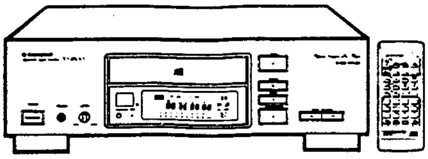
PIONEER
The future of sound and vision.

Service Manual



ORDER NO.
ARP2062

COMPACT DISC PLAYER

PD-8500

PD-8500 HAS FOLLOWING VERSIONS :

Type	Power requirement	Export destination
KU/CA	AC120V only	U.S.A and Canada
HEM	AC220V, 240V (switchable) *	European continent
HB	AC220V, 240V (switchable) *	United kingdom
HPW	AC220V, 240V (switchable) *	Australia
SD	AC110V, 120V-127V, 220V, 240V (switchable)	Kingdom of Saudi Arabia and General market

* Change the primary wiring of the transformer board assembly.

- **This manual is applicable to the KU/CA, HEM, HB, HPW and SD types.**
- **As to the HEM, HB, HPW and SD types, refer to pages 66.**
- **As to the circuit descriptions, refer to the PD-8500 service guide (ARP2090)**
- **Ce manuel pour le service comprend les explications de réglage en français.**
- **Este manual de servicio trata del método ajuste escrito en español.**

CONTENTS

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IFI JUNE. 1990 Printed in Japan

This service manual is intended for qualified service technicians; it is not meant for the casual do-it-yourselfer. Qualified technicians have the necessary test equipment and tools, and have been trained to properly and safely repair complex products such as those covered by this manual. Improperly performed repairs can adversely affect the safety and reliability of the product and may void the warranty. If you are not qualified to perform the repair of this product properly and safely, you should not risk trying to do so and refer the repair to a qualified service technician.

WARNING
Lead in solder used in this product is listed by the California Health and Welfare agency as a known reproductive toxicant which may cause birth defects or other reproductive harm (California Health & Safety Code, Section 25249.5).
When servicing or handling circuit boards and other components which contain lead in in solder, avoid unprotected skin contact with the solder. Also, when soldering do not inhale any smoke or fumes produced.

1. SAFETY INFORMATION

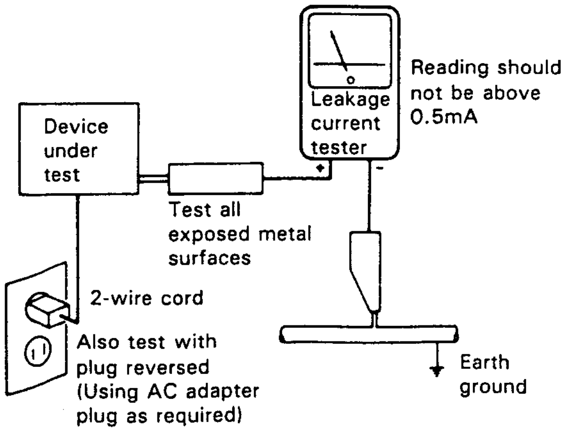
(FOR USA MODEL ONLY)

1. SAFETY PRECAUTIONS

The following check should be performed for the continued protection of the customer and service technician.

LEAKAGE CURRENT CHECK

Measure leakage current to a known earth ground (water pipe, conduit, etc.) by connecting a leakage current tester such as Simpson Model 229-2 or equivalent between the earth ground and all exposed metal parts of the appliance (input/output terminals, screwheads, metal overlays, control shaft, etc.). Plug the AC line cord of the appliance directly into a 120V AC 60Hz outlet and turn the AC power switch on. Any current measured must not exceed 0.5mA.



AC Leakage Test

ANY MEASUREMENTS NOT WITHIN THE LIMITS OUTLINED ABOVE ARE INDICATIVE OF A POTENTIAL SHOCK HAZARD AND MUST BE CORRECTED BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

2. PRODUCT SAFETY NOTICE

Many electrical and mechanical parts in the appliance have special safety related characteristics. These are often not evident from visual inspection nor the protection afforded by them necessarily can be obtained by using replacement components rated for voltage, wattage, etc. Replacement parts which have these special safety characteristics are identified in this Service Manual.

Electrical components having such features are identified by marking with a ⚠ on the schematics and on the parts list in this Service Manual.
The use of a substitute replacement component which dose not have the same safety characteristics as the PIONEER recommended replacement one, shown in the parts list in this Service Manual, may create shock, fire, or other hazards.

Product Safety is continuously under review and new instructions are issued from time to time. For the latest information, always consult the current PIONEER Service Manual. A subscription to, or additional copies of, PIONEER Service Manual may be obtained at a nominal charge from PIONEER.

(FOR EUROPEAN MODEL ONLY)

VARO!
AVATTAESSA JA SUOJALUKITUS OHITETTAESSA OLET ALTTIINA NÄKYMÄTTÖMÄLLE LASERSÄTEILYLLE. ÄLÄ KATSO SÄTEESEEN.

LASER
Kuva 1
Lasersateilyn varoitusmerkki

ADVERSEL:
USYNLIG LASERSTRÅLING VED ÅBNING NÅR SIKKERHEDSAFBRYDERE ER UDE AF FUNKTION UNDGÅ UDSAETTELSE FOR STRÅLING.

VARNING!
OSYNLIG LASERSTRÅLNING NÄR DENNA DEL ÄR ÖPPNAD OCH SPÄRREN ÄR URKOPPLAD. BETRAKTA EJ STRÅLEN.

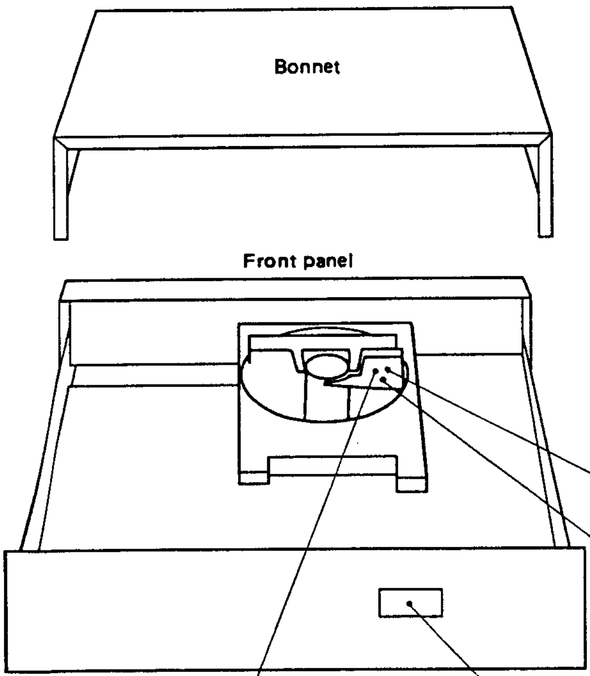
WARNING!
DEVICE INCLUDES LASER DIODE WHICH EMITS INVISIBLE INFRARED RADIATION WHICH IS DANGEROUS TO EYES. THERE IS A WARNING SIGN ACCORDING TO PICTURE 1 INSIDE THE DEVICE CLOSE TO THE LASER DIODE.

LASER
Picture 1
Warning sign for laser radiation

IMPORTANT
THIS PIONEER APPARATUS CONTAINS LASER OF HIGHER CLASS THAN 1. SERVICING OPERATION OF THE APPARATUS SHOULD BE DONE BY A SPECIALLY INSTRUCTED PERSON.

LASER DIODE CHARACTERISTICS
MAXIMUM OUTPUT POWER: 5 mw
WAVELENGTH: 780-785 nm

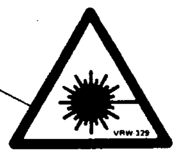
LABEL CHECK (SINGLE type)



Additional Laser Caution

1. Laser Interlock Mechanism
   The position of the switch (S102) for detecting loading completion is detected by the system microprocessor, and the design prevents laser diode oscillation when the switch (S102) is not in $\overline{CLMP}$ terminal side (when the mechanism is not clamped and $\overline{CLMP}$ signal is high level).
   Thus, the interlock will no longer funmction if the switch (S102) is deliberately set to $\overline{CLMP}$ terminal side (if $\overline{CLMP}$ signal is low level).
   In the test mode*, the interlock mechanism will not function.
   Laser diode oscillation will continue if pins 10 of TA8137N (IC101) are connected pin 11 to ground or pin 12 is connected to high level (ON) or the terminals of Q101 are shorted to each other (fault condition).
2. When the cover is opened, close viewing of the objective lens with the naked eye will cause exposure to a class 1 or higher laser beam.

* Refer to page 30.



HEM and HB types

CAUTION
INVISIBLE LASER RADIATION WHEN OPEN, AVOID EXPOSURE TO BEAM
PRW1018

HB type

CLASS 1
LASER PRODUCT
VRW-328

HEM and HB types

ADVARSEL
USYNLIG LASERSTRÅLING VED ÅBNING NÅR SIKKERHED SAF-BRYDERE ER UDE AF FUNKTION.
UNDGÅ UDSÆTTELSE FOR STRÅLING.
VORSICHT!
UNSICHTBARE LASER-STRAHLUNG TRITT AUS, WENN DECKEL (ODER KLAPPE) GEÖFFNET IST! NICHT DEM STRAHL AUSSETZEN!
VRW1094

HEM type

2. EXPLODED VIEWS AND PARTS LIST

NOTES :
- Parts without part number cannot be supplied.
- The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
- Parts marked by "◉" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.

2.1 EXTERIOR

Parts List

Mark	No.	Part No.	Description
⚠	1	CM-22C	Strain relief
⚠	2	PDG1002	AC power cord
⚠	3	PTT1109	Power transformer (AC120V)
	4	ABE1009	Washer
	5	PBA1027	Floating screw
	6	PNM1008	Cushion
	7	PNM1095	Stopper
	8	PNM1099	Tape
	9	PNW1761	Slide guide
	10	RNH-184	Cord holder
	11	PBH1013	Spring
	12	PBP-001	Steel ball $\phi 4$
	13	PEB1032	Stopper rubber
	14	PNW1084	Clamp holder
	15	PNW1085	Clamp retainer
	16	PEB1031	Floating rubber
	17	PNM1010	Disc cushion
	18	PAA1007	Gold button
	19	PAC1498	Power knob
	20	PAD1056	Play button assembly
	21	PNW1258	Play lens
	22	PAM1323	Display screen
	23	PAM1444	Display window
	24	PBK1079	Earth plate
	25	PNW1762	Tray name plate
	26	RAC1414	Knob B
	27	BBT30P080FCU	Screw
	28	BBZ30P060FCC	Screw
	29	BBZ30P080FCC	Screw
	30	BBZ30P140FCC	Screw
	31	BBZ40P080FZK	Screw
	32	BPZ30P250FMC	Screw
	33	FBT40P080FZK	Screw
	34	IBZ30P060FCC	Screw
	35	IBZ30P080FCC	Screw
	36	IBZ30P100FCC	Screw
	37	IBZ30P150FCU	Screw
	38	PMZ30P060FCU	Screw
	39	PPZ30P150FMC	Screw
	40	WA32F070M080	Washer
	41	PEA1087	Front panel assembly
	42	PYY1071	Bonnet
◉	43	PWZ1751	Main board assembly
◉	44	PWZ1936	Audio board assembly
◉	45	PWX1133	Sub board assembly
	46	PNM1107	Stopper

Mark	No.	Part No.	Description
	101		Lead wire unit
	102		Shield cover
	103		Spacer
	104		Under base
	105		Rear base
	106		Side angle
	107		Mechanism plate
	108		Mechanism base
	109		Base
	110		Clamp
	111		PCB spacer
	112		P plate holder
	113		Loading base assembly
	114		Tray assembly
	115		Servo mechanism assembly
	116		Name plate
	117		Front panel
	118		Function panel
	119		Headphone board assembly
	120		Transformer board assembly
	121		Primary board assembly
	122		Cushion
	123		Cushion

PIONEER
The future of sound and vision.

Service Manual

SERVICE GUIDE
ORDER NO.
ARP2090

COMPACT DISC PLAYER

PD-8500

- Refer to the service manual ARP2062, PD-8500/KU/CA, HEM, HB, HPW and SD types.

- This manual is applicable to the PD-8500/KU/CA, HEM, HB, HPW and SD types.

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IFI JULY.1990 Printed in Japan

1. CIRCUIT DESCRIPTION

1.1 Preamplifier

In the preamplifier block, analog processing of pickup signals is executed to make signals so send to a servo block and a decoder block.
The main part of this circuit is IC101 : TA8137N. Each part is explained below.
Fig. 1-1 shows a block diagram of the internal configuration of the TA8137N.

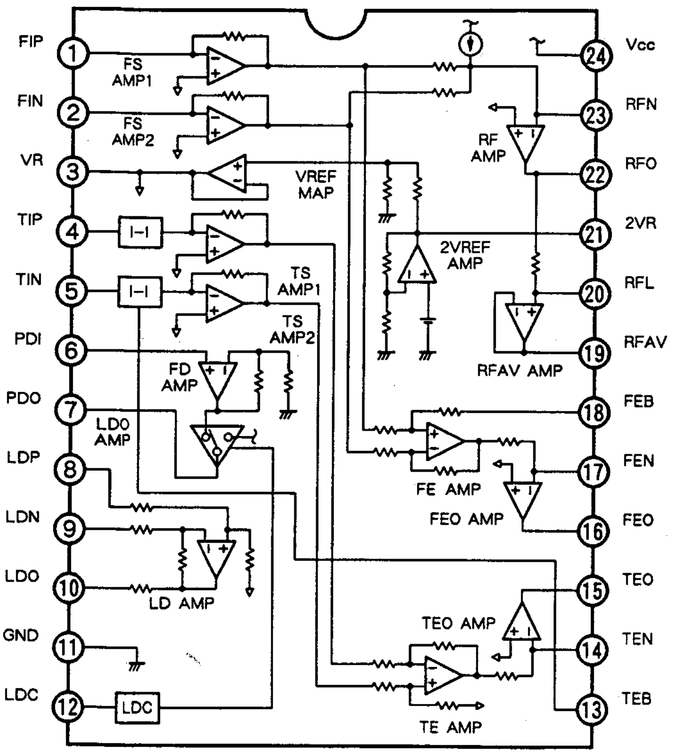


Fig. 1-1 Block diagram of TA8137N

1. Accurate focus system

To reduce distortion of an RF signal which is read with a pickup, the output signals of the preceding two photodiodes among fourdivision photodiodes are delayed and added. Then frequency response, distortion, signal-to-noise ratio, etc. are improved, and high-accuracy signal reading is obtained. (See Fig. 1-2)

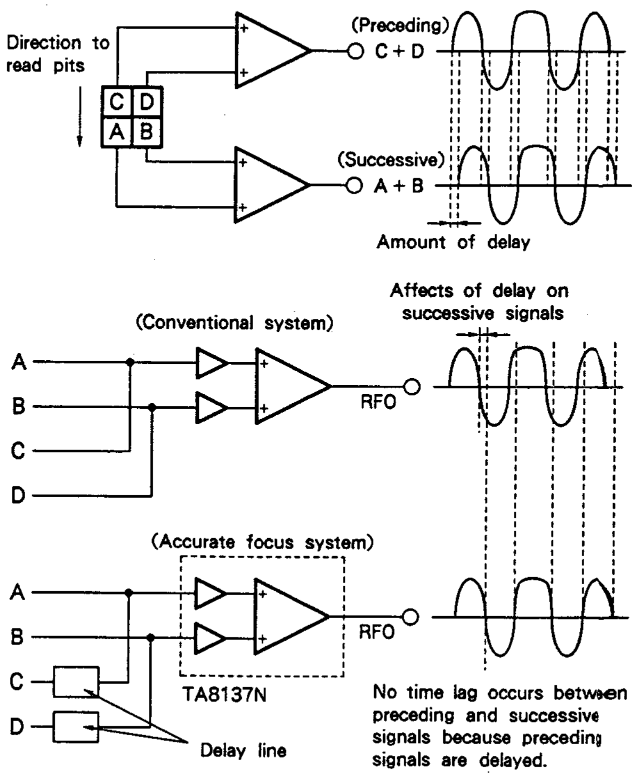


Fig. 1-2

2. RF amplifier

The digital servo LSI used in the PD-8500 is driven with a single 5 V power source. As a pickup, a new OEIC is used and is driven with a single 5 V power source, because of RF amplifier is driven with a single 5V power source. So the output voltage from the pickup is supplied based on the reference voltage of 2 V of the LSI system.
In a conventional system, the output voltage of a photodiode is that dozens to several hundred mV are added to GND, while that of this system is that dozens to several hundred mV are added to the 2 V.

The OEIC output voltages supplied to the input terminals (FIP, FIN) are amplified in RF I-V amplifiers (1) and (2), and are added in an RF summing amplifier. The added and amplified OEIC output voltage (A + B + C + D) is output from the RFO terminal. The eye pattern is checked at this terminal.
The current source "i" which is input to the RF summing amplifier and an externally attached R18 lower the central voltage of the RF at the RFO terminal below the reference voltage (VR).
Adjust the RFO level using VR1 for the LD power adjustment so that the level is usually 1.5Vp-p.

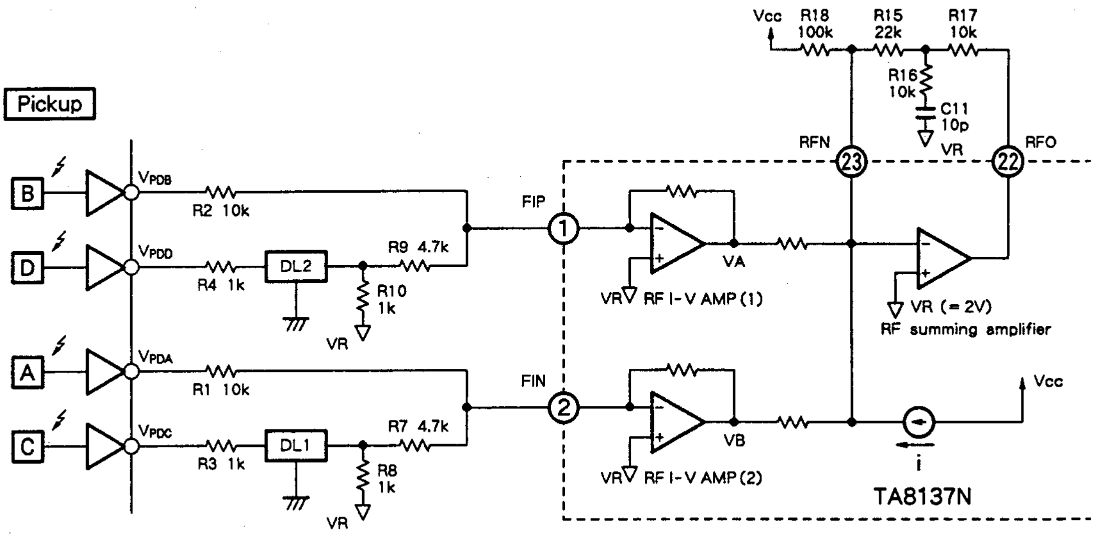


Fig. 1-3

3. RF AV amplifier

The LPF output of an RF signal is an RFAV signal, which is input to servo IC TC9220F-002. The RFAV signal is converted to a digital signal in the servo IC, then changed to the following signals :
① Focus OK signal
② Signal which decides the on-track status during search
RFAV is an abbreviation for average RF signal.

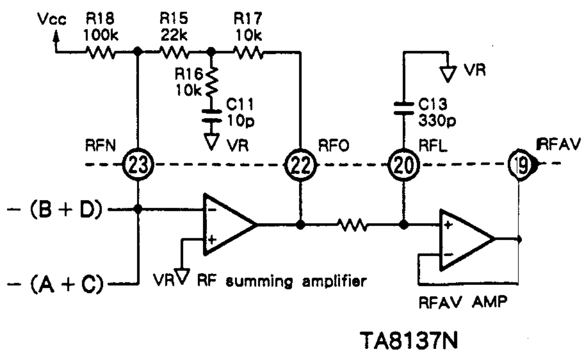


Fig. 1-4

4. Focus error amplifier

The difference between the output of the RF I-V amplifier (1) V_A and that of the RF I-V amplifier (2) V_B is obtained, and the OEIC output signal (B + D) - (A + C) is supplied at the center of the reference voltage. (See Fig. 1-5.)
The offset and gain are automatically adjusted (for details, see "Servo IC") so a semi-fixed resistor for adjustment which is essential in a conventional system is not provided.
An externally attached C15, which functions as an equalizer in a conventional system, functions as an LPF for an input signal of an A/D converter because an FE signal is input to the A/D converter after input to the servo IC.
This signal is also used to decide whether focus-in is OK or not when the focus gain is automatically adjusted. The S-character level at the FEO terminal is usually set to 1.5 to 2.0 Vp-p.

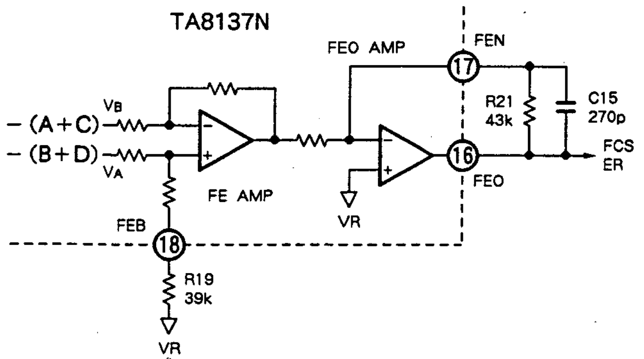


Fig. 1-5

5. Tracking error amplifier

The OEIC output voltages of a side spot which are input to the TIP and TIN terminals are converted to the current at input resistors R5 and R6, and the polarity is reversed in I-I conversion blocks. (See Fig. 1-6.)
The control voltage is input to the I-I conversion blocks from the servo IC through TEB (pin 13) with which the tracking error balance is automatically adjusted in the same way as the focus gain adjustments.
The control signal for balance adjustment is adjusted to the optimum level with R28 and R29.
After the I-I conversion, the signal is amplified in the TS, TE and TEO amplifiers, and is output from the TEO terminal at the center of the reference voltage.
The TRK ER level with the tracking servo set to OPEN is usually set to 1.5 to 2.0 Vp-p.
As the offset and gain are automatically adjusted (including the tracking error balance adjustment) in the same way as focus adjustment, the TROF, TRGA and TRBL semifixed resistors are not provided.

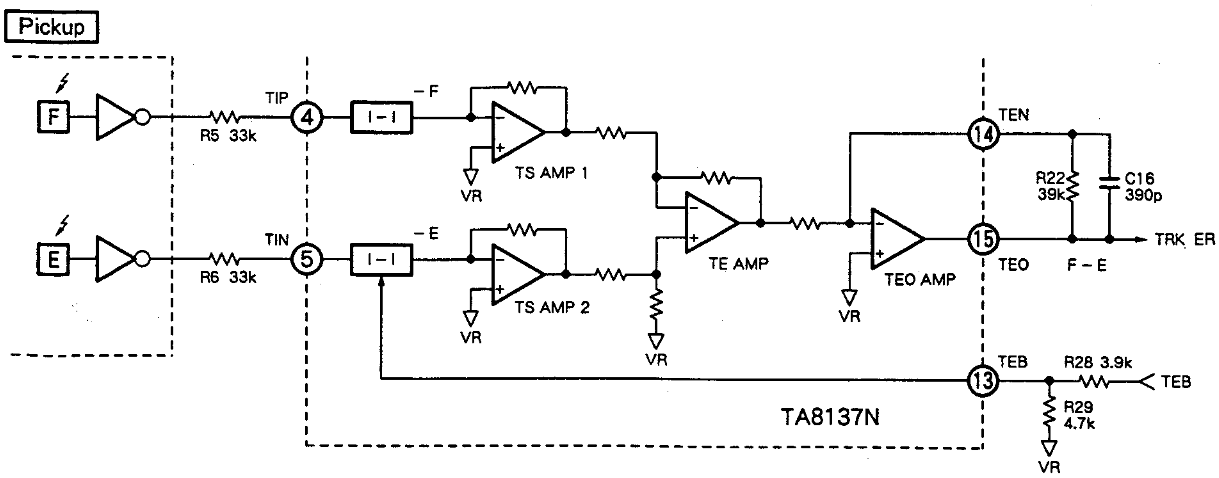


Fig. 1-6

6. APC (Automatic Power Control) circuit

As photo-output has great negative temperature characteristics when a laser diode is driven with a constant current, the current should be controlled so that constant output is obtained at the monitor photo diode. This is the purpose of an APC circuit.

The APC circuit of the RF amplifier IC used in PD-8500 is different from the conventional CXA1081S. So when a pickup assembly which is adjusted with CXA1081S is connected (for example when the servo mechanism is changed, etc.), the LD power may exceed the rated value (130 mW). In this case, the RFp-p level should be readjusted with VR1 for the LD power adjustment.

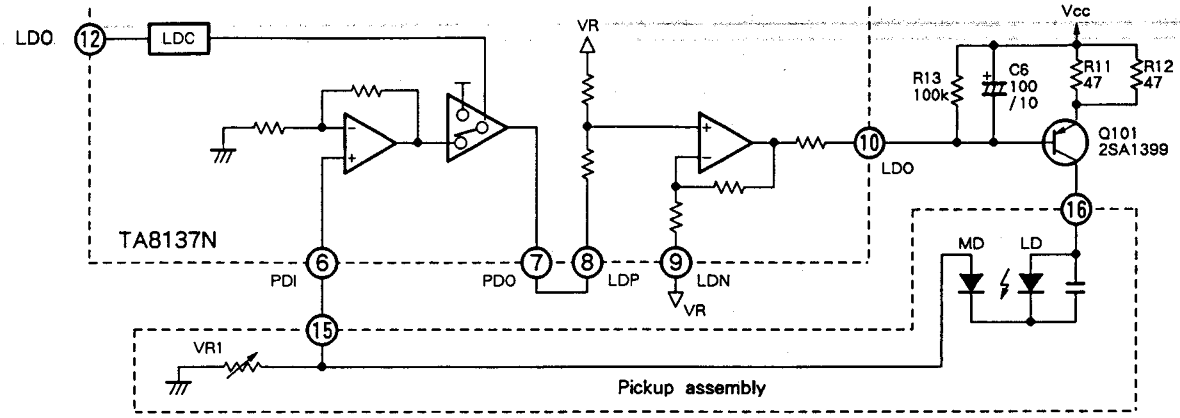


Fig. 1-7

7. Peripheral circuit

(a) Tracking error system

The TRK ER signal is converted from analog to digital after it is input to servo IC TC9220F-002. In the servo IC, the flaw component of a tracking error signal is detected, and the gain of the tracking servo is raised. (During flaw detection, the level of the GUP terminal, pin 38 of the servo IC, is set to "H"). With this flag signal, Q5 is set to OFF during flaw detection. During normal playback, Q5 is set to ON, and the high frequency range of the TRK ER signal is cut.

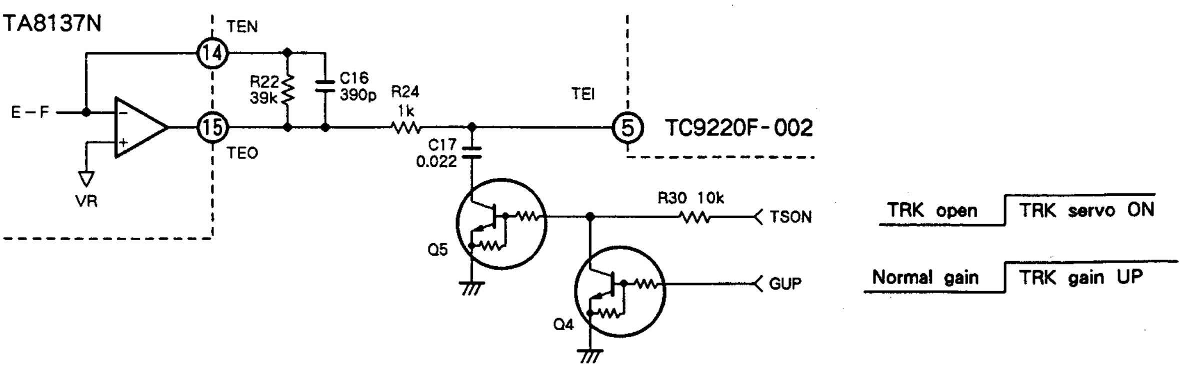


Fig. 1-8

(b) RFAV system

An RFAV signal is obtained by cutting the high-frequency range of an RF signal so that it is about the median value of the RF signal. When surface of a disc is dirty, the amount of light will be reduced at the dirty part which causes depression of the RF signal. This causes depression of the RFAV signal. (See Fig. 1-9.)

In this system, a hysteresis operation is done to brake the jump. During this hysteresis operation, the DC level difference caused by the depression is depressed, which improves convergence after the jump.

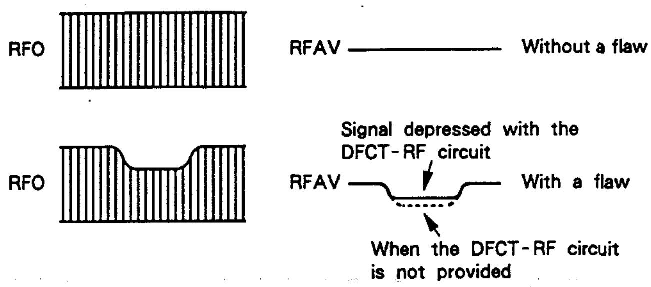


Fig. 1-9

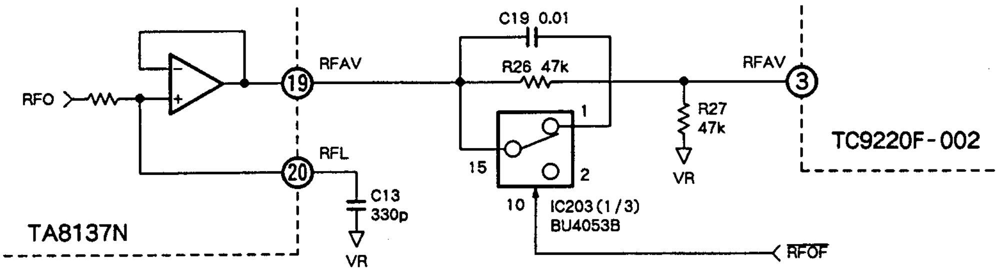


Fig. 1-10

8. Reference power-source circuit

This system operates with a single 5 V power source so a reference voltage which is equivalent to 0 V, the median voltage of ±5 V in a conventional system, is required. The reference voltage VR is 2 V, and is generated in an RF amplifier and supplied to servo IC TC9220F-002, DSP TC9221F, etc.

As a single 5 V operation, the upper-limit voltage 5 V is not used. The negative side against 2 V is from 0 to 2 V and the positive side is from 2 to 4 V. The upper limit value 2VR (= 4V) is also generated in this IC and supplied to each IC.

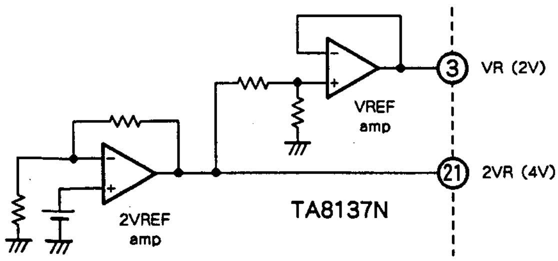
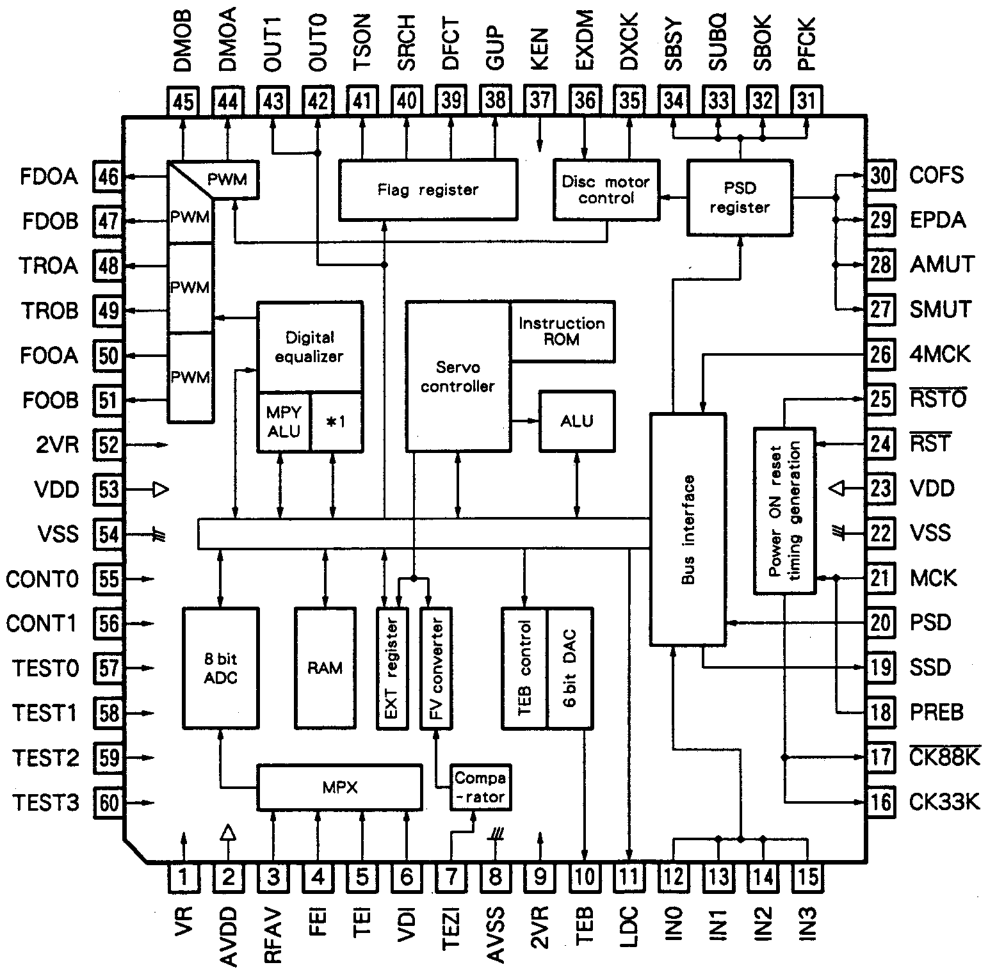


Fig. 1-11

1.2 Servo Block

In a servo block, ordinary servo operations such as focus servo, tracking servo, carriage servo and spindle servo, and also special servo operations such as focus-in, track jump, etc. are controlled with the system controller through the DSP.
In this system, this block also adjusts focus offset, tracking offset, focus gain, tracking gain and tracking balance automatically.
The main part of this block is IC100 : TC9220F-002 (abbreviated to TC9220F), and each part is explained below.



