# ONKYO® SERVICE MANUAL

## COMPACT DISC AUTOMATIC CHANGER
## MODEL DX-C600

| | |
|---|---|
| BUDN, BUD | 120V AC, 60 Hz |
| BUU, BUUX | 110/120/220/240V AC, 50/60Hz |

### SAFETY-RELATED COMPONENT WARNING!!

COMPONENTS IDENTIFIED BY MARK ⚠ ON THE SCHEMATIC DIAGRAM AND IN THE PARTS LIST ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE THESE COMPONENTS WITH ONKYO PARTS WHOSE PART NUMBERS APPEAR AS SHOWN IN THIS MANUAL.

MAKE LEAKAGE-CURRENT OR RESISTANCE MEASUREMENTS TO DERMINE THAT EXPOSED PARTS ARE ACCEPTABLY INSULATED FROM THE SUPPLY CIRCUIT BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

## SPECIFICATIONS

| | |
|---|---|
| **Audio Characteristics** | |
| Number of Channel | 2 (Stereo) |
| Frequency Response | 20 – 20,000 Hz |
| Signal-to-Noise Ratio | 96 dB (at 1 kHz) |
| Channel Separation | 85 dB (at 1 kHz) |
| Total Harmonic Distortion | 0.03% (at 1 kHz) |
| Wow and Flutter | Below threshold of measurability |
| Ouptut Level | 2 Volts, r.m.s. |
| **Signal Format** | |
| Sampling Frequency | 88.2 kHz |
| Quantization | 16 Bits |
| Filter | Two times over sampling<br>Digital Filter + Analogue Filter |
| **Disc** | |
| Diameter | 120 mm (4-3/4")<br>500 – 200 rpm (inside – Outside) |
| Tracking Pitch | 1.6 μm |
| Play Time | 60 Min. |
| Tracking System | Non-Contact Solid State Laser<br>PCM Wavelength 0.79 μm |
| **General** | |
| Power Requirements | |
| USA & Canadian Models | AC 120V, 60 Hz |
| Worldwide Model | AC 110, 120, 220, 240V switchable, 50/60 Hz |
| Power Consumption | 14 Watts |
| Dimensions (W x H x D) | 435 x 114 x 348 mm<br>17-1/8" x 4-1/2" x 13-11/16" |
| Weight | 6.6 kg, 14.6 lbs |
| Supplied Accessories | • Output Signal Cord<br>• Remote Control Transmitter RC-109C<br>• "AA" size (UM-3) battery x 2<br>• CD Magazine<br>• Instruction Manual |

Specifications are subject to change without notice.

ONKYO
AUDIO COMPONENTS

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# SERVICE PROCEDURES

**1. Safety-check out (U.S.A. model)**

After correcting the original service problem, perform the following safety check before releasing the set to the customer:

Connect the insulating-resistance tester between the plug of power supply cable and chassis.

Specifications: more than 10Mohm at 500V.

**2. Procedures for replacement of flat packaged ICs**

**1. Tools to be used:**

(1) **Soldering iron** . . . . Grounded soldering iron or soldering iron with leak resistance of 10 Mohms or more.

Form of soldering iron's tip:

Fig. 1

(2) **Magnifying glass** . . . for checking of finished works

(3) **Tweezers** . . . . . . . . for handling of IC and forming of leads

(4) **Grounding ring** . . . . Countermeasure for electrostatic breakdown

(5) **Nipper** . . . . . . . . . for removing defective IC

(6) **Small brush** . . . . . . for application of flux

**3. Work Procedures:**

(1) **Remove the defective IC**

Cut all leads of the defective IC one by one using a nipper and remove the IC.

(2) **Clean the pattern surface of the PC board.**

Get rid of the remaining leads and solder.

(3) Check and from the leads of the new flat packaged IC to be installed.

From every lead on the new IC using a pair of tweezers, so that all of them are aligned neatly without being risen, twisted or inclined toward one side. Especially the rising portion of every lead must be formed with greatest care.

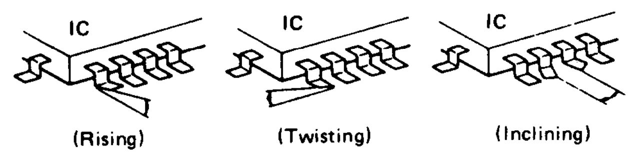



Fig. 2

(4) **Apply flux to the PC board.**

Apply flux to the pattern surface of the PC board which has been cleaned, as shown in the illustration. The area to be applied with flux is the portion of about 2.5mm in width where the IC's leads are to be soldered.

Be careful to apply minimum amount of flux required so as not to smear it on unwanted areas.

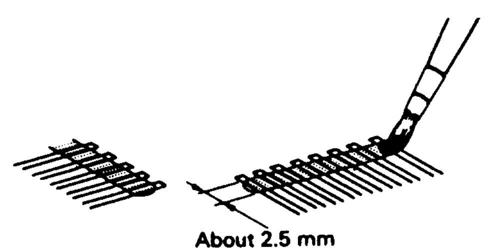



Fig. 3

(5) **Temporarily tighten the IC**

Carefully align the pattern and IC's leads, so that the IC will be temporarily tightened to the pattern on the four leads at the corners. At this time, soldering is required, but no need to apply soldering material.

