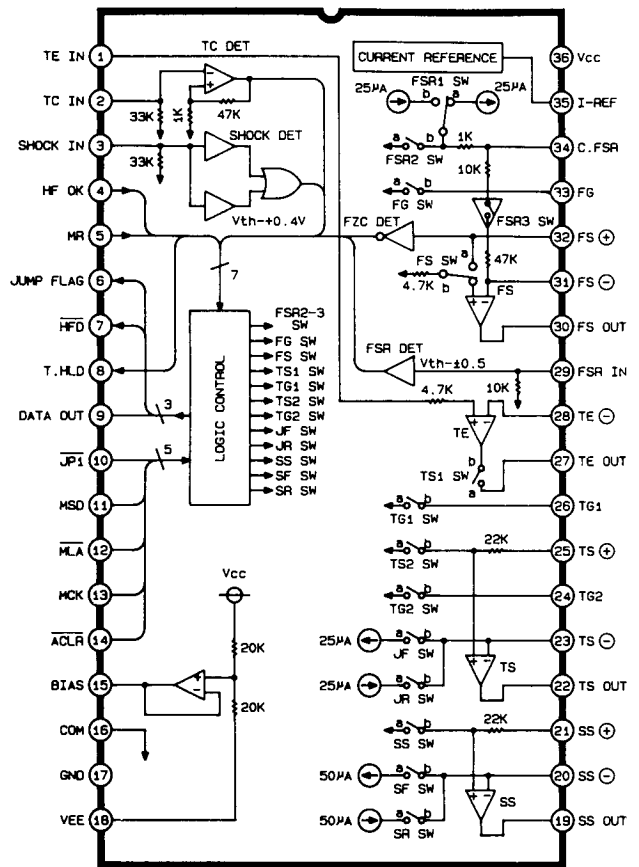


IC BLOCK DIAGRAM

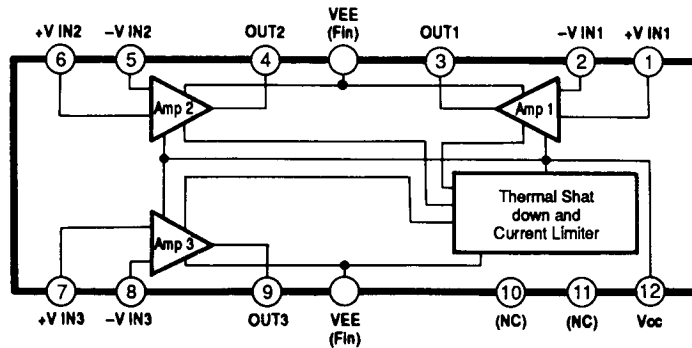
IC101 : CXA1081S
RF Amp.



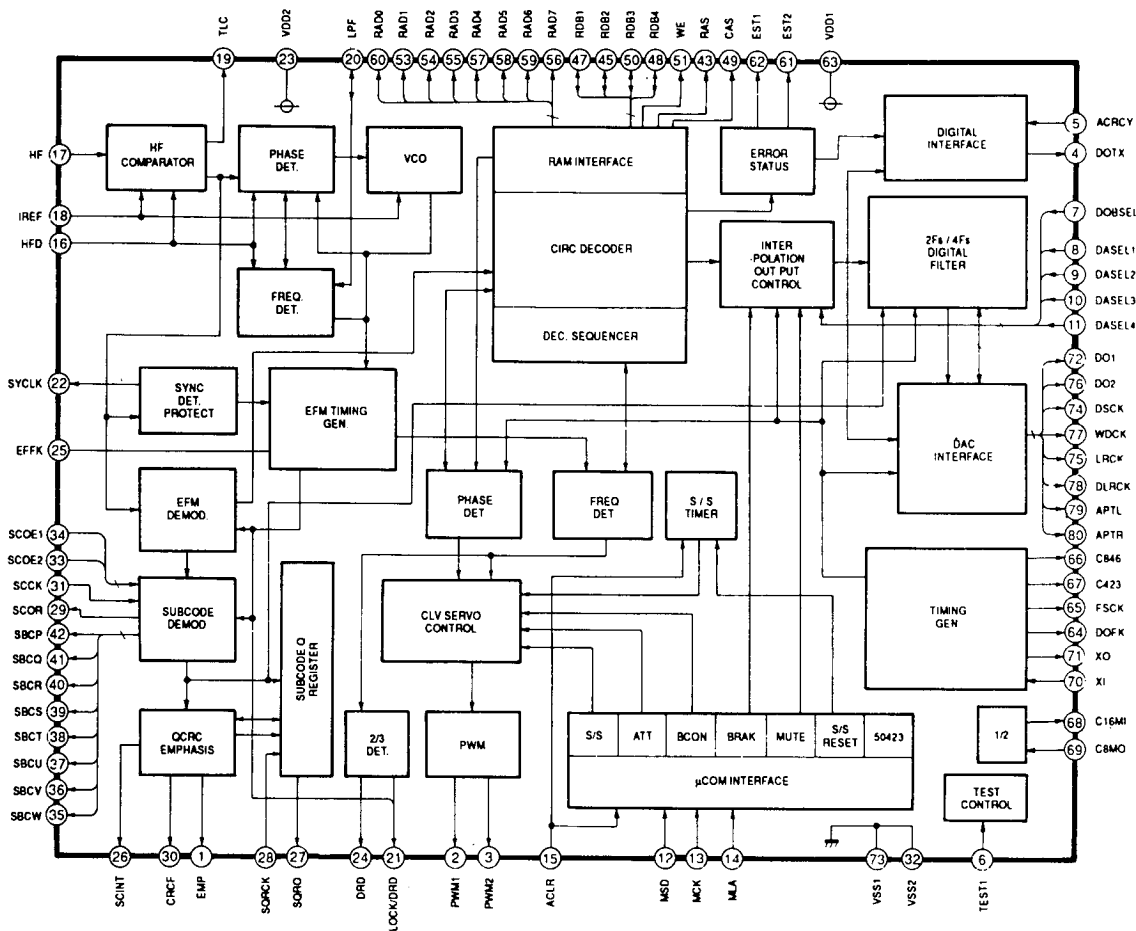
IC102
M51564P
Optical Pick-up Servo Control



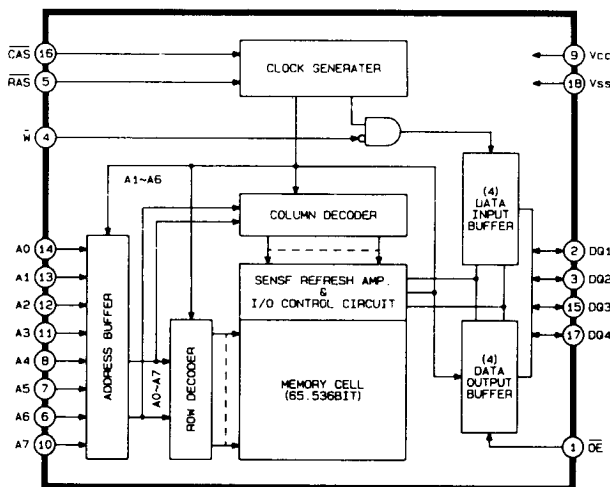
IC103 : LA6520
3 channel Power OP-Amp.



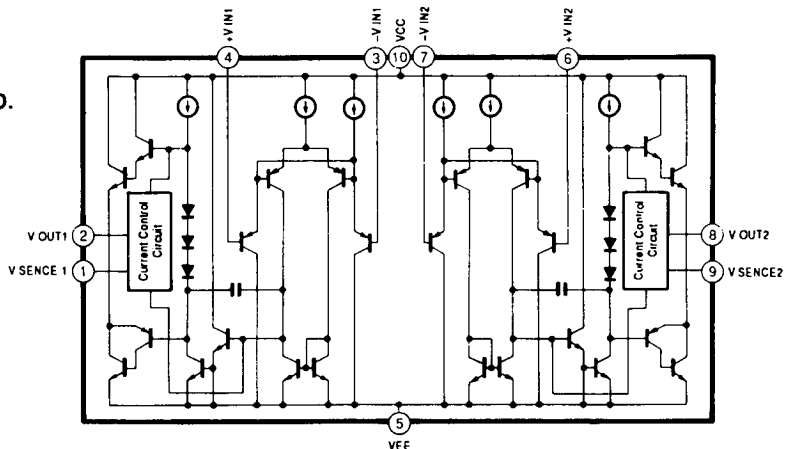
IC201 : M50423FP
Digital Signal Processor



IC202
M5M4416P-15
65536-Bit (16384-Word by 4-Bit)
Dynamic RAM



IC203 : LA6515
2 channel Power OP-Amp.