*1 : Coefficient control ROM.

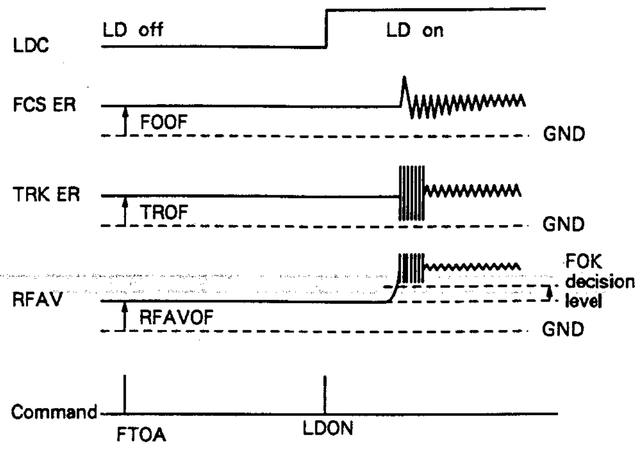
Fig. 1-12 Block diagram of TC9220F-002

1. Offset automatic adjustment (FTOA) system

In a conventional system, an operating point may shift because of an offset in the preamplifier, etc., and adjustment using a semi-fixed resistor is necessary. In this system, this adjustment is automatically executed in a servo IC with digital processing of the offset component.

The offset adjustment system extracts the DC offset of a focus error signal and tracking error signal, and stores the level of an RFAV signal with the focus servo off. This operation is executed with the offset adjustment command sent from the microcomputer rest after the power turned on or when reset is released. When the servo IC accepts this command, it reads the focus error level and tracking error level from the A/D converter with the LD set to off, and stores the value as the median value of the error. Using this value, the DC offset of a focus error signal or a tracking error signal which is internally processed, is completely compensated.

In normal playback, offset is always adjusted automatically for compensation of temperature change. When adjusting offset after reset, the RFAV signal level is also stored as the reference level to decide whether focus-in is OK or not, and an FOK signal is generated.



Note : FTOA = FOCUS TRACKING OFFSET ADJUST
FOOF = FOCUS OFFSET
TROF = TRACKING OFFSET
RFAVOF = RFAV OFFSET
LDC = LASER DIODE CONTROL

Fig. 1-13

2. Focus servo system

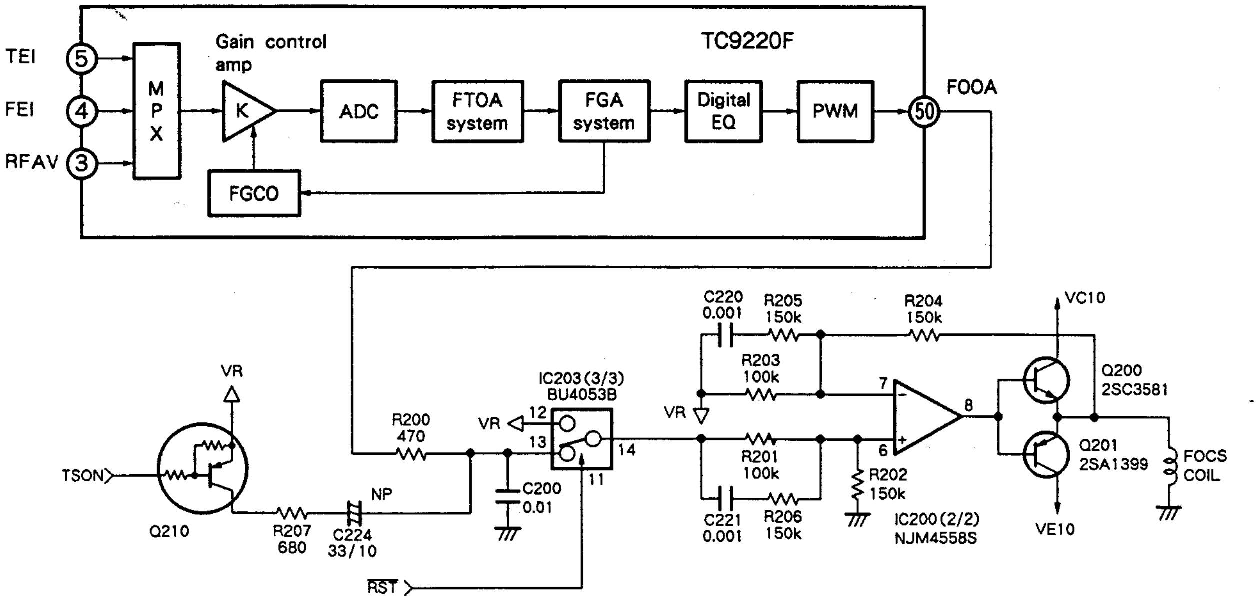


Fig. 1-14

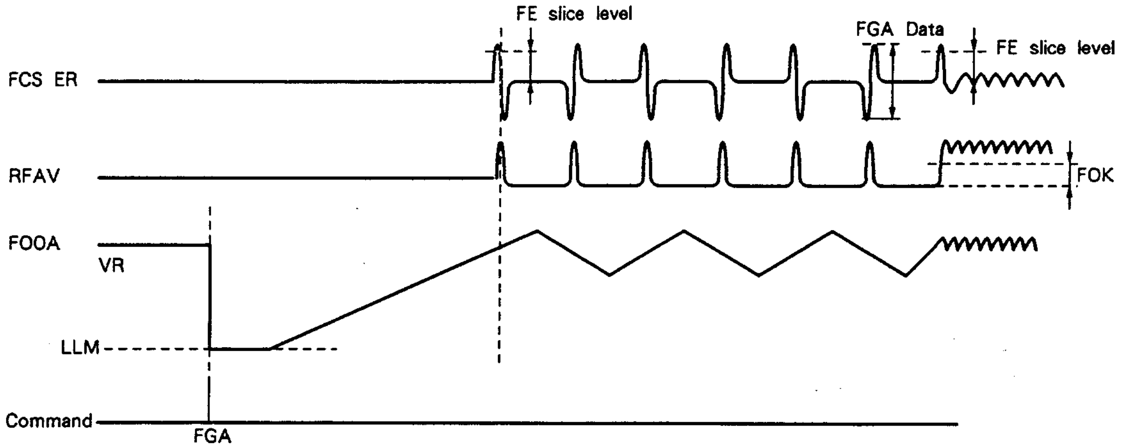
(a) Focus gain automatic adjustment (FGA) system

The focus gain automatic adjustment system adjusts the DC gain of the focus servo loop. When the microcomputer sends a gain adjustment command, the output at the FOOA terminal brings the lens down to the LLM level, then it raises the lens with the internally set time constant. When the lens comes near the in-focus point, an S-character is generated in the FEO signal, with which an error can be detected. After a specific amount of time has passed, the polarity of the output at the FOOA terminal is reversed. The up-and-down operation of the lens is repeated for a specified number of times as shown in the timing chart (Fig. 1-15.)

The IC automatically sets the gain with the focus gain control (FGCO) by digital conversion of S-character error data. When gain adjustment completes, the focus-in operation follows.

During this adjustment, the disc rotates a little to average the S-character before the gain adjustment. Focus gain adjustment is necessary with each focus-in operation. So when a disc is changed and the reflection ratio of the disc is different, gain adjustment is necessary for each disc.

The analog switch (IC203 (3/3)) in Fig. 1-14 functions as a muting circuit to prevent the lens from attaching to a disc when the power is turned on.



Note : FGA = FOCUS GAIN ADJ.   FGA Data = FOCUS GAIN error data

Fig. 1-15

Note :

As FOOA (IC100 : TC9220F, pin 50) is a PWM output, it is shown with an average DC voltage in Fig. 1-15.

Actually compression waves of pulses with "L" of 0 to VR and "H" of VR to 2VR are observed. (Fig. 1-16)

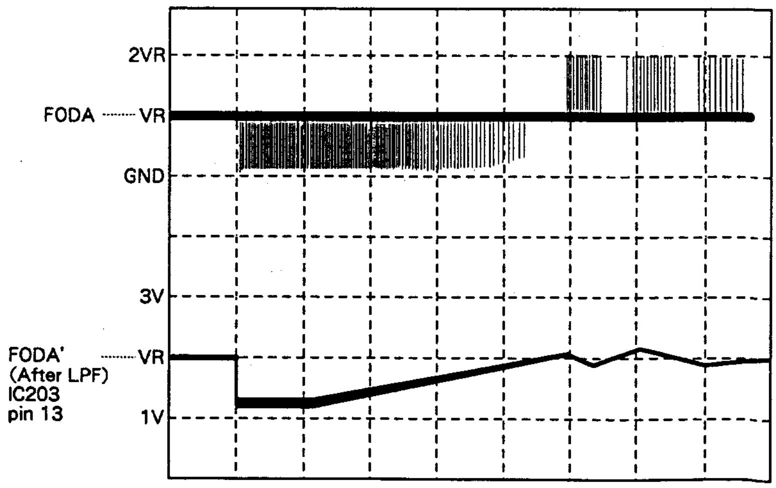


Fig. 1-16

(b) Focus search system

When the focus gain automatic adjustment is finished, IC100 : TC92220F automatically starts the focus search operation.

After automatic adjustment, the lens descends, then rises. When it rises past the in-focus point and a focus error signal also exceeds the set slice level, the focus servo goes to standby mode, and the focus servo on operation is done at zero-cross of an FEO signal.

After the focus-in operation, the difference between the RFAV signal and the value of RFAV in STOP mode stored with the FTOA command is checked, and it is decided whether the focus search operation has been performed successfully or not (FOK).

When the disc is not set, the focus gain automatic adjustment operation (up and down operation of the lens) is repeated three times (UP 3, DOWN 3), then it is tried again and the system returns to STOP mode.

3. Tracking servo system

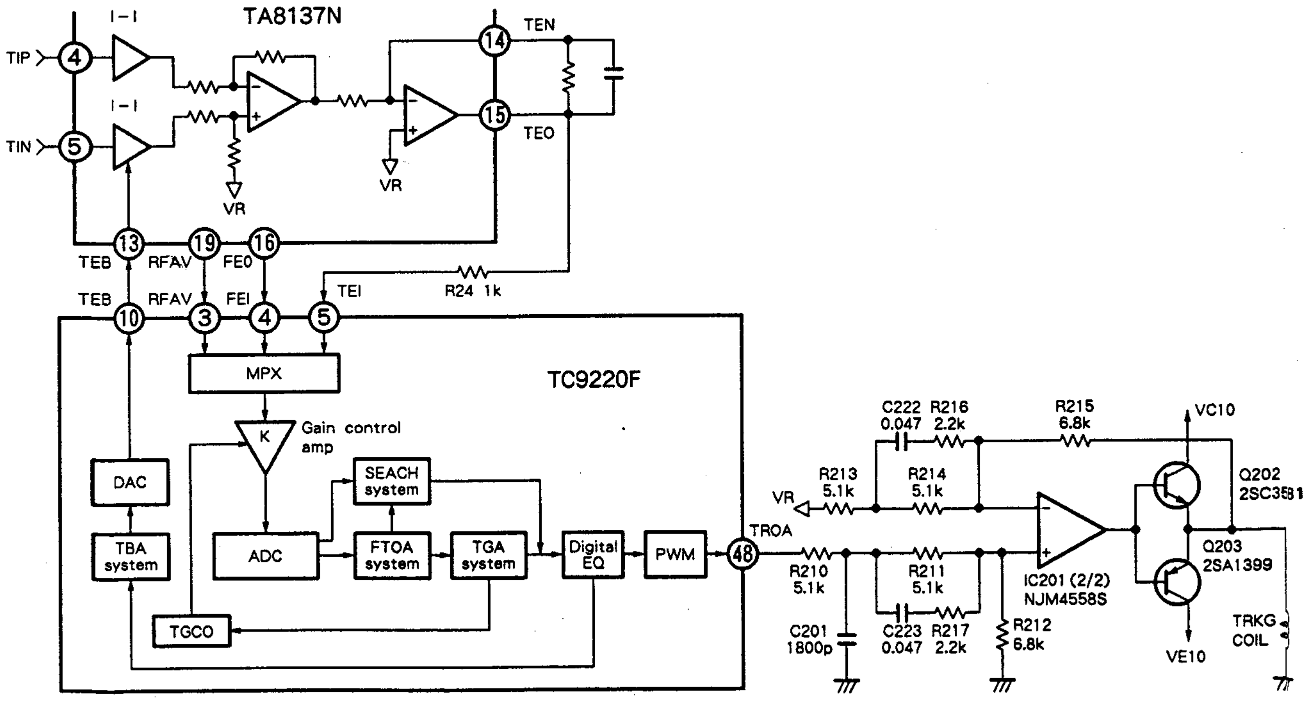
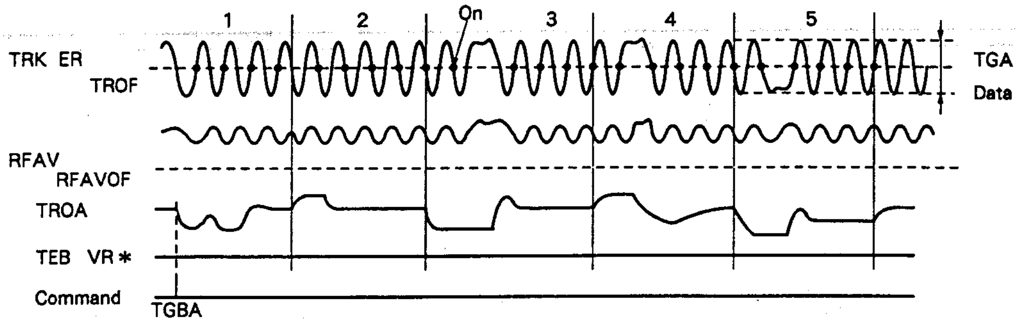


Fig. 1-17

(a) Tracking gain automatic adjustment (TGA) system

The tracking gain automatic adjustment system adjusts the DC gain of a tracking servo loop. After adjusting the focus gain, the gain adjustment command is sent from the microcomputer, then a tracking actuator drive signal is output from the TROA terminal. When the system reads tracking error data across the set track, the lens drive signal which is output from the TROA terminal is reversed.

This operation is repeated the specified number of times. Values for wave height for five data of a tracking error signal are read and are converted to digital data. Then the IC automatically adjusts the gain setting with tracking gain control (TGCO). Tracking gain adjustment is performed every time the tray is opened and closed. So each time a disc is changed, this adjustment is performed, which means that the optimum gain can be set for each disc.



VR*: The first TGBA after the power is turned on starts from VR but the value changes to VR' when the balance is adjusted after gain adjustment. So the second TGBA (for example, TGBA after changing a disc) starts from VR'.

Note: TGA Data = Tracking error level data; TEB = Tracking error balance; TGBA = Tracking gain balance adjustment; TGA = Tracking gain adjustment; TBA = Tracking balance adjustment

Fig. 1-18

(b) Tracking balance adjustment (TBA) system

When the tracking gain adjustment is finished, the IC automatically executes tracking balance adjustment. Gain and balance adjustments are executed with a single command from the microcomputer. So a new command is not be sent.

A lens drive signal which is output from the TROA terminal is reversed for each set track in the same process as in gain adjustment. This operation is repeated a specified number of times. The amount of shift in balance is calculated from the read TE data, which is output from the TEB terminal to RF amplifier IC101 : TA8137N for automatic balance adjustment.

The target value of this adjustment is not VR but the value of TROF stored with the offset adjustment. (Fig. 1-13)

Gain and balance adjustments are executed at the optimum point in the system. So if a spindle servo is rough in test mode, the optimum settings of gain and balance adjustment may not be obtained.

In such a case, readjust the gain and balance, or readjust them by manually turning the disc to decrease the rotation of the disc if the disc is grossly off-center.

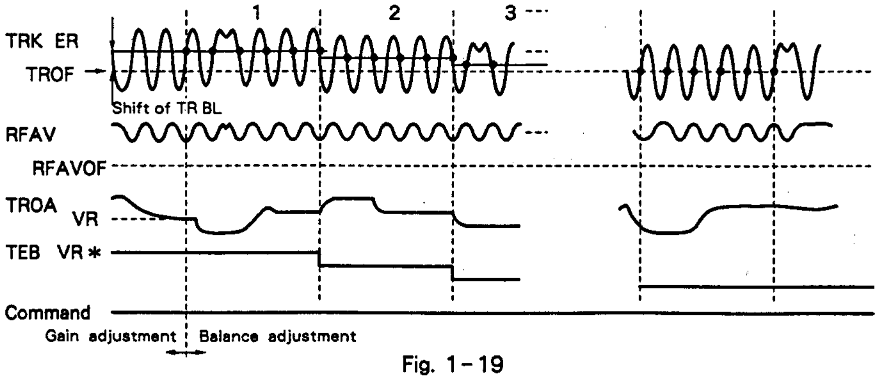


Fig. 1-19

4. Carriage servo system

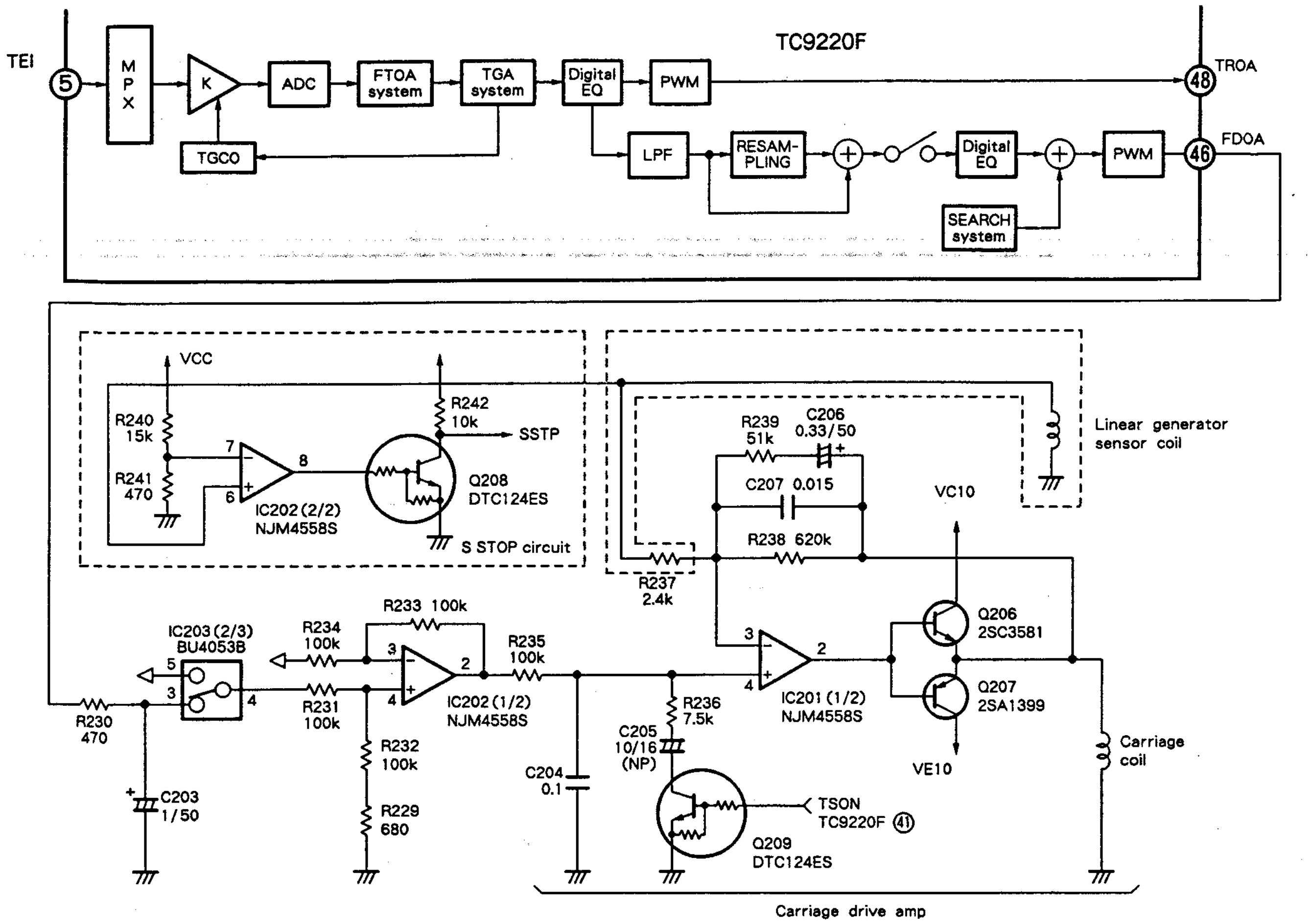


Fig. 1-20

The carriage error signal is generated from the low frequency component of the tracking error signal which has been converted from analog to digital in servo IC TC9220F.

As the carriage servo system is closed under normal conditions, the carriage can smoothly follow tracking deviation.

As this system uses a linear motor, it is provided with a carriage drive amplifier, which is optimum for a linear motor, and a speed feedback system using a DC linear generator, and S STOP circuit which generates a limit position detection signal for the innermost track.

Analog switch IC203 (2/3) is a circuit to prevent the linear motor from being activated with an offset when the power is turned on.

To obtain optimum servo characteristics in normal play and search modes, the signal is switched by Q209.

5. Track search system

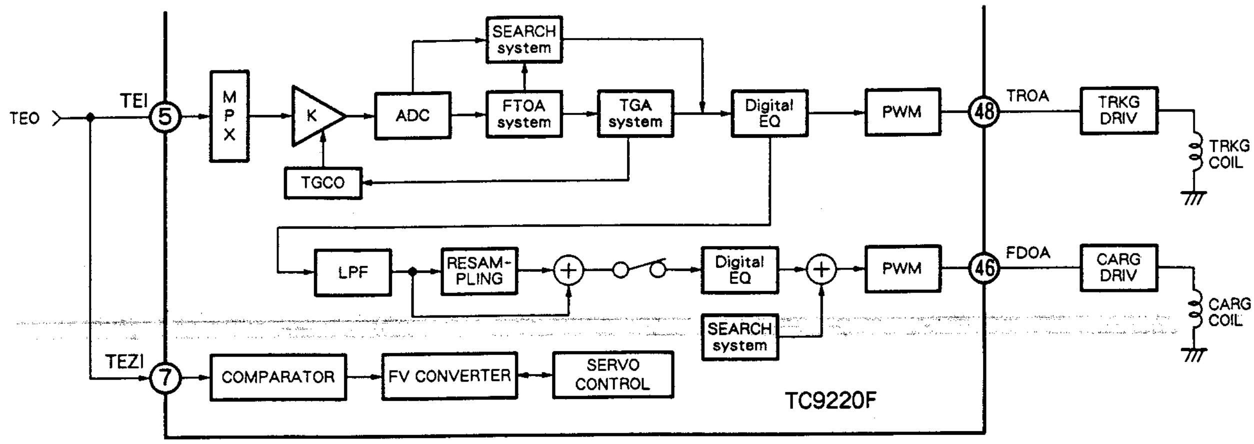


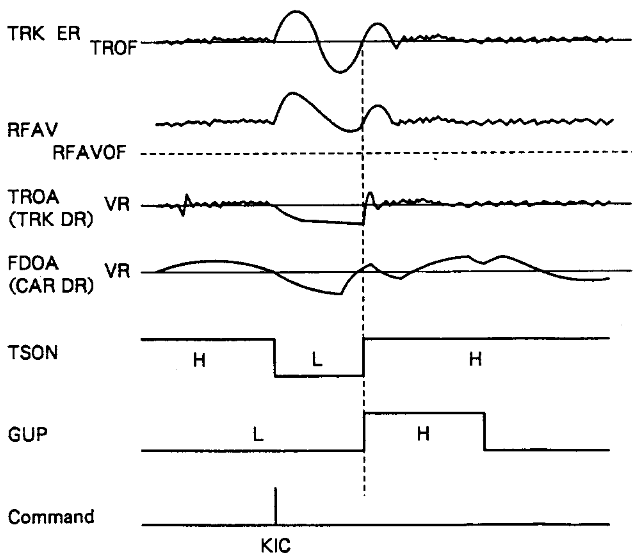
Fig. 1-21

(a) Lens kick

This system performs track search by kicking the lens. This kick is used for a small- or middle-scale search. (Fig. 1-22: Example 1 Tr. manual search, etc.)
In this system, the number of tracks is counted with the A/D converted digital data, and during search, the frequency of the TE signal is always monitored with the frequency-voltage conversion circuit (FV converter).
The output signal from the FV converter is feed back to the kick voltage so that the target frequency set to the optimum value for each kick is obtained.
The target frequency of the FV converter varies with the number of kicked tracks. When the target track is far from the current point, the target frequency (speed) of the lens is high, and as the target track nears, the frequency becomes low.
When kicking the lens, the carriage servo is set to ON. So even if the lens is kicked a considerable number of times, the carriage will move with lens deviation. In a conventional system, the carriage should also be kicked at the same time the lens is kicked.
Thus as the number of kicked tracks nears the target number for this lens kick, the kick speed is reduced, and when the target track is jumped, the speed is sufficiently reduced. To make the convergence high after kicking, gain-up for the tracking and brake operation are activated when kicking is finished.
For the braking operation, the phase difference between the tracking error and RFAV signal is observed, and energy opposite to the kick direction is generated. (Fig. 1-24)

Example 1)

FWD 1 Tr. search



Note: As TROA and FDOA are PWM output, the average values are shown in the Figure.
TSON = TRACKING SERVO ON
GUP = GAIN UP
FDOA = FEED OA output (Carriage output)

Fig. 1-22

Example 2)

FWD 150 Tr. search

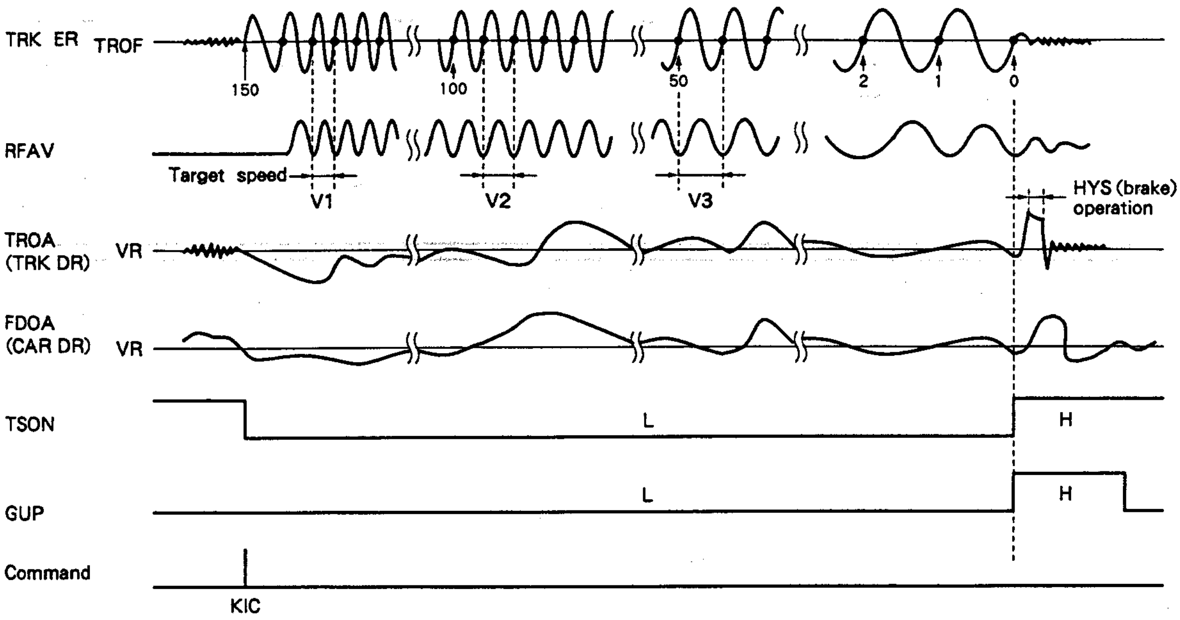


Fig. 1-23

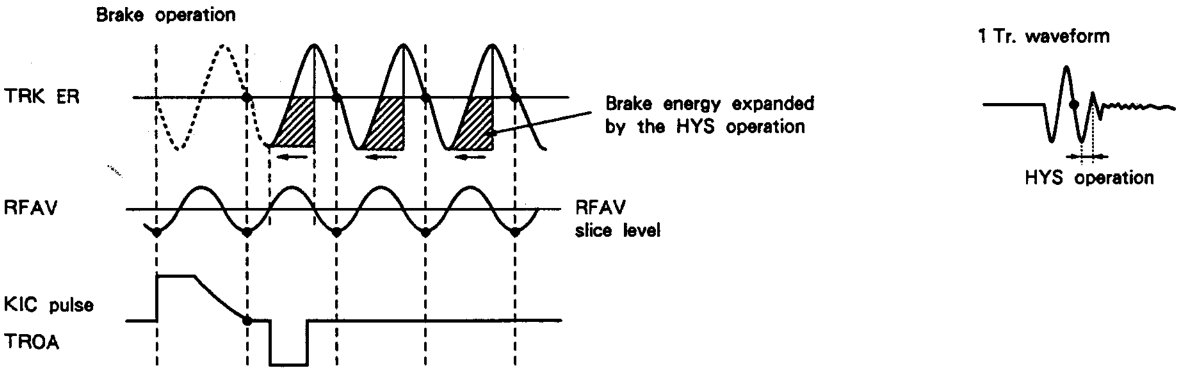


Fig. 1-24

As for GUP and HYP (brake) time, the optimum time is set for each search to obtain high convergence after a search.

In this system, when the lens speed moves in the opposite direction because of external elements such as shock, the disc being grossly off-center, etc., the direction is detected, and the search operation is stopped there.

(b) Carriage kick

By kicking the carriage motor, a track search is executed. In a carriage kick, the FV converter functions in the same way as with a lens kick, and the feedback function is activated to the FDOA so that the target speed is obtained depending on the number of tracks to be searched.

The timing of this kick operation is almost the same as that of a lens kick. When the kick command is sent, the tracking servo and carriage servo are set to OFF as shown in Fig. 1-21, and a kick output signal is generated by the carriage search system, and is output from the FDOA terminal.

The kick voltage is decreased to 0 when the specified number of tracks is crossed by counting them using A/D converted digital data, FV-converted analog data and the RFAV signal. After deciding that the speed is sufficiently reduced, the tracking and carriage servos are set to ON for the next track, and normal play is restored. At the same time, the gain is raised and the HYS operation is activated.

If the lens speed is faster than the target speed when the specified track is crossed, the carriage kick signal is set to 0. Then the relative speed of the lens and track is lowered to the specified value as time passes, and the tracking and carriage servos are set to ON.

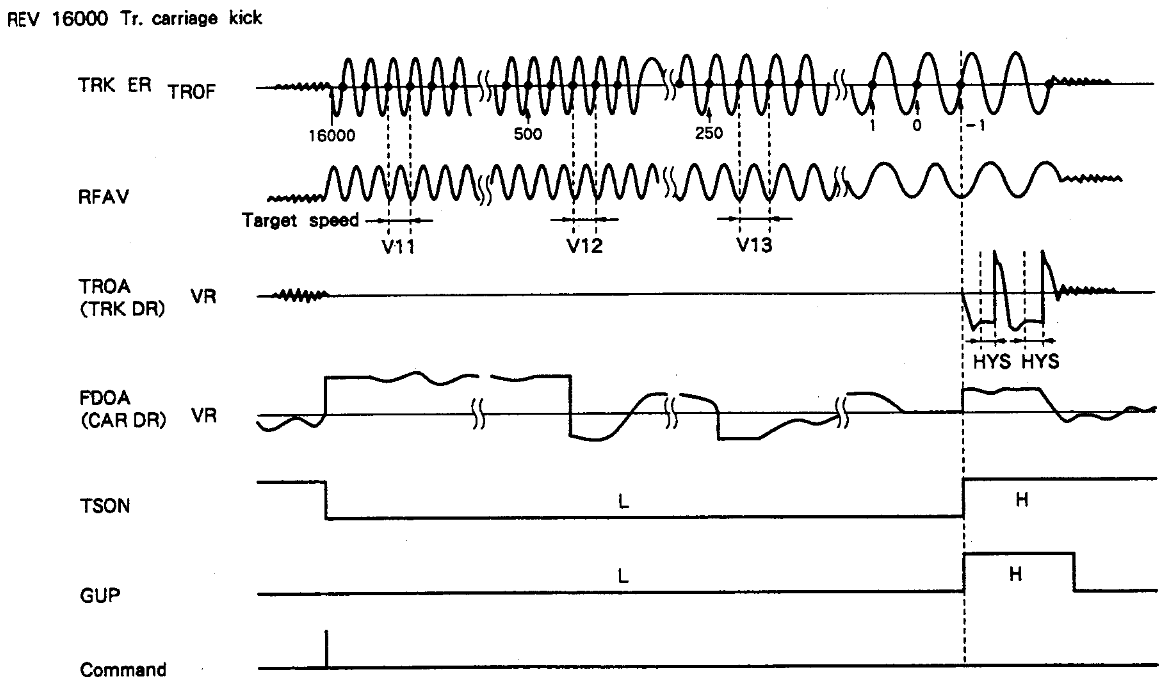


Fig. 1-25

6. Digital servo equalizer

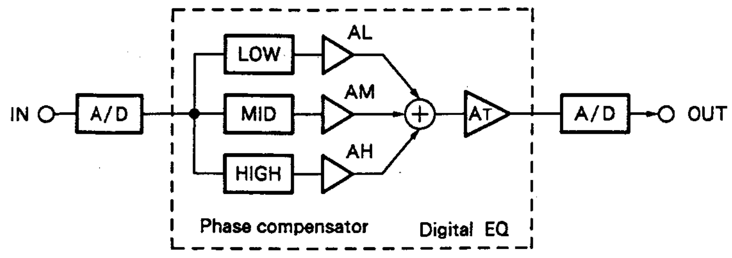


Fig. 1-26 Construction of Digital EQ

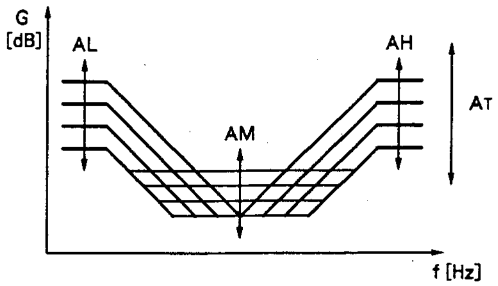


Fig. 1-27 Gain characteristic of Digital EQ

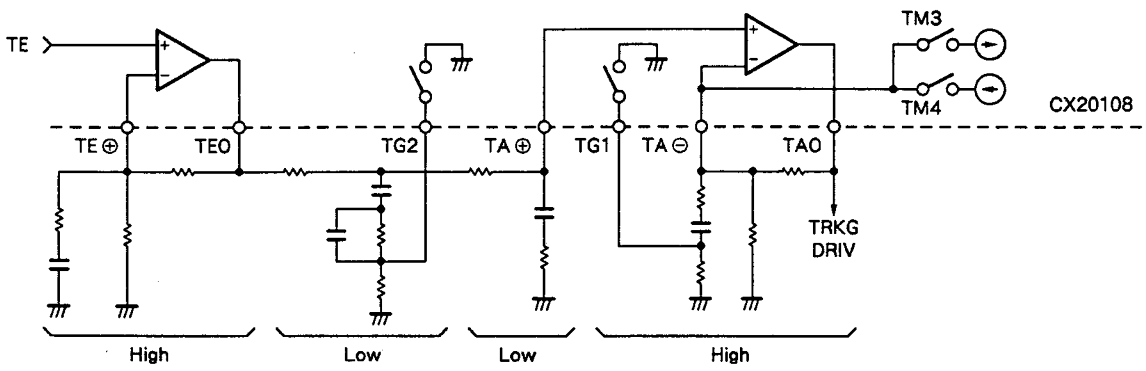


Fig. 1-28 Example of an analog equalizer circuit

For optimum servo action of the pickup, disc and motor, an equalizer is composed of operation amplifiers, resistors, capacitors, etc. in a conventional system as shown in Fig. 1-28.