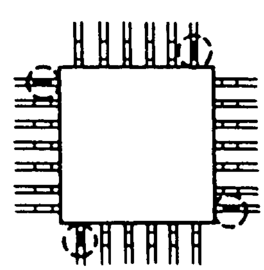


Fig. 4

**(6) Apply flux to IC's leads**

Apply flux to the areas of IC's leads where soldering is to be performed. Be careful not to smear flux on the root portion of any lead or the body of IC.

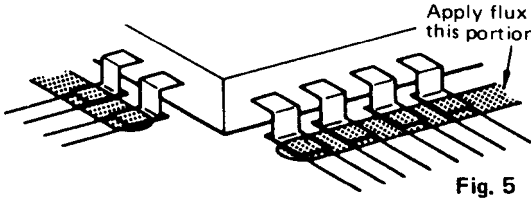



Fig. 5

**(7) Soldering**

While attaching the tip of the soldering iron to the soldering point as shown in the illustration, feed 2 –5mm of soldering wire. Then, slowly move the iron in the direction indicated by the arrow in the illustration, so that the leads will be soldered to the pattern. Move the iron in the rate of approximately 1cm in 5sec. Proceed with your work while confirming a clean fillet of solder is formed on each lead, subsequent to the melting of flux.

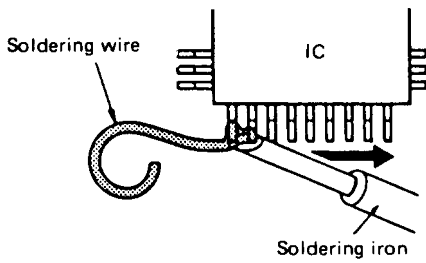



Fig. 6

**CAUTION**

1) If you move the iron too quickly, loose soldering is likely to result.
2) Be especially careful when soldering the first lead where loose soldering is most liable to be formed.

**(8) Check the results**

When soldering of all leads is finished, check the soldered portion on every lead with a magnifying glass. A tester must not be used or checking of any soldered position

# NOTE ON COMPACT DISC

**• Holding Compact Discs**

Hold Compact Discs by the edges so that you do not touch the surface of disc. Remember that the side of the disc with the "rainbow" reflection is the side containing the audio information.

Do not attach tape or paper to the label side of the disc and always be careful not to leave fingerprints on the side that is played.

**• Storing Compact Discs**

Store Compact Discs in a location protected from direct sunlight, high heat and humidity and extremely high and low temperatures. Discs should never be left in the trunk or interior of an automobile in the sun since the temperature can become very high in such a closed environment.

Always store Compact Discs in the holders in which they were sold. Never leave a disc in the player's disc holder for a long period of time.

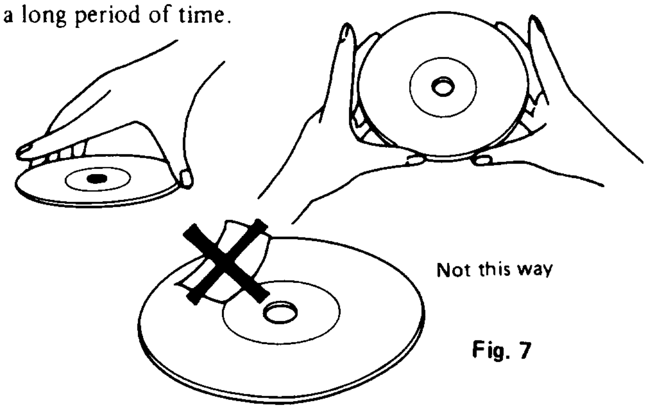



Fig. 7

**• Cleaning Compact Discs**

Before playing a disc wipe off the playing surface with a soft cloth to remove dust and other soil. Wipe the surface in straight lines from the center of the disc outward, not in a circular motion as you would with a phonograph record.

Do not use benzene, chemical cleansers or phonograph record cleaning solutions to clean Compact Discs. Also avoid static electricity prevention solutions since they can damage the surface of Compact Discs.

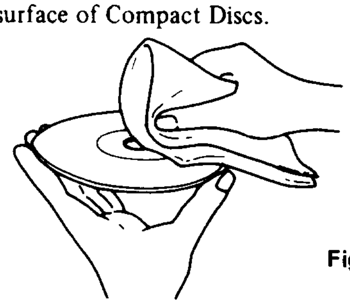


Fig. 8

**Problems Caused by Dew**

Dew can form inside a Compact disc player when it is brought from a cold environment into a warm room, when a room is rapidly heated and if a player is left in a humid environment.

This dew can prevent the laser pickup from reading the data contained in the pits in the disc surface. If the player does not operate properly because of dew, remove the disc and leave the player's power switch on for about one hour to remove all moisture.

### Regarding Merketed Compact Discs

Among compact discs being marketed, nonstandard discs may occasionally be produced in a lot and marketed without being sifted out at inspection.
Trouble areas and symptoms of these are as outlined below:

- **Scratches or dirt on the playback surface**
  To some extent, a disc will play even with scratches or dirt, but if its condition is bad enough, there will be skips in the playback or in the time display, or playback may become impossible.

- **The external dimensions are too big**
  If a disc larger than standard size (120±0.3mm) is inserted, the disc may not be ejected from the magazine and the player reacts as though there is no disc. The same symptom may occur if there are rough edges on the disc.

- **When the modulation depth is too shallow**
  Standard is 0.6 or above, but occasionally a disc with less than 0.6 may appear in a lot and be marketed. The disc will be ignored by the player.
  The modulation depth of discs may vary even within the same lot, and in some cases, tracks may differ within the same disc.