PARTS LIST

Ser.No	Ref. No.	Part No.	Description	Ser.No	Ref. No.	Part No.	Description
PCB-1 MAIN P.C. BOARD							
CAPACITORS							
512	C2	5354-104593	CAP, MYL .1μ	690	C304	5345-S06DM227	CAP, MINI ELE 220μ/25V
512	C3	5354-104593	CAP, MYL .1μ	688	C305	5345-106C0951	CAP, MINI ELE 10μ/16V
507	C4	5345-107E0962	CAP, MINI ELE 100μ/35V	688	C306	5345-106C0951	CAP, MINI ELE 10μ/16V
509	C5	5345-227C0962	CAP, MINI ELE 220μ/16V	694	C307	5353-100534	CAP, MCA 10p
507	C6	5345-107E0962	CAP, MINI ELE 100μ/35V	694	C308	5353-100534	CAP, MCA 10p
507	C7	5345-107E0962	CAP, MINI ELE 100μ/35V	692	C309	5359-1525851	CAP, PPP 1500p
511	C8	5345-478C0962	CAP, MINI ELE 4700μ/16V	692	C310	5359-1525851	CAP, PPP 1500p
511	C9	5345-478C0962	CAP, MINI ELE 4700μ/16V	692	C311	5359-1525851	CAP, PPP 1500p
509	C10	5345-227C0962	CAP, MINI ELE 220μ/16V	692	C312	5359-1525851	CAP, PPP 1500p
509	C11	5345-227C0962	CAP, MINI ELE 220μ/16V	693	C313	5359-5625851	CAP, PPP 5600p
510	C14	5345-108A0962	CAP, MINI ELE 1000μ/6.3V	693	C314	5359-5625851	CAP, PPP 5600p
510	C15	5345-108A0962	CAP, MINI ELE 1000μ/6.3V	689	C315	5345-107B0951	CAP, MINI ELE 100μ/10V
507	C16	5345-107E0962	CAP, MINI ELE 100μ/35V	689	C316	5345-107B0951	CAP, MINI ELE 100μ/10V
775	C51	5345-226D0962	CAP, MINI ELE 22μ/25V	691	C317	5345-S06BM107	CAP, MINI ELE 100μ/10V
779	C52	5345-106C0962	CAP, MINI ELE 10μ/16V	691	C318	5345-S06BM107	CAP, MINI ELE 100μ/10V
775	C53	5345-226D0962	CAP, MINI ELE 22μ/25V	691	C319	5345-S06BM107	CAP, MINI ELE 100μ/10V
777	C54	5345-227B0962	CAP, MINI ELE 220μ/10V	691	C320	5345-S06BM107	CAP, MINI ELE 100μ/10V
776	C55	5345-477C0962	CAP, MINI ELE 470μ/16V	687	C321	5345-336B0951	CAP, MINI ELE 33μ/10V
589	C101	5345-107B0962	CAP, MINI ELE 100μ/10V	687	C322	5345-336B0951	CAP, MINI ELE 33μ/10V
577	C102	5361-100DSL	CAP, CER 10p	696	C601	5353-820534	CAP, MCA 82p
577	C103	5361-100DSL	CAP, CER 10p	696	C602	5353-820534	CAP, MCA 82p
578	C104	5361-100DCH	CAP, CER 10p	695	C603	5353-330534	CAP, MCA 33p
582	C105	5361-332KB	CAP, CER 3300p	695	C604	5353-330534	CAP, MCA 33p
572	C106	5369-333144	CAP, SCD .033μ	697	C605	5359-1525851	CAP, PPP 1500p
572	C107	5369-333144	CAP, SCD .033μ	697	C606	5359-1525851	CAP, PPP 1500p
571	C108	5369-103144	CAP, SCD .01μ	746	C701	5345-S06BM107	CAP, MINI ELE 100μ/10V
588	C109	5345-476B0962	CAP, MINI ELE 47μ/10V	746	C702	5345-S06BM107	CAP, MINI ELE 100μ/10V
588	C110	5345-476B0962	CAP, MINI ELE 47μ/10V	746	C703	5345-S06BM107	CAP, MINI ELE 100μ/10V
588	C111	5345-476B0962	CAP, MINI ELE 47μ/10V	746	C704	5345-S06BM107	CAP, MINI ELE 100μ/10V
585	C112	5345-474F0962	CAP, MINI ELE .47μ/50V	743	C705	5345-S06DM227	CAP, MINI ELE 220μ/25V
590	C113	5345-226D0962	CAP, MINI ELE 22μ/25V	744	C706	5345-S06FM106	CAP, MINI ELE 10μ/50V
574	C114	5369-823144	CAP, SCD .082μ	747	C707	5353-050534	CAP, MCA 5p
581	C115	5361-681KSL	CAP, CER 680p	747	C708	5353-050534	CAP, MCA 5p
576	C116	5354-274593	CAP, MYL .27μ	746	C709	5345-S06BM107	CAP, MINI ELE 100μ/10V
584	C117	5342-105F0951	CAP, ELE BP 1μ/50V	744	C710	5345-S06FM106	CAP, MINI ELE 10μ/50V
575	C118	5369-104144	CAP, SCD .1μ	824	C910	5345-226C0962	CAP, MINI ELE 22μ/16V
579	C119	5361-472KB	CAP, CER 4700p	RESISTORS			
571	C121	5369-103144	CAP, SCD .01μ	525	R2	5134-151J25P	RES, CBN 1/4P 150
586	C122	5354-684593	CAP, MYL .68μ	528	R5	5232-471J16P	RES, CBN 1/6P 470
583	C123	5361-392KB	CAP, CER 3900p	528	R6	5232-471J16P	RES, CBN 1/6P 470
580	C124	5361-151KSL	CAP, CER 150p	530	R7	5232-102J16P	RES, CBN 1/6P 1K
587	C125	5345-106F0962	CAP, MINI ELE 10μ/50V	530	R8	5232-102J16P	RES, CBN 1/6P 1K
585	C126	5345-474F0962	CAP, MINI ELE .47μ/50V	523	R9	5134-101J25P	RES, CBN 1/4P 100
573	C127	5369-563144	CAP, SCD .056μ	527	R10	5232-101J16P	RES, CBN 1/6P 100
588	C128	5345-476B0962	CAP, MINI ELE 47μ/10V	521	R11	5135-1R0522	RES, CBN 1/2P 1
588	C129	5345-476B0962	CAP, MINI ELE 47μ/10V	521	R12	5135-1R0522	RES, CBN 1/2P 1
537	C130	5369-104144	CAP, SCD .1μ	524	R13	5134-220J25P	RES, CBN 1/4P 22
537	C131	5369-104144	CAP, SCD .1μ	529	R29	5232-273J16P	RES, CBN 1/6P 27K
537	C132	5369-104144	CAP, SCD .1μ	793	R51	5134-821J25P	RES, CBN 1/4P 820
536	C133	5345-107D0962	CAP, MINI ELE 100μ/25V	798	R52	5232-824J16P	RES, CBN 1/6P 820K
536	C134	5345-107D0962	CAP, MINI ELE 100μ/25V	797	R53	5232-473J16P	RES, CBN 1/6P 47K
665	C201	5361-332KB	CAP, CER 3300p	789	R54	5135-471522	RES, CBN 1/2P 470
664	C202	5361-562KB	CAP, CER 5600p	792	R55	5232-101J16P	RES, CBN 1/6P 100
663	C203	5361-471KSL	CAP, CER 470p	788	R56	5134-154J25P	RES, CBN 1/4P 150K
661	C204	5354-154593	CAP, MYL .15μ	795	R59	5232-102J16P	RES, CBN 1/6P 1K
660	C206	5345-S06BM476	CAP, MINI ELE 47μ/10V	794	R60	5232-471J16P	RES, CBN 1/6P 470
538	C209	5361-471KSL	CAP, CER 470p	796	R61	5232-103J16P	RES, CBN 1/6P 10K
538	C210	5361-471KSL	CAP, CER 470p	787	R62	5134-4R7J25P	RES, CBN 1/4P 4.7
537	C211	5369-104144	CAP, SCD .1μ	604	R101	5134-220J25P	RES, CBN 1/4P 22
539	C212	5361-220KSL	CAP, CER 22p	611	R102	5232-222J16P	RES, CBN 1/6P 2.2K
537	C213	5369-104144	CAP, SCD .1μ	619	R103	5232-163J16P	RES, CBN 1/6P 16K
536	C214	5345-107D0962	CAP, MINI ELE 100μ/25V	616	R104	5232-822J16P	RES, CBN 1/6P 8.2K
536	C215	5345-107D0962	CAP, MINI ELE 100μ/25V	621	R105	5232-223J16P	RES, CBN 1/6P 22K
667	C220	5361-223ZF	CAP, CER .022μ	605	R106	5134-102J25P	RES, CBN 1/4P 1K
666	C225	5345-S06CM106	CAP, MINI ELE 10μ/16V	601	R107	5134-910J25P	RES, CBN 1/4P 91
690	C301	5345-S06DM227	CAP, MINI ELE 220μ/25V	620	R108	5232-183J16P	RES, CBN 1/6P 18K
690	C302	5345-S06DM227	CAP, MINI ELE 220μ/25V	618	R109	5232-153J16P	RES, CBN 1/6P 15K
690	C303	5345-S06DM227	CAP, MINI ELE 220μ/25V	605	R110	5134-102J25P	RES, CBN 1/4P 1K
				606	R111	5134-103J25P	RES, CBN 1/4P 10K
				627	R112	5232-104J16P	RES, CBN 1/6P 100K
				617	R113	5232-103J16P	RES, CBN 1/6P 10K