In this system, a conventional analog equalizer is digitized as with a digital filter in an audio stage. An IIR (Infinite Impulse Response) type digital filter and a coefficient ROM which decides equalizing characteristics are built into the servo IC, which set the optimum equalizing characteristics for this pickup when initialized from the microcomputer. The built-in equalizer is divided into three ranges, low, middle and high as shown in Fig. 1-26 and 27, and the optimum DC level for the total system is selected from the built-in patterns. These servo equalizer characteristics as shown below are initialized when the power is turned on, but do not change in gain automatic adjustment which is executed every time a disc is changed.

①Focus servo equalizer
②Tracking servo equalizer (for normal play)
③Tracking servo equalizer (for raising gain after search)
④Tracking servo equalizer (for defects such as a flaw)
⑤Carriage servo equalizer
⑥Spindle servo equalizer

An error signal to which digital signal processing, phase compensation and gain compensation are executed, is converted from digital to analog with PWM (Pulse Width Modulation), and output from the focus, tracking, carriage and spindle terminals as ternary output (0, VR, 2VR). In this system, the PWM carrier frequency is set to 88.2 kHz.

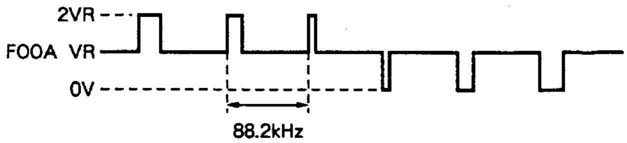


Fig. 1-29 Example of PWM drive waveform of TC9220F

7. Spindle motor control system

(a) CLV control system

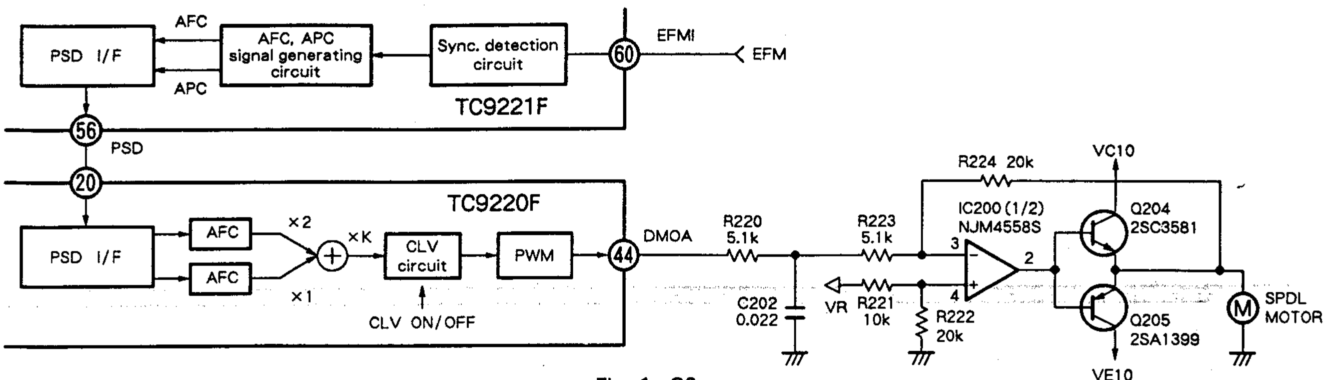


Fig. 1-30

For the spindle servo, reproduced frame signals WFCK (7.35 kHz) which are output from the sync. signal separation circuit using the EFM which is input to DSP IC from an RF amplifier are counted, and AFC data is generated. The APC data, that is the phase difference between divided waves of a master clock and WFCK, are output from the PSD terminal. Using the AFC and APC which are input to the servo IC, PWM is output from the DMOA terminal to lock the spindle motor with the CLV servo.

< AFC circuit >
The AFC circuit generates frequency error data which is required for the CLV servo of the spindle motor. When the spindle motor rotates at its regular speed, the frequency of the reproduced frame signal WFCK which is an output signal from a sync signal separation circuit, is 7.35 kHz. One cycle of this WFCK is counted using the master clock dividing wave, and the results are output from the PSD terminal using an interface circuit.

< APC circuit >
The phase difference between a clock which is obtained by dividing a master clock and that which is obtained by dividing a reproduced frame signal WFCK, is output from the PSD terminal using an interface circuit. The number of divisions for phase comparison is initially set by the microcomputer.

(b) Spindle motor brake circuit

The spindle motor brake circuit detects that the rotating speed of the spindle motor is sufficiently reduced when the CLV OFF command is sent from the microcomputer. In this brake system, when the microcomputer sends the CLV OFF command, DSP IC (TC9221F) counts the rotating speed using an EFM signal, and when the speed drops below the specified value, spindle deceleration is stopped, and the servo is automatically set to OFF.

8. Servo IC ⟷ DSP IC interface

This system and the microcomputer communicate using six terminals of BUCK, BUS 0 to 3 and $\overline{CCE}$ of DSP IC TC9221F. So the servo IC and microcomputer do not directly transmit data. PREB, SSD, PSD, MCK and 4MCK are used for data transmission between a servo IC and the microcomputer or a servo IC and DSP. A PREB signal is used to synchronize TC9220F and TC9221F.

(a) PSD input circuit

The PSD input circuit accepts commands and data from DSP TC9221F. Commands from the microcomputer to TC9221F and internal data of TC9221F are converted to serial data with a selector, and input to the PSD terminal synchronized with 4MCK.
From TC9221F, output signals from a sync. separation circuit and the disc motor brake circuit, and an audio muting output, AFC and APC output, subcode signals, the results of a correction circuit, etc. are input.

(b) SSD output circuit

A SSD output circuit is to output various data from a servo IC TC9220F to DSP IC TC9221F. The output data from the SSD terminal of TC9220F is serial data synchronized with 4MCK.
Major SSD data are as follows :

①MODE Data to show the servo operation mode
②FGAI Data set by the focus gain automatic adjustment
③TGAI Data set by the tracking gain automatic adjustment
④SRCH Data which is set to "H" during search
⑤AUK Data which is set to "H" during carriage kick

1.3 DSP Block

The DSP block is composed of TC9221F and several peripheral circuits, and has the following functions.

1. Reproducing the bit clock using the EFM-PLL circuit
2. Demodulation of EFM data
3. Detection, protection and insertion of frame sync signals
4. Error detection and correction of C1 double and C2 triple
5. Interpolation using an average value or holding the previous value
6. Demodulation of subcode signals and error detection of sub-code Q
7. AFC/APC generation circuit for the CLV servo
8. Digital output
9. Microcomputer interface circuit
10. VCO free run frequency of the VCO automatic adjustment function

Among these, only the PLL block requires an external circuit, and the other parts are processed in DSP and servo IC TC9220F. Fig. 1-31 shows the internal block configuration of the TC9221F, and each part is explained below.

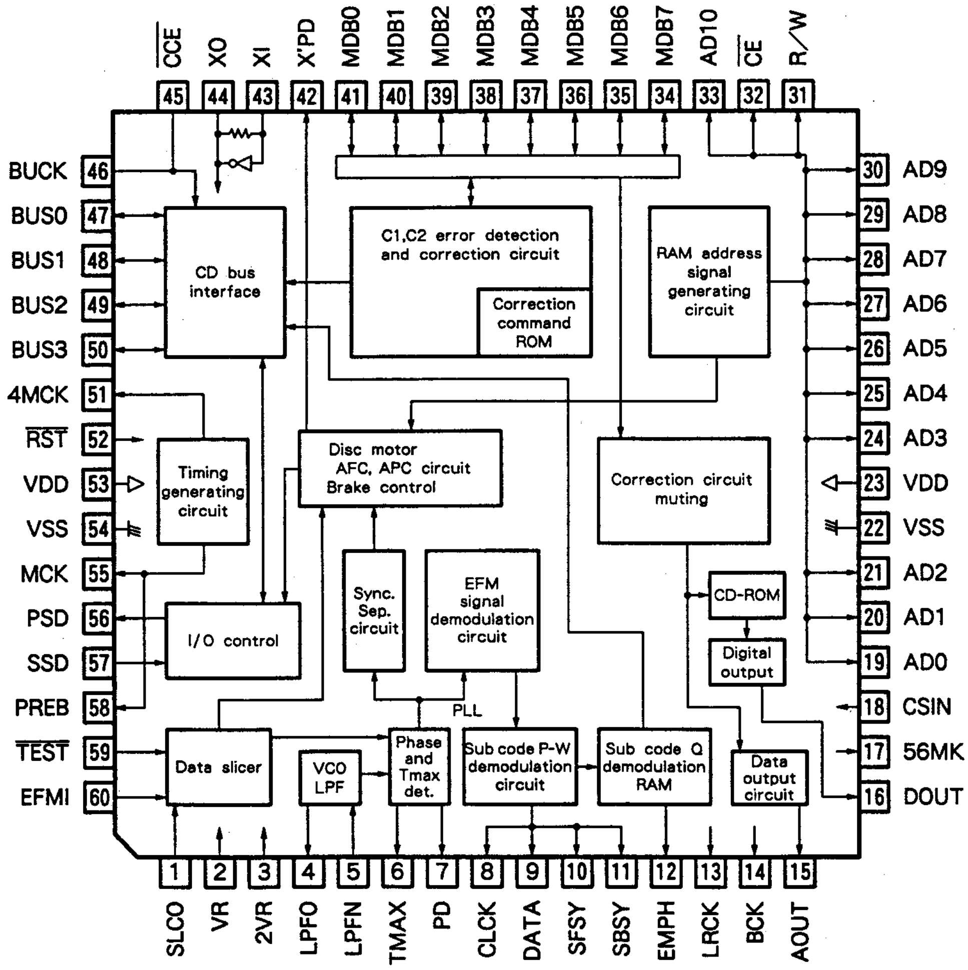


Fig. 1-31 Block diagram of TC9221F

1. Command code

IC100 : TC9220F and IC300 : TC9221F send data to and accept from the control microcomputer using $\overline{CCE}$, BUCK and BUS 0 to 3. Control data for a servo IC is also transmitted through DSP.

This command includes an idle mode which accepts servo information, a write command mode which sends data to TC9221F from the microcomputer, and a read command mode which accepts data such as Q data from servo IC DSP.

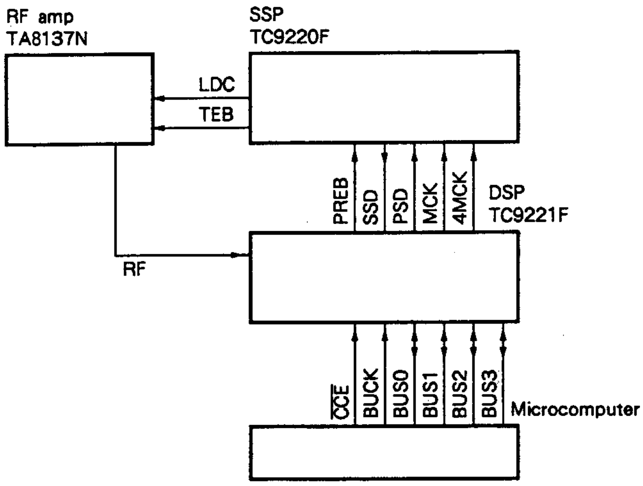


Fig. 1-32

(a) Idle mode

In this mode, status information (servo status) is output to BUS 0 to 3 when the microcomputer sets $\overline{CCE}$ from H to L. The internal status detected just before $\overline{CCE}$ is changed from H to L is output, and the mode is held until $\overline{CCE}$ is changed from L to H or the mode is changed to write command mode or read command mode by setting BUCK to L.

So if $\overline{CCE}$ is kept at L because the pattern is short-circuited, etc., the next operation cannot start. Under correction conditions, $\overline{CCE}$ changes every time from L to H. When $\overline{CCE}$ is H, DSP IC TC9221F does not communicate with the microcomputer, but automatically operates with data transmission with servo IC TC9220F.

BUS	Servo status
0	LD OFF (LASER OFF)
1	LD ON (LESER ON)
2	FGA (FOCUS GAIN ADJUST)
3	FS (FOCUS SEARCH)
4	NONP1 (NONPLAY CLV SERVO OFF)
5	NONP2 (NONPLAY CLV SERVO ON)
6	TGBA (TRACKING GAIN/BALANCE ADJ.)
7	NP (NORMAL PLAY QDRC NG)
8	SEARCH (TRACKING SEARCH)
9	DMBK (DISC MOTOR BRAKE)
A	OFFADJ (OFFSET ADJUST)
B	FTOA (FOCUS/TRACKING OFFSET ADJ.)
C	――――――――
D	――――――――
E	INIT (INITIALIZE)
F	NP (NORMAL PLAY QDRC OK)

eg. status 7
BUS3 = L
BUS2 = H
BUS1 = H
BUS0 = H
⇩
LHHH = 0111 (binary notation)
= 7 (hexadecimal notation)

Table 1-1 Servo status output

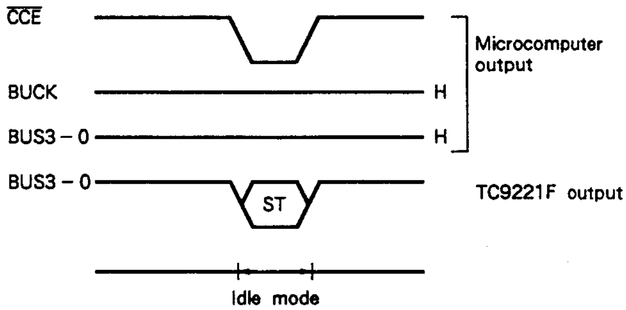


Fig. 1-33

(2) Write command input mode

In this mode, the microcomputer sends data to TC9221F. The microcomputer sets the $\overline{CCE}$ terminal from H to L, and a command of four words is output to the BUS 3 to 0 terminals synchronizing with the trailing edge of BUCK. The microcomputer keeps BUS 3 to 0 terminals at H in modes other than data output. After accepting the data of four words, the TC9221F outputs the ACK signal of L when the number of clocks which is input to BUCK and the results of comparison of each BUS data at the rising and trailing edges of BUCK are normal, and BUCK is L. If the results are not normal, the ACK signal is set to H.

Note: An ACK (acknowledge) is a flag which shows the decision whether signal reception is OK or not.

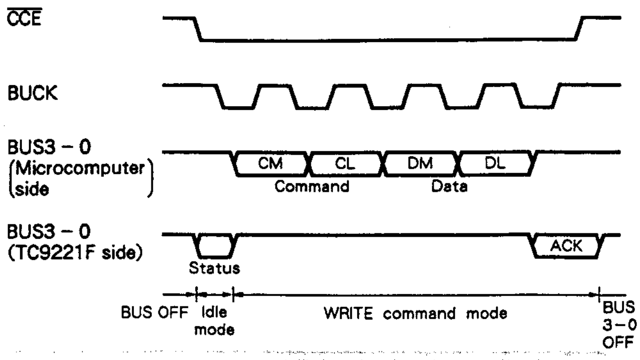


Fig. 1-34 Write command input mode timing

Note: Data of status, etc. are hexadecimal notation.
0000 = 0
0001 = 1
⋮
1001 = 9
1010 = A
1011 = B
1100 = C
1101 = D
1110 = E
1111 = F

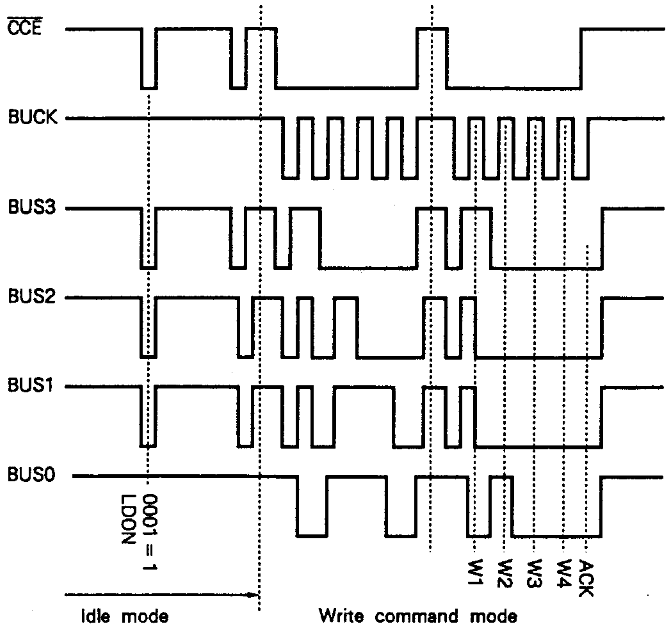


Fig. 1-35 Example of confirmed command send and accept

(3) Read command mode

The microcomputer sets the $\overline{CCE}$ terminal from H to L, and a read command of one word is output to BUS 3 to 0 terminals synchronizing with the trailing edge of BUCK. There are two read commands, a Q-DATA read command (Q DRC) and a STATUS read command (SRC 1 to 7).

When data transmission from TC9221F with the read command is finished, even parity for each bus is output from BUS 3 to 0 until the $\overline{CCE}$ terminal is changed from L to H.

Note: A STATUS read command is the command to read the results of servo status, gain adjustment, etc.

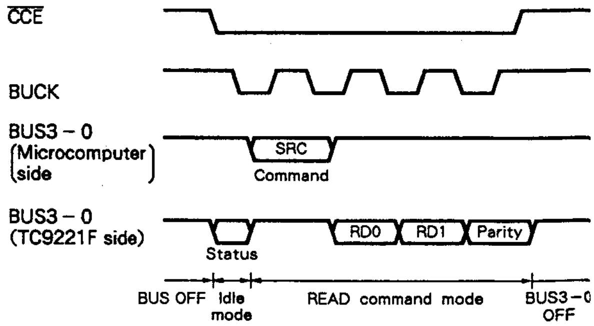


Fig. 1-36 Read command input mode timing

2. Data slicer and PLL circuit

(a) Data slicer

A data slicer is a circuit to obtain binary digital signals by slicing an RF signal which is input from the EFMI terminal with the voltage which is output from the SLCO terminal.

There are three slice modes as described below. The mode to be used is selected according to servo status.

① Integral slice mode

The difference of time integral amounts in the period when an EFM signal is H and in the period when an EFM signal is L, is detected, and the signal is always sliced at the median of the eye pattern.

② Edge detection slice mode

The phase difference between the rising edge of PLCK and an EFM signal is detected, and the signal is sliced at the median of the eye pattern.

③ Fixed slice mode

The slice level is fixed so that noise from the off tracks is ignored during search.

(b) PLL circuit

Fig. 1-37 shows the basic configuration of the PLL circuit. The PLL circuit extracts a bit clock from an EFM signal (PLCK). When PLL is locked, PLCK (IC300 : TC9221F, pin 17) is 4.3218 MHz, and the built-in VCO generates 17.2872 MHz, four times the PLCK frequency. As an analog PLL system is used, wide capture and lock range and stable locking are achieved. This system is provided with a VCO free-run frequency automatic adjustment function, and when the system reference voltage VR is input to VCO, the VCO oscillates at a frequency of about 17 MHz. So a semifixed resistor for VCO adjustment, which is essential in a conventional system, is not necessary in this system.

A PD circuit detects any phase error between PLCK and an EFM signal, and ternary output of L, H and Hiz is obtained at the PD terminal having timing shown in Fig. 1-38.

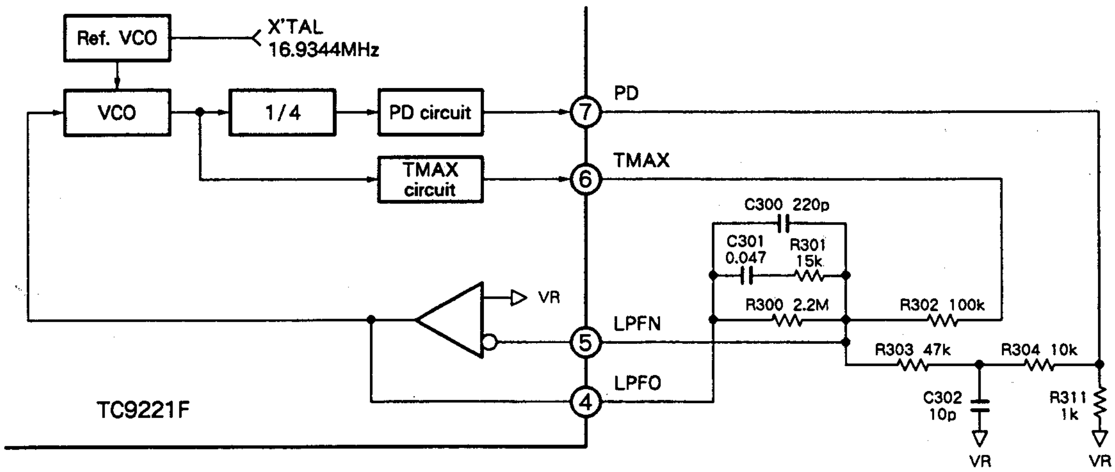


Fig. 1-37

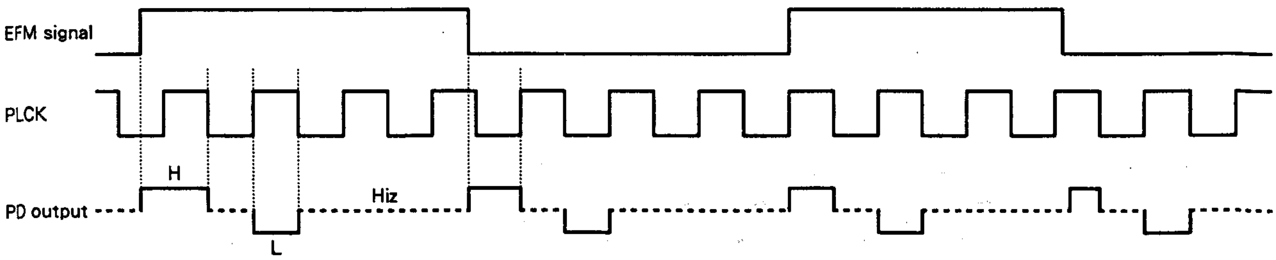


Fig. 1-38 Timing chart of phase detection

(c) TMAX circuit

The TMAX circuit detects the maximum reverse distance of an EFM signal TMAX using a built-in VCO oscillation clock (17.2872 MHz when locked). When the counted value is less than 11T (TMAX = 11T, 1T = PLCK), (When the frequency of PLCK is less than the specified value) 2VR is output from the TMAX terminal; when it is more, L is output; when it is the specified value, Hiz is output.
This circuit operates when a PLL circuit operation is unstable and a sync signal cannot be detected normally just after power is turned on or during a search operation, to prevent mis-locking and for quick locking.
TMAX is detected during a specified period of an EFM signal, and when the number of iterations set in the window is continuously detected, the output from the TMAX terminal is controlled.

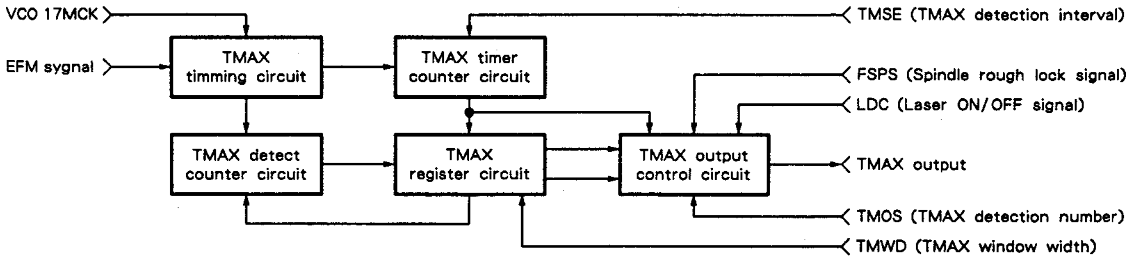


Fig. 1-39

3. EFM demodulation

In the EFM demodulation block, sync dividing, sync protection, insertion, EFM demodulation, subcode signal Q data demodulation, subcode signal demodulation and emphasis detection are executed.
After error detection and the decision on the demodulated subcode Q data in the unit of 98 frames (1 block), the data is stored in a built-in register. When a read command is sent, data is read through BUS 3 to 0 of DSP IC TC9221F.
In this system, error detection and correction are executed twice at two points, C1 and C2. Double error detection and correction is executed at C1, and triple at C2 (double at C2 in a conventional system). The results of detection and correction are output from the PSD terminal and servo IC (TC9220F, pin 29) EPDA as serial data.

4. Audio output

In this IC, a digital filter is not provided. Audio data of 1 fs MSB First is output from the AOUT terminal, and digital audio data is output from the DOUT terminal. BCLK is 1.4112 MHz (DF OFF in a conventional Sony system is 2.1168 MHz), and a WDCK signal for a digital attenuator is generated in an external circuit.
A digital audio interface has two series of output, coaxial and optical. A digital signal which is output from DSP IC300 is converted to formatted output of 0.5 Vp-p in the IC800 inverter driver and L800 pulse transformer. The optical output is connected to optical driver JA800.

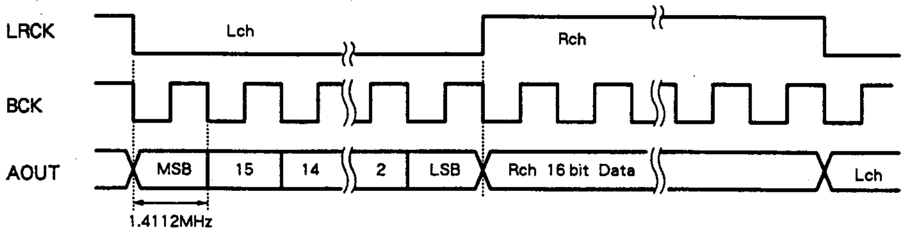


Fig. 1-40 Audio data output

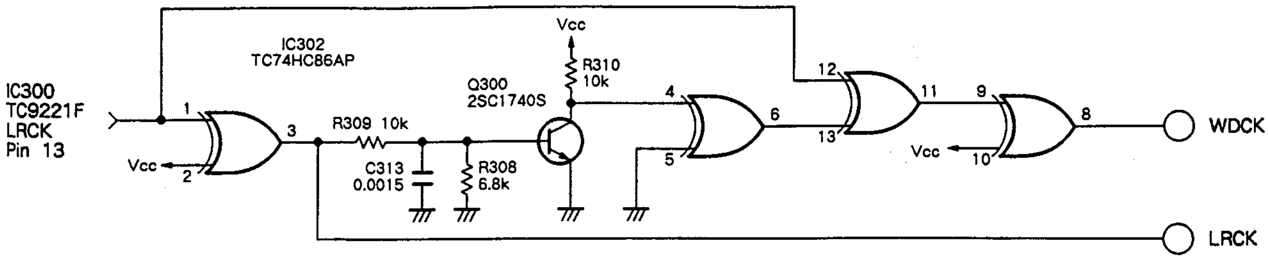


Fig. 1-41 WDCK generating circuit

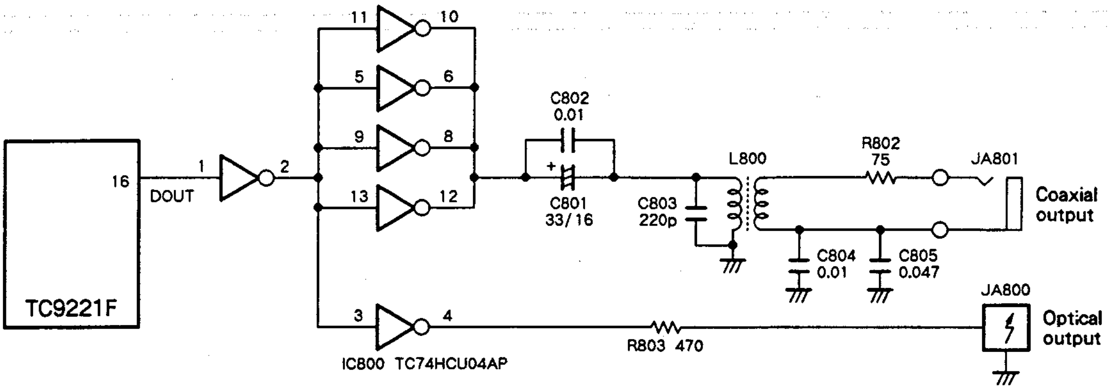


Fig. 1-42 Digital audio interface

1.4 Digital filter

In this system, a digital filter of 8-times-sampling 18-bit output type is used. Operation is executed by connecting three stages FIR 153 + 29 + 17.

1.5. Audio block

1. D/A converter

The 20-bit data which is obtained by 8-times-sampling with a digital filter is converted from digital to analog with D/A converters IC730 and IC731. This converter is a resistor-ladder type D/A converter, and outputs current (MAX ±2 mA). Then the current is converted to voltage in the next stage, IC750 (1/2) and IC751 (1/2), and an output voltage of ±10 Vp-p is obtained.

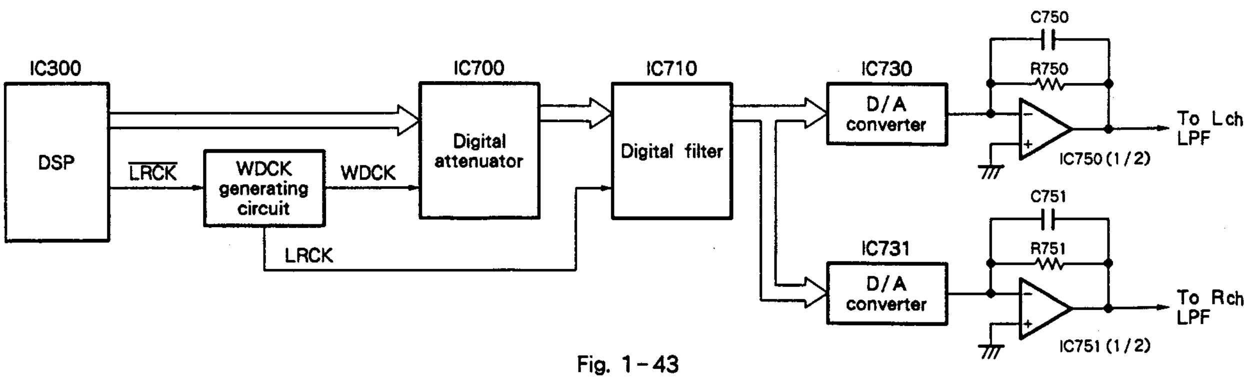


Fig. 1-43

2. De-emphasis and low-pass filter

The output of an I/V amplifier is input to the two -stage LPF (Low Pass Filter) which includes a de-emphasis circuit. When de-emphasis is ON, it is controlled in Q751 and Q752 with the control microcomputer. The LPF is a two-stage tertiary Butterworth type filter. With an FET buffer in the latter stage of IC770, high quality sound is achieved.