  Modulation depth = $\frac{Vo}{V}$

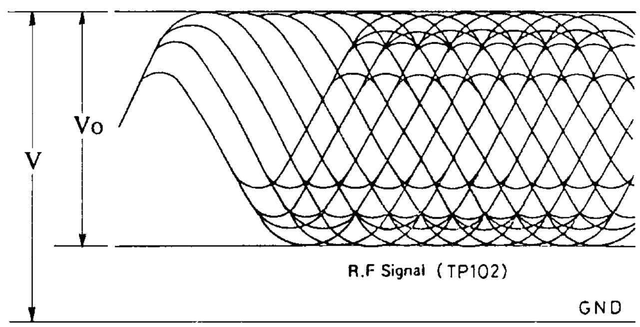



Fig-9

# DISPLAY INDICATORS

OP: When the EJECT operation has occurred, this lights until the magazine has been extended.
CH: This displays the memory number. Up to 32 songs can be memorized.
E: When there is condensation on the optical pickup, or the operation of the changer is obstructed in some way, an E is displayed.
DP: ( 88.88 :Decimal point)
This blinks when the changer mechanism is operating.
DM: Disc Mark (This disappears when no disc is entered, but appears when PLAY is pressed.)

# PROTECTION OF EYES FROM LASER BEAM DURING SERVICING

This set employs a laser. Therefore, be sure to follow carefully the instructions below when servicing.

**WARNING!!**

WHEN SERVICING, DO NOT APPROACH THE LASER EXIT WITH THE EYE TOO CLOSELY. IN CASE IT IS NECESSARY TO CONFIRM LASER BEAM EMMISION, BE SURE TO OBSERVE FROM A DISTANCE OF MORE THAN 30cm FROM THE SURFACE OF THE OBJECTIVE LENS ON THE OPTICAL PICK-UP BLOCK.

**Laser Diode Properties**

- Material: GaAS/GaAlAs
- Wavelength: 790nm
- Emission Duration: continuous
- Laser output: max. 0.2mW*

  *This output is the value measured at a distance about 2mm from the objective lens surface on the Optical Pick-up Block.

# CERTIFICATION LABEL

This label is located on the back panel.

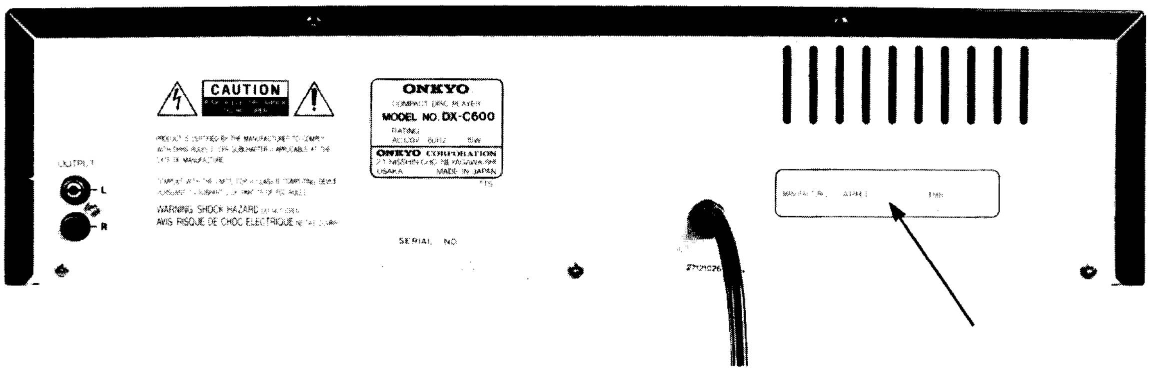



Photo 1

# CAUTION ON REPLACEMENT OF PICK-UP

The laser diode in the optical pick-up block is so sensitive to static electricity, surge current and etc. that the components are liable to be broken down or its reliability remarkably deteriorated.

During repair, carefulley take the following precautions. (The following precautions are included in the service parts).

## PRECAUTIONS

1. **Ground for the work-desk.**
   Place a conductive sheet such as a sheet of copper (with impedance lower than $10^6\,\Omega$) on the work-desk and place the set on the conductive sheet so that the chassis.
2. **Grounding for the test equipment and tools.**
   Test equipments and toolings should be grounded in order that their ground level is the same the ground of the power source.
3. **Grounding for the human body.**
   Be sure to put on a wrist-strap for grounding whose other end is grounded.
   Be particularly careful when the workers wear synthetic fiber clothes, or air is dry.
4. **Select a soldering iron that permits no leakage and have the tip of the iron well-grounded.**
5. **Do not check the laser diode terminals with the probe of a circuit tester or oscilloscope.**