Ser.No	Ref. No.	Part No.	Description	Ser.No	Ref. No.	Part No.	Description
621	R114	5232-223J16P	RES, CBN 1/6P 22K	721	R310	5134-184J25P	RES, CBN 1/4P 180K
626	R115	5232-683J16P	RES, CBN 1/6P 68K	717	R311	5134-683J25P	RES, CBN 1/4P 68K
618	R116	5232-153J16P	RES, CBN 1/6P 15K	717	R312	5134-683J25P	RES, CBN 1/4P 68K
615	R117	5232-682J16P	RES, CBN 1/6P 6.8K	710	R313	5134-102J25P	RES, CBN 1/4P 1K
610	R118	5232-221J16P	RES, CBN 1/6P 220	710	R314	5134-102J25P	RES, CBN 1/4P 1K
625	R119	5232-473J16P	RES, CBN 1/6P 47K	708	R315	5134-561J25P	RES, CBN 1/4P 560
606	R120	5134-103J25P	RES, CBN 1/4P 10K	708	R316	5134-561J25P	RES, CBN 1/4P 560
606	R121	5134-103J25P	RES, CBN 1/4P 10K	714	R317	5134-682J25P	RES, CBN 1/4P 6.8K
622	R122	5232-273J16P	RES, CBN 1/6P 27K	714	R318	5134-682J25P	RES, CBN 1/4P 6.8K
606	R124	5134-103J25P	RES, CBN 1/4P 10K	704	R319	5134-2R2J25P	RES, CBN 1/4P 2.2
551	R125	5232-102J16P	RES, CBN 1/6P 1K	704	R320	5134-2R2J25P	RES, CBN 1/4P 2.2
627	R126	5232-104J16P	RES, CBN 1/6P 100K	709	R321	5134-331J25P	RES, CBN 1/4P 330
627	R127	5232-104J16P	RES, CBN 1/6P 100K	709	R322	5134-331J25P	RES, CBN 1/4P 330
625	R128	5232-473J16P	RES, CBN 1/6P 47K	724	R323	5232-822J16P	RES, CBN 1/6P 8.2K
617	R129	5232-103J16P	RES, CBN 1/6P 10K	724	R324	5232-822J16P	RES, CBN 1/6P 8.2K
616	R130	5232-822J16P	RES, CBN 1/6P 8.2K	710	R325	5134-102J25P	RES, CBN 1/4P 1K
627	R131	5232-104J16P	RES, CBN 1/6P 100K	710	R326	5134-102J25P	RES, CBN 1/4P 1K
627	R132	5232-104J16P	RES, CBN 1/6P 100K	707	R327	5134-471J25P	RES, CBN 1/4P 470
614	R133	5232-562J16P	RES, CBN 1/6P 5.6K	707	R328	5134-471J25P	RES, CBN 1/4P 470
612	R134	5232-332J16P	RES, CBN 1/6P 3.3K	704	R329	5134-2R2J25P	RES, CBN 1/4P 2.2
620	R135	5232-183J16P	RES, CBN 1/6P 18K	704	R330	5134-2R2J25P	RES, CBN 1/4P 2.2
621	R136	5232-223J16P	RES, CBN 1/6P 22K	708	R331	5134-561J25P	RES, CBN 1/4P 560
624	R137	5232-393J16P	RES, CBN 1/6P 39K	708	R332	5134-561J25P	RES, CBN 1/4P 560
621	R138	5232-223J16P	RES, CBN 1/6P 22K	710	R333	5134-102J25P	RES, CBN 1/4P 1K
613	R139	5232-472J16P	RES, CBN 1/6P 4.7K	710	R334	5134-102J25P	RES, CBN 1/4P 1K
624	R140	5232-393J16P	RES, CBN 1/6P 39K	710	R335	5134-102J25P	RES, CBN 1/4P 1K
550	R141	5232-100J16P	RES, CBN 1/6P 10	710	R336	5134-102J25P	RES, CBN 1/4P 1K
550	R142	5232-100J16P	RES, CBN 1/6P 10	706	R337	5134-101J25P	RES, CBN 1/4P 100
550	R143	5232-100J16P	RES, CBN 1/6P 10	706	R338	5134-101J25P	RES, CBN 1/4P 100
613	R144	5232-472J16P	RES, CBN 1/6P 4.7K	708	R339	5134-561J25P	RES, CBN 1/4P 560
603	R150	5134-4R7J25P	RES, CBN 1/4P 4.7	708	R340	5134-561J25P	RES, CBN 1/4P 560
603	R151	5134-4R7J25P	RES, CBN 1/4P 4.7	706	R341	5134-101J25P	RES, CBN 1/4P 100
554	△ R154	5102-4R75116	RES, FUSE 4.7	706	R342	5134-101J25P	RES, CBN 1/4P 100
554	△ R155	5102-4R75116	RES, FUSE 4.7	713	R343	5134-222J25P	RES, CBN 1/4P 2.2K
679	R201	5232-223J16P	RES, CBN 1/6P 22K	713	R344	5134-222J25P	RES, CBN 1/4P 2.2K
678	R202	5232-222J16P	RES, CBN 1/6P 2.2K	720	R345	5134-104J25P	RES, CBN 1/4P 100K
674	R203	5134-124J25P	RES, CBN 1/4P 120K	720	R346	5134-104J25P	RES, CBN 1/4P 100K
673	R204	5134-473J25P	RES, CBN 1/4P 47K	718	R347	5134-563J25P	RES, CBN 1/4P 56K
680	R205	5232-104J16P	RES, CBN 1/6P 100K	718	R348	5134-563J25P	RES, CBN 1/4P 56K
549	R207	5134-223J25P	RES, CBN 1/4P 22K	711	R349	5134-182J25P	RES, CBN 1/4P 1.8K
552	R209	5232-104J16P	RES, CBN 1/6P 100K	711	R350	5134-182J25P	RES, CBN 1/4P 1.8K
552	R210	5232-104J16P	RES, CBN 1/6P 100K	703	R351	5134-470J25P	RES, CBN 1/4P 47
553	R211	5232-334J16P	RES, CBN 1/6P 330K	703	R352	5134-470J25P	RES, CBN 1/4P 47
553	R212	5232-334J16P	RES, CBN 1/6P 330K	705	R353	5134-4R7J25P	RES, CBN 1/4P 4.7
550	R213	5232-100J16P	RES, CBN 1/6P 10	705	R354	5134-4R7J25P	RES, CBN 1/4P 4.7
552	R214	5232-104J16P	RES, CBN 1/6P 100K	705	R355	5134-4R7J25P	RES, CBN 1/4P 4.7
552	R215	5232-104J16P	RES, CBN 1/6P 100K	705	R356	5134-4R7J25P	RES, CBN 1/4P 4.7
552	R216	5232-104J16P	RES, CBN 1/6P 100K	704	R357	5134-2R2J25P	RES, CBN 1/4P 2.2
552	R217	5232-104J16P	RES, CBN 1/6P 100K	704	R358	5134-2R2J25P	RES, CBN 1/4P 2.2
550	R218	5232-100J16P	RES, CBN 1/6P 10	704	R359	5134-2R2J25P	RES, CBN 1/4P 2.2
671	R219	5134-471J25P	RES, CBN 1/4P 470	704	R360	5134-2R2J25P	RES, CBN 1/4P 2.2
554	△ R220	5102-4R75116	RES, FUSE 4.7	719	R601	5134-103J25P	RES, CBN 1/4P 10K
554	△ R221	5102-4R75116	RES, FUSE 4.7	719	R602	5134-103J25P	RES, CBN 1/4P 10K
628	R223	5232-824J16P	RES, CBN 1/6P 820K	719	R603	5134-103J25P	RES, CBN 1/4P 10K
602	R224	5134-222J25P	RES, CBN 1/4P 2.2K	719	R604	5134-103J25P	RES, CBN 1/4P 10K
602	R225	5134-222J25P	RES, CBN 1/4P 2.2K	719	R605	5134-103J25P	RES, CBN 1/4P 10K
602	R226	5134-222J25P	RES, CBN 1/4P 2.2K	719	R606	5134-103J25P	RES, CBN 1/4P 10K
672	R227	5134-222J25P	RES, CBN 1/4P 2.2K	719	R607	5134-103J25P	RES, CBN 1/4P 10K
672	R228	5134-222J25P	RES, CBN 1/4P 2.2K	719	R608	5134-103J25P	RES, CBN 1/4P 10K
672	R229	5134-222J25P	RES, CBN 1/4P 2.2K	716	R609	5134-123J25P	RES, CBN 1/4P 12K
675	R230	5134-4R7J25P	RES, CBN 1/4P 4.7	716	R610	5134-123J25P	RES, CBN 1/4P 12K
548	R250	5212-103J0701	R COMPOSITE 10K (x7)	723	R611	5232-105J16P	RES, CBN 1/6P 1M
547	R251	5212-103J0401	R COMPOSITE 10K (x4)	723	R612	5232-105J16P	RES, CBN 1/6P 1M
710	R301	5134-102J25P	RES, CBN 1/4P 1K	722	R615	5134-105J25P	RES, CBN 1/4P 1M
710	R302	5134-102J25P	RES, CBN 1/4P 1K	761	R701	5232-472J16P	RES, CBN 1/6P 4.7K
713	R303	5134-222J25P	RES, CBN 1/4P 2.2K	756	R702	5134-471J25P	RES, CBN 1/4P 470
713	R304	5134-222J25P	RES, CBN 1/4P 2.2K	757	R703	5134-4R7J25P	RES, CBN 1/4P 4.7
717	R305	5134-683J25P	RES, CBN 1/4P 68K	755	R704	5134-101J25P	RES, CBN 1/4P 100
717	R306	5134-683J25P	RES, CBN 1/4P 68K	822	R910	5232-473J16P	RES, CBN 1/6P 47K
720	R307	5134-104J25P	RES, CBN 1/4P 100K	821	R911	5134-470J25P	RES, CBN 1/4P 47
720	R308	5134-104J25P	RES, CBN 1/4P 100K	820	R912	5134-271J25P	RES, CBN 1/4P 270
721	R309	5134-184J25P	RES, CBN 1/4P 180K	823	R913	5232-392J16P	RES, CBN 1/6P 3.9K