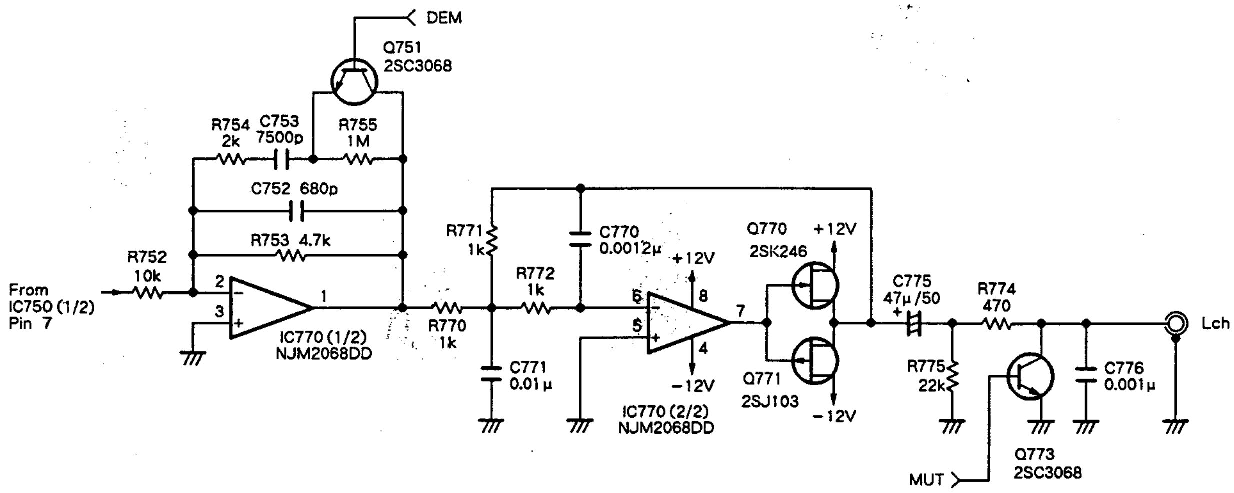


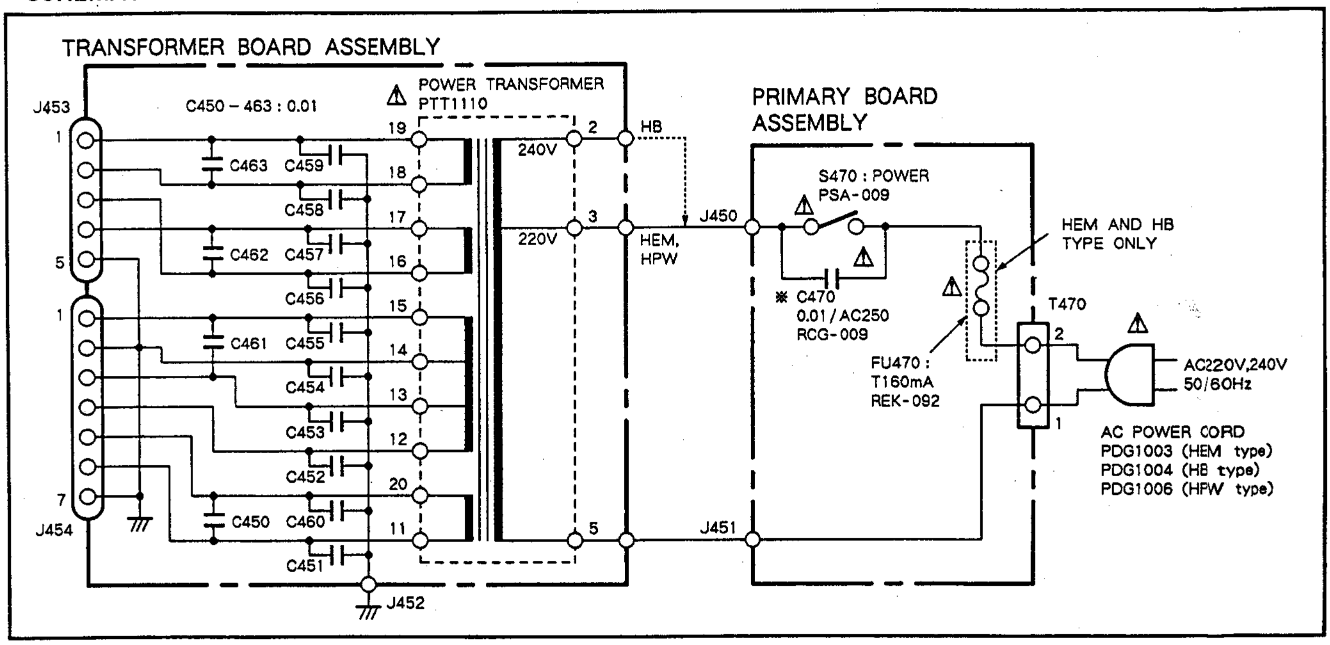
Fig. 1-44

10.2 SCHEMATIC DIAGRAM AND P. C. BOARDS PATTERN

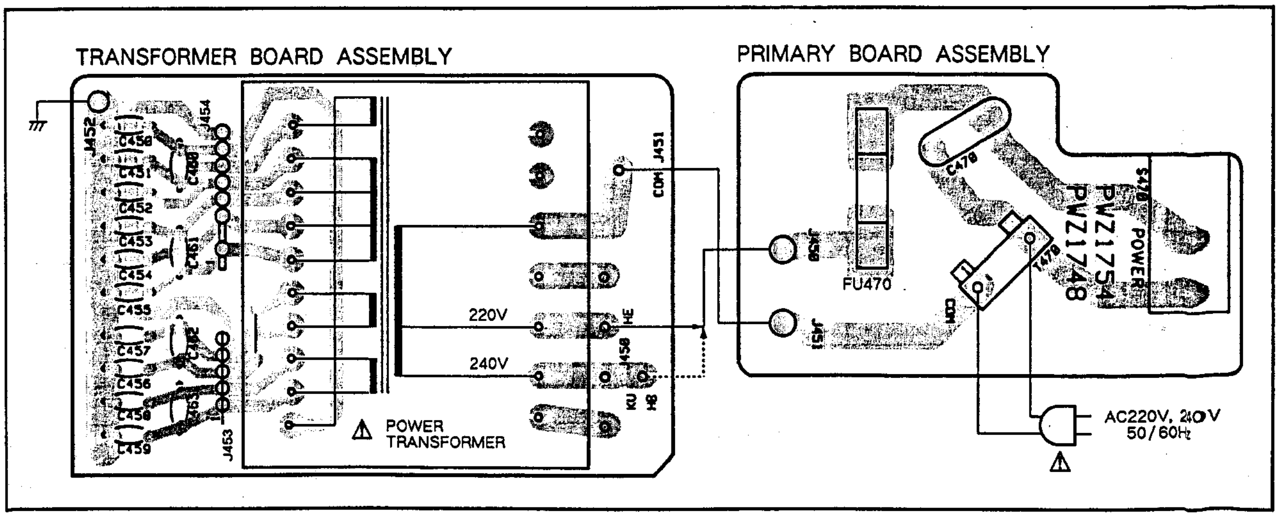
Note: The SCHEMATIC DIAGRAM and the P. C. BOARDS CONNECTION DIAGRAM of the HEM, HB, HPW and SD types are showed in the KU/CA type with the exception of the power supply section. (Pages 15 – 18.)

10.2.1 FOR HEM, HB AND HPW TYPES

● SCHEMATIC DIAGRAM



● P. C. BOARDS PATTERN



● Line Voltage Selection

Line voltage can be changed with following steps.

1. Disconnect the AC power cord.
2. Remove the Bonnet case.
3. Change the connection of the primary lead wires (J450). (Connect as shown in schematic diagram)
4. Stick the line voltage label on the rear panel.

Description	Part No.
220V label	AAX-193
240V label	AAX-192

6. P. C. B's PARTS LIST

NOTES :

- Parts without part number cannot be supplied.
- Parts marked by "◉" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.
- The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
- When ordering resistors, first convert resistance values into code form as shown in the following examples.

Ex.1 When there are 2 effective digits (any digit apart from 0), such as 560 ohm and 47k ohm (tolerance is shown by J = 5 %, and K = 10 %).

560 Ω→56 × 10¹ →561 ········ RD1/4PS [5][6][1] J
47k Ω→47 × 10³ →473 ········ RD1/4PS [4][7][3] J
0.5 Ω→0R5 ········ RN2H [0][R][5] K
1 Ω→010 ········ RS1P [0][1][0] K

Ex.2 When there are 3 effective digits (such as in high precision metal film resistors).

5.62k Ω→562 × 10¹ →5621 ········ RN1/4SR [5][6][2][1] F

◉ SUB BOARD Assembly (PWX1133)

SEMICONDUCTORS

Mark	NO	Description	Part NO.
	IC601	MICROCOMPUTER	PDG036
	Q601-603		DTA124ES
	Q604-606	TRANSISTOR	2SC1740S
	D601		SLH-34MC3H3
	D602		SLH-34YC3H3
	D603		SLH-56VC3H

SWITCHES

Mark	NO	Description	Part NO.
	S601-607	SWITCH (STOP, OPEN/CLOSE, PLAY, PAUSE, DISPLAY OFF, TRACK SEARCH (◁◁, ▷▷))	PSG-065

CAPACITORS

Mark	NO	Description	Part NO.
	C601	CERAMIC CAPACITOR	CKCYF103Z50
	C602	CERAMIC CAPACITOR	CKDYF473Z50
	C603	ELECTROLYTIC CAPACIT	CEAS330M16
	C604	CERAMIC CAPACITOR	CKCYF103Z50

RESISTORS

Mark	NO	Description	Part NO.
		All resistors	RD1/6PM □□□ J

OTHERS

Mark	NO	Description	Part NO.
	V601	FLUORESCENT INDICATOR TUBE	PEL1047
	X601	CERAMIC RESONATOR	VSS1014
		REMOTE SENSOR	GP1U52X

◉ MAIN BOARD Assembly (PWZ1751)

SEMICONDUCTORS

Mark	NO	Description	Part NO.
	IC100		TC9220F-002
	IC101	PRE AMP•IC	TA8137N
	IC200-202		NJM4558S
	IC203		BU4053B
⚠	IC30	IC PROTECTOR	ICP-N10
	IC300		TC9221F
	IC301	MEMORY IC	CXK5816PN-12L
	IC302	LOGIC IC	MC74HC86N
⚠	IC31	IC PROTECTOR	ICP-N10
⚠	IC32	IC PROTECTOR	ICP-N15
	IC350	MICROCOMPUTER	PD3165A
⚠	IC406		NJM7905FA
⚠	IC407		NJM7805FA
	IC408	SYSTEM RESET IC	M51957AL
	IC700		PD0026A
	IC710	IC	SM5813AP
	IC800	IC	MC74HCU04N
⚠	D400		RB-152LF
⚠	D412		10E2
⚠	D413	ZENER DIODE	HZS27NB2
⚠	D414		10E2
⚠	D415	ZENER DIODE	HZS5. 1NB2
	D900-906	DIODE	1SS254
	Q101	TRANSISTOR	2SA1399
	Q200	TRANSISTOR	2SC3581
	Q201	TRANSISTOR	2SA1399
	Q202	TRANSISTOR	2SC3581
	Q203	TRANSISTOR	2SA1399
	Q204	TRANSISTOR	2SC3581
	Q205	TRANSISTOR	2SA1399
	Q206	TRANSISTOR	2SC3581
	Q207	TRANSISTOR	2SA1399
	Q208, 209	TRANSISTOR	DTC124ES
	Q210	TRANSISTOR	DTA124ES
	Q250, 251	TRANSISTOR	DTC124ES
	Q252	TRANSISTOR	DTA124ES
	Q253	TRANSISTOR	2SA854S
	Q254	TRANSISTOR	2SC1741S
	Q300	TRANSISTOR	2SC1740S
	Q4	TRANSISTOR	DTC124ES
	Q400	TRANSISTOR	2SA1048
	Q5, 6	TRANSISTOR	DTC124ES
	Q778	TRANSISTOR	DTA124ES
	Q800, 900	TRANSISTOR	DTC124ES

SWITCH

Mark	NO	Description	Part NO.
	S890	SLIDE SWITCH(DIGITAL OUT)	RSH1025

COILS

Mark	NO	Description	Part NO.
	L100, 200	RADIAL INDUCTOR	LFA010K
	L201, 3	RADIAL INDUCTOR	LFA010K
	L4, 400	RADIAL INDUCTOR	LFA010K
	L401, 710	RADIAL INDUCTOR	LFA010K
	L800	COIL	PTL1003
	L801, 900	RADIAL INDUCTOR	LFA010K

CAPACITORS

Mark	NO	Description	Part NO.
	C1, 10	ELECTR. CAPACITOR	CEAS101M25
	C100	ELECTR. CAPACITOR	CEAS330M16
	C104	ELECTR. CAPACITOR	CEAS101M25
	C105, 106	CERAMIC CAPACITOR	CKCYF103Z50
	C11	CERAMIC CAPACITOR	CCCCH100D50
	C12	ELECTR. CAPACITOR	CEAS101M25
	C13	CERAMIC CAPACITOR	CCCSL331J50
	C14	AUDIO FILM CAPACITOR	CFTXA473J50
	C15	CERAMIC CAPACITOR	CCCSL271J50
	C16	CERAMIC CAPACITOR	CCCSL391J50
	C17	AUDIO FILM CAPACITOR	CFTXA223J50
	C19	AUDIO FILM CAPACITOR	CFTXA103J50
	C2, 20	ELECTR. CAPACITOR	CEAS101M25
	C200	AUDIO FILM CAPACITOR	CFTXA103J50
	C201	AUDIO FILM CAPACITOR	CFTXA182J50
	C202	AUDIO FILM CAPACITOR	CFTXA223J50
	C203	ELECTR. CAPACITOR	CEAS010M50
	C204	AUDIO FILM CAPACITOR	CFTXA104J50
	C205	ELECTR. CAPACITOR	CEANP100M16
	C206	ELECTR. CAPACITOR	CEASR33M50
	C207	AUDIO FILM CAPACITOR	CFTXA153J50
	C21	AUDIO FILM CAPACITOR	CFTXA473J50
	C211, 213	ELECTR. CAPACITOR	CEAS330M50
	C218, 219	ELECTR. CAPACITOR	CEAS330M16
	C220, 221	AUDIO FILM CAPACITOR	CFTXA102J50
	C222, 223	AUDIO FILM CAPACITOR	CFTXA473J50
	C224	ELECTROLYTIC CAPACIT	CEANP330M10
	C3	ELECTR. CAPACITOR	CEAS101M25
	C300	CERAMIC CAPACITOR	CCCSL221J50
	C301	AUDIO FILM CAPACITOR	CFTXA473J50
	C302	CERAMIC CAPACITOR	CCCCH100D50
	C303	AUDIO FILM CAPACITOR	CFTXA103J50
	C304	CERAMIC CAPACITOR	CKCYF103Z50
	C305	ELECTR. CAPACITOR	CEAS101M25
	C307	CERAMIC CAPACITOR	CKCYF103Z50
	C308	ELECTR. CAPACITOR	CEAS101M25
	C309	CERAMIC CAPACITOR	CCCCH100D50
	C310	ELECTR. CAPACITOR	CEAS101M25
	C311	CERAMIC CAPACITOR	CKCYF103Z50
	C313	AUDIO FILM CAPACITOR	CFTXA152J50
	C314	CERAMIC CAPACITOR	CKCYF103Z50
	C315	ELECTR. CAPACITOR	CEAS101M25
	C351	CERAMIC CAPACITOR	CKCYF473Z50
	C352, 356	CERAMIC CAPACITOR	CKCYF103Z50
	C357	ELECTROLYTIC CAPACIT	CEAS101M25
	C4	CERAMIC CAPACITOR	CCCCH330J50
	C400, 401	ELECTROLYTIC CAPACIT	CENA222M16
	C402, 403	ELECTROLYTIC CAPACIT	CENA102M16
	C412-415	ELECTR. CAPACITOR	CEAS101M50
	C416	CERAMIC CAPACITOR	CKCYF103Z50
	C417	ELECTR. CAPACITOR	CEASR47M50
	C430	CERAMIC CAPACITOR	CKCYF103Z50
	C5	CERAMIC CAPACITOR	CCCCH330J50
	C6	ELECTR. CAPACITOR	CEAS101M10
	C700, 701	CERAMIC CAPACITOR	CKCYB102K50
	C710, 711	CERAMIC CAPACITOR	CCCCH070D50
	C712	CERAMIC CAPACITOR	CCCSL101J50
	C713	ELECTR. CAPACITOR	CEAS101M50
	C714	CERAMIC CAPACITOR	CKCYF473Z50
	C715	CERAMIC CAPACITOR	CCCCH470J50
	C8	ELECTR. CAPACITOR	CEAS101M25
	C800, 801	ELECTR. CAPACITOR	CEAS330M16
	C802	AUDIO FILM CAPACITOR	CFTXA103J50
	C803	CERAMIC CAPACITOR	CCCSL221J50
	C804	CERAMIC CAPACITOR	CKCYF103Z50
	C805	CERAMIC CAPACITOR	CKCYF473Z50
	C806	ELECTR. CAPACITOR	CEAS101M10
	C807, 809	CERAMIC CAPACITOR	CKCYF473Z50
	C890, 891	CERAMIC CAPACITOR	CKCYF103Z50
	C9	CERAMIC CAPACITOR	CKCYF103Z50
	C901, 902	CERAMIC CAPACITOR	CKCYF103Z50
	C903, 904	CERAMIC CAPACITOR	CCCSL101J50

RESISTORS

Mark	NO	Description	Part NO.
	R231-234		RN1/6PQ1003F
	R305	RESISTOR ARRAY (10K)	RA6T103J
	Other resistors		RD1/6PM□□□J

OTHERS

Mark	NO	Description	Part NO.
	DL1, 2	FILTER	PTF1009
	JA800	OPTICAL OUTPUT JACK	TOTX178
	JA801	JACK	PKB1004
	JA900	JACK	RKN1014
	JA901, 902	JACK	RKN1004
	CN1	FLEXIBLE CONNECTOR	5597-21CPB
	X350	CERAMIC RESONATOR (4MHz)	FCR4.0MC
	X710	XTAL RES (OSC)	PSS1001

HEADPHONE BOARD Assembly

SEMICONDUCTOR

Mark	NO	Description	Part NO.
	IC500		M5218L

COILS

Mark	NO	Description	Part NO.
	L500-502	RADIAL INDUCTOR	LFA010K

CAPACITORS

Mark	NO	Description	Part NO.
	C500, 501	ELECTR. CAPACITOR	CEAS330M16
	C502	AUDIO FILM CAPACITOR	CFTXA104J50
	C503	AUDIO FILM CAPACITOR	CFTXA561J50
	C504	AUDIO FILM CAPACITOR	CFTXA104J50
	C505	AUDIO FILM CAPACITOR	CFTXA561J50
	C507-511	CERAMIC CAPACITOR	CKCYF103Z50

RESISTORS

Mark	NO	Description	Part NO.
	VR500	VARIABLE RESISTOR	PCS1002
	Other resistors		RD1/6PM□□□J

OTHERS

Mark	NO	Description	Part NO.
	JA500	JACK	RKN1001

TRANSFORMER BOARD Assembly

CAPACITORS

Mark	NO	Description	Part NO.
	C450-463	CERAMIC CAPACITOR	CKCYF103Z50

PRIMARY BOARD ASSEMBLY

SWITCH

Mark	NO	Description	Part NO.
⚠	S470	SWITCH(POWER)	PSA-009

CAPACITOR

Mark	NO	Description	Part NO.
⚠	C470	CAPACITOR (CERAMIC)	RCG-009

◉AUDIO BOARD Assembly (PWZ1936)

SEMICONDUCTORS

Mark	NO	Description	Part NO.
⚠	IC400		NJM7805FA
⚠	IC401		NJM7812FA
⚠	IC402		NJM7912FA
⚠	IC403		NJM7905FA
	IC730, 731	D/A CONVERTER, IC	PCM63P-J
	IC732, 733	IC	MC74HCU04N
	IC750, 751		NE5532P
	IC770, 771		NJM2068DD
	Q750	TRANSISTOR	DTA124ES
	Q751, 752	TRANSISTOR	2SC3068
	Q770	N-FET	2SK246
	Q771	P-FET	2SJ103
	Q772	TRANSISTOR	2SD1302
	Q773	TRANSISTOR	2SC3068
	Q774	N-FET	2SK246
	Q775	P-FET	2SJ103
	Q776	TRANSISTOR	2SD1302
	Q777	TRANSISTOR	2SC3068
	Q779	TRANSISTOR	DTC124ES
⚠	D404-411		10E2

COILS

Mark	NO	Description	Part NO.
	L403, 404	FERRITE BEAD	VTH1013
	L701, 702	FERRITE BEAD	VTH1013

CAPACITORS

Mark	NO	Description	Part NO.
	C404, 405	(2200µ/35V)	VCH1032
	C406	ELECTROLYTIC CAPACIT	CENA102M16
	C407	ELECTROLYTIC CAPACIT	CEAS102M35
	C408	ELECTROLYTIC CAPACIT	CENA102M16
	C409	ELECTROLYTIC CAPACIT	CEAS102M35
	C410, 411	CERAMIC CAPACITOR	CKCYF103Z50
	C420-423	CERAMIC CAPACITOR	CKCYF103Z50
	C716	AUDIO FILM CAPACITOR	CFTXA103J50
	C730	ELECTR. CAPACITOR	CENA101M50
	C731	AUDIO FILM CAPACITOR	CFTXA104J50
	C732	ELECTR. CAPACITOR	CENA101M50
	C733, 734	ELECTR. CAPACITOR	CEAS101M25
	C736	AUDIO FILM CAPACITOR	CFTXA104J50
	C737	ELECTR. CAPACITOR	CENA101M50
	C738	ELECTR. CAPACITOR	CEAS330M16
	C740	ELECTR. CAPACITOR	CENA101M50
	C741	AUDIO FILM CAPACITOR	CFTXA104J50
	C742	ELECTR. CAPACITOR	CENA101M50
	C743, 744	ELECTR. CAPACITOR	CEAS101M25
	C746	AUDIO FILM CAPACITOR	CFTXA104J50
	C747	ELECTR. CAPACITOR	CENA101M50
	C748	ELECTR. CAPACITOR	CEAS330M16
	C750, 751	PL. STYRENE CAPACITOR	CQSF301J50
	C752	PL. STYRENE CAPACITOR	CQSF681J50
	C753	PL. PROPYTENE CAPACIT	CQPYA752J2A
	C754	PL. STYRENE CAPACITOR	CQSF681J50
	C755	PL. PROPYTENE CAPACIT	CQPYA752J2A
	C756-759	ELECTR. CAPACITOR	CEAS101M25
	C769	CERAMIC CAPACITOR	CKCYF473Z50
	C770	PL. PROPYTENE CAPACIT	CQPYA122J2A
	C771	PL. PROPYTENE CAPACIT	CQPYA103J2A
	C773, 774	ELECTR. CAPACIT	CENA101M50
	C775	ELECTROLYTIC (47µ/50V)	PCH1094
	C776	PL. STYRENE CAPACITOR	CQSF102J50
	C780	PL. PROPYTENE CAPACIT	CQPYA122J2A
	C781	PL. PROPYTENE CAPACIT	CQPYA103J2A
	C783, 784	ELECTR. CAPACITOR	CENA101M50
	C785	ELECTROLYTIC (47µ/50V)	PCH1094
	C786		CQSF102J50

RESISTORS

Mark	NO	Description	Part NO.
	VR730, 731	VR	VRTB6VS104
	VR740, 741	VR	VRTB6VS104
	R750, 751	CARBON FILM RESISTOR	RDR1/2PM332J
	R774, 784	CARBON FILM RESISTOR	RDR1/2PM471J
	R406-411, 790	CARBON FILM	RD1/2PM □□□ J
	Other resistors		RD1/6PM □□□ J

OTHERS

Mark	NO	Description	Part NO.
	JA700	JACK	PKB1011
	CN401		KPC5
	CN700		KPC10

7. ADJUSTMENTS

The adjustments for this unit are given below. Adjustments must be made in the order in which they are listed.

● Adjustments and check items

1. Focus lock and spindle lock check
2. Automatic adjustment check of the tracking balance
3. Grating adjustment
4. RF level adjustment
5. LD (Laser Diode) power check
6. Tangential adjustment
7. Radial adjustment
8. 2SB adjustment

● Measuring equipment

1. Dual trace oscilloscope
2. Optical power meter
3. Test disc (YEDS-7), 8 cm disc
4. Other regular measuring equipment

● About the test mode

How to activate and release the test mode

① To activate the test mode, turn ON the power switch (S470) with the test mode jumper short-circuited.

② The test mode is released by turning the power switch OFF.

The functions of the keys in the test mode are outlined in Table 7-1.

● Adjustment VR and their names

VR1 : Laser power

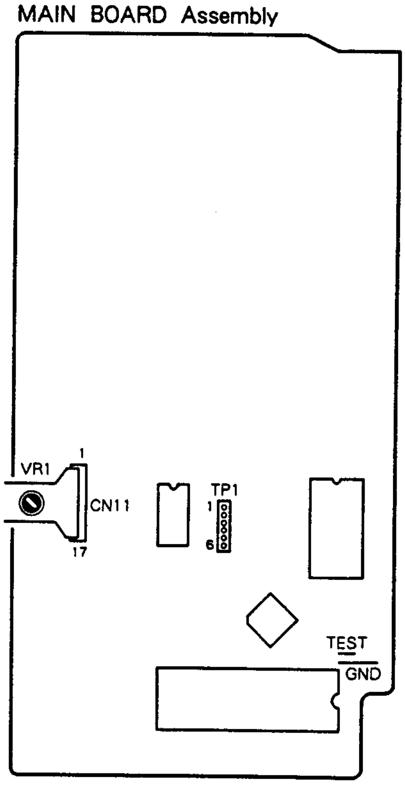
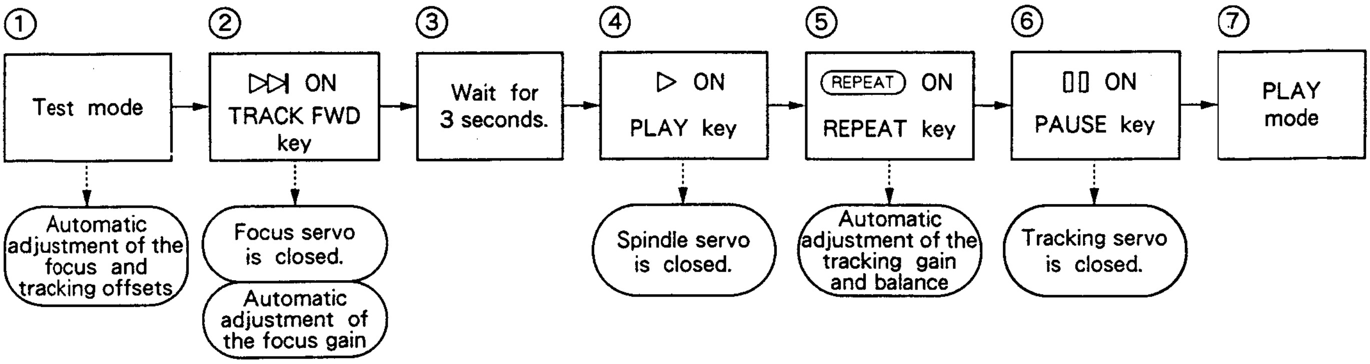


Fig. 7-1 Adjusting point

In the test mode, the servos must be closed and opened individually. Consequently, the servos must each be closed in the proper sequence (serial sequence) in order to put the machine into the play mode. Note also that the machine will not enter the play mode when the PAUSE (▯▯) key is pressed.
For example, in order to change from the stop to the play mode, the function keys must be pressed in the following order.

*1: The MANUAL SEARCH and REPEAT keys are not available on the panel. Use the remote control unit for these key operations. For other keys (PLAY, TRACK, PAUSE, etc.), both the panel and the remote control unit can be used.

*2: Servos in test mode are controlled in serial sequence. Note that no command is accepted in this model as long as the focus servo is not closed while the spindle is rotated in conventional models only by pressing the PLAY button.

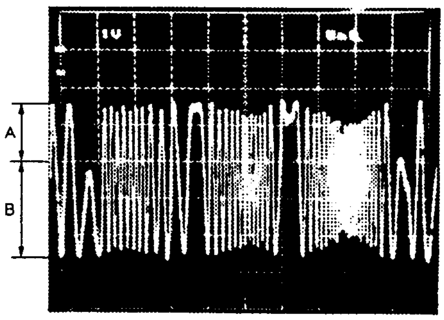


• Key Functions in Test Mode

Symbol	Key name	Function in test mode	Description
▷▷|	TRACK FWD	Focus servo close Automatic adjustment of the focus gain	After illuminating the laser diode, slightly kicking the disc and moving up/down the focus actuator to adjust the focus gain, the focus servo is closed.
▷	PLAY	Spindle servo close	Closes the servo in the rough servo mode after kicking the spindle motor.
(REPEAT)	REPEAT	Automatic adjustment of the tracking gain and balance	The tracking gain and balance are automatically adjusted using the error waveform in the tracking open loop condition.
▯▯	PAUSE	Tracking servo close/open	Acts as a toggle : closes the tracking servo and activates play mode when pressed (provided the focus and spindle servos are closed), at which time the PAUSE indicator illuminates ; opens the tracking servo when pressed again.
◁◁	MANUAL SEARCH REV	Carriage reverse (moves inward)	Moves carriage quickly (3cm/s) toward innermost track. Be careful not to move too far as there is no safety device to stop the carriage.
▷▷	MANUAL SEARCH FWD	Carriage forward (moves outward)	Moves carriage quickly (3cm/s) toward outermost track. Be careful not to move too far as there is no safety device to stop the carriage.
□	STOP	Stop	Stops all servos and returns system to its initial state.
⏏	OPEN/CLOSE	Disc tray open/close	Opens and closes the disc tray. However, pickup does not return to rest on OPEN, and it remains stationary on CLOSE.

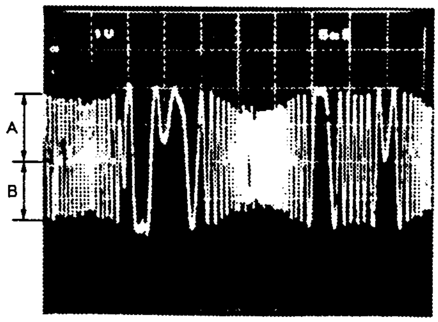
Table 7-1

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
1	**Focus lock and spindle lock check**					
	0.5V/div	100msec / div	TP1 Pin 1 (RF output)		RF signal is output. Forward (clockwise) rotation	● Set the test disc. ● Put unit in the test mode. (※) ● Press the MANUAL SEARCH FWD (▷▷) key to move the pickup to the center of the disc. Note: Be sure to perform this operation. ● Observe the output of TP1 pin 1 (RF output) on the oscilloscope. Confirm that the RF signal is output after the TRACK FWD (▷▷|) key is pressed. ● Press the PLAY (▷) key and confirm that the disc rotates at constant speed (approx. 300 rpm) near center of disc in the forward (clockwise) direction ; disc may not run away or rotate counterclockwise.
2	**Automatic adjustment check of the tracking balance**					
	0.5V/div	5msec / div	TP1 Pin 2 (TRK. ERR)		TRK. ERR	● Set the test disc. ● Put unit in the test mode. (※) ● While observing pin 2 of TP1 or TRK. ERR (tracking error) on an oscilloscope, adjust the DC offset to set the voltage to center on the oscilloscope. ● Press the MANUAL SEARCH FWD (▷▷) key to position the carriage near the center of the disc. ● Press the TRACK FWD (▷▷|) and PLAY (▷) keys sequentially to cause the disc to rotate. ● Press the REPEAT key and check that the DC component in the tracking error is gone (A=B). Note : In normal mode, this adjustment is performed at an appropriate timing after the spindle kick. Therefore, a disc that is drastically off center may not result in A=B upon confirmation in test mode. In this case, press the REPEAT key again and check if the DC level varies.



A ≠ B

Photo. 7-1 DC elements mixed in signal



A = B

Photo. 7-2 DC elements eliminated

※ : See page 30.

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
3	**Grating Adjustment (1) (When an 8 cm disc is used.)**					
						Note : This adjustment can be made by using an 8 cm disc, having pits within the diameter range of 75 mm. ● Put unit in the test mode. (※) ● Press the MANUAL SEARCH FWD (▷▷) key to move the pickup to the center of the disc, so that the grating adjustment screw of the pickup can be viewed through the oval hole (one of the oval holes which is near to the spindle motor) on the base plate of the servo mechanism. ● As shown in Fig. 7-2, insert a (slotted) ⊖ screwdriver from the top of the mechanism and check that the grating adjusting screw can be rotated. ● Mount the test disc. ● Press the TRACK FWD (▷▷|), PLAY (▷) and REPEAT keys in sequence to close the focus servo and spindle servo (do not turn on the tracking servo). ● Insert a 4 kHz-cutoff low pass filter between the oscilloscope and TP1 pins 2 (TRK. ERR) and 4 (GND) as shown in Fig. 7-3 and observe the waveform of TP1 pin 2 (tracking error) on the oscilloscope.
	0.5V/div	5msec /div	TP1 Pin 2 (TRK. ERR)	Grating adjustment screw Grating adjustment screw	Null point Maximum amplitude	● Insert a ⊖ screwdriver into the grating hole, turn and find the null point (see Photo 7-3). ● Next, slowly turn the ⊖ screwdriver COUNTERCLOCKWISE from the null point and adjust until the waveform (tracking error signal) reaches maximum amplitude (see Photo 7-4). Note: Avoid applying pressure to the ⊖ screw-driver while adjusting the screw. Doing so causes the pickup to move inward, making adjustment more difficult.
						● Lastly, make sure that there is no major fluctuation in the p-p voltage of the tracking error signal (do not insert the cutoff 4 kHz low-pass filter) when the pickup is moved to the inner and outer periphery. If there is a difference of more than ±10% again turn the grating adjustment screw and adjust the tracking error signal to maximum.

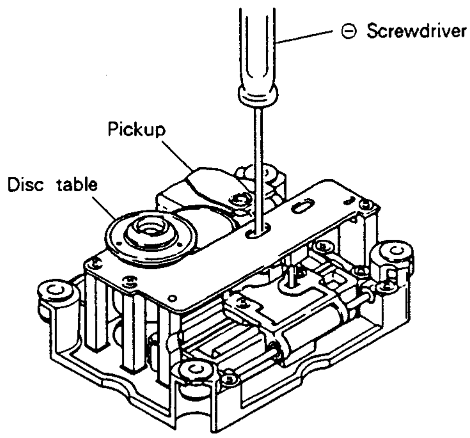


Fig. 7-2

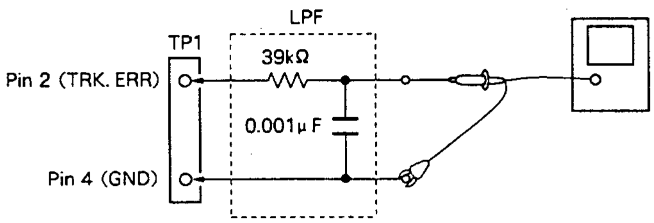


Fig. 7-3

※ : See page 30.

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
3'	Grating adjustment (2) (When no 8 cm disc is available.)					