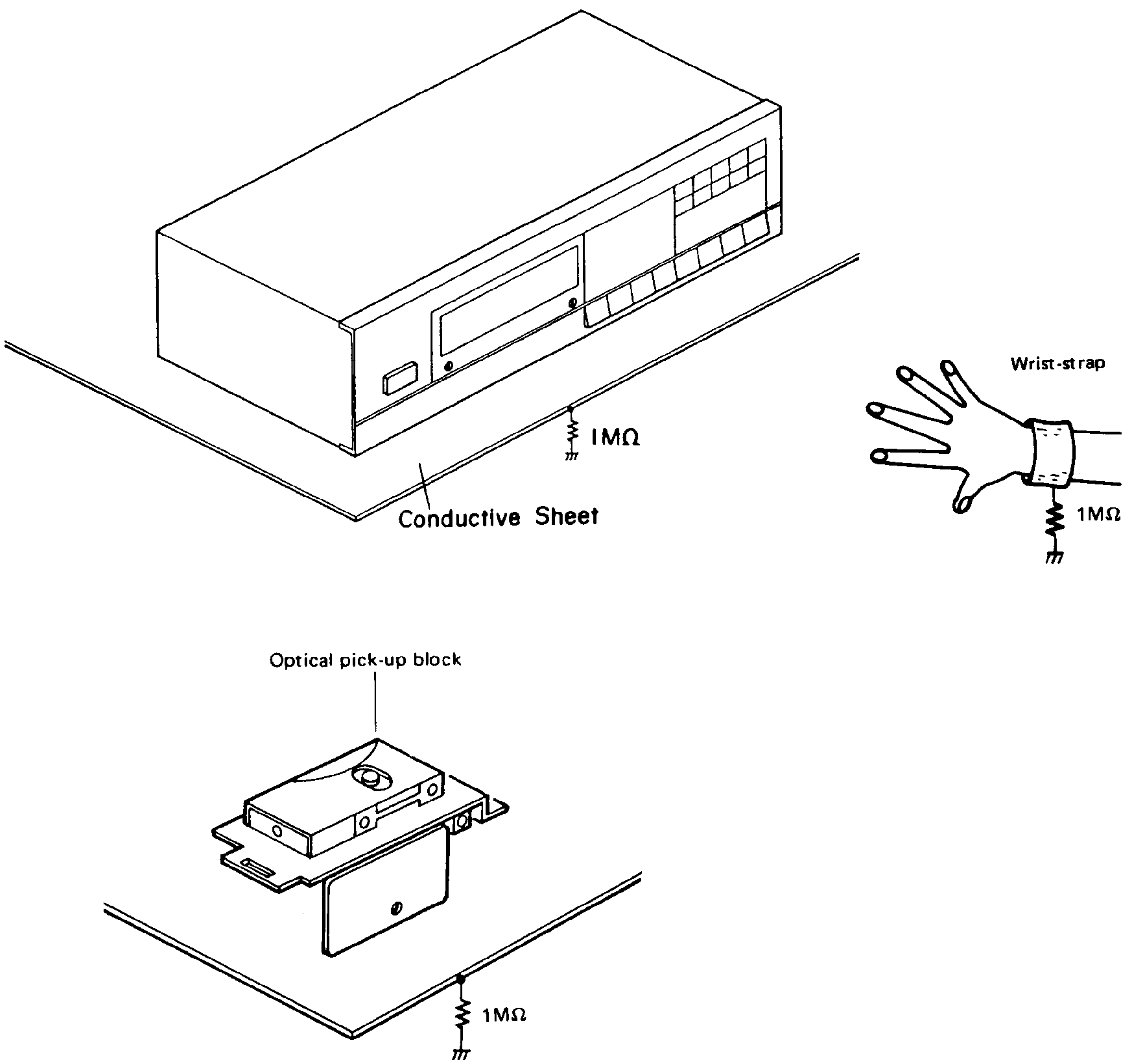