Ser.No	Ref. No.	Part No.	Description
INTEGRATED CIRCUITS			
561	IC101	5653-CXA1081S	IC, LINEAR
562	IC102	5654-M51564P	IC, DIGITAL
531	IC103	5653-LA6520	IC, LINEAR
651	IC201	5654-M50423FP	IC, DIGITAL
652	IC202	5654-M5M4416P	IC, DIGITAL
532	IC203	5653-LA6515	IC, LINEAR
741	IC701	5654-MN6471M	IC, DIGITAL

Ser.No	Ref. No.	Part No.	Description
TRANSISTORS			
501	Q1	5614-2012	XISTOR, NPN A
502	Q2	5612-1375	XISTOR, PNP A
504	Q3	5611-999(F)	XISTOR, PNP R
503	Q4	5613-2320(F)	XISTOR, NPN R
504	Q5	5611-999(F)	XISTOR, PNP R
503	Q6	5613-2320(F)	XISTOR, NPN R
505	Q7	5616-SK246GR2	FET, N-CH
505	Q8	5616-SK246GR2	FET, N-CH
771	Q51	5611-999(F)	XISTOR, PNP R
773	Q54	5613-2320(F)	XISTOR, NPN R
772	Q55	5611-RN2202	XISTOR, PNP R
566	Q101	5612-647(C)	XISTOR, PNP A
567	Q103	5613-2320(F)	XISTOR, NPN R
567	Q104	5613-2320(F)	XISTOR, NPN R
656	Q201	5613-2320(F)	XISTOR, NPN R
681	Q301	5613-2320L(F)	XISTOR, NPN R
681	Q302	5613-2320L(F)	XISTOR, NPN R
682	Q303	5611-999L(F)	XISTOR, PNP R
682	Q304	5611-999L(F)	XISTOR, PNP R
681	Q305	5613-2320L(F)	XISTOR, NPN R
681	Q306	5613-2320L(F)	XISTOR, NPN R
682	Q307	5611-999L(F)	XISTOR, PNP R
682	Q308	5611-999L(F)	XISTOR, PNP R
682	Q309	5611-999L(F)	XISTOR, PNP R
682	Q310	5611-999L(F)	XISTOR, PNP R
681	Q311	5613-2320L(F)	XISTOR, NPN R
681	Q312	5613-2320L(F)	XISTOR, NPN R
682	Q313	5611-999L(F)	XISTOR, PNP R
682	Q314	5611-999L(F)	XISTOR, PNP R
681	Q315	5613-2320L(F)	XISTOR, NPN R
681	Q316	5613-2320L(F)	XISTOR, NPN R
685	Q317	5616-SK246GR2	FET, N-CH
685	Q318	5616-SK246GR2	FET, N-CH
684	Q319	5613-2878(B)	XISTOR, NPN R
684	Q320	5613-2878(B)	XISTOR, NPN R
684	Q321	5613-2878(B)	XISTOR, NPN R
684	Q322	5613-2878(B)	XISTOR, NPN R
685	Q601	5616-SK246GR2	FET, N-CH
685	Q602	5616-SK246GR2	FET, N-CH
683	Q603	5611-RN2202	XISTOR, PNP R
812	Q910	5611-RN2201	XISTOR, PNP R

Ser.No	Ref. No.	Part No.	Description
DIODES			
515	△ D1	5632-GP10E	DIODE, RECT
515	△ D2	5632-GP10E	DIODE, RECT
515	△ D3	5632-GP10E	DIODE, RECT
515	△ D4	5632-GP10E	DIODE, RECT
515	△ D5	5632-GP10E	DIODE, RECT
515	△ D6	5632-GP10E	DIODE, RECT
515	△ D7	5632-GP10E	DIODE, RECT
518	D8	5635-HZ27-2	DIODE, ZENER
517	D9	5635-HZ6C3L	DIODE, ZENER
517	D10	5635-HZ6C3L	DIODE, ZENER
515	△ D11	5632-GP10E	DIODE, RECT
515	△ D12	5632-GP10E	DIODE, RECT
516	D15	5635-HZ5B-2	DIODE, ZENER
782	D53	5631-1SS133	DIODE, DET
784	D54	5635-HZ6A1-L	DIODE, ZENER
785	D55	5635-HZ3B-2	DIODE, ZENER
782	D56	5631-1SS133	DIODE, DET
783	D57	5632-GP10E	DIODE, RECT
592	D103	5631-1SS133	DIODE, DET
543	D104	5635-HZ3B-2	DIODE, ZENER

Ser.No	Ref. No.	Part No.	Description
543	D105	5635-HZ3B-2	DIODE, ZENER
592	D106	5631-1SS133	DIODE, DET
700	D601	5631-1SS133	DIODE, DET
700	D602	5631-1SS133	DIODE, DET