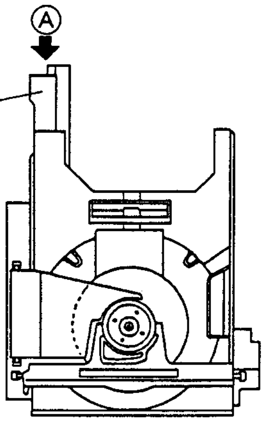


Fig. 7-4

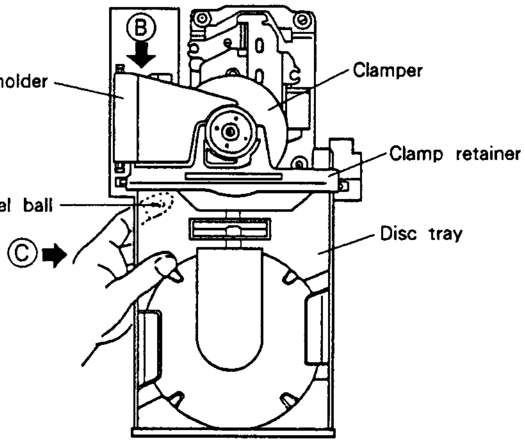


Fig. 7-5

This adjustment is made if no 8 cm disc is available and the grating adjustment (1) cannot be effectuated. Remove the disc tray to perform this adjustment.

● Removal of the disc tray

1. Press the rear edge of the rack, (*1) marked Ⓐ in Fig. 7-4, while pulling the disc tray out to the position where it catches, illustrated in Fig. 7-5.

(*1) When the rear edge of rack Ⓐ is pressed, first the disc clamp is released. If you continue pressing after it has been released completely, the disc tray is ejected.

2. While pulling the clamp holder Ⓑ (see Fig. 7-5) upward with the right hand, hold the tray as indicated by Ⓒ in the left hand and pull it outward. Take care not to allow the $\phi 4$ steel ball to fall (we recommend holding the ball in place with the left index finger while extracting the tray.)

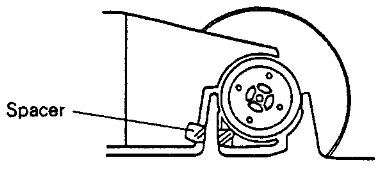


Fig. 7-6

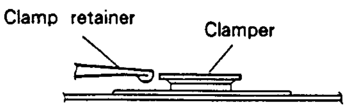


Fig. 7-7

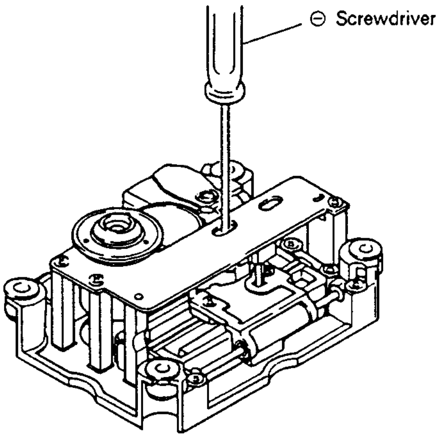
<table>
<tr><th rowspan="2">Step No.</th><th colspan="2">Oscilloscope Setting</th><th rowspan="2">Test Points</th><th rowspan="2">Adjusting Points</th><th rowspan="2">Check items/ Adjustment specifications</th><th rowspan="2">Adjustment procedure</th></tr>
<tr><th>V</th><th>H</th></tr>
<tr><td></td><td colspan="5">

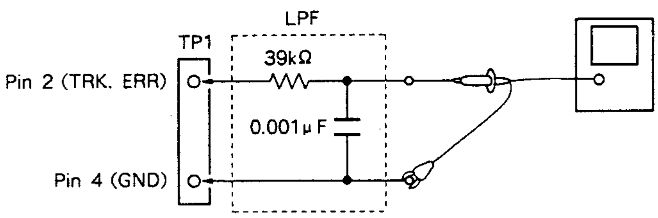
Fig. 7-8


Fig. 7-9</td><td>● Put unit in the test mode. (※)
● Press the MANUAL SEARCH FWD (▷▷|) key to move the pickup to the center of the disc, so that the grating adjustment screw of the pickup can be viewed through the oval hole (one of the oval holes which is near to the spindle motor) on the base plate of the servo mechanism.
● As shown in Fig. 7-8, insert a (slotted) ⊖ screwdriver from the top of the mechanism and check that the grating adjusting screw can be rotated.
● Mount the test disc; be sure to insert a 3-5 mm spacer (if no spacer is available, use a hex wrench) between the clamp holder and clamp retainer, as shown in Fig. 7-6.
● Confirm that the clamper and the clamp retainer are not contacting one another (Fig. 7-7).
● Press the TRACK FWD (▷▷|), PLAY (▷) and REPEAT keys sequentially to close the focus and spindle servos (do not close the tracking servo).
● Insert a 4 kHz-cutoff low pass filter between the oscilloscope and TP1 pins 2 (TRK. ERR) and 4 (GND) as shown in Fig. 7-9 and observe the waveform of TP1 pin 2 (tracking error) on the oscilloscope.</td></tr>
<tr><td></td><td>0.5V/div</td><td>5msec /div</td><td>TP1
Pin 2
(TRK. ERR)</td><td>Grating adjusting screw

Grating adjusting screw</td><td>Null point

Maximum amplitude</td><td>● Turn the grating adjusting screw with the ⊖ screwdriver to find the null point (see Photo 7-3.).
● Next, slowly turn the ⊖ screwdriver COUNTERCLOCKWISE and adjust to the point where the waveform (tracking error signal) first achieves its maximum amplitude (see Photo 7-4).

Note: Avoid applying pressure to the ⊖ screwdriver while adjusting the screw. Doing so causes the pickup to move inward, making adjustment more difficult.

● Lastly, remove the low pass filter and confirm that the tracking error signal (do not insert the cutoff 4 kHz low-pass filter) p-p voltage does not greatly vary when the pickup is moved to the inner-most and outer-most tracks of the disc.
·If the levels diverge by ±10% or more, re-adjust the maximum error amplitude point by turn the grating adjusting screw.</td></tr>
</table>

※ : See page 30.

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
						Re-mount the disc tray according to the following procedure when the grating adjustment is complete. 1. Remove the disc and the spacer. 2. While lifting the clamp holder [marked Ⓑ in Fig. 7-5] with the right hand, hold the tray in the left hand as indicated by Ⓒ and slide the slide base into the hard resin fittings on the loading base as shown in Fig. 7-10 to re-insert the disc tray. At this time, be sure to hold the steel ball in place with the index finger of the left hand. Also, be careful that the front panel is not damaged by the slide base and bearing of the steel ball's bearing (in the slide base) coming into contact with the panel. 3. Insert the slide base so that it fits into the two hard resin fittings at the rear of the loading base (see Fig. 7-11). 4. Insert the tray tightly.

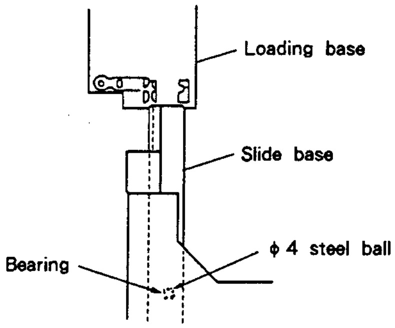


Fig. 7-10

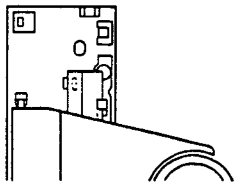


Fig. 7-11

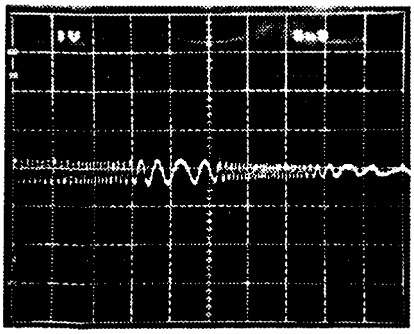


Photo. 7-3
Null point

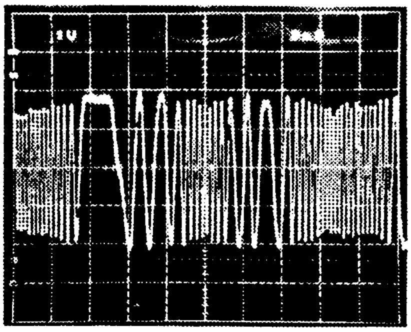


Photo. 7-4
Maximum amplitude

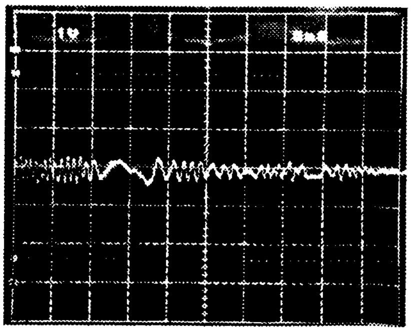
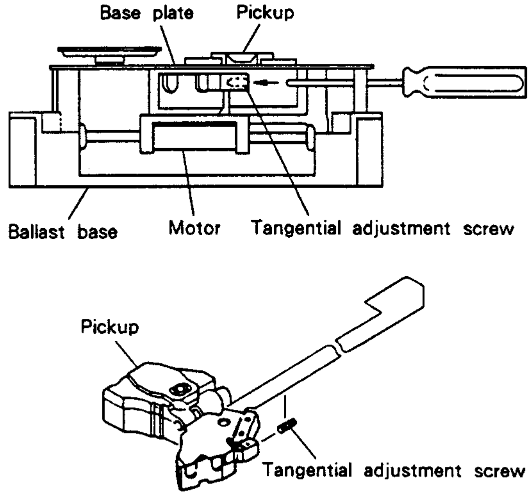


Photo. 7-5
This is not the null-point waveform.

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
4	**RF level adjustment**					
			TP1 Pin 1 (RF OUTPUT)	VR1 (Laser power)	$1.5Vp\text{-}p^{+0.2V}_{-0.1V}$	● Put unit in the test mode. (※) ● Connect the oscilloscope to TP1 pin 1 (RF output), play the test disc, and measure the P-P voltage of the RF waveform. ● Adjust VR1 (Laser power) so that the voltage is $1.5Vp\text{-}p^{+0.2V}_{-0.1V}$.
5	**LD (laser diode) power check**					
				VR1	Less than 0.13mW	● Put unit in the test mode. (※) ● Press the TRACK FWD (▷▷|) key to turn ON the laser diode (LD). ● Place the sensor of the optical power meter directly above the objective lens and confirm that the LD power is less than 0.13mW.
6	**Tangential adjustment**					
	 Fig. 7-12					● Put unit in the test mode. (※) ● Open the tray and load the test disc. ● Press the MANUAL SEARCH FWD (▷▷) key to position the pickup near the center of the disc. ● Insert a hex wrench into the tangential adjustment screw section from the rear of the mechanism. ● Close the tray. Note: Do not use an L-shaped hex wrench. Use one such as shown to the left. Using an L-shaped hex wrench can cause the tray to come loose (see page 34 3'. Grating adjustment (2)). ● Press the TRACK FWD (▷▷|), PLAY (▷), REPEAT and PAUSE (▯▯) keys sequentially to close the all servos (PAUSE indicator will illuminate).

※ : See page 30.

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
		200nsec / div	TP1 Pin 1 RF output	Tangential adjustment screw	Sharpest possible eye pattern	● Observe TP1 pin 1 (RF output) on the oscilloscope and adjust the tangential adjustment screw to achieve the sharpest possible eye pattern. ● The point to which the adjusting screw should be set lies about halfway between the points at which the eye pattern becomes most blurred when the screw is rotated clockwise and counterclockwise. When the whole waveform becomes clear, concentrate on sharpening the fine lines forming the diamond at the center of the eye pattern (see Photo 7-7). Adjust until the fine lines on all four sides of the diamond are both sharply defined and dense. Note: Use a hex wrench to raise the pickup some what while making this adjustment.

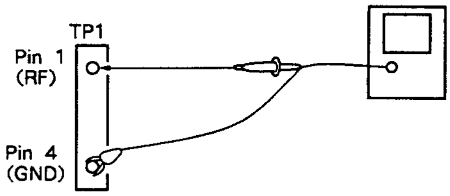


Fig. 7-13

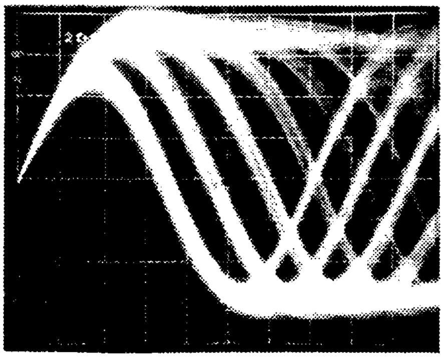


Photo. 7-6

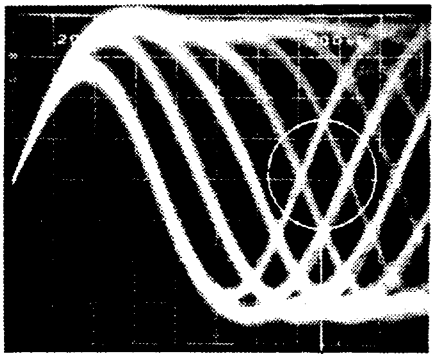


Photo. 7-7

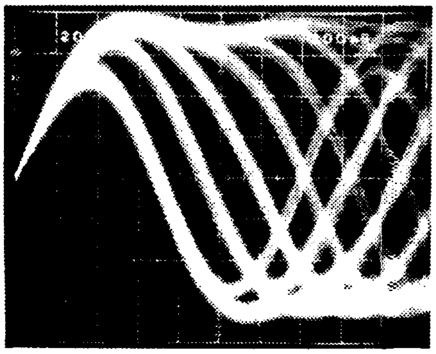
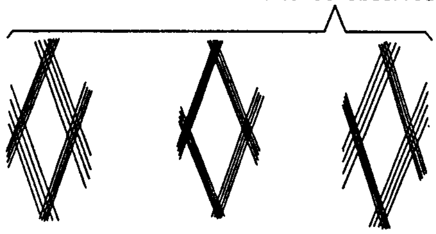


Photo. 7-8

Part to be observed



Unsatisfactory | Optimum adjustment | Unsatisfactory

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
7	**Radial adjustment**					
			TP1 Pin 1 (RF output)	Radial adjustment screw	Sharpest possible eye pattern	Remove the disc tray before beginning this adjustment. Note: Refer to page 34 "3'. Grating adjustment (2)" for the removal of the disc tray. ● Load the test disc. ● Put unit in the test mode. (※) ● Press the MANUAL SEARCH FWD (▷▷) key to move the pickup to the center of the disc, so that tangential adjustment screw can be viewed from the top (refer to Fig. 7-12). ● Press the TRACK FWD (▷▷|), PLAY (▷), REPEAT and PAUSE (▯▯) keys sequentially to close all servos(PAUSE indicator will illuminate). ● Observe TP1 pin 1 (RF output) on the oscilloscope and adjust the radial adjustment screw to achieve the sharpest possible eye pattern. (Fig. 7-14) ● When the whole waveform becomes clear, concentrate on sharpening the fine lines forming the diamond at the center of the eye pattern. Adjust until the fine lines on all four sides of the diamond are both sharply defined and dense, as shown in Photo 7-7. ● Perform the tangential adjustment and the radial adjustment twice or more alternately.

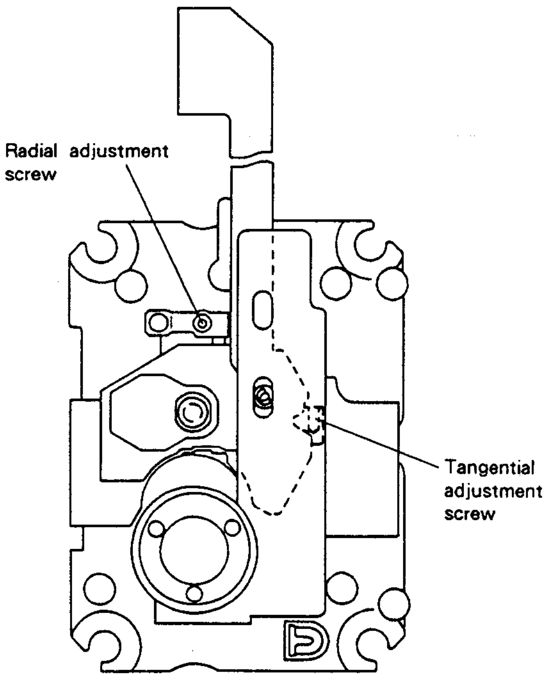


Fig. 7-14

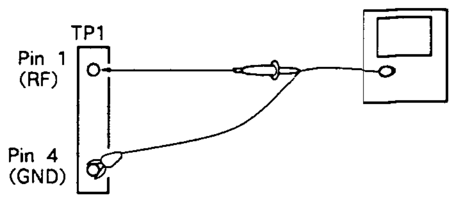


Fig. 7-15

※ : See page 30.

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
8	**D/A converter (2SB) adjustment**					
						● When replacing the D/A converter For IC730 : Remove R730 through R733. For IC731 : Remove R740 through R743. (In this case, no adjustment is performed for 2SB. However, the initial condition of the performance of the D/A converter is resumed by removing the resistors.)

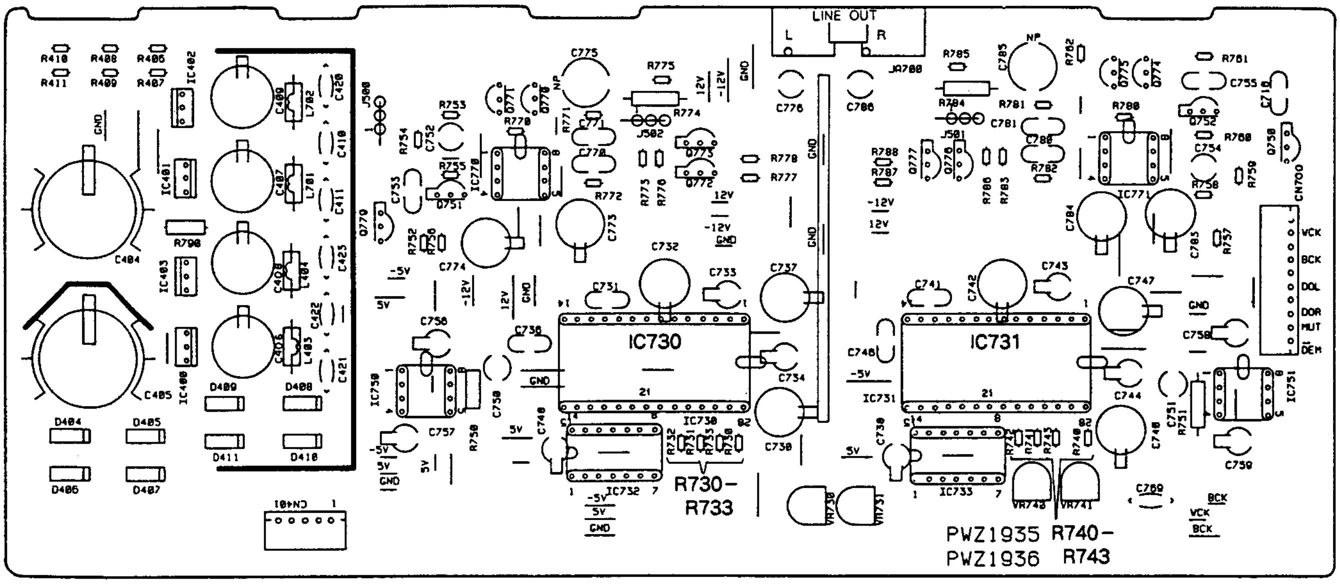


Fig. 7-16 AUDIO BOARD Assembly

8. IC INFORMATION

■ PD3165A

System control microcomputer

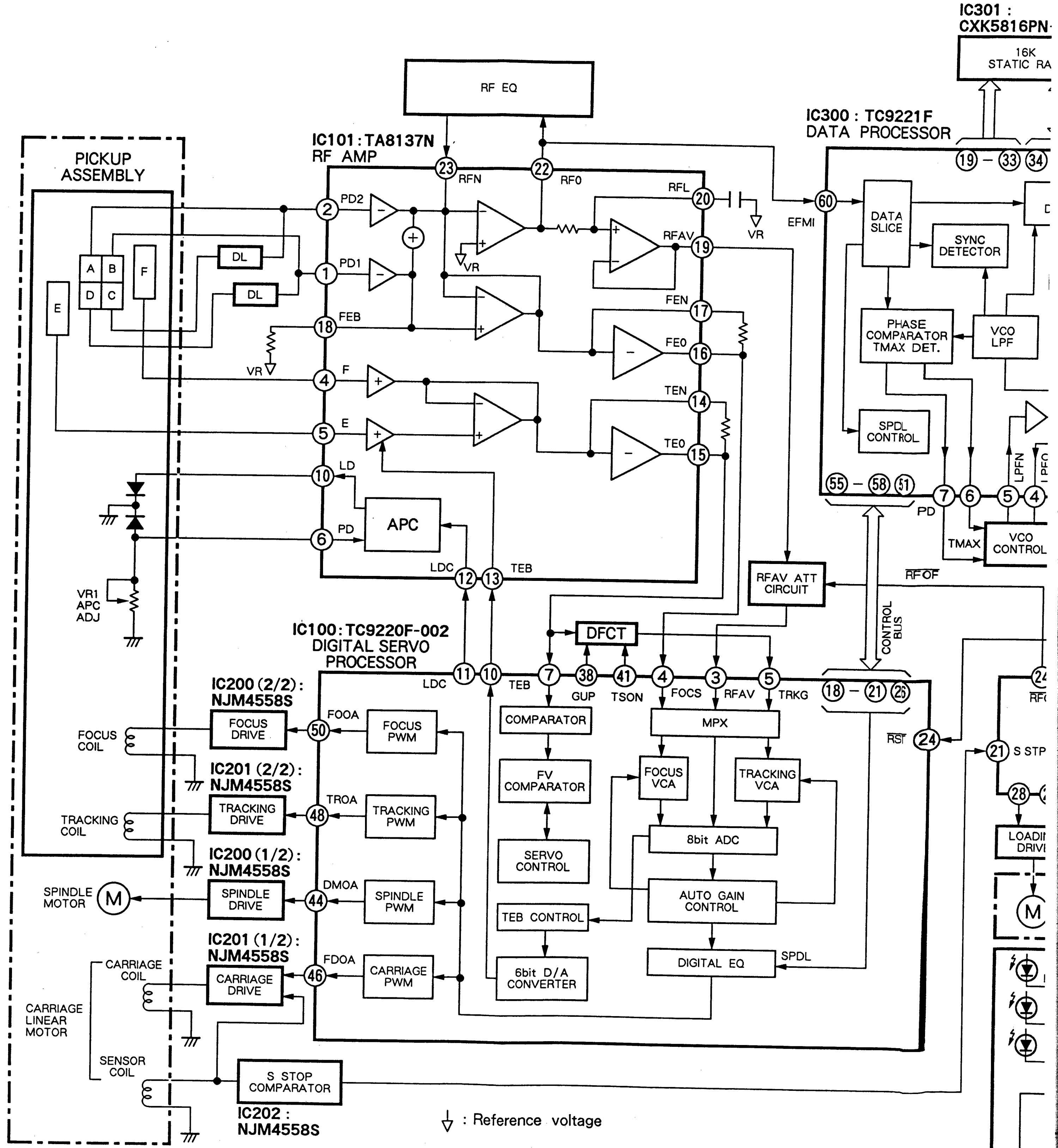
● Pin functions

Pin	Symbol	Name	I/O	Function	Reset
1	Vss	—	—	GND	—
2	XTAL	—	—	Built-in clock circuit input	—
3	EXTAL	—	—	Built-in clock circuit input	—
4	MP0	—	I	+5V	—
5	MP1	—	I	+5V	—
6	$\overline{RES}$	—	I	CPU reset input Reset / RUN	—
7	$\overline{STBY}$	—	I	CPU stand-by input Stand-by / RUN	—
8	$\overline{NMI}$	*1	I	+5V	—
9	P20	$\overline{TEST}$	I	Test mode SW input TEST / NORMAL	—
10	P21	SYC1	I	Input terminal for deck synchro.	—
11	P22	SYC3	O	Output terminal for deck synchro.	L
12	P23	*1	O	(OPEN)	L
13	P24	*1	O	(OPEN)	L
14	P25	$\overline{DEMP}$	O	De-emphasis ON/OFF ON / OFF	H
15	P26	$\overline{CCE}$	O	Chip enable Enable	H
16	P27	BUCK	O	Bus clock	H
17	P50	BUS0	I/O	Bus data 0	—
18	P51	BUS1	I/O	Bus data 1	—
19	P52	BUS2	I/O	Bus data 2	—
20	P53	BUS3	I/O	Bus data 3	—
21	P54	SSTP	I	Slider inside detection input NOT / STOP	—
22	P55	DFCT	I	Defect detection input *2 NOT / Defect	—
23	P56	TSON	I	Tracking servo ON detection input *2 NOT / ON	—
24	P57	$\overline{RFOF}$	O	RFAV level ON/OFF switch output ON / OFF	H
25	P60	*1	O	(OPEN)	L
26	P61	*1	O	(OPEN)	L
27	P62	*1	O	(OPEN)	L
28	P63	LIN	O	Disc tray loading IN	L
29	P64	LOUT	O	IN/OUT output Brake / OUT	L
30	P65	$\overline{OPEN}$	I	OPEN end OPEN / NOT	—
31	P66	$\overline{CLMP}$	I	Clamp end CLAMP / NOT	—
32	P67	*1	O	(OPEN)	L
33	Vcc	—	—	+5V power supply voltage	—
34	P47	$\overline{ALAT}$	O	Attenuation level latch pulse output Execute	H

Pin	Symbol	Name	I/O	Function	Reset
35	P46	ADAT	O	Attenuation level data 0 1 2 3 4 5 6 7	H
36	P45	ACLK	O	Attenuation level clock	H
37	P44	$\overline{KS}$	I	Main unit key strobe input ON / OFF	—
38	P43	$\overline{RKS}$	I	Remote control key strobe input ON / OFF	—
39	P42	*1	O	(OPEN)	L
40	P41	MDSW		GND	—
41	P40	STS	I	Display data transfer permission input Permit / Inhibit	—
42	Vss	—	—	GND	—
43	P17	*1	O	(OPEN)	L
44	P16	*1	O	(OPEN)	L
45	P15	*1	O	(OPEN)	L
46	P14	$\overline{DOFF}$	O	Display LED of digital out output condition ON / OFF	H
47	P13	$\overline{AOFF}$	O	Display LED of analog out output condition ON / OFF	H
48	P12	SCK	O	Display data serial transfer clock	H
49	P11	SD	O	Display data serial output	H
50	P10	SRES	O	Key display and microcomputer reset output RESET / RUN	L
51	P37	KD7	I	Main unit and remote control key code input (MSB)	—
52	P36	KD6	I	Main unit and remote control key code input	—
53	P35	KD5	I	Main unit and remote control key code input	—
54	P34	KD4	I	Main unit and remote control key code input	—
55	P33	KD3	I	Main unit and remote control key code input	—
56	P32	KD2	I	Main unit and remote control key code input	—
57	P31	KD1	I	Main unit and remote control key code input	—
58	P30	KD0	I	Main unit and remote control key code input (LSB)	—
59	P74	*1	O	(OPEN)	L
60	P73	*1	O	(OPEN)	L
61	P72	*1	O	(OPEN)	L
62	P71	*1	O	(OPEN)	L
63	P70	*1	O	(OPEN)	L
64	E	—	O	(OPEN)	—

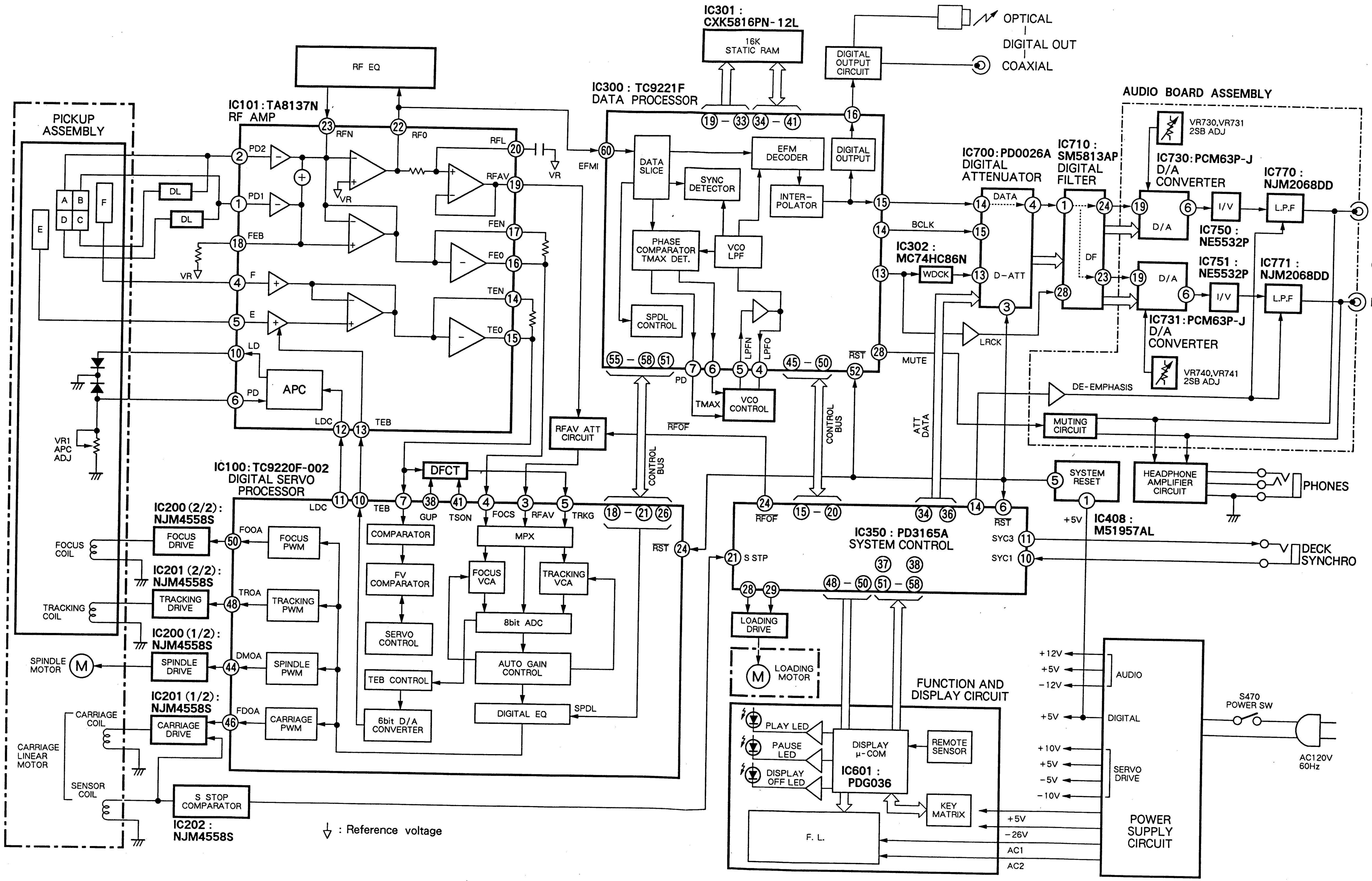
*1 : Not used
*2 : Set to input port, but these functions are not used by the use of software.

9. BLOCK DIAGRAM



9. BLOCK DIAGRAM

	Reset
I	H
ʃ⌐ʃ	H
ON OFF	–
ON OFF	–
	L
	–
on input	–
	–
	L
	L
	L
ut condition	H
t condition	H
ck ʃ⌐ʃ	H
	H
eset output	L
MSB) — LSB)	–
	L
	–



10. FOR HEM, HB, HPW AND SD TYPES

10.1 CONTRAST OF MISCELLANEOUS PARTS

NOTES :
- Parts without part number cannot be supplied.
- Parts marked by "◉" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.
- The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
- When ordering resistors, first convert resistance values into code form as shown in the following examples.

Ex.1 When there are 2 effective digits (any digit apart from 0), such as 560 ohm and 47k ohm (tolerance is shown by J = 5 %, and K = 10 %).

560 Ω → 56 × 10^1 → 561 ········ RD1/4PS[5][6][1]J
47k Ω → 47 × 10^3 → 473 ········ RD1/4PS[4][7][3]J
0.5 Ω → 0R5 ········ RN2H[0][R][5]K
1 Ω → 010 ········ RS1P[0][1][0]K

Ex.2 When there are 3 effective digits (such as in high precision metal film resistors).

5.62k Ω → 562 × 10^1 → 5621 ········ RN1/4SR[5][6][2][1]F

The HEM, HB, HPW and SD types are the same as the KU/CA type with the exception of the following sections.

Mark	Symbol & Description	Part No.					Remarks
		KU/CA type	HEM type	HB type	HPW type	SD type	
⚠	Strain relief	CM-22C	CM-22B	CM-22B	CM-22B	CM-22B	
	Display screen	PAM1323	PAM1305	PAM1305	PAM1323	PAM1323	
	Connection cord with mini plug	PDE-319	• • • • •	• • • • •	PDE-319	• • • • •	
⚠	AC power cord	PDG1002	PDG1003	PDG1004	PDG1006	PDG1013	
	Operating instructions (English)	PRB1130	• • • • •	PRB1130	PRB1130	PRB1130	
	Operating instructions (English/German/French/Italian/Dutch/Swedish/Portuguese/Spanish)	• • • • •	PRE1130	• • • • •	• • • • •	• • • • •	
⚠	Power transformer (AC120V)	PTT1109	• • • • •	• • • • •	• • • • •	• • • • •	
⚠	Power transformer (AC220V,240V)	• • • • •	PTT1110	PTT1110	PTT1110	• • • • •	
⚠	Power transformer (AC110V,120−127V,220V,240V)	• • • • •	• • • • •	• • • • •	• • • • •	PTT1111	
◉	Main board assembly	PWZ1751	PWZ1745	PWZ1745	PWZ1751	PWZ2003	
	Headphone board assembly	Non supply	Non supply	Non supply	Non supply	Non supply	
	Transformer board assembly	Non supply	Non supply	Non supply	Non supply	Non supply	
	Primary board assembly	Non supply	Non supply	Non supply	Non supply	Non supply	
◉	Audio board assembly	PWZ1936	PWZ1935	PWZ1935	PWZ1936	PWZ2007	
◉	Sub board assembly	PWX1133	PWX1132	PWX1132	PWX1133	PWX1132	
⚠	Voltage selector (AC110V,120−127V,220V,240V)	• • • • •	• • • • •	• • • • •	• • • • •	PSB1002	
⚠	FU470 Fuse (T160mA)	• • • • •	REK-092	REK-092	• • • • •	• • • • •	

MAIN BOARD ASSEMBLY

The Main board assembly (PWZ1745) and (PWZ2003) are the same as the Main board assembly (PWZ1751) with the exception of the following sections.