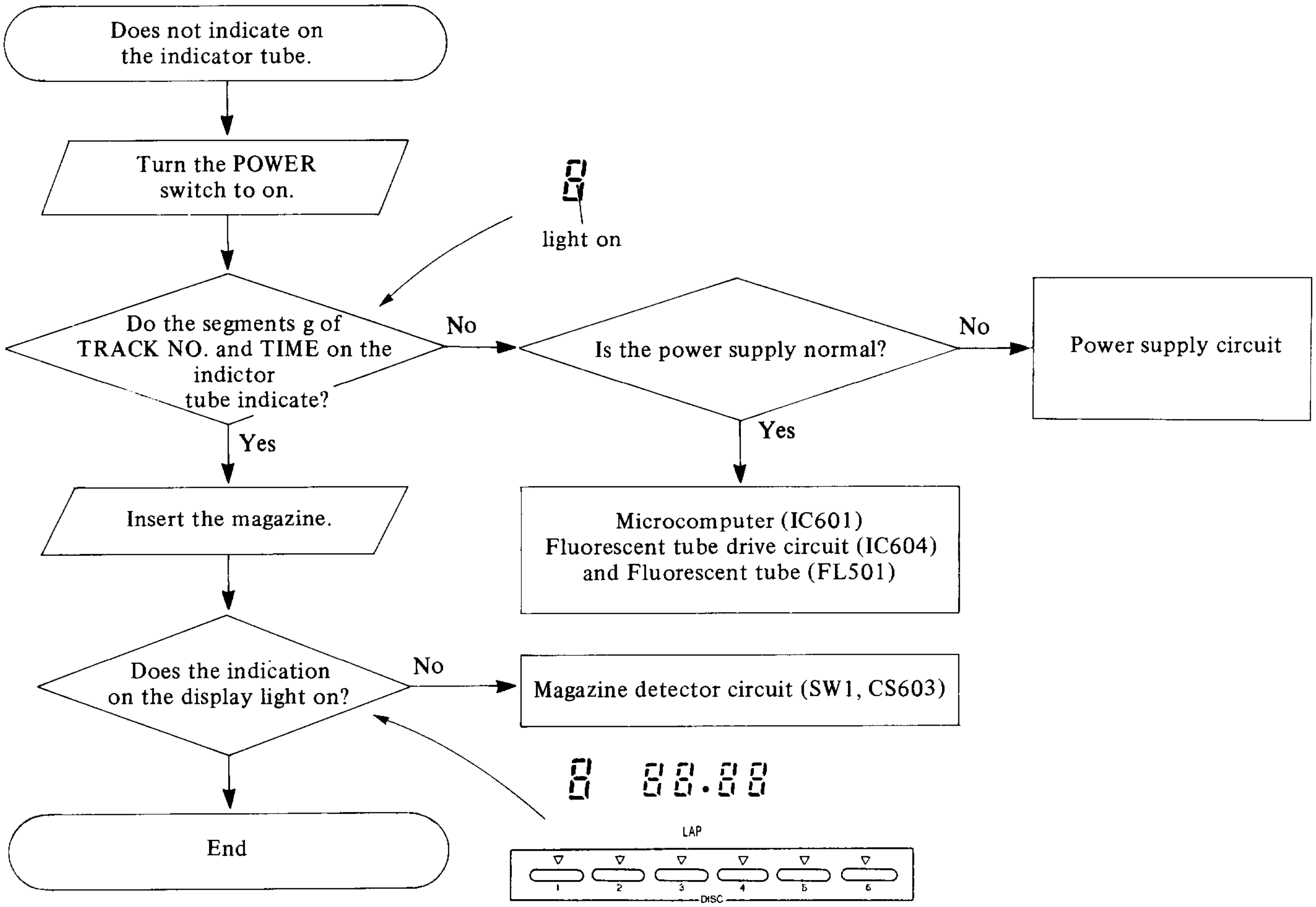
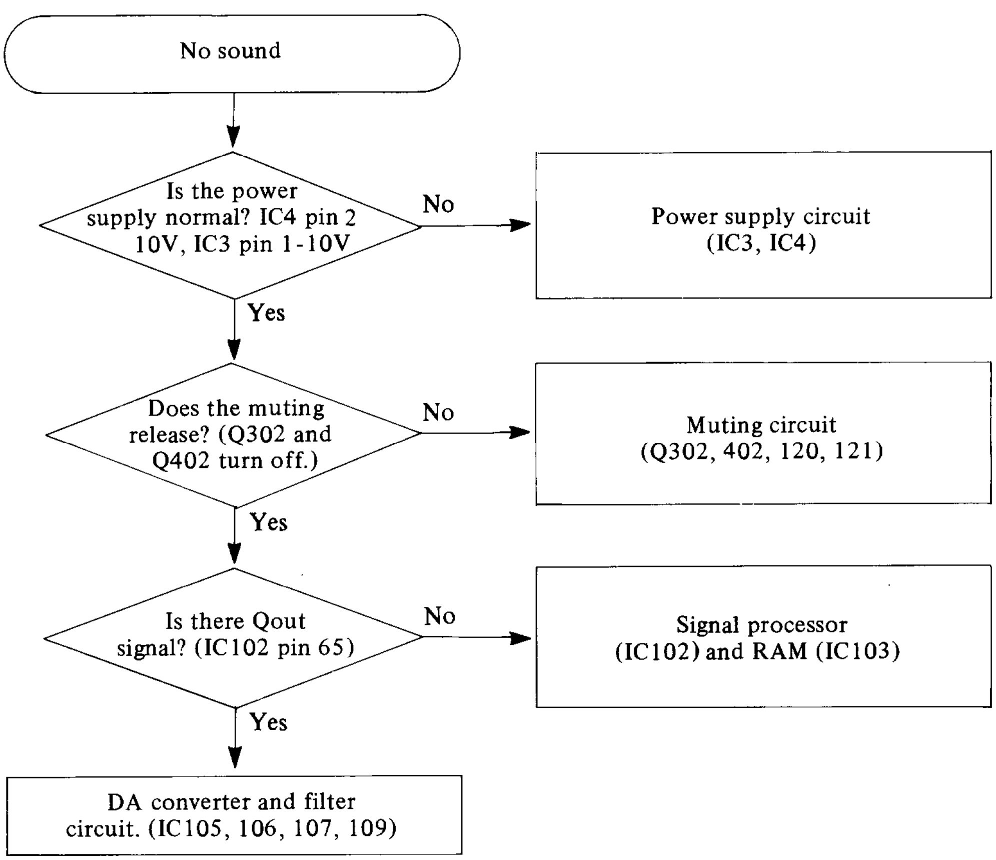