Ser.No	Ref. No.	Part No.	Description
CONTROLS			
599	VR101	5101-22301934	RES, SEMI FIX 22K
600	VR102	5101-50201934	RES, SEMI FIX 5K

Ser.No	Ref. No.	Part No.	Description
MISCELLANEOUS			
831	CN110	4443-0801140	CONNECTOR
836	CN111	4443-0701140	CONNECTOR
835	CN112	4443-0501140	CONNECTOR
835	CN113	4443-0501140	CONNECTOR
833	CN114	4443-03901008	CONNECTOR
831	CN115	4443-0801140	CONNECTOR
835	CN116	4443-0501140	CONNECTOR
834	CN117	4443-0401140	CONNECTOR
837	CN118	4443-060185	CONNECTOR
838	CN120	4443-0301140	CONNECTOR
832	CN122	4443-0201140	CONNECTOR
871	GND1	4214-132	TERMINAL
840	△ J301	4489-02501002	PIN JACK, MLT
830	△ J901	4451-00184	JACK, 1P
830	△ J902	4451-00184	JACK, 1P
809	PH910	5624-ON3161	PHOTO COUPLR
727	W701	4132-R0102181	CORD, 2C
728	W702	4132-R0102221	CORD, 2C
751	X701	5691-S0901343	XTAL, OSC

PCB-2 FRONT P.C. BOARD

Ser.No	Ref. No.	Part No.	Description
CAPACITORS			
806	C401	5345-S06FM106	CAP, MINI ELE 10μ/50V
808	C402	5354-104593	CAP, MYL .1μ
806	C403	5345-S06FM106	CAP, MINI ELE 10μ/50V
807	C404	5345-S06BM107	CAP, MINI ELE 100μ/10V

Ser.No	Ref. No.	Part No.	Description
RESISTORS			
815	R401	5212-103J0401	R COMPOSITE 10K (x4)
816	R402	5134-102J25P	RES, CBN 1/4P 1K
817	R403	5134-101J25P	RES, CBN 1/4P 100

Ser.No	Ref. No.	Part No.	Description
INTEGRATED CIRCUITS			
801	IC401	5654-M957-243	IC, DIGITAL

Ser.No	Ref. No.	Part No.	Description
DIODES			
814	D401	5631-1S2473	DIODE, DET
814	D402	5631-1S2473	DIODE, DET
814	D403	5631-1S2473	DIODE, DET
814	D404	5631-1S2473	DIODE, DET
814	D405	5631-1S2473	DIODE, DET
814	D406	5631-1S2473	DIODE, DET
814	D407	5631-1S2473	DIODE, DET
814	D408	5631-1S2473	DIODE, DET
814	D409	5631-1S2473	DIODE, DET
814	D410	5631-1S2473	DIODE, DET
814	D411	5631-1S2473	DIODE, DET
814	D412	5631-1S2473	DIODE, DET
813	D413	5631-1SS133	DIODE, DET
814	D414	5631-1S2473	DIODE, DET

Ser.No	Ref. No.	Part No.	Description
MISCELLANEOUS			
802	FL401	5722-046	TUBE DISPLAY
825	LCN110	4163-S0108161	CONNECTOR W/W
826	LCN111	4163-S0107161	CONNECTOR W/W
827	LCN112	4163-S0105161	CONNECTOR W/W
828	LCN116	4163-S0105301	CONNECTOR W/W
810	LCN120	4163-S0103321	CONNECTOR W/W
829	LCN122	4163-S0102301	CONNECTOR W/W
803	RC401	6143-00802	RECEIV BLOCK
811	SW401	4437-00610	SWITCH, PU-TC
811	SW402	4437-00610	SWITCH, PU-TC

Ser.No	Ref. No.	Part No.	Description
811	SW403	4437-00610	SWITCH, PU-TC
811	SW404	4437-00610	SWITCH, PU-TC
811	SW405	4437-00610	SWITCH, PU-TC
811	SW406	4437-00610	SWITCH, PU-TC
811	SW407	4437-00610	SWITCH, PU-TC
811	SW408	4437-00610	SWITCH, PU-TC
811	SW409	4437-00610	SWITCH, PU-TC
811	SW410	4437-00610	SWITCH, PU-TC
811	SW411	4437-00610	SWITCH, PU-TC
811	SW412	4437-00610	SWITCH, PU-TC
811	SW413	4437-00610	SWITCH, PU-TC
811	SW414	4437-00610	SWITCH, PU-TC

PCB-3 POWER SWITCH P.C. BOARD

CAPACITORS

865 Δ C1	5352-S010M103	CAP, MTL .01 μ BK
865B Δ C1	5352-1030961	CAP, MTL .01 μ I IB BB
865B Δ C1	5352-1030961	CAP, MTL .01 μ WB

RESISTORS

027B Δ R1	5135-335J50P	RES, CBN 1/2P 3.3M I
027C Δ R1	5134-335J25P	RES, CBN 1/4P 3.3M IB BB
027B Δ R1	5135-335522	RES, CBN 1/2P 3.3M WB

TRANSFORMERS

861 Δ T1	5584-S8801	XFORMER, POWER BK
861B Δ T1	5584-S8802	XFORMER, POWER I IB BB WB

MISCELLANEOUS

864 Δ SW1	4433-01301	SWITCH, PU-PW BK
026B Δ SW2	4411-1047111	SWITCH, ROTRY I IB BB WB
872 Δ TM1	4214-122	TERMINAL
872 Δ TM2	4214-122	TERMINAL
867	4242-R0406201	JUMPER LEAD

CHASSIS MISCELLANEOUS

MISCELLANEOUS

887 Δ P1	4161-03601202	CORD W/PLUG BK
887B Δ P1	4161-03701220	CORD W/PLUG I IB BB
887B Δ P1	4161-7256	CORD W/PLUG WB
880	4191-0355	BATTERY, DRY
883	4163-03211008	CONNECTOR W/W
884	4163-03210008	CONNECTOR W/W
885	4163-03212005	CONNECTOR W/W
886	4163-03207004	CONNECTOR W/W
888	4161-71184	CORD W/PLUG, RCA TYPE (ACCESSORY)
882	4162-00201800	LUG W/WIRE

ABBREVIATIONS IN PARTS LIST

CAPACITORS

CAP, MINI ELE	: Electrolytic
CAP, CER	: Ceramic
CAP, PPP	: Polypropylene
CAP, MYL	: Mylar
CAP, MCA	: Mica
CAP, MINI BP	: Bipolar
CAP, ELE BP	: Electrolytic Bipolar
470 μ	: 470 μ F
6800p	: 6800pF
.047 μ	: 0.047 μ F

RESISTORS

RES, CBN 1/6P	: Carbon 1/6W
RES, FUSE	: Fuse
RES, CEM 5P	: Cement 5W
RES, MTL 1P	: Metal 1W
2.2K	: 2.2K Ω
220	: 220 Ω