Mark	Symbol & Description	Part No.			Remarks
		PWZ1751	PWZ1745	PWZ2003	
	C903,C904	CCCSL101J50	• • • • •	• • • • •	
	D903 − D906	1SS254	• • • • •	• • • • •	
	JA901,JA902 Remote control jack	RKN1004	• • • • •	• • • • •	
	R904	RD1/6PM244J	• • • • •	• • • • •	
	R905	RD1/6PM102J	• • • • •	• • • • •	

HEADPHONE BOARD ASSEMBLY

The Headphone board assembly of SD type is the same as that of KU/CA type with the exception of the following sections. Other types are the same as the KU/CA type for the service supply parts.

Mark	Symbol & Description	Part No.		Remarks
		KU/CA type	SD type	
	IC500	M5218L	M5218AL	

Other P. C. Board Assemblies are the same as the KU/CA type for the service supply parts.

MAIN BOARD ASSEMBLY

The Main board assembly (PWZ1745) and (PWZ2003) are the same as the Main board assembly (PWZ1751) with the exception of the following sections.

Mark	Symbol & Description	Part No.			Remarks
		PWZ1751	PWZ1745	PWZ2003	
	C903,C904	CCCSL101J50	• • • • • •	• • • • • •	
	D903 – D906	1SS254	• • • • • •	• • • • • •	
	JA901,JA902 Remote control jack	RKN1004	• • • • • •	• • • • • •	
	R904	RD1/6PM244J	• • • • • •	• • • • • •	
	R905	RD1/6PM102J	• • • • • •	• • • • • •	

HEADPHONE BOARD ASSEMBLY

The Headphone board assembly of SD type is the same as that of KU/CA type with the exception of the following sections. Other types are the same as the KU/CA type for the service supply parts.

Mark	Symbol & Description	Part No.		Remarks
		KU/CA type	SD type	
	IC500	M5218L	M5218AL	

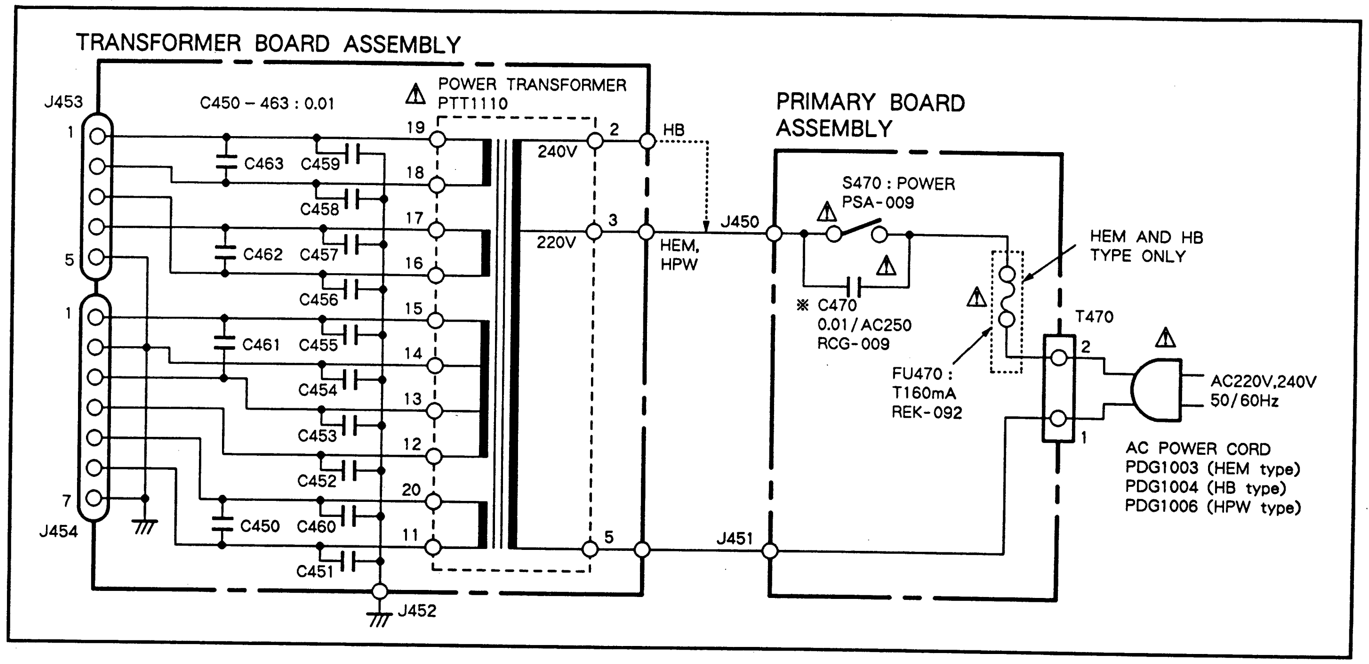
Other P. C. Board Assemblies are the same as the KU/CA type for the service supply parts.

10.2 SCHEMATIC DIAGRAM AND P. C. BOARDS PATTERN

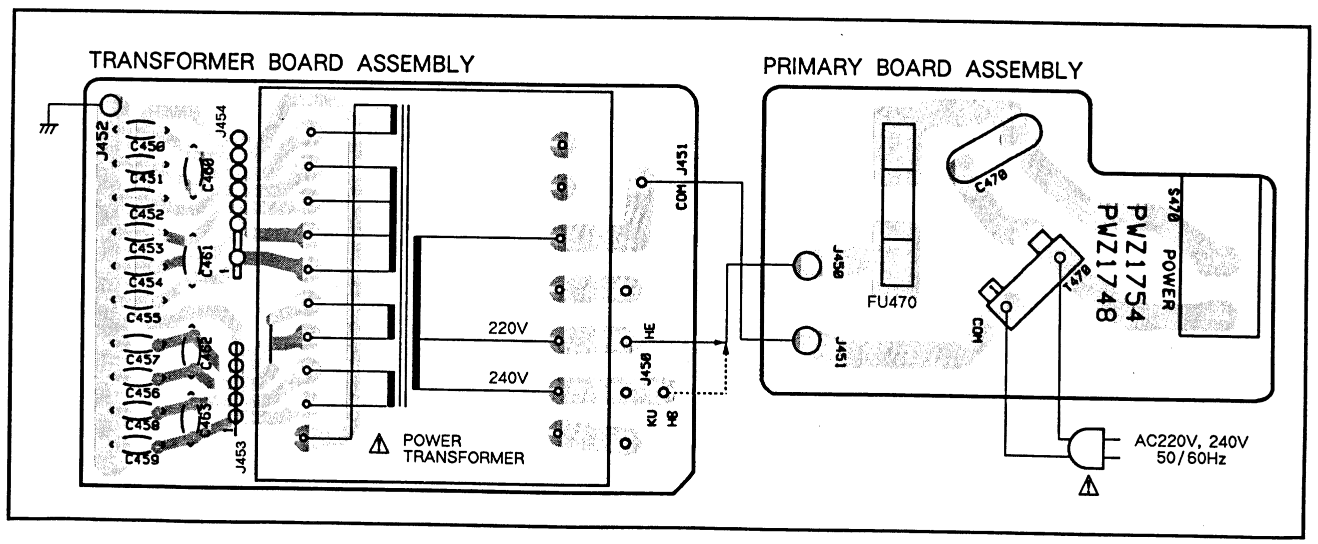
Note: The SCHEMATIC DIAGRAM and the P. C. BOARDS CONNECTION DIAGRAM of the HEM, HB, HPW and SD types are showed in the KU/CA type with the exception of the power supply section. (Pages 15 – 18.)

10.2.1 FOR HEM, HB AND HPW TYPES

● SCHEMATIC DIAGRAM



● P. C. BOARDS PATTERN



● Line Voltage Selection

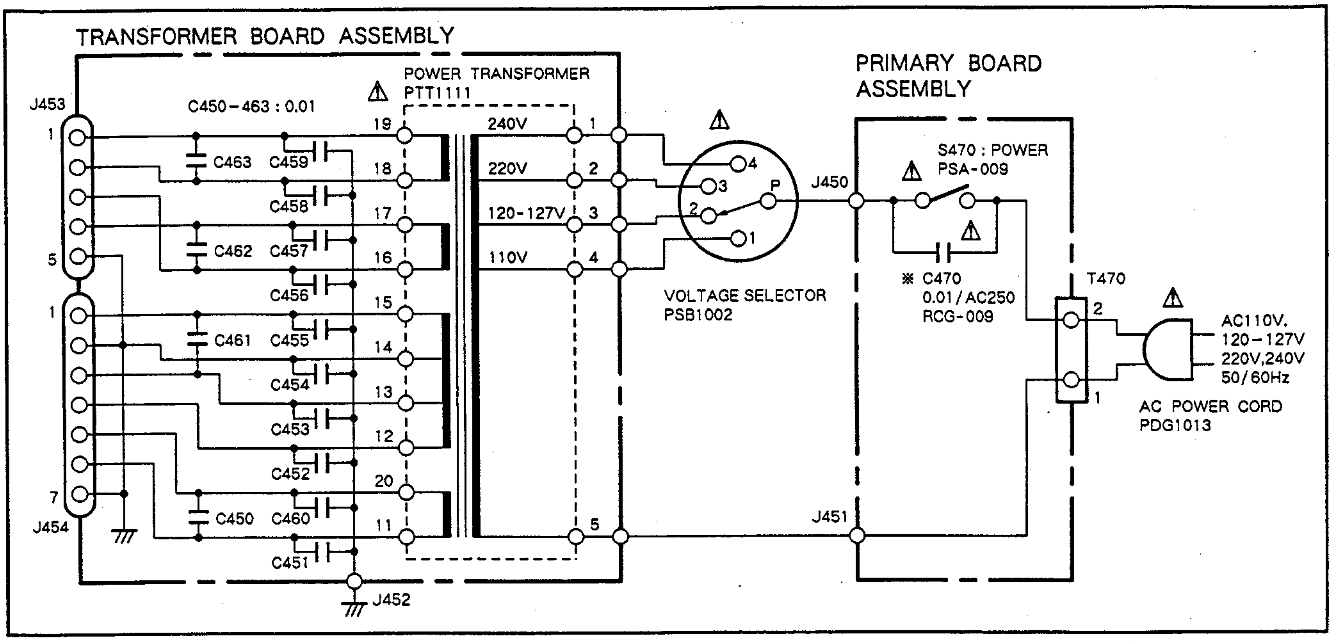
Line voltage can be changed with following steps.

1. Disconnect the AC power cord.
2. Remove the Bonnet case.
3. Change the connection of the primary lead wires (J450). (Connect as shown in schematic diagram)
4. Stick the line voltage label on the rear panel.

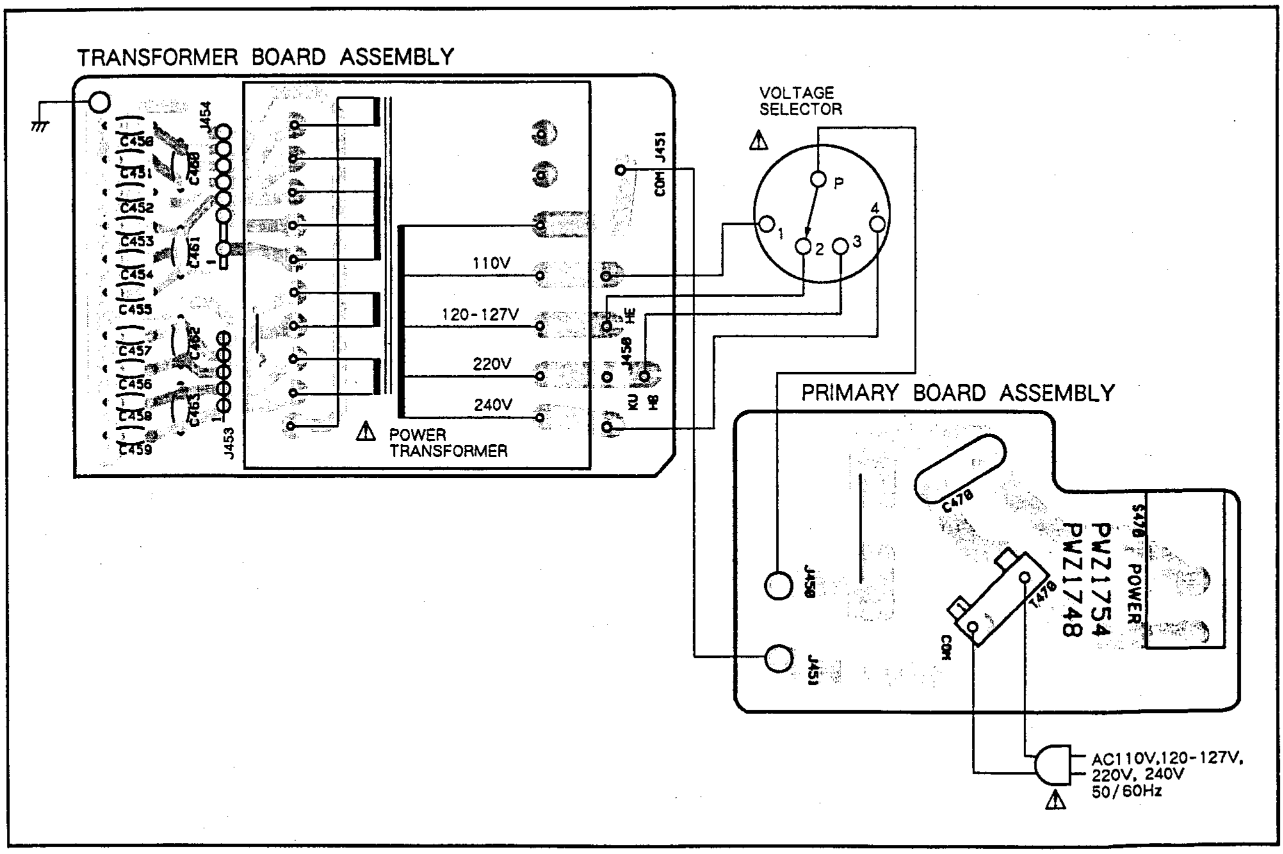
Description	Part No.
220V label	AAX-193
240V label	AAX-192

10.2.2 FOR SD TYPE

● SCHEMATIC DIAGRAM



● P. C. BOARDS PATTERN



11. SPECIFICATIONS

1. General

Type .... Compact disc digital audio system
Usable discs .... Compact Disc
Power requirements
U.K.and Australian models .... AC 240V, 50/60Hz
European model .... AC 220V, 50/60Hz
U.S. and Canadian models .... AC 120V, 60Hz
Multi-voltage model .... AC 110/120–127/220/240V (switchable) 50/60Hz
Power consumption 17W
Operating temperature .... +5°C – +35°C (+41°F – +95°F)
Weight 8.0kg (17lb, 10oz)
External dimensions .... 420(W) × 326(D) × 132(H)mm
16-9/16(W) × 12-13/16(D) × 5-3/16(H) in.

2. Audio section

Frequency response 2Hz–20kHz
S/N .... 112dB or more (EIAJ)
Dynamic range .... 98dB or more (EIAJ)
Channel separation .... 108dB or more (EIAJ)
Total harmonic distortion .... 0.0019% or less (EIAJ)
Output voltage 2.0V
Wow and flutter .... Limit of measurement (±0.001% W.PEAK) or less (EIAJ)
Number of channels .... 2 channels (stereo)

3. Output terminal

- Audio line output terminals
- CD-DECK SYNCHRO terminal
- Control input/output terminals
  (U.S., Canadian and Australian models only)
- Headphone jack (with volume control)
- Optical digital output terminal
- Coaxial digital output terminal

4. Functions

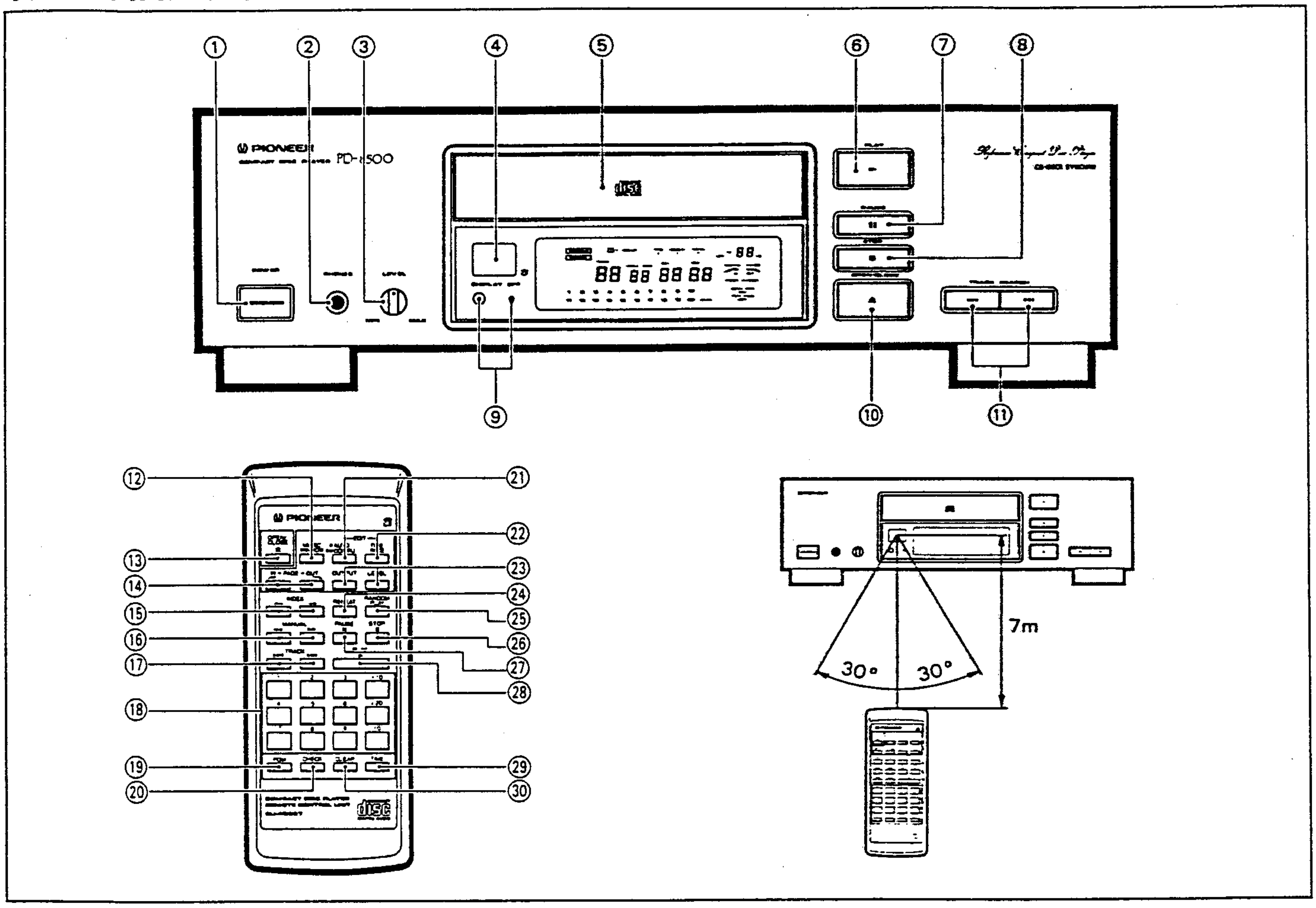
- Play
- Pause
- Stop
- Track search
- Manual search
- Index search
- Direct selection
- Single track repeat
- All track repeat
- Programmed repeat
- Random play repeat
- Programmed random play repeat
- Programmed playback (up to 24 tracks)
- Pause program
- Program check
- Program correction
- Program clear
- Auto program edit
- Compu program edit
- Time fade edit (Fade time variable)
- One touch fade (Fade time variable)
- Digital level control
- Random play
- Programmed random play
- Music window
- Time location
- Display off
- Timer start
- CD-deck synchro

5. Accessories

- Remote control unit 1
- Size AAA/R03 dry cell batteries 2
- Output cable 1
- Control cord 1
  (U.S., Canadian and Australian models only)
- Operating instructions 1

NOTE:
The specifications and design of this product are subject to change without notice, due to improvements.

12. PANEL FACILITIES



FRONT PANEL

① **POWER switch**
Press to turn power ON and OFF. If the power is turned ON when a disc is already loaded, the player will automatically enter the play mode (timer start function).

② **Headphones jack (PHONES)**

③ **Headphones volume control (PHONES LEVEL)**

④ **Remote sensor**

⑤ **Disc tray**

⑥ **PLAY button/indicator (▷)**

⑦ **PAUSE button/indicator (▯▯)**

⑧ **STOP button (■)**

⑨ **DISPLAY OFF button/indicator**

⑩ **OPEN/CLOSE button (⏏)**

⑪ **TRACK SEARCH buttons (⏮, ⏭)**

REMOTE CONTROL UNIT

Buttons listed here but not accompanied with explanations have the same functions as the corresponding front-panel buttons.
If use is made of the supplied remote control unit, remote operation is possible.
To use the remote control unit, aim at the remote sensor.
The remote control unit can operate over a range of approximately 23 feet (7 meters), within angles of 30 degrees left and right.

NOTE:
If the remote control sensor window is in a position where it receives strong light such as sunlight or fluorescent light, control may not be possible.

⑫ **MUSIC WINDOW button**

⑬ **OPEN/CLOSE button (⏏)**

⑭ **FADE IN/OUT buttons (↗ , ↘)**

⑮ **Index search buttons (INDEX ← , →)**

⑯ **Manual search buttons (MANUAL ◀◀, ▶▶)**

⑰ **Track search buttons (TRACK ⏮, ⏭)**

⑱ **Track number buttons (1−10, +10, ≧20)**

⑲ **Program button (PGM)**

⑳ **CHECK button**

㉑ **Program edit button (EDIT)**
(■ AUTO/ ■■ COMPU)

㉒ **TIME FADE EDIT button**

㉓ **OUTPUT LEVEL buttons (−, +)**

㉔ **REPEAT button**

㉕ **RANDOM PLAY button**

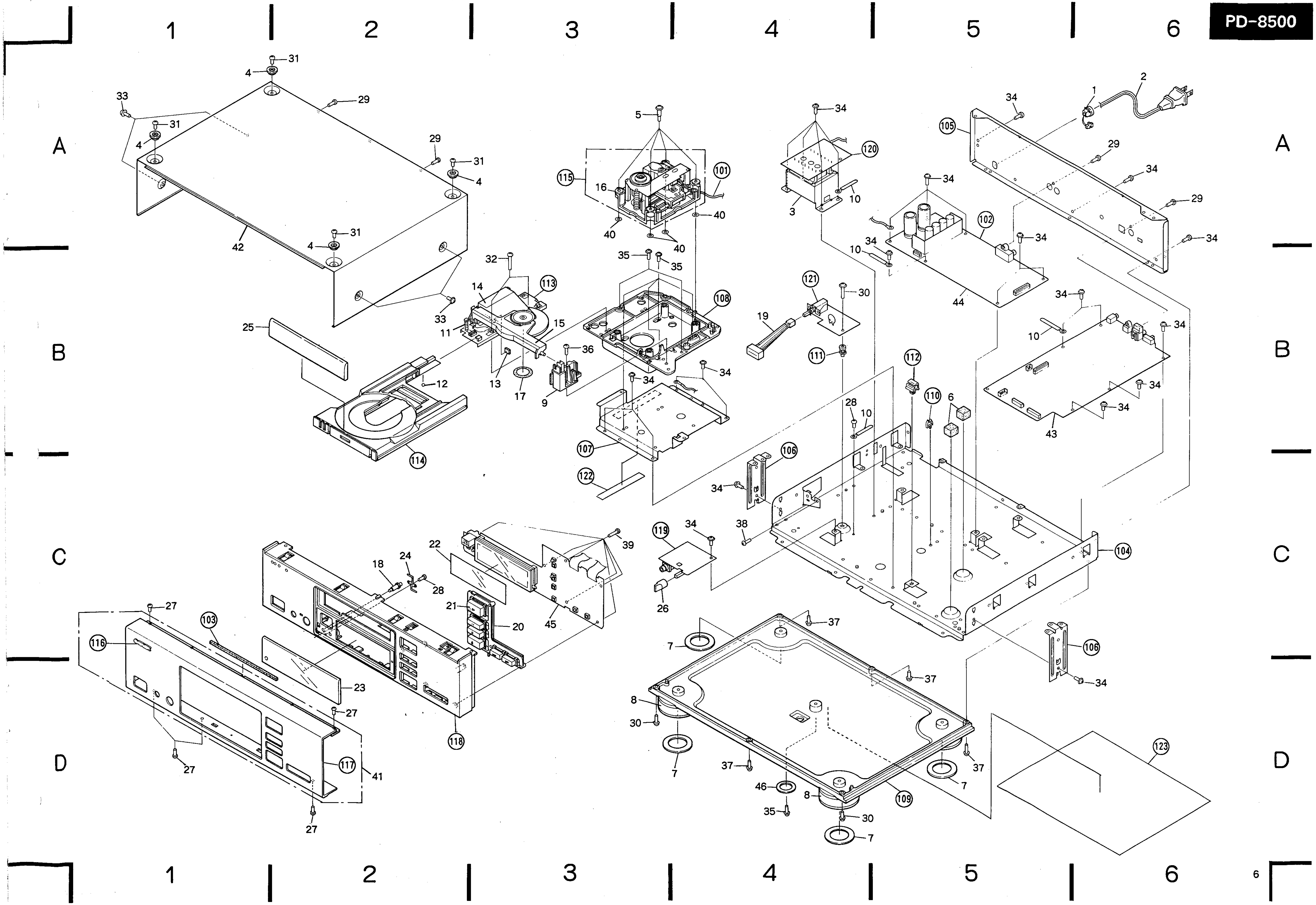
㉖ **STOP button (■)**

㉗ **PAUSE button (▮▮)**

㉘ **PLAY button (▶)**

㉙ **TIME button**

㉚ **CLEAR button**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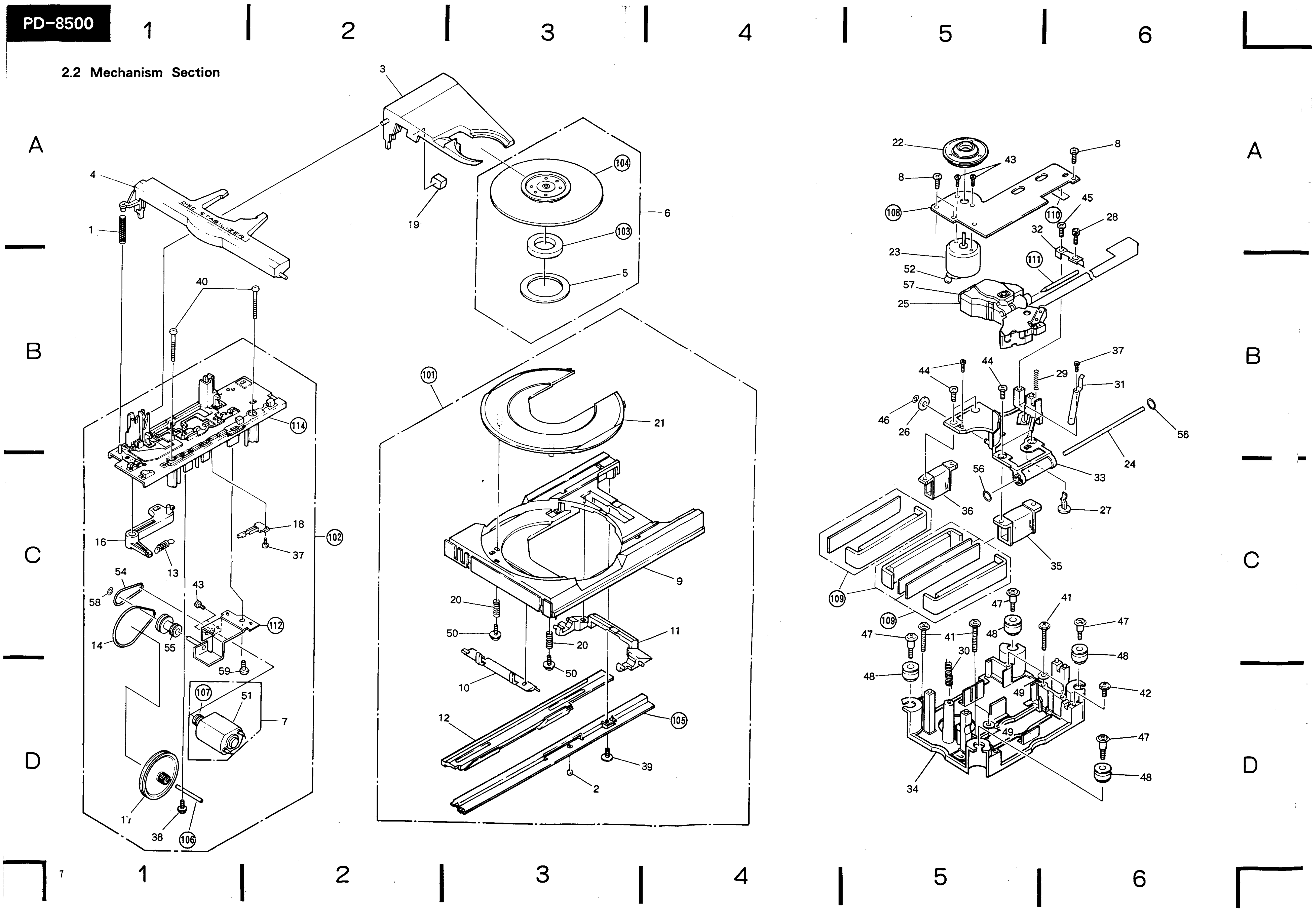
2.2 Mechanism Section

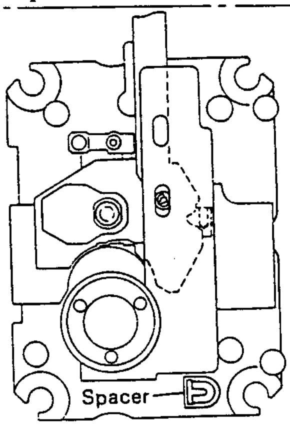


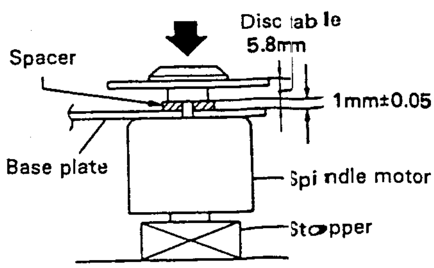
Parts List of Mechanism Section

Mark	No.	Part No.	Description
	1	PBH1013	Spring
	2	PBP-001	Steel ball ϕ 4
	3	PNW1084	Clamp holder
	4	PNW1085	Clmap retainer
	5	PNM1010	Disc cushion
	6	PYY1084	Clamper assembly
	7	PYY1025	Motor assembly (LOADING)
	8	PBA1031	Screw (2 × 8)
	9	PNW1830	Tray
	10	PNW1330	Plate lever (F)
	11	PNW1331	Plate lever (R)
	12	PNW1332	Rack
	13	PBH1012	Clamp spring
	14	PEB1013	Belt (loading)
	15		• • • • •
	16	PNW1083	Clamp lever
	17	PNW1171	Gear pulley
	18	VSK-015	Leaf switch (CLAMP : S102)
	19	PEB1032	Stopper rubber
	20	PBH1045	Plate spring
	21	PNW1829	Disc plate
	22	PNW1064	Disc table
	23	PEA1086	Motor assembly (Spindle with oil)
	24	PLA1061	Guide bar
	25	PWY1011	Pickup assembly
	26	PNW1408	Roller
	27	PNW1407	Adjustment shaft
	28	PBA1026	Adjustment screw
	29	PBH1029	Shaft spring
	30	PBH1068	Earth spring
	31	PBK1045	Plate spring T
	32	PBK1046	Plate spring R
	33	PNW1405	Carriage
	34	PNW1406	Mechanism chassis
	35	PXP1003	Drive unit
	36	PXP1004	Detector unit
	37	BPZ20P080FZK	Screw
	38	IBZ30P050FZK	Screw
	39	PPZ30P080FMC	Screw
	40	BPZ30P250FMC	Screw
	41	IBZ30P180FMC	Screw
	42	IPZ30P080FMC	Screw
	43	PMZ20P030FMC	Screw
	44	PMZ26P040FMC	Screw
	45	PPZ26P080FMC	Screw
	46	WT25D047D025	Washer
	47	PBA1027	Floating screw
	48	PEB1031	Floating rubber
	49	WA32F100M050	Washer
	50	PBA1025	Screw
	51	PXM1002	Motor (LOADING)
	52	CKDYF103Z50	Ceramic capacitor
	53		• • • • •
	54	PEB1125	Belt
	55	PNW1594	2 steps pulley
	56	PEB1097	Rubber ring
	57	PNB1232	Weight
	58	WT26D047D050	Washer
	59	PDZ30P050FMC	Screw
	101		Tray assembly
	102		Loading base assembly
	103		Clamp magnet
	104		Clamper
	105		Slide base
	106		Gear shaft
	107		Motor pulley
	108		Base plate
	109		Yoke unit
	110		Felt
	111		PU guide bar
	112		Pulley angle
	113		• • • • •
	114		Loading base

• Mounting of disc table

When pushing the disc table in, a stopper must be placed (with a pressure of approx. 9kg) on the bottom of the spindle motor. Insert the spacer (cut from the mechanism chassis) between the base plates and disc table as shown in the Figure below.