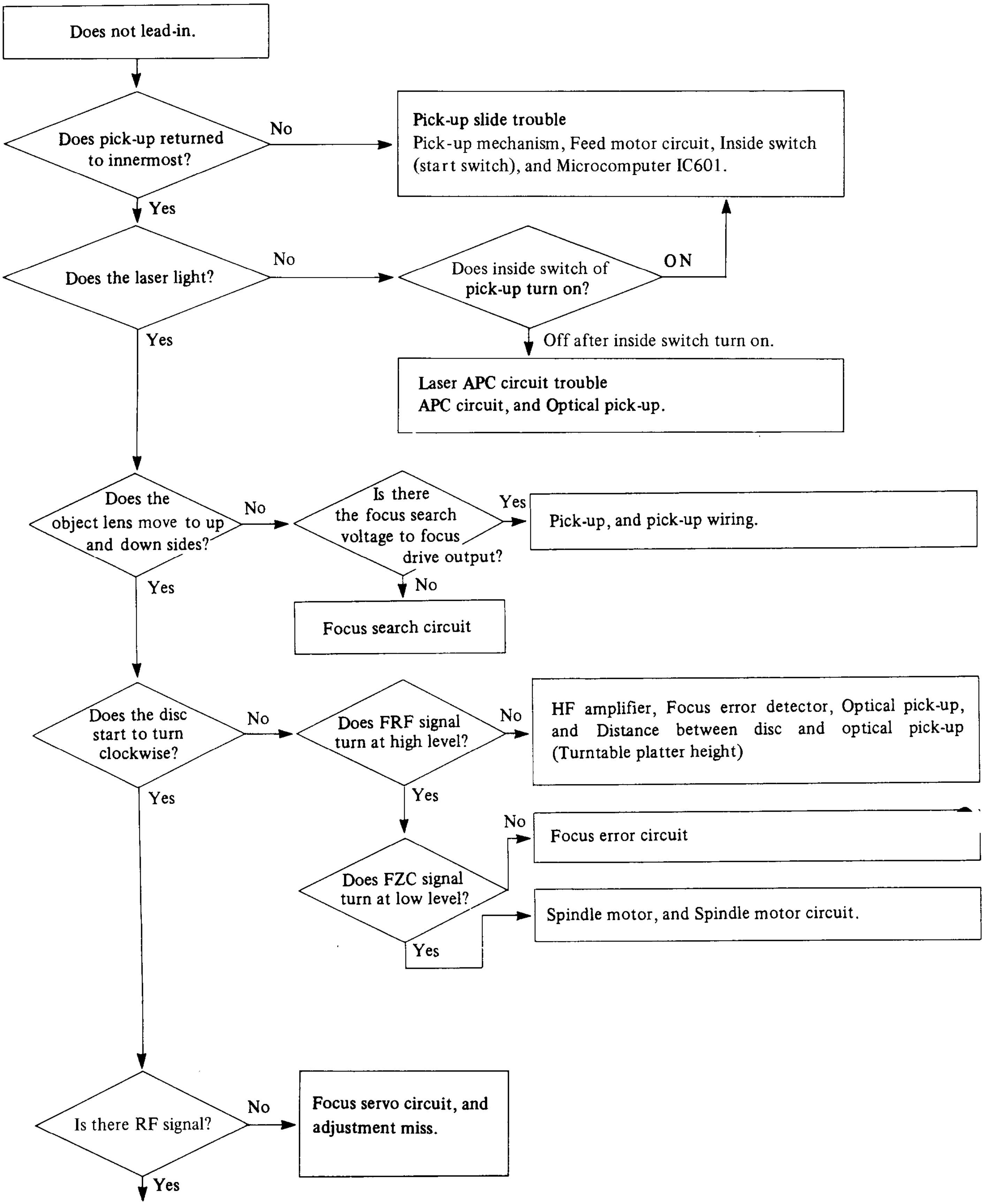