TRANSISTORS

XISTOR	: Transistor
FET	: Field Effect Transistor

CONTROLS

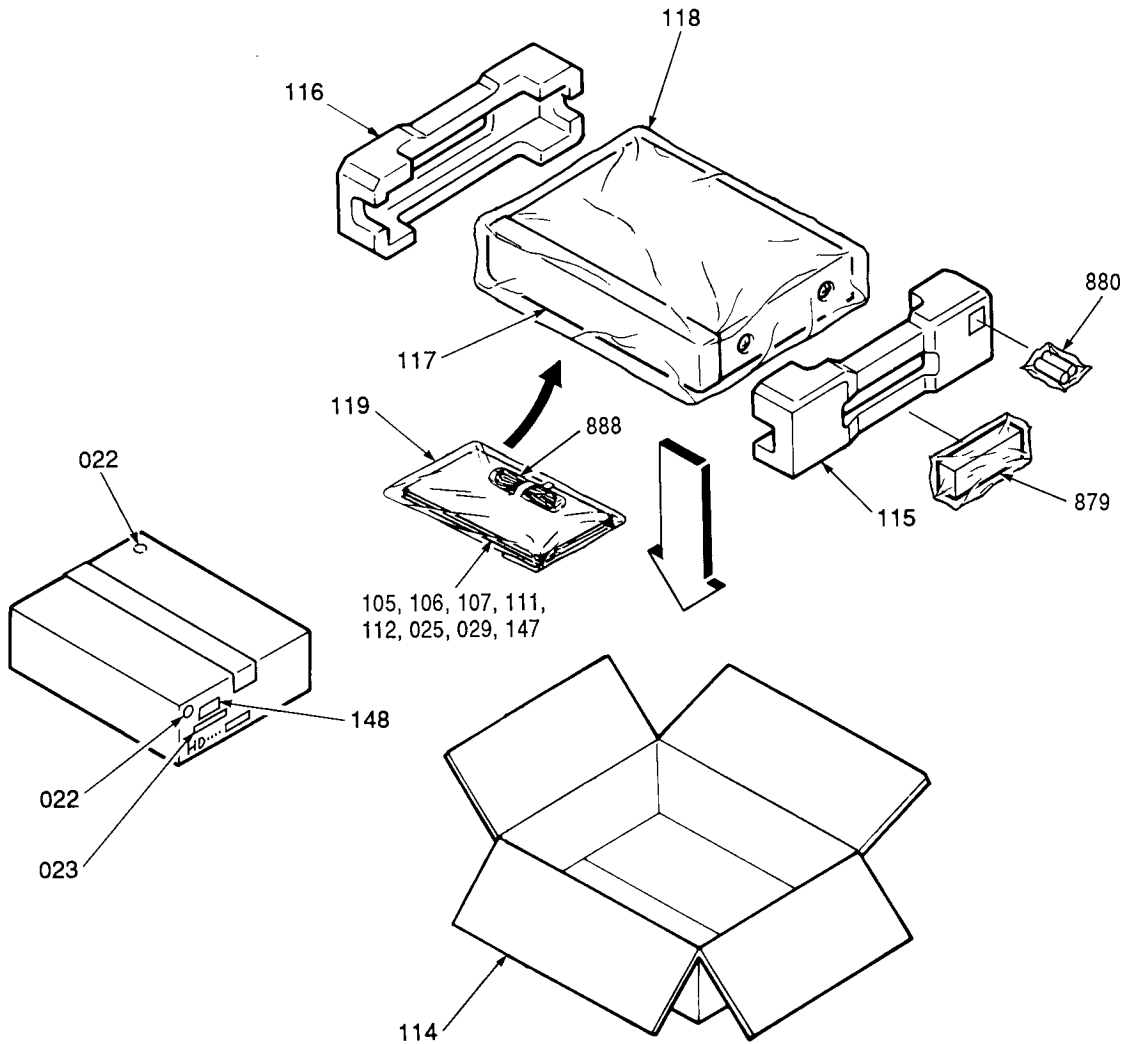
RES, SEMI FIX	: Semi-fixed Resistor
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NOTE



SAFETY RELATED COMPONENT. USE ONLY EXACT REPLACEMENT PART AS SPECIFIED.

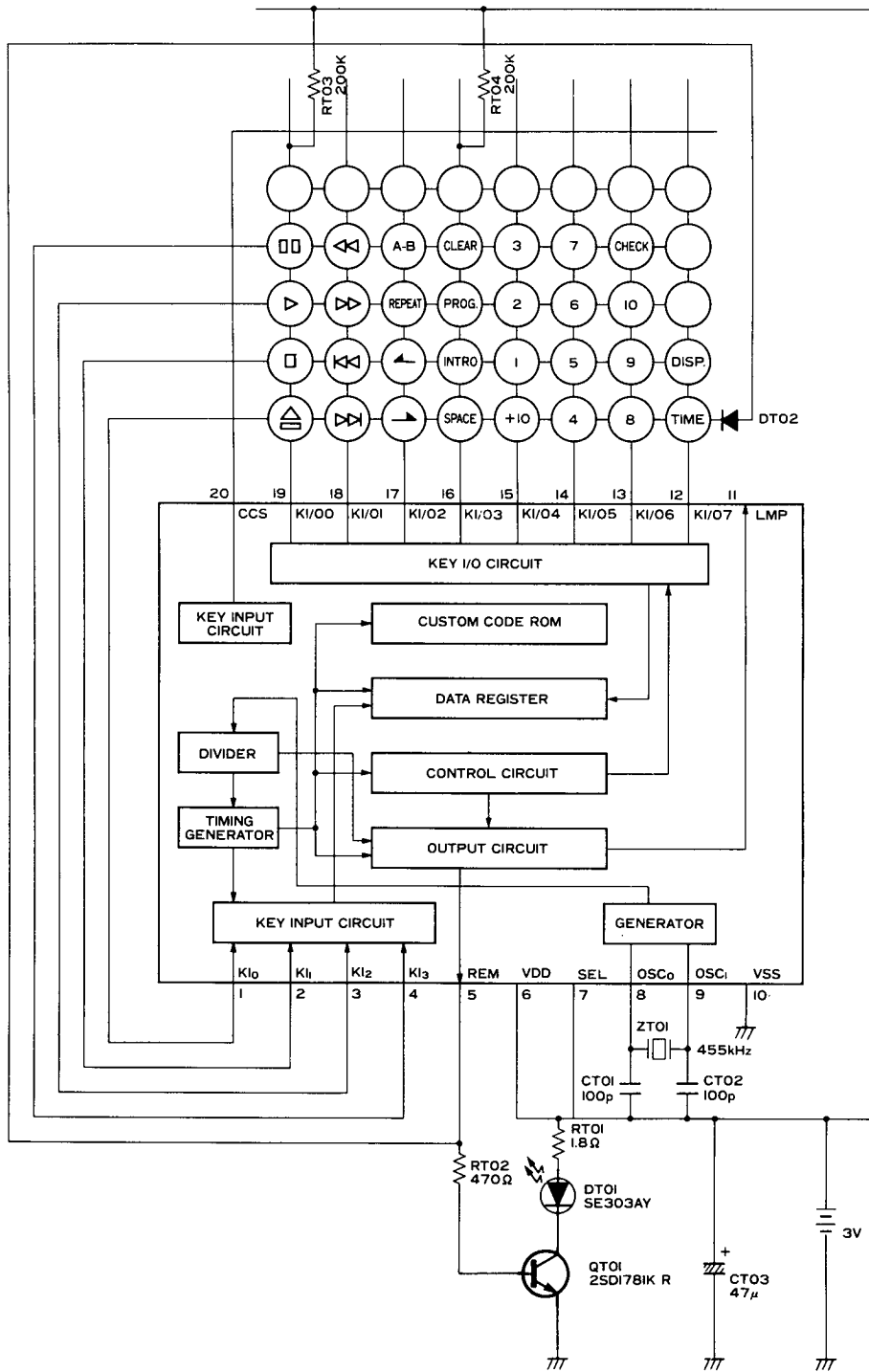
PACKAGE



PARTS LIST (PACKAGE)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
022	1756-03108	LABEL I (x2) I IB BB	112	1119-03402	ATTACH SHEET BK
022	1756-03101	LABEL W (x2) WB	114	1221-28110	CARTON BOX I
023	1756-06303	LABEL VOLTAGE I IB BB WB	114	1221-28111	CARTON BOX BK IB BB
025	1111-M30253	OWNER GUIDE I IB	114	1221-28119	CARTON BOX WB
025	1111-M30319	OWNER GUIDE BB	115	1222-7366	CUSHION, R
025	1111-J30253	OWNER GUIDE WB	116	1222-7367	CUSHION, L
029	1756-08501	LABEL, 240V BB	117	1223-11729	SOFT SHEET, FRONT PANEL
029	1111-J30320	OWNER GUIDE, ADDENDUM SHEET WB	118	1241-C1491	POLYETHY BAG
105	1111-M30331	OWNER GUIDE BK	119	1241-R0123350	POLYETHY BAG
105	1111-M30332	OWNER GUIDE I IB	148	1756-11701	LABEL, DHHS CARD BK
105	1111-J30331	OWNER GUIDE WB	879	6142-05505	REMOTE CONTROL UNIT
106	1119-01202	ATTACH SHEET BK	880	4191-0355	BATTERY, DRY
107	1113-717004	OWNER CARD BK	888	4191-71184	CORD W/PLUG (ACCESSORY)
111	1119-03102	ATTACH SHEET BK			