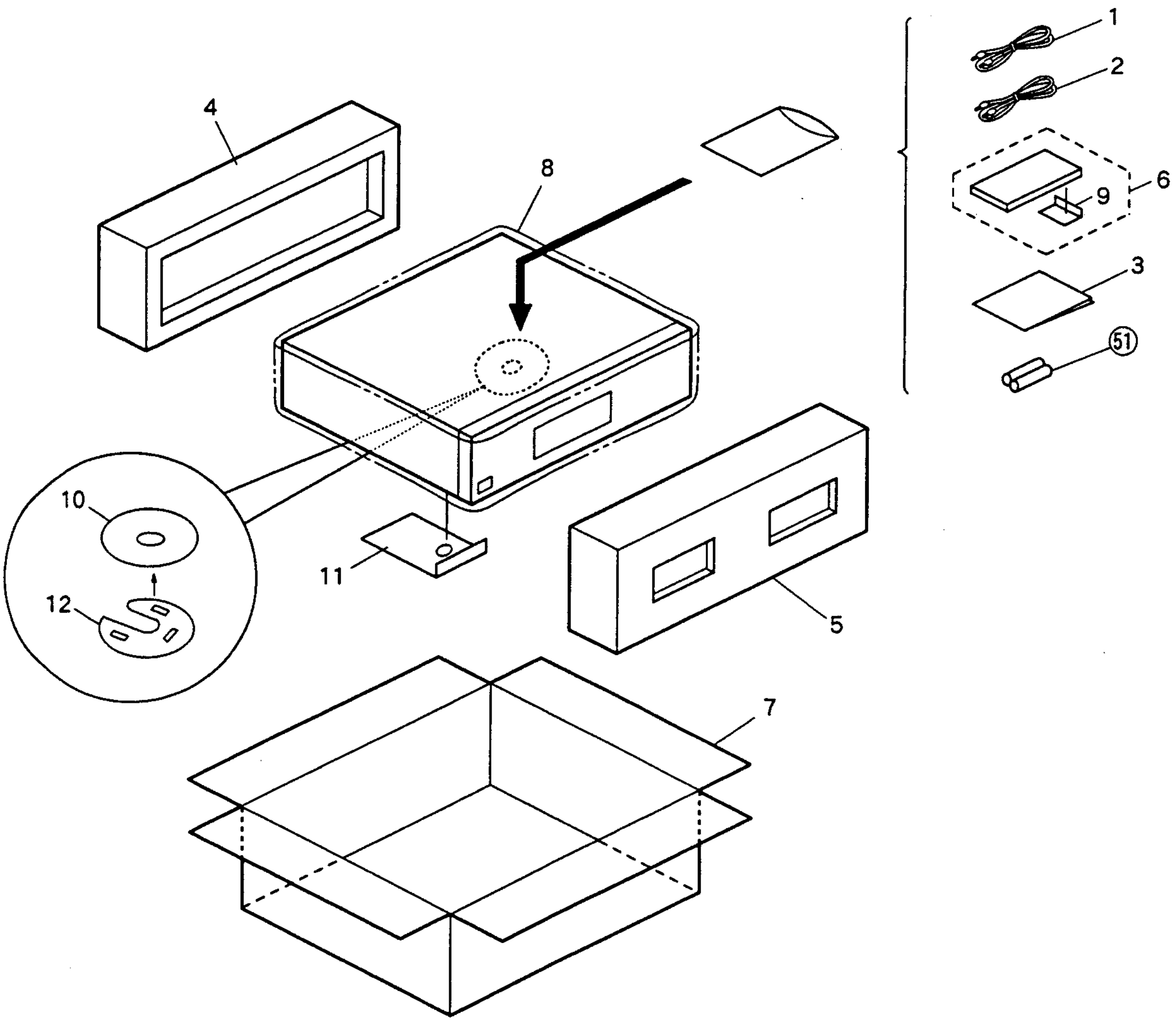




3. PACKING

Parts List

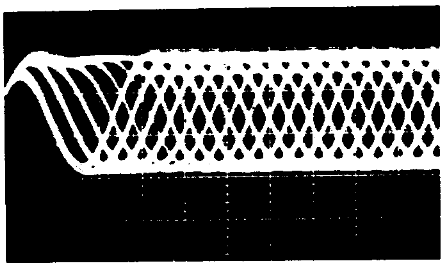
Mark	No.	Part No.	Description
	1	PDE-319	Connection cord with mini plug
	2	PDE1001	Cord with pin plug
	3	PRB1130	Operating instructions (English)
	4	PHA1137	Protector R
	5	PHA1136	Protector F
	6	PWW1044	Remote control unit
	7	PHG1526	CD packing case
	8	VHL-037	Sheet
	9	PZN1001	Battery cover
	10	PHC1030	Spacer (into the tray)
	11	PRM1016	Caution card
	12	PHC1022	Sheet
	51		Battery



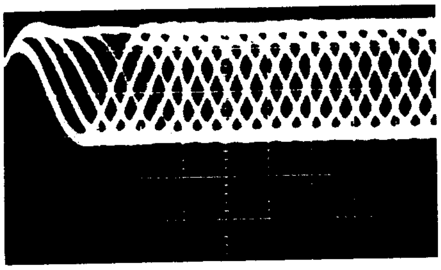
WAVE FORMS

NOTE : The encircled numbers denote measuring points in the schematic diagram.

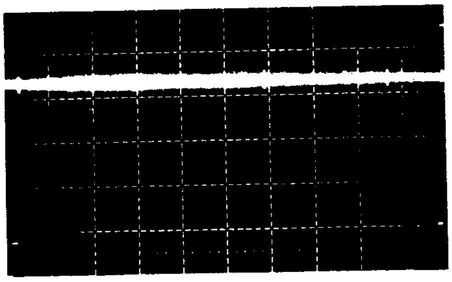
① TP1-1 Pin : PLAY MODE
500mV/div 500nsec/div


2V
GND

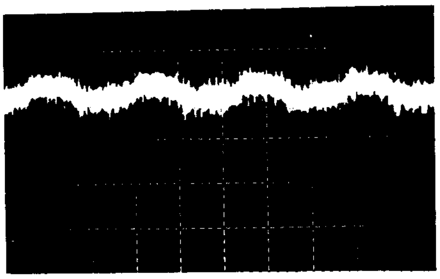
② IC300 60 Pin : PLAY MODE
500mV/div 500nsec/div


2V
GND

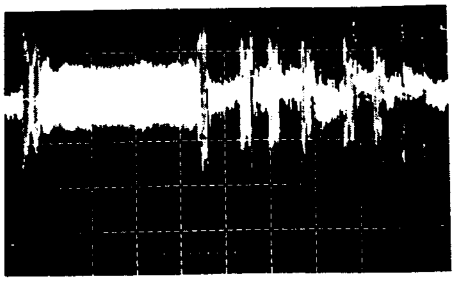
③ TP1-6 Pin : PLAY MODE
500mV/div 50msec/div


2V
GND

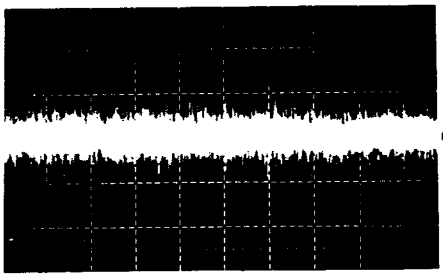
④ TP 1-2 Pin : PLAY MODE
500mV/div 50msec/div


2V
GND

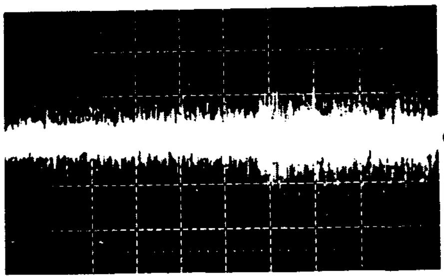
④ TP 1-2 Pin : SEARCH MODE
500mV/div 100msec/div


2V
GND

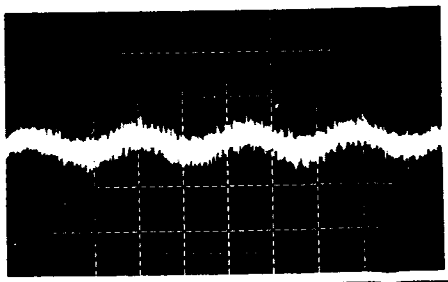
⑤ Q200 Emitter : PLAY MODE
1V/div 50msec/div


GND

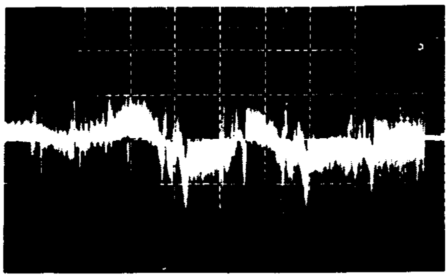
⑤ Q200 Emitter : SEARCH MODE
1V/div 100msec/div


GND

⑥ Q202 Emitter : PLAY MODE
500mV/div 50msec/div

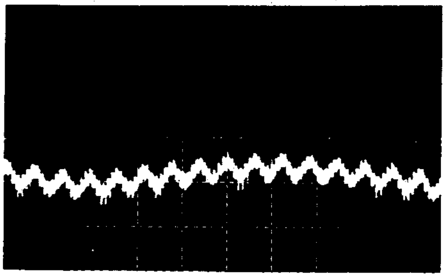

GND

⑥ Q202 Emitter : SEARCH MODE
500mV/div 50msec/div



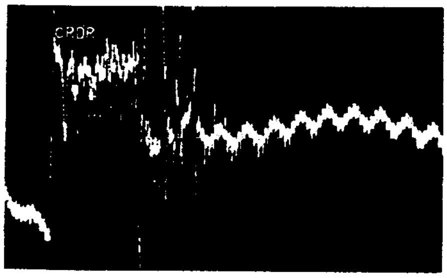
GND

⑦ Q206 Emitter : PLAY MODE
500mV/div 200msec/div



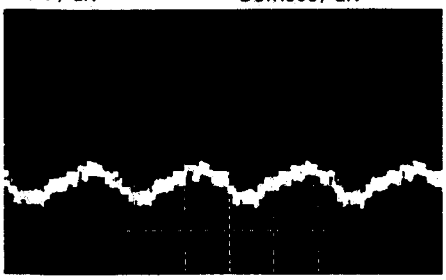
GND

⑦ Q206 Emitter : SEARCH MODE
500mV/div 200msec/div



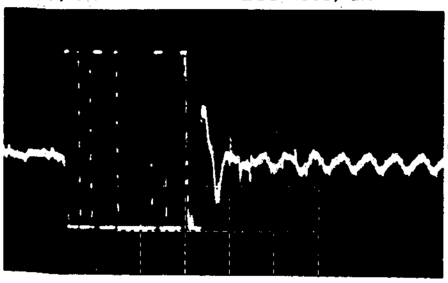
GND

⑧ Q204 Emitter : PLAY MODE
1V/div 50msec/div



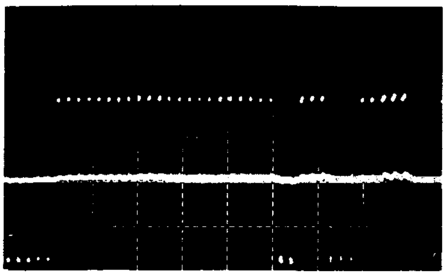
GND

⑧ Q204 Emitter : SEARCH MODE
2V/div 200msec/div



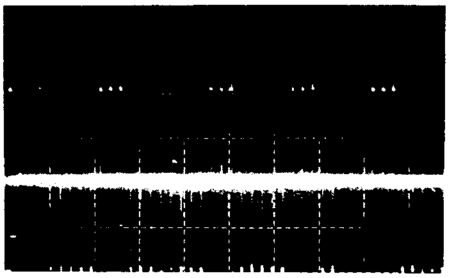
GND

⑨ IC100-50 Pin : PLAY MODE
1V/div 50μsec/div



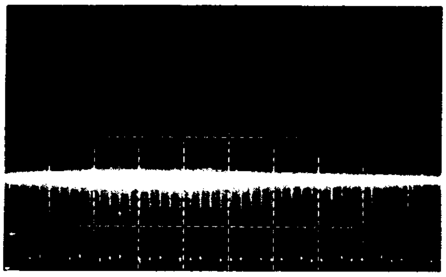
2V
GND

⑩ IC100-48 Pin : PLAY MODE
1V/div 50μsec/div

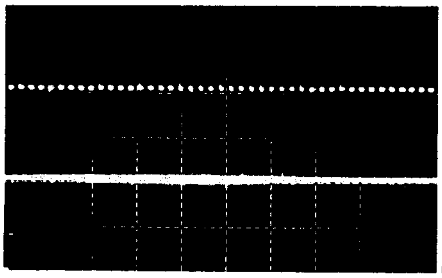


2V
GND

⑪ IC100-46 Pin : PLAY MODE
1V/div 50μsec/div

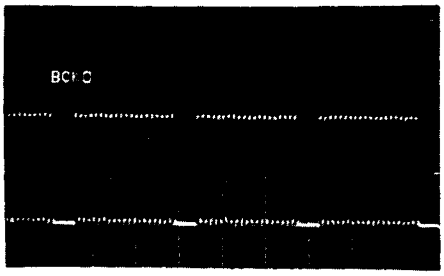


⑫ IC100-44 Pin : PLAY MODE
1V/div 50μsec/div

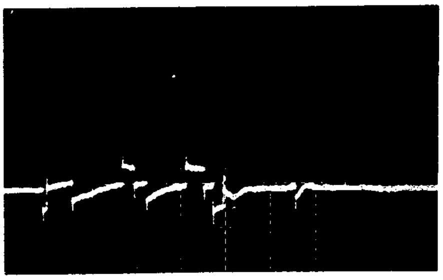


2V
GND

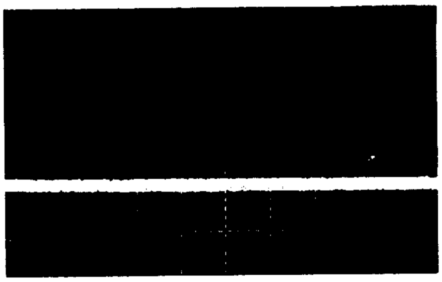
⑬ IC300-4 Pin : PLAY MODE
1V/div 50msec/div



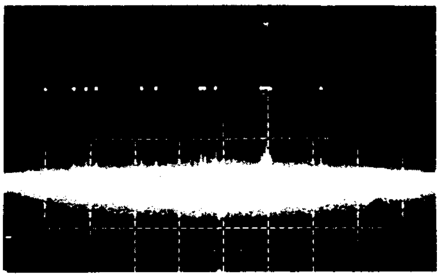
⑬ IC300-4 Pin : SEARCH MODE
1V/div 100msec/div



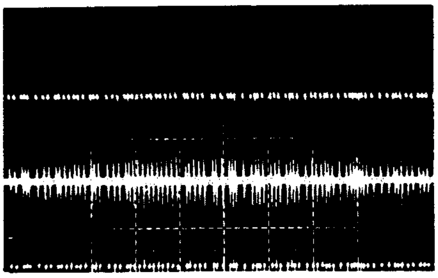
⑭ IC300-6 Pin : PLAY MODE
1V/div 20msec/div



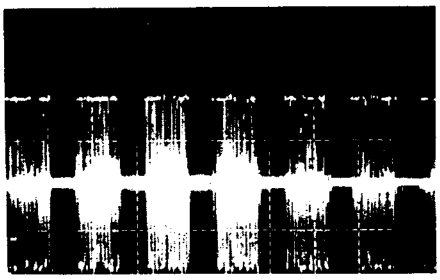
⑭ IC300-6 Pin : SEARCH MODE
1V/div 100msec/div



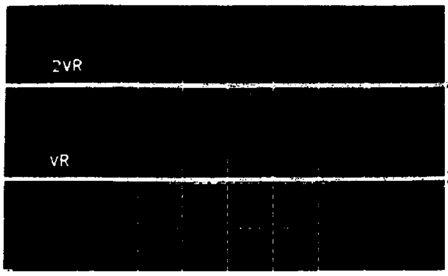
⑮ IC300-7 Pin : PLAY MODE
1V/div 10μsec/div



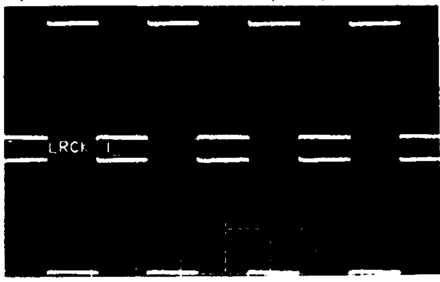
⑮ IC300-7 Pin : SEARCH MODE
1V/div 100msec/div



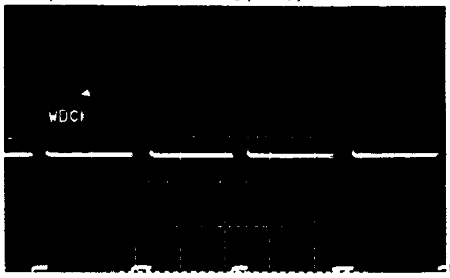
⑯ IC101-3 Pin ⑰ IC101-21 Pin : STOP MODE
1V/div 100msec/div



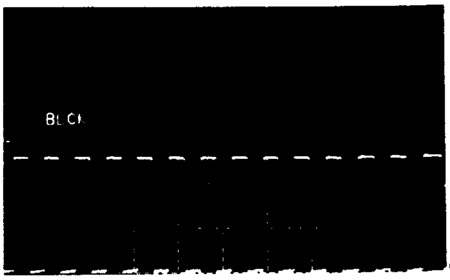
⑱ IC300-13 Pin (下) ⑲ IC302-3 Pin (上) : STOP MODE
2V/div 10μsec/div



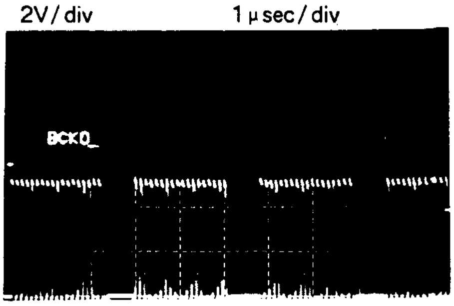
⑳ IC302-8 Pin : STOP MODE
2V/div 5μsec/div



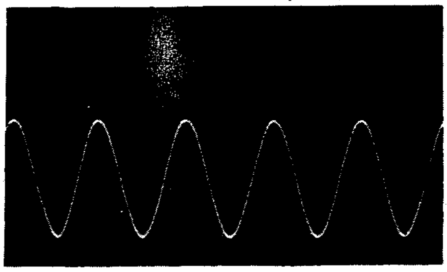
㉑ IC300-14 Pin : STOP MODE
2V/div 1μsec/div



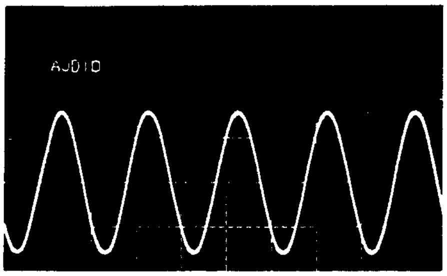
㉒ IC710-26 Pin : STOP MODE
2V/div 1μsec/div



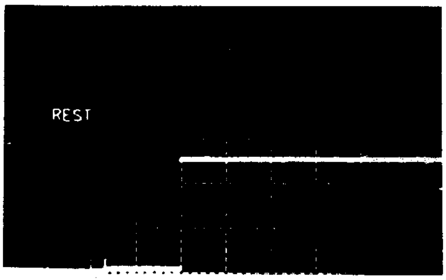
㉓ IC750-1 Pin : PLAY MODE
5V/div 500μsec/div



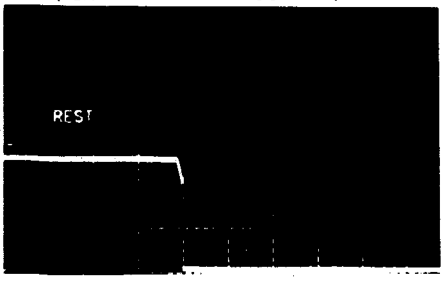
㉔ OUTPUT Lch : PLAY MODE
2V/div 500msec/div



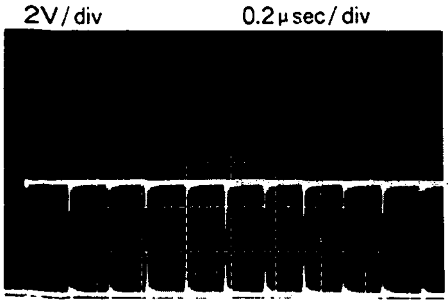
㉕ IC408-5 Pin : POWER ON
2V/div 100msec/div



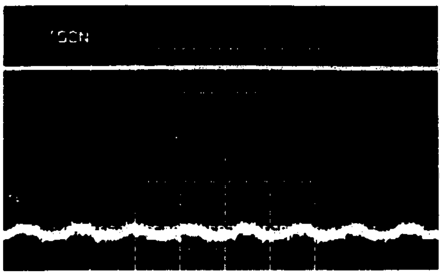
㉕ IC408-5 Pin : POWER OFF
2V/div 100msec/div



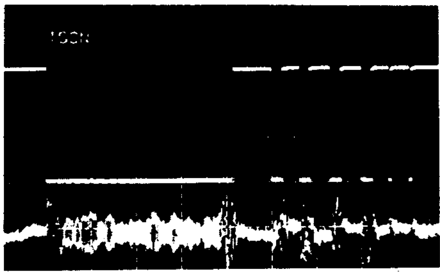
㉖ IC300-16 Pin : DOUT PLAY MODE
2V/div 0.2μsec/div



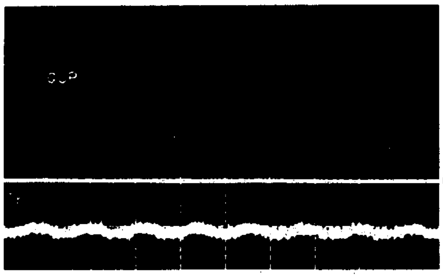
㉗ IC100-41 Pin : PLAY MODE
2V/div 100msec/div



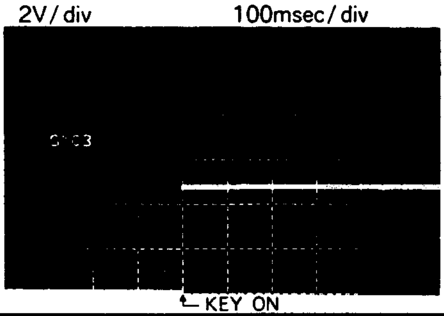
㉗ IC100-41 Pin : SEARCH MODE
2V/div 100msec/div



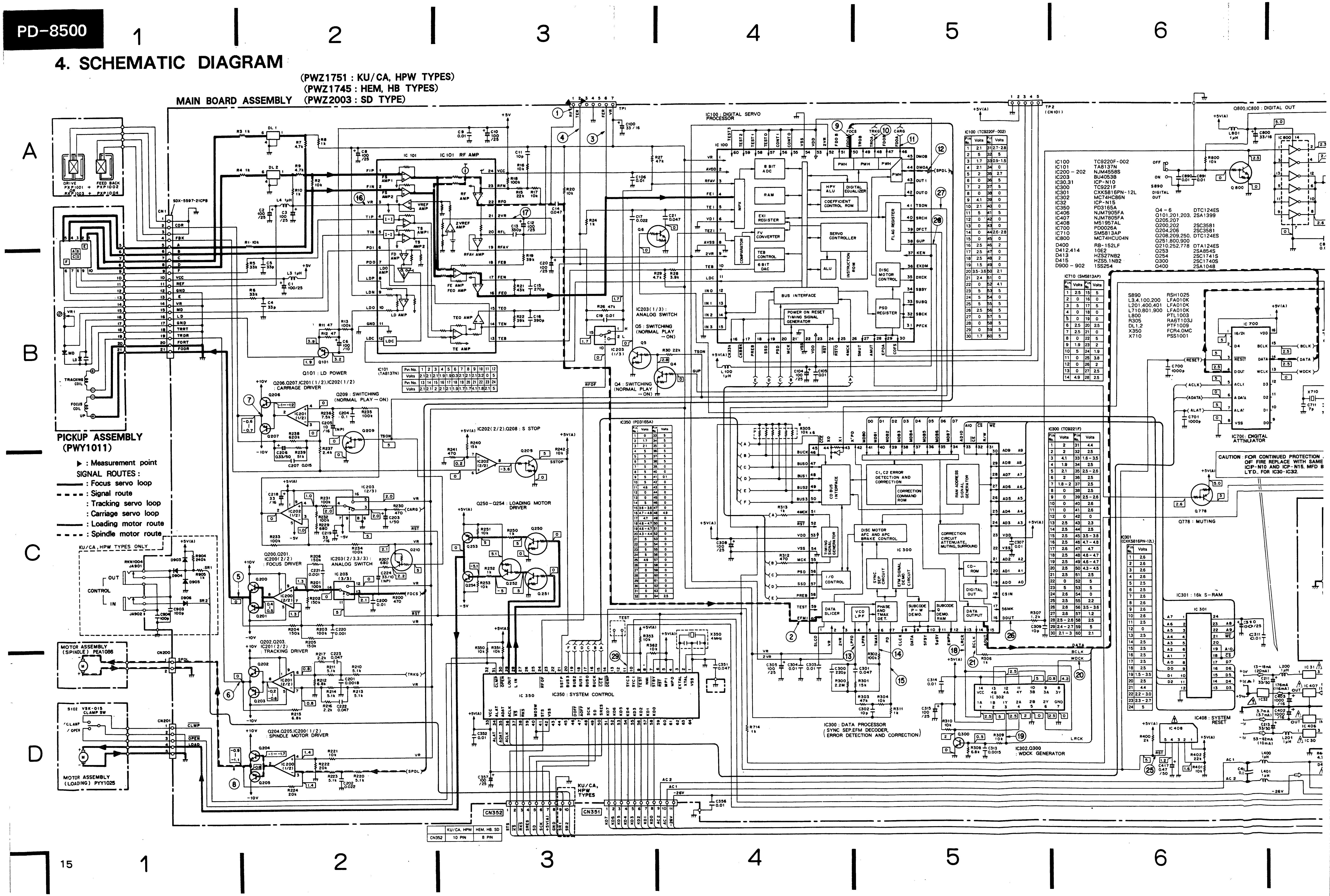
㉘ IC100-38 Pin : PLAY MODE
2V/div 100msec/div

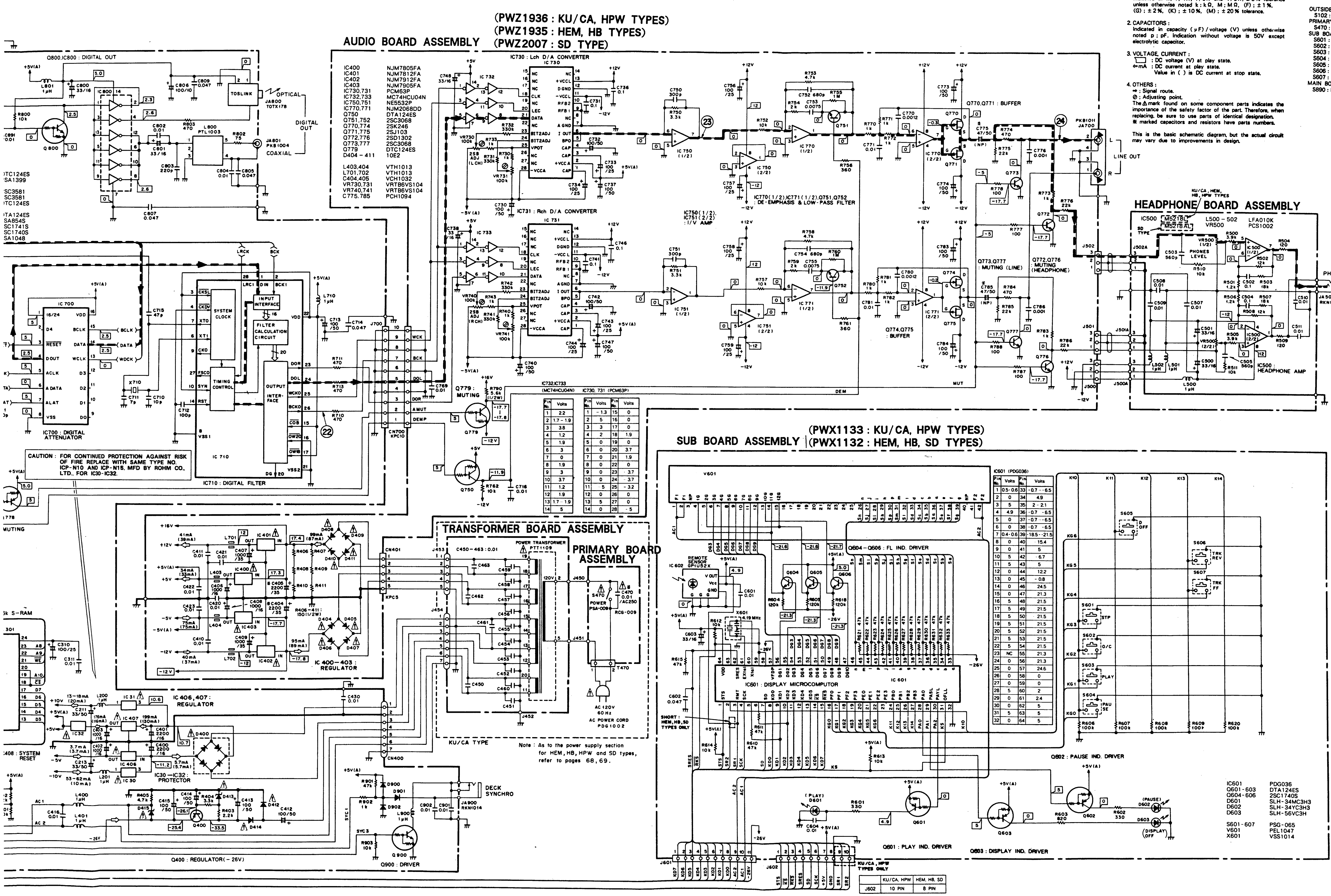


㉙ IC350-11 Pin : PLAY KEY ON
2V/div 100msec/div



4. SCHEMATIC DIAGRAM





1. RESISTORS :
Indicated in Ω, 1/4W, 1/6W and 1/8W, ±5% tolerance unless otherwise noted k : kΩ, M : MΩ, (F) : ±1%, (G) : ±2%, (K) : ±10%, (M) : ±20% tolerance.

2. CAPACITORS :
Indicated in capacity (μF) / voltage (V) unless otherwise noted p : pF. Indication without voltage is 50V except electrolytic capacitor.

3. VOLTAGE, CURRENT :
▭ : DC voltage (V) at play state.
⇐mA : DC current at play state.
Value in ( ) is DC current at stop state.

4. OTHERS :
➡ ; Signal route.
⊘ ; Adjusting point.
The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
※ marked capacitors and resistors have parts numbers.

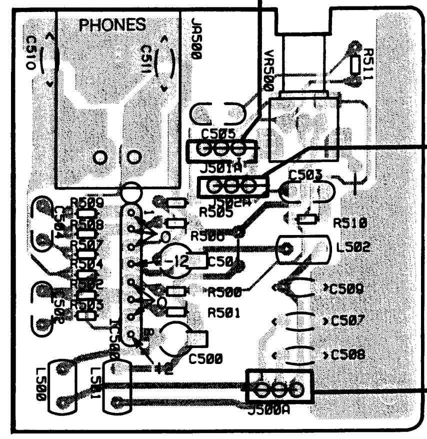
This is the basic schematic diagram, but the actual circuit may vary due to improvements in design.