Fig-10

# TROUBLE SHOOTING GUIDE



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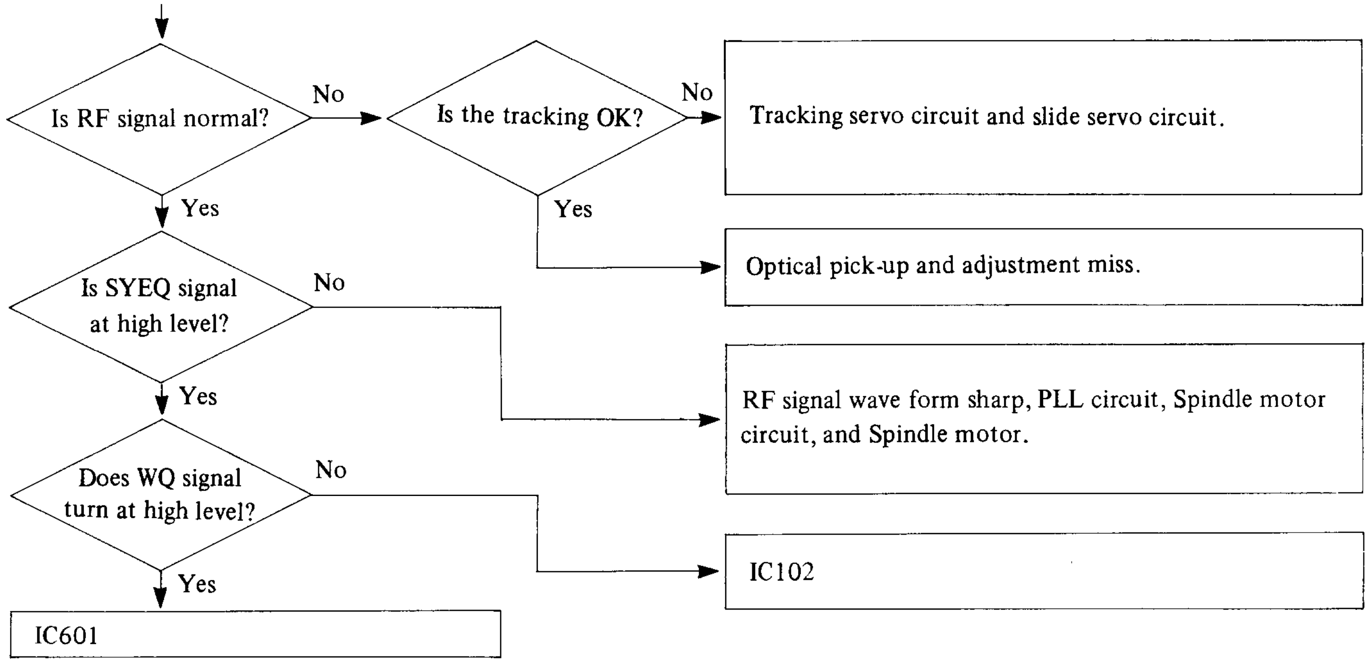
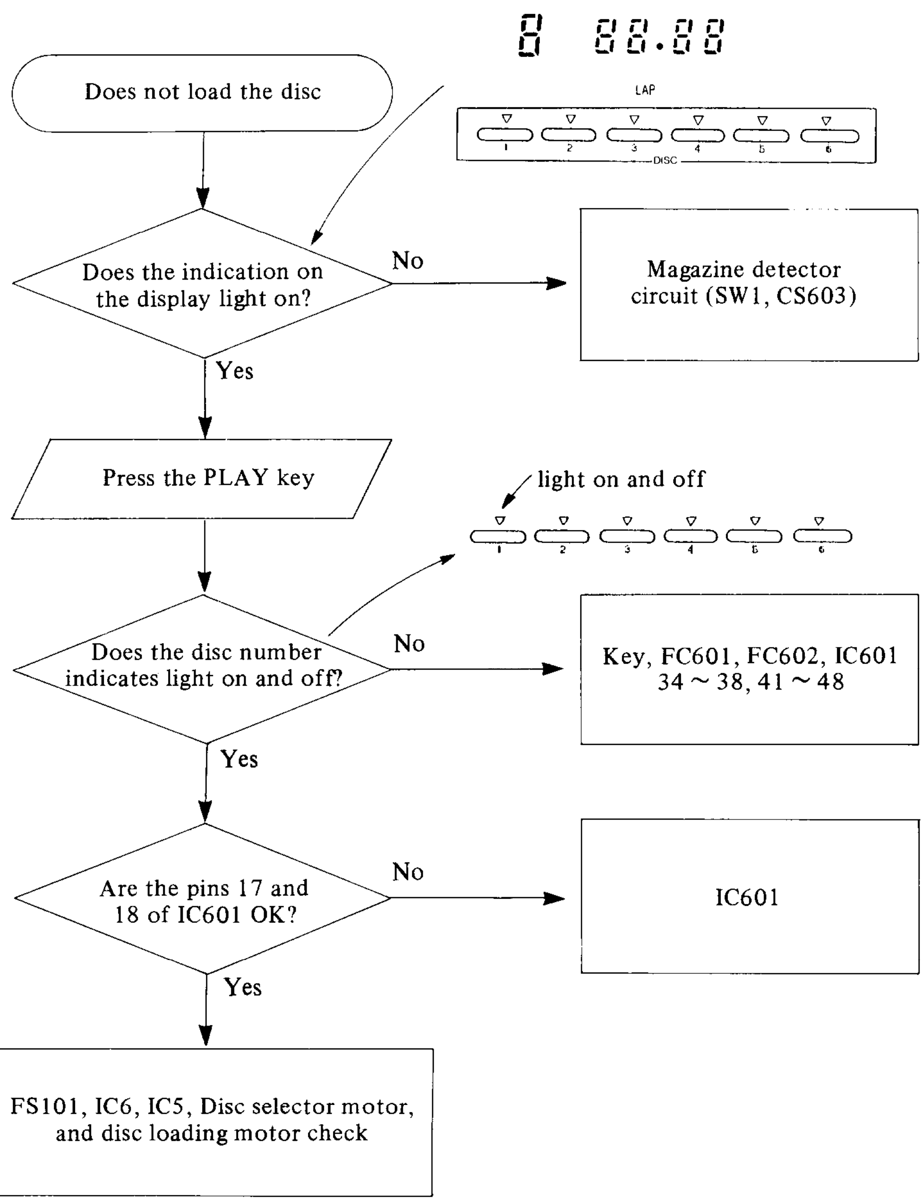

Is RF signal normal?
No
Is the tracking OK?
No
Tracking servo circuit and slide servo circuit.
Yes
Yes
Optical pick-up and adjustment miss.
Is SYEQ signal at high level?
No
Yes
RF signal wave form sharp, PLL circuit, Spindle motor circuit, and Spindle motor.
Does WQ signal turn at high level?
No
Yes
IC102
IC601


Does not load the disc
LAP
DISC
Does the indication on the display light on?
No
Magazine detector circuit (SW1, CS603)
Yes
Press the PLAY key
light on and off
Does the disc number indicates light on and off?
No
Key, FC601, FC602, IC601 34 ~ 38, 41 ~ 48
Yes
Are the pins 17 and 18 of IC601 OK?
No
IC601
Yes
FS101, IC6, IC5, Disc selector motor, and disc loading motor check

# CIRCUIT DESCRIPTIONS

## 1. Focus Servo Circuit

The focus servo ensures that the laser beam emitted by the optical pickup is always focused on the reflective surface of the disc. It does this by moving the optical pickup's objective lens in response to oscillations in the disc surface.