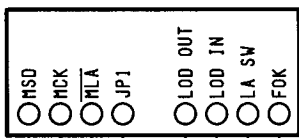
INFRARED REMOTE CONTROL SCHEMATIC DIAGRAM



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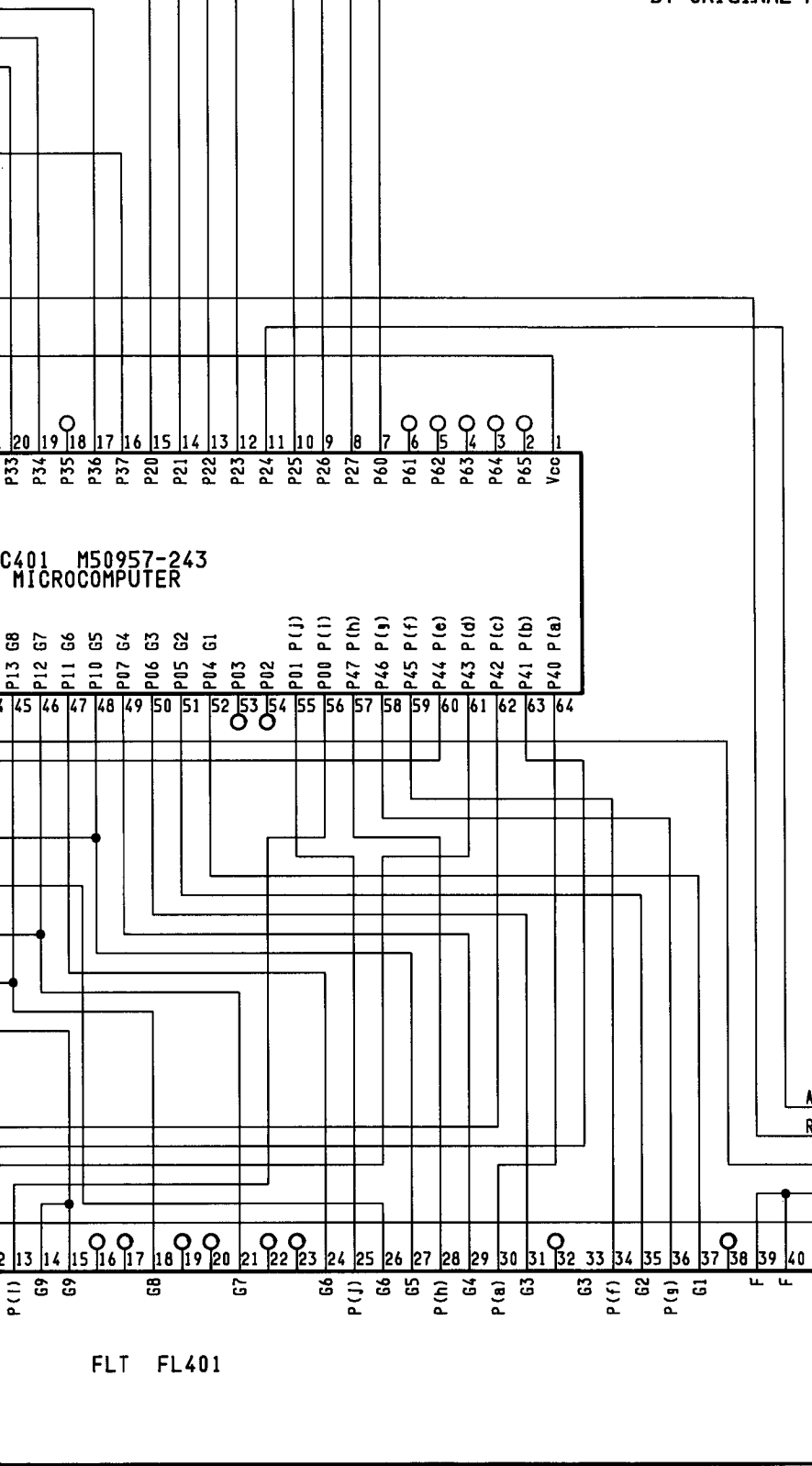


LCN110

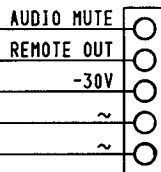


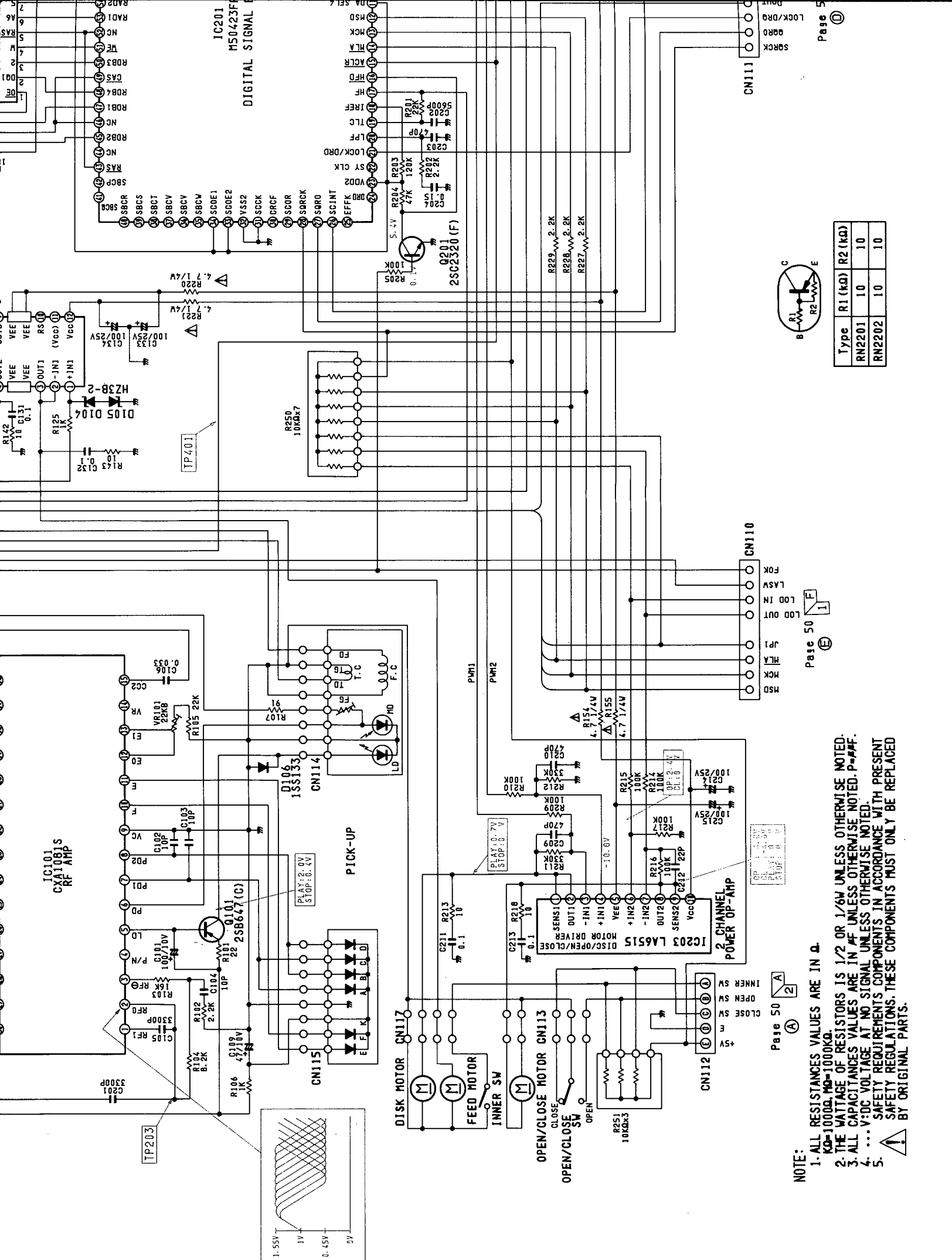
NOTE:

1. ALL RESISTANCES VALUES ARE IN Ω .
 $K\Omega=1000\Omega$, $M\Omega=1000K\Omega$.
2. THE WATTAGE OF RESISTORS IS 1/4W OR 1/2W UNLESS OTHERWISE NOTED.
3. ALL CAPACITANCES VALUES ARE IN μF UNLESS OTHERWISE NOTED. P= μF .
4. ... V:DC VOLTAGE AT NO SIGNAL UNLESS OTHERWISE NOTED.
5. SAFETY REQUIREMENTS COMPONENTS IN ACCORDANCE WITH PRESENT SAFETY REGULATIONS. THESE COMPONENTS MUST ONLY BE REPLACED BY ORIGINAL PARTS.