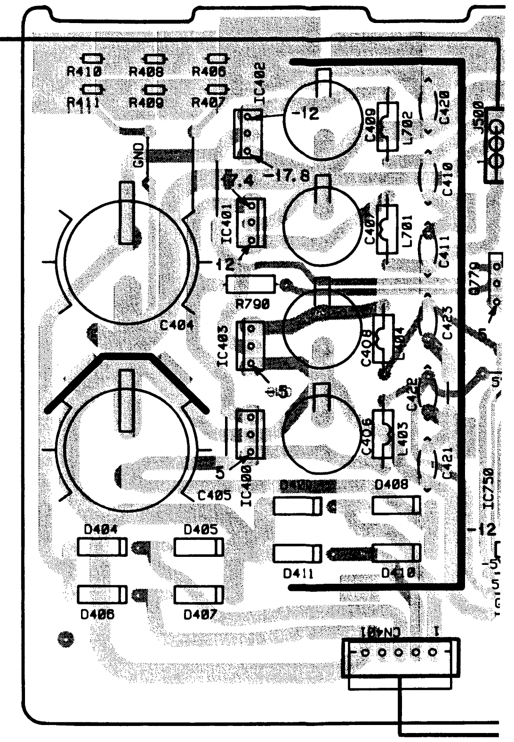
5. SWITCHES : (The underlined indicates the switch position)
OUTSIDE OF P. C. BOARDS ASSEMBLY
S102 : CLAMP CLAMP — OPEN
PRIMARY BOARD ASSEMBLY
S470 : POWER ON — OFF
SUB BOARD ASSEMBLY
S601 : STOP
S602 : OPEN/CLOSE
S603 : PLAY
S604 : PAUSE
S605 : DISPLAY OFF
S606 : ◁◁ } TRACK SEARCH
S607 : ▷▷ }
MAIN BOARD ASSEMBLY
S890 : DIGITAL OUT ON — OFF

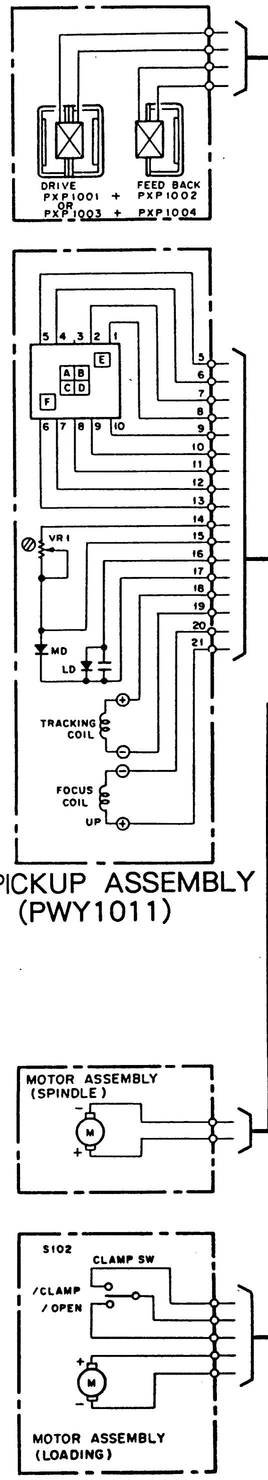
5. P.C.BOARDS CONNECTION DIAGRAM

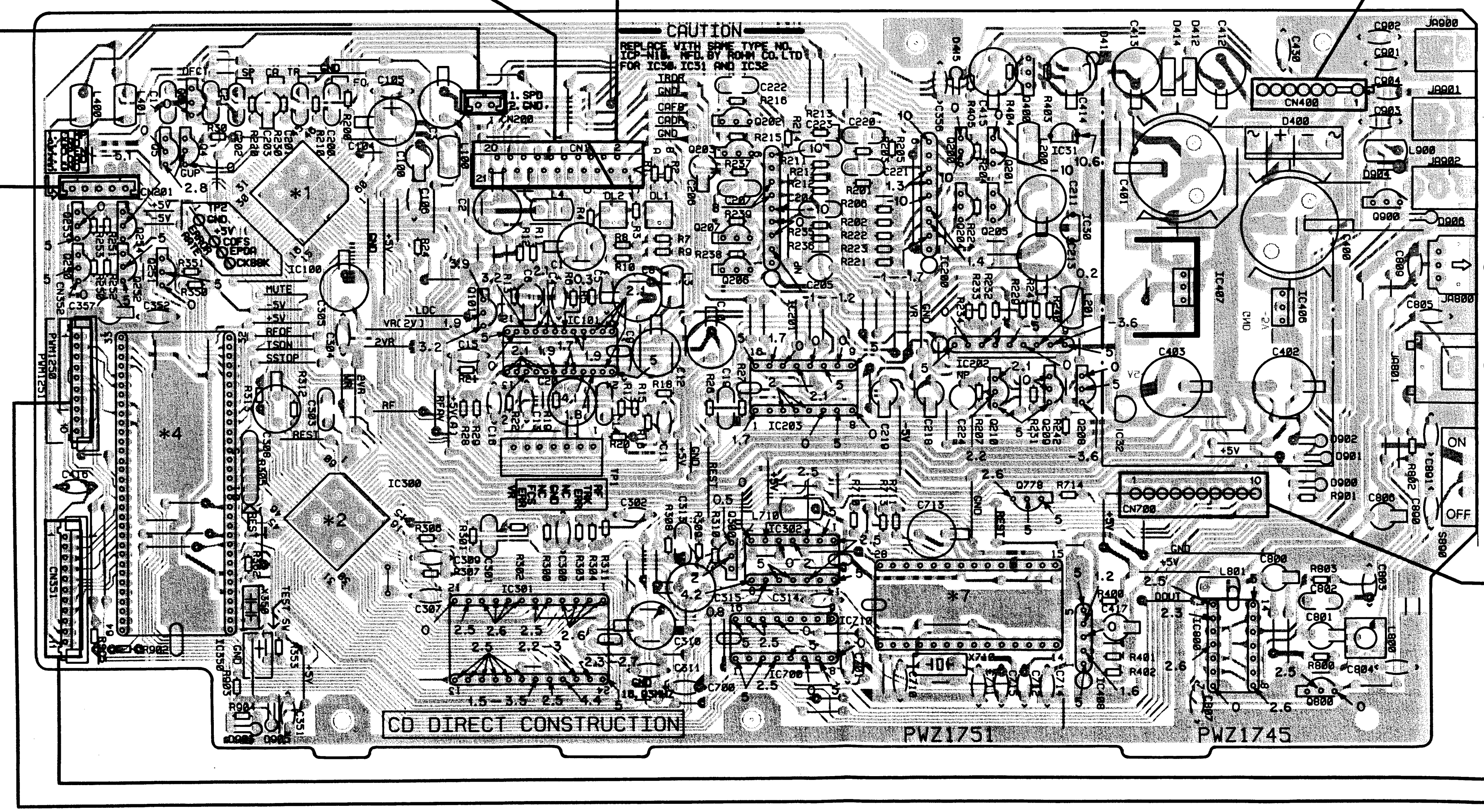
P.C.B. pattern diagram indication	Corresponding part symbol	Part name	P.C.B. pattern diagram indication	Corresponding part symbol	Part name
		Transistor			Ceramic capacitor
		FET			Mylar capacitor
		Diode			Styrol capacitor
					Electrolytic capacitor (Non polarized)
					Electrolytic capacitor (Noiseless)
		Zenner diode			Electrolytic capacitor (Polarized)
					Electrolytic capacitor (Polarized)
		LED			Power capacitor
		Varactor			Semi-fixed resistor
		Tact switch			Resistor array
		Inductor			Resistor
		Coil			Resonator
		Transformer			Thermistor
		Filter			

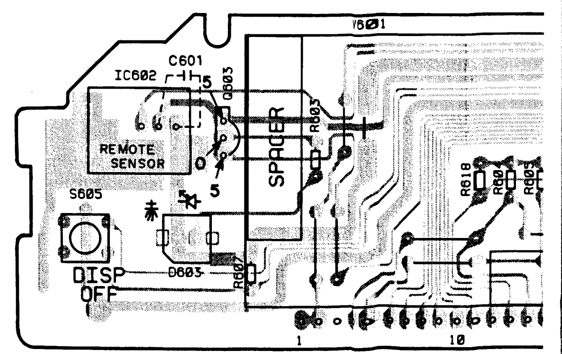
1. This P.C.B. connection diagram is viewed from the parts mounted side.
2. The parts which have been mounted on the board can be replaced with those shown with the corresponding wiring symbols listed in the above Table.
3. The capacitor terminal marked with ▭ shows negative terminal.
4. The diode marked with O shows cathode side.
5. The transistor terminal marked with ▭ shows emitter.



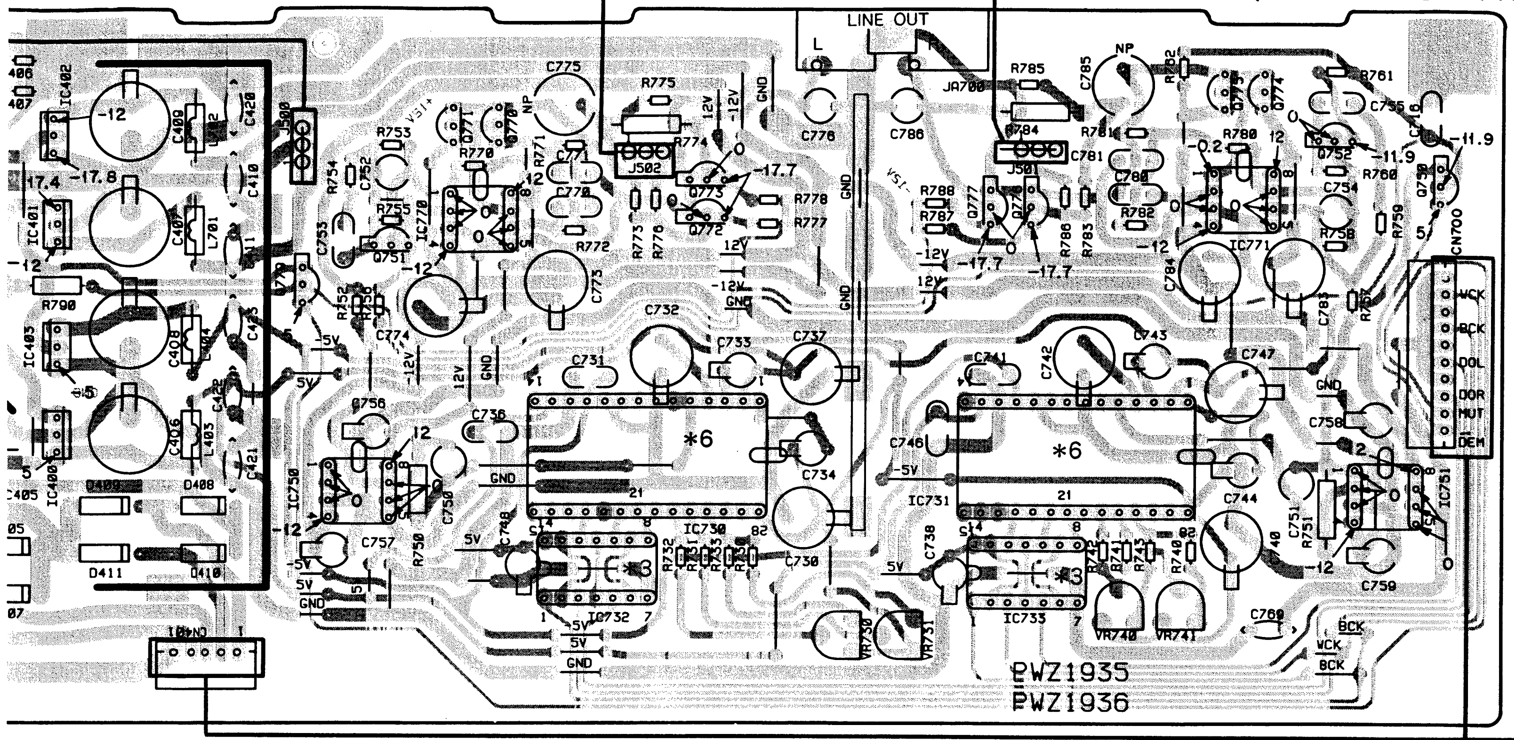








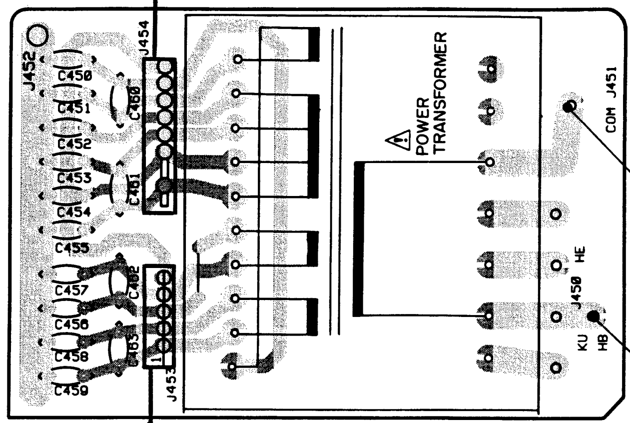
AUDIO BOARD ASSEMBLY (PWZ1936 : KU/CA, HPW TYPES)
(PWZ1935 : HEM, HB TYPES)
(PWZ2007 : SD TYPE)



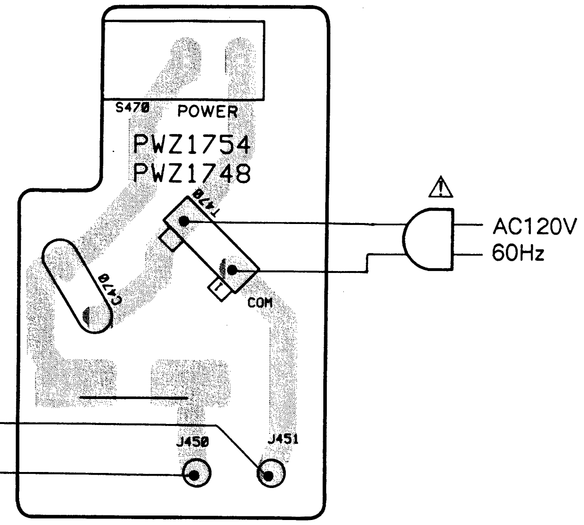
VR730 VR731 VR740 VR741

00 — IC403 Q779 Q751 Q771 Q770 IC730 Q773 Q777 Q776 IC731 Q775 Q774 Q752 Q750
IC750 IC770 IC732 Q772 IC733 IC771 IC751

TRANSFORMER BOARD ASSEMBLY



PRIMARY BOARD ASSEMBLY



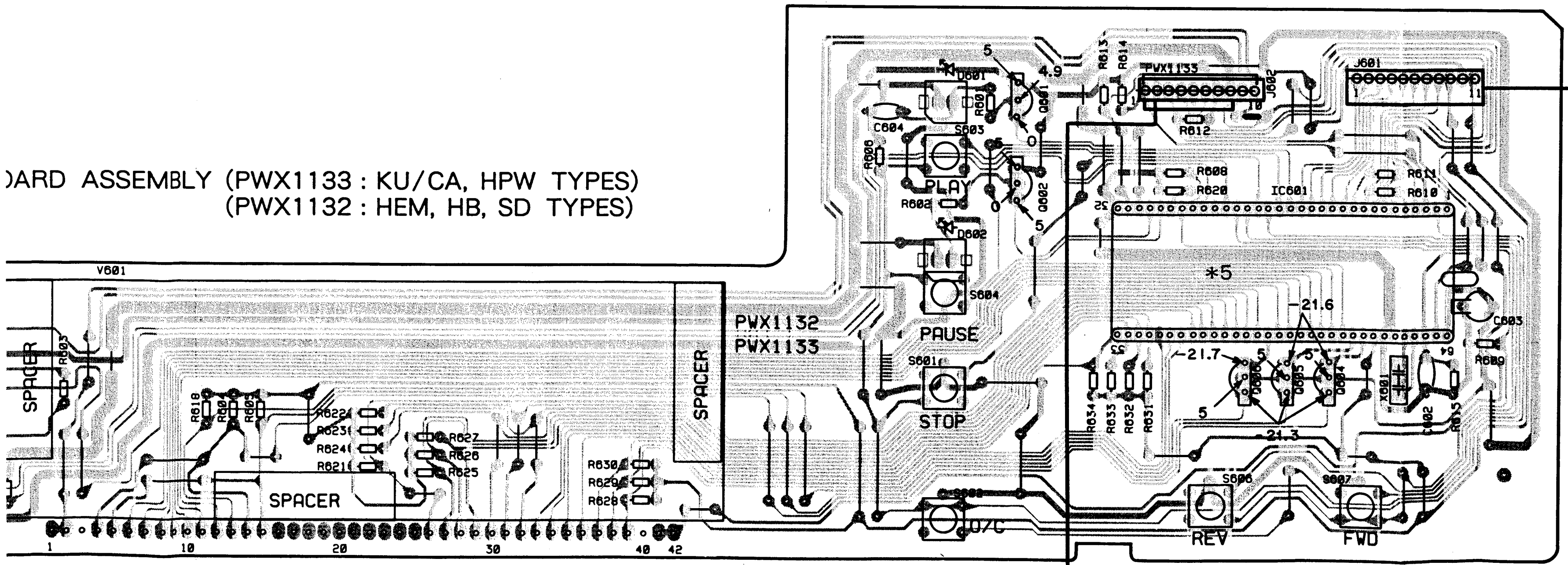
A

B

C

D

)ARD ASSEMBLY (PWX1133 : KU/CA, HPW TYPES)
(PWX1132 : HEM, HB, SD TYPES)



Q601 Q602 IC601 Q606 Q605 Q604

*1
IC100 (TC9220F-002)

Pin No.	Volts	Pin No.	Volts
1	2.1	31	2.7-2.8
2	5	32	5
3	1.7	33	0.9-1.5
4	2.1	34	0
5	2	35	2.7
6	0	36	5
7	2	37	5
8	0	38	0
9	4.1	39	0
10	2.1	40	0
11	5	41	5
12	0	42	0
13	0	43	0
14	0	44	2.6-2.8
15	0	45	0
16	2.5	46	2
17	2.5	47	0
18	2.5	48	2
19	1.5	49	0
20	3.5-3.6	50	2.1
21	2.4	51	0
22	0	52	4.1
23	5	53	5
24	5	54	0
25	5	55	5
26	2.5	56	5
27	0	57	5
28	0	58	5
29	0	59	5
30	1.7	60	5

*2
IC300 (TC9221F)

Pin No.	Volts	Pin No.	Volts
1	2	31	4.4
2	2	32	2.5
3	4.1	33	1.6 – 3.5
4	1.9	34	2.5
5	2.1	35	2.5 – 2.6
6	2	36	2.5
7	1.8 – 2	37	2.5
8	0	38	2.5
9	0	39	2.5 – 2.6
10	0	40	2.6
11	0	41	2.6
12	0	42	0
13	2.5	43	2.3
14	2.5	44	2.5
15	2.5	45	3.5 – 3.8
16	2.5	46	4.7 – 4.8
17	2.6	47	4.7
18	2.5	48	4.6 – 4.7
19	2.5	49	4.6 – 4.7
20	2.5	50	4.3 – 4.5
21	2.5	51	2.5
22	0	52	5
23	5	53	5
24	2.6	54	0
25	2.5	55	2.2
26	2.6	56	3.5 – 3.6
27	2.6	57	1.2
28	2.5 – 2.6	58	2.5
29	2.4 – 2.7	59	5
30	2.1 – 3	60	2.1

*3
IC732, IC733
(MC74HCU04N)

Pin No.	Volts
1	2.2
2	1.7 – 1.9
3	3.8
4	1.2
5	1.9
6	3
7	0
8	1.9
9	3
10	3.7
11	1.2
12	1.9
13	1.7 – 1.9
14	5

*4
IC350 (PD3165A)

Pin No.	Volts	Pin No.	Volts
1	0	33	5
2	1.7	34	5
3	2.1	35	0
4	5	36	5
5	5	37	5
6	5	38	5
7	5	39	0
8	5	40	0
9	5	41	0.1
10	5	42	0
11	4.6	43	0
12	0	44	0
13	0	45	0
14	5	46	0
15	3.6 – 3.8	47	0
16	4.7 – 4.8	48	4.9
17	4.7	49	0
18	4.6 – 4.7	50	5
19	4.6 – 4.7	51	0
20	4.3 – 4.4	52	0
21	5	53	0
22	0	54	0
23	5	55	0
24	5	56	0
25	4.9	57	0
26	0	58	0
27	0	59	0
28	0	60	0
29	0	61	0
30	5	62	0
31	0	63	0
32	0	64	2.5

*5
IC601 (PDG036)

Pin No.	Volts	Pin No.	Volts
1	0.5-0.6	33	-0.7 – -6.5
2	0	34	4.9
3	5	35	2 – 2.1
4	4.9	36	-0.7 – -6.5
5	0	37	-0.7 – -6.5
6	0	38	-0.7 – -6.5
7	0.4-0.6	39	-18.5 – -21.5
8	0	40	– 15.4
9	0	41	5
10	5	42	– 6.7
11	5	43	5
12	0	44	– 12.2
13	0	45	– 0.8
14	0	46	– 24.5
15	0	47	– 21.3
16	5	48	– 21.5
17	5	49	– 21.5
18	5	50	– 21.5
19	5	51	– 21.5
20	5	52	– 21.5
21	5	53	– 21.5
22	5	54	– 21.5
23	NC	55	– 21.3
24	0	56	– 21.3
25	0	57	– 24.6
26	0	58	0
27	0	59	0
28	5	60	2
29	0	61	2.4
30	0	62	5
31	5	63	5
32	0	64	5

*6
IC730, 731 (PCM63P)

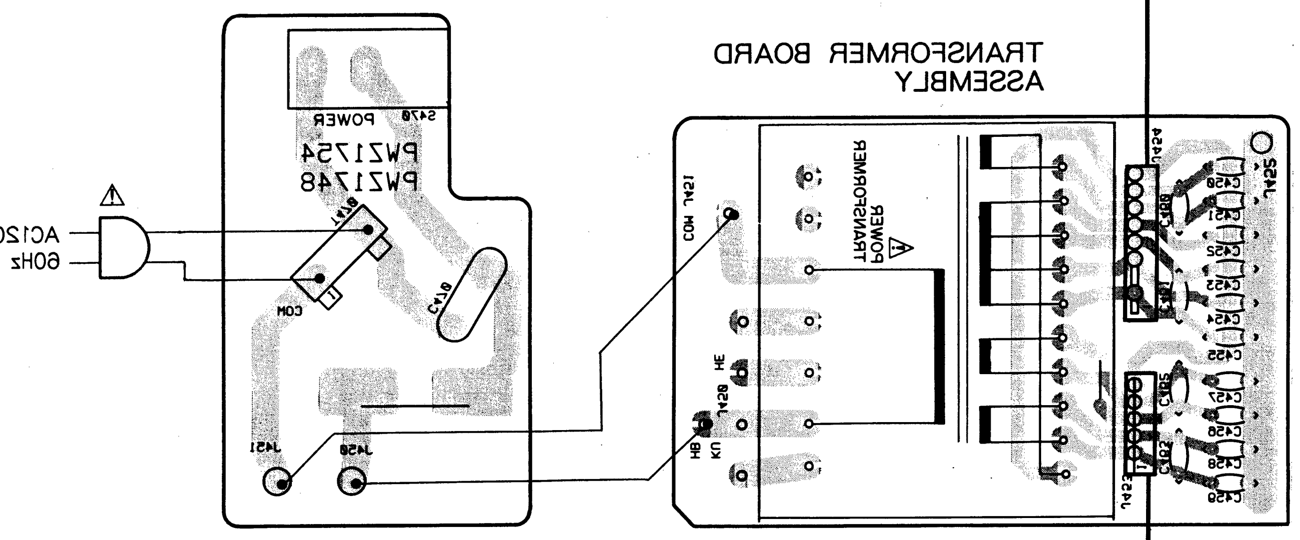
Pin No.	Volts	Pin No.	Volts
1	– 1.3	15	0
2	5	16	0
3	3	17	0
4	2	18	1.9
5	0	19	0
6	0	20	3.7
7	0	21	1.9
8	0	22	0
9	0	23	– 3.7
10	0	24	– 3.7
11	– 5	25	– 3.2
12	0	26	0
13	5	27	0
14	0	28	– 5

*7
IC710 (SM5813AP)

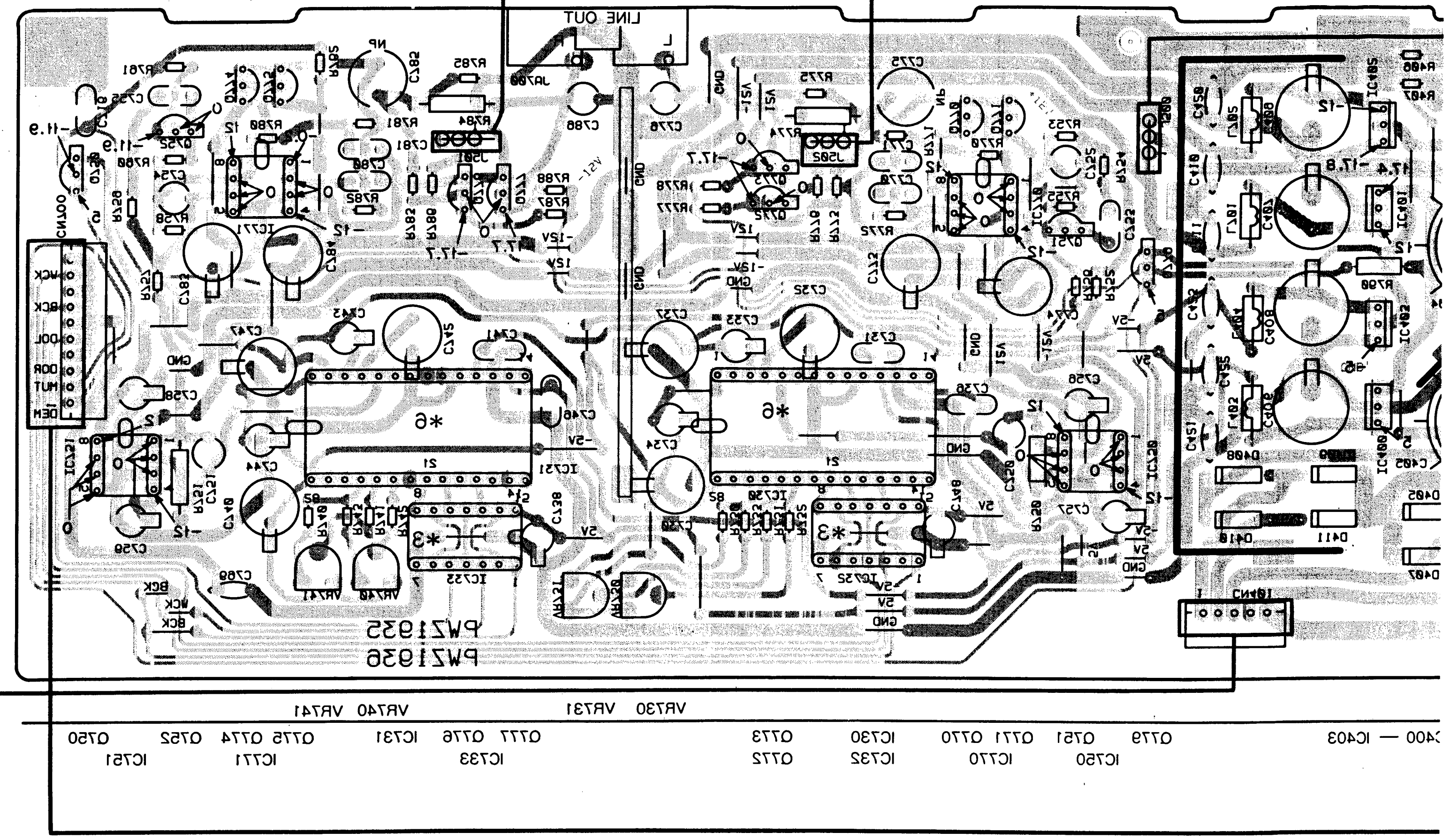
Pin No.	Volts	Pin No.	Volts
1	2.5	15	5
2	0	16	0
3	5	17	5
4	0	18	0
5	0	19	0
6	2.5	20	2.5
7	2.5	21	0
8	0	22	5
9	1.9	23	2
10	5	24	1.9
11	0	25	3.8
12	0	26	2
13	0	27	2.5
14	4.9	28	2.5

PRIMARY BOARD ASSEMBLY

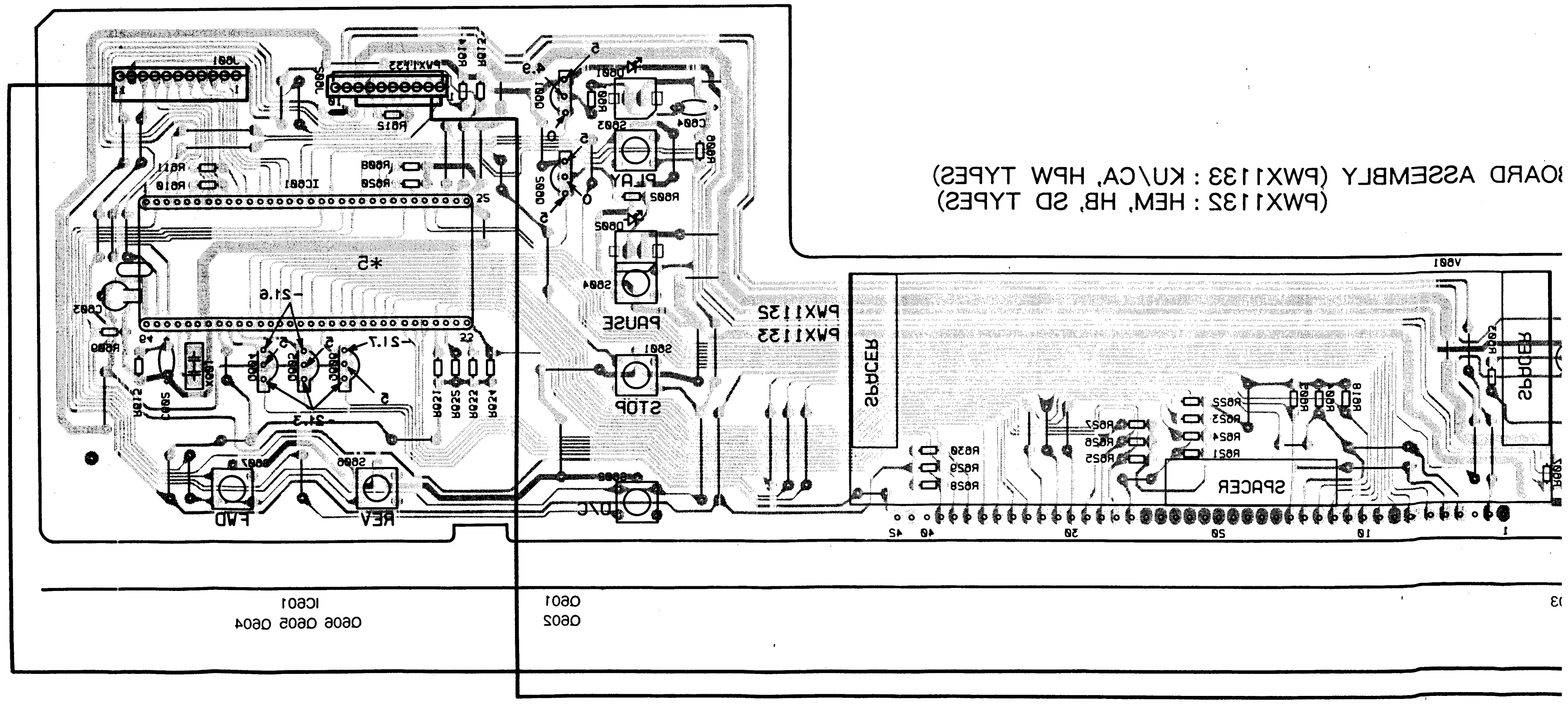
TRANSFORMER BOARD ASSEMBLY



AUDIO BOARD ASSEMBLY (PWZ1936 : KU/CA, HPW TYPES) (PWZ1935 : HEM, HB TYPES) (PWZ2007 : SD TYPE)



BOARD ASSEMBLY (PWX1133 : KU/CA, HPW TYPES) (PWX1132 : HEM, HB, SD TYPES)



*1 IC100 (TC9220F-002)

Pin No.	Volts	Pin No.	Volts
1	2.1	31	2.7-2.8
2	5	32	5
3	1.7	33	0.9-1.5
4	2.1	34	0
5	2	35	2.7
6	0	36	5
7	2	37	5
8	0	38	0
9	4.1	39	0
10	2.1	40	0
11	5	41	5
12	0	42	0
13	0	43	0
14	0	44	2.6-2.8
15	0	45	0
16	2.5	46	2
17	2.5	47	0
18	2.5	48	2
19	1.5	49	0
20	3.5-3.6	50	2.1
21	2.4	51	0
22	0	52	4.1
23	5	53	5
24	5	54	0
25	5	55	5
26	2.5	56	5
27	0	57	5
28	0	58	5
29	0	59	5
30	1.7	60	5

*2 IC300 (TC9221F)

Pin No.	Volts	Pin No.	Volts
1	2	31	4.4
2	2	32	2.5
3	4.1	33	1.6 – 3.5
4	1.9	34	2.5
5	2.1	35	2.5 – 2.6
6	2	36	2.5
7	1.8 – 2	37	2.5
8	0	38	2.5
9	0	39	2.5 – 2.6
10	0	40	2.6
11	0	41	2.6
12	0	42	0
13	2.5	43	2.3
14	2.5	44	2.5
15	2.5	45	3.5 – 3.8
16	2.5	46	4.7 – 4.8
17	2.6	47	4.7
18	2.5	48	4.6 – 4.7
19	2.5	49	4.6 – 4.7
20	2.5	50	4.3 – 4.5
21	2.5	51	2.5
22	0	52	5
23	5	53	5
24	2.6	54	0
25	2.5	55	2.2
26	2.6	56	3.5 – 3.6
27	2.6	57	1.2
28	2.5 – 2.6	58	2.5
29	2.4 – 2.7	59	5
30	2.1 – 3	60	2.1

*3 IC732,IC733 (MC74HCU04N)

Pin No.	Volts
1	2.2
2	1.7 – 1.9
3	3.8
4	1.2
5	1.9
6	3
7	0
8	1.9
9	3
10	3.7
11	1.2
12	1.9
13	1.7 – 1.9
14	5

*4 IC350 (PD3165A)

Pin No.	Volts	Pin No.	Volts
1	0	33	5
2	1.7	34	5
3	2.1	35	0
4	5	36	5
5	5	37	5
6	5	38	5
7	5	39	0
8	5	40	0
9	5	41	0.1
10	5	42	0
11	4.6	43	0
12	0	44	0
13	0	45	0
14	5	46	0
15	3.6 – 3.8	47	0
16	4.7 – 4.8	48	4.9
17	4.7	49	0
18	4.6 – 4.7	50	5
19	4.6 – 4.7	51	0
20	4.3 – 4.4	52	0
21	5	53	0
22	0	54	0
23	5	55	0
24	5	56	0
25	4.9	57	0
26	0	58	0
27	0	59	0
28	0	60	0
29	0	61	0
30	5	62	0
31	0	63	0
32	0	64	2.5

*5 IC601 (PDG036)

Pin No.	Volts	Pin No.	Volts
1	0.5-0.6	33	-0.7 – -6.5
2	0	34	4.9
3	5	35	2 – 2.1
4	4.9	36	-0.7 – -6.5
5	0	37	-0.7 – -6.5
6	0	38	-0.7 – -6.5
7	0.4-0.6	39	-18.5 – -21.5
8	0	40	– 15.4
9	0	41	5
10	5	42	– 6.7
11	5	43	5
12	0	44	– 12.2
13	0	45	– 0.8
14	0	46	– 24.5
15	0	47	– 21.3
16	5	48	– 21.5
17	5	49	– 21.5
18	5	50	– 21.5
19	5	51	– 21.5
20	5	52	– 21.5
21	5	53	– 21.5
22	5	54	– 21.5
23	NC	55	– 21.3
24	0	56	– 21.3
25	0	57	– 24.6
26	0	58	0
27	0	59	0
28	5	60	2
29	0	61	2.4
30	0	62	5
31	5	63	5
32	0	64	5

*6 IC730, 731 (PCM63P)

Pin No.	Volts	Pin No.	Volts
1	– 1.3	15	0
2	5	16	0
3	3	17	0
4	2	18	1.9
5	0	19	0
6	0	20	3.7
7	0	21	1.9
8	0	22	0
9	0	23	– 3.7
10	0	24	– 3.7
11	– 5	25	– 3.2
12	0	26	0
13	5	27	0
14	0	28	– 5

*7 IC710 (SM5813AP)

Pin No.	Volts	Pin No.	Volts
1	2.5	15	5
2	0	16	0
3	5	17	5
4	0	18	0
5	0	19	0
6	2.5	20	2.5
7	2.5	21	0
8	0	22	5
9	1.9	23	2
10	5	24	1.9
11	0	25	3.8
12	0	26	2
13	0	27	2.5
14	4.9	28	2.5

5. P.C.BOARDS CONNECTION DIAGRAM

This P.C.B. connection diagram is viewed from the foil side.