LCN116





Type	R1 (kΩ)	R2 (kΩ)
RN2201	10	10
RN2202	10	10

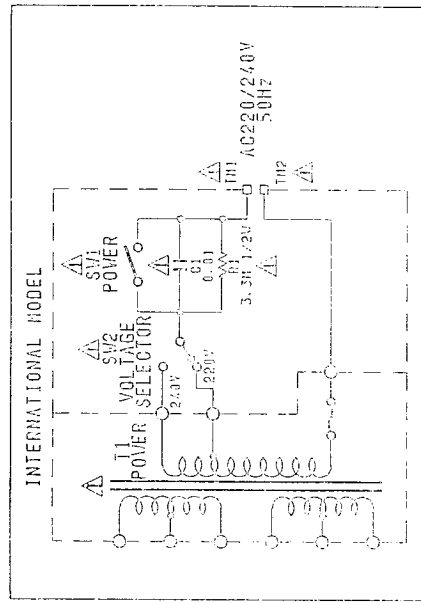
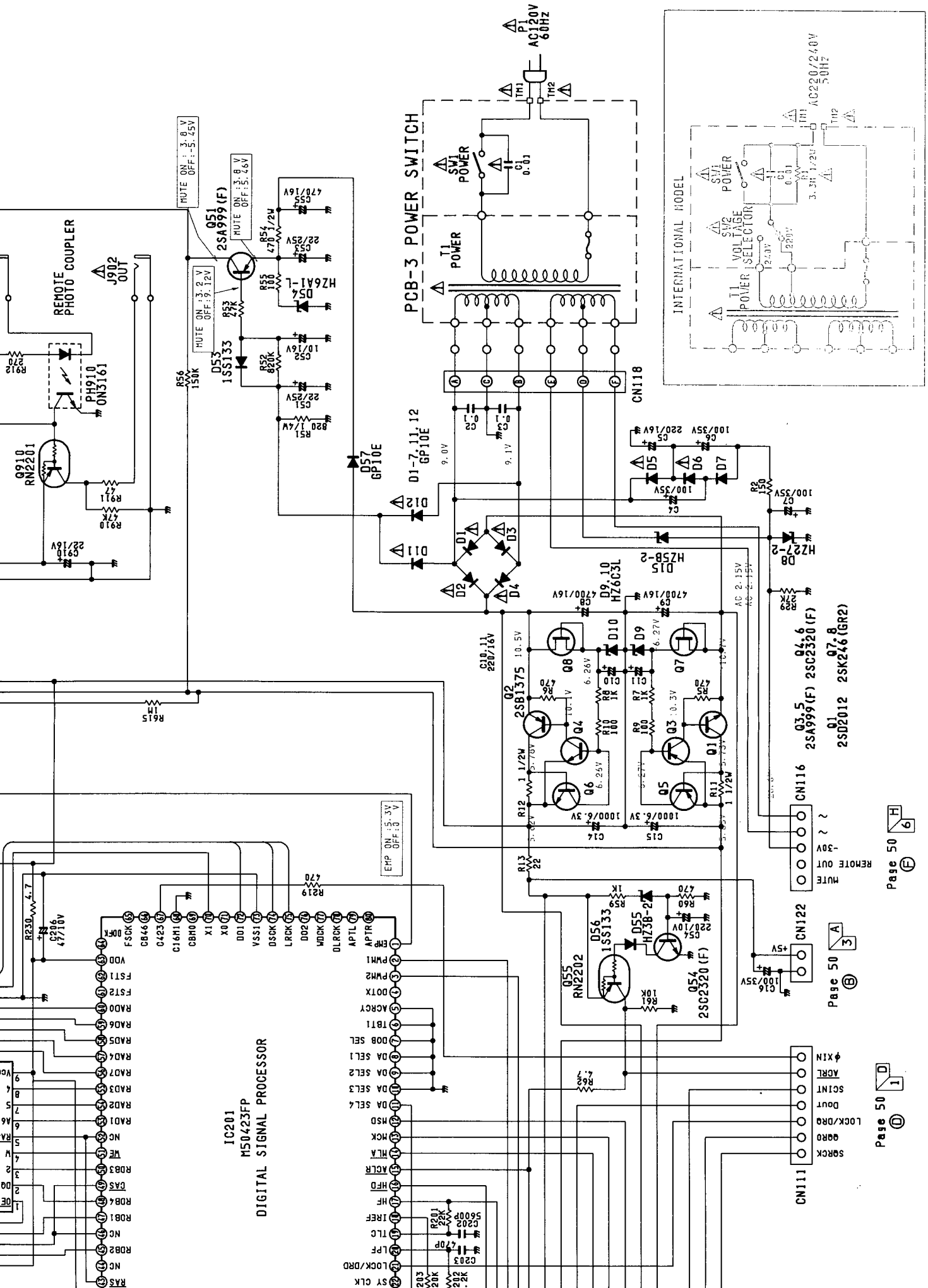


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NOTE:
 1. ALL RESISTANCE VALUES ARE IN Ω.
 2. THE WATTAGE OF RESISTORS IS 1/2 OR 1/8W UNLESS OTHERWISE NOTED. P=1000Ω, M=10000Ω.
 3. ALL CAPACITANCE VALUES ARE IN pF UNLESS OTHERWISE NOTED. P=100pF.
 4. ... V:DC VOLTAGE AT NO SIGNAL UNLESS OTHERWISE NOTED.
 5. SAFETY REQUIREMENTS COMPONENTS IN ACCORDANCE WITH PRESENT SAFETY REGULATIONS. THESE COMPONENTS MUST ONLY BE REPLACED BY ORIGINAL PARTS.





IC201
H50423FP
DIGITAL SIGNAL PROCESSOR

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Q3 5 2SA999(F) 2SC2320 (F)
Q7 8 2SK246 (Gr2)

D5 100/35V 220/16V
D6 100/35V
D7 100/35V

Q1 2SD2012 2SK246 (Gr2)

Q2 2SB1375 10.5V
Q4 6.26V
Q5 6.27V
Q6 6.26V
Q8 6.27V

Q9 1.0V
Q10 1.0V

Q11 1.0V
Q12 1.0V

Q13 1.0V
Q14 1.0V

Q15 1.0V
Q16 1.0V

Q17 1.0V
Q18 1.0V

Q19 1.0V
Q20 1.0V

Q21 1.0V
Q22 1.0V

Q23 1.0V
Q24 1.0V

Q25 1.0V
Q26 1.0V

Q27 1.0V
Q28 1.0V

Q29 1.0V
Q30 1.0V

Q31 1.0V
Q32 1.0V

Q33 1.0V
Q34 1.0V

Q35 1.0V
Q36 1.0V

Q37 1.0V
Q38 1.0V

Q39 1.0V
Q40 1.0V

Q41 1.0V
Q42 1.0V

Q43 1.0V
Q44 1.0V

Q45 1.0V
Q46 1.0V

Q47 1.0V
Q48 1.0V

Q49 1.0V
Q50 1.0V

Q51 1.0V
Q52 1.0V

Q53 1.0V
Q54 1.0V

Q55 1.0V
Q56 1.0V

Q57 1.0V
Q58 1.0V

Q59 1.0V
Q60 1.0V

Q61 1.0V
Q62 1.0V

Q63 1.0V
Q64 1.0V

Q65 1.0V
Q66 1.0V

Q67 1.0V
Q68 1.0V

Q69 1.0V
Q70 1.0V

Q71 1.0V
Q72 1.0V

Q73 1.0V
Q74 1.0V

Q75 1.0V
Q76 1.0V

Q77 1.0V
Q78 1.0V

Q79 1.0V
Q80 1.0V

Q81 1.0V
Q82 1.0V

Q83 1.0V
Q84 1.0V

Q85 1.0V
Q86 1.0V

Q87 1.0V
Q88 1.0V

Q89 1.0V
Q90 1.0V

Q91 1.0V
Q92 1.0V

Q93 1.0V
Q94 1.0V

Q95 1.0V
Q96 1.0V

Q97 1.0V
Q98 1.0V

Q99 1.0V
Q100 1.0V