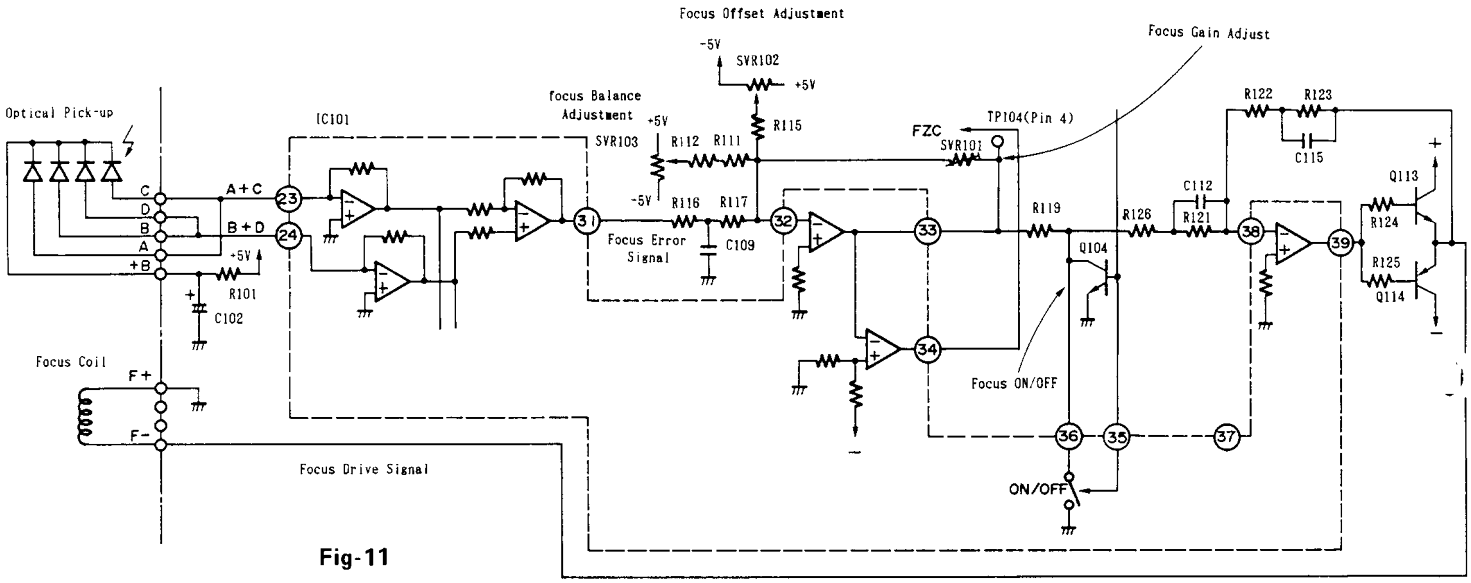



Fig-11

### 1-1. Focus Error Detector

The detector obtains the difference between the signals produced by the diagonal elements of a four-section photodiode housed in the pickup and utilizes an astigmatic method to detect focusing errors.

FE (focus error) = (A + C) – (B + D)

(A + C) and (B + D) are input into pin 23 and pin 24 of IC101 respectively. The FE signal is calculated by the three opamps in IC101 and output via pin 31.

### 1-2. Phase Correctors - Drivers

The focus error signal is relayed from IC101 pin 31 to pins 32, 33, 38 and 39 in succession. Then, after passing through drivers Q113 and Q114, it is fed back to the focus coil of the pickup.

C109, C112 and C115 are phase correctors which enhance the servo's stability. Semi-fixed resistors SVR101, SVR102 and SVR103 are used to regulate offset, balance, and gain in the servo circuitry. Q207 and the switch in pin 36 turn the servo loop on and off. Control is maintained by means of the FCS signal sent from microprocessor IC102.

### 1-3. FZC (Focus Zero Cross) and FCS (Focus Search) Circuits

The focusing servo's capture range is only approximately 10$\mu$m, so, when the objective lens is being moved up or down, the above-mentioned servo on/off switch must be controlled to close the loop when the point of focus of the laser beam is positioned precisely. When a focus search command is received from the microprocessor, the LSR signal switches to LOW and a laser beam is emitted (see fig. 12). At the same time, the FCS signal switches to HIGH.

As the laser beam approaches the point of focus, the FE signal builds up (+) electrical potential which falls when optimum focus is reached. This comparator's output FZC signal is output from pin 34 of IC101. According to this timing, FCS changes to LOW, and Q104 and the switch of pin 36 shut off, closing the servo loop.

Fig. 12 illustrates the timing. The dotted lines show the waveforms produced by focus capture erros.

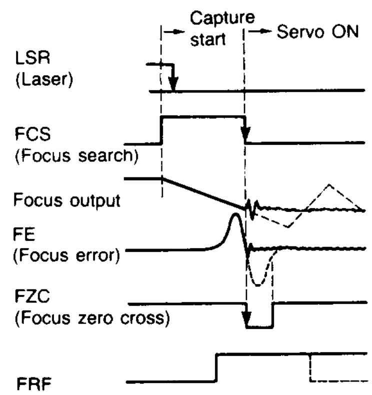



Fig-12

## 2. Tracking servo

This control circuit moves the objective lens radially to keep the laser beam precisely centered in the tracks on the disc surface (which are only 1.6$\mu$m wide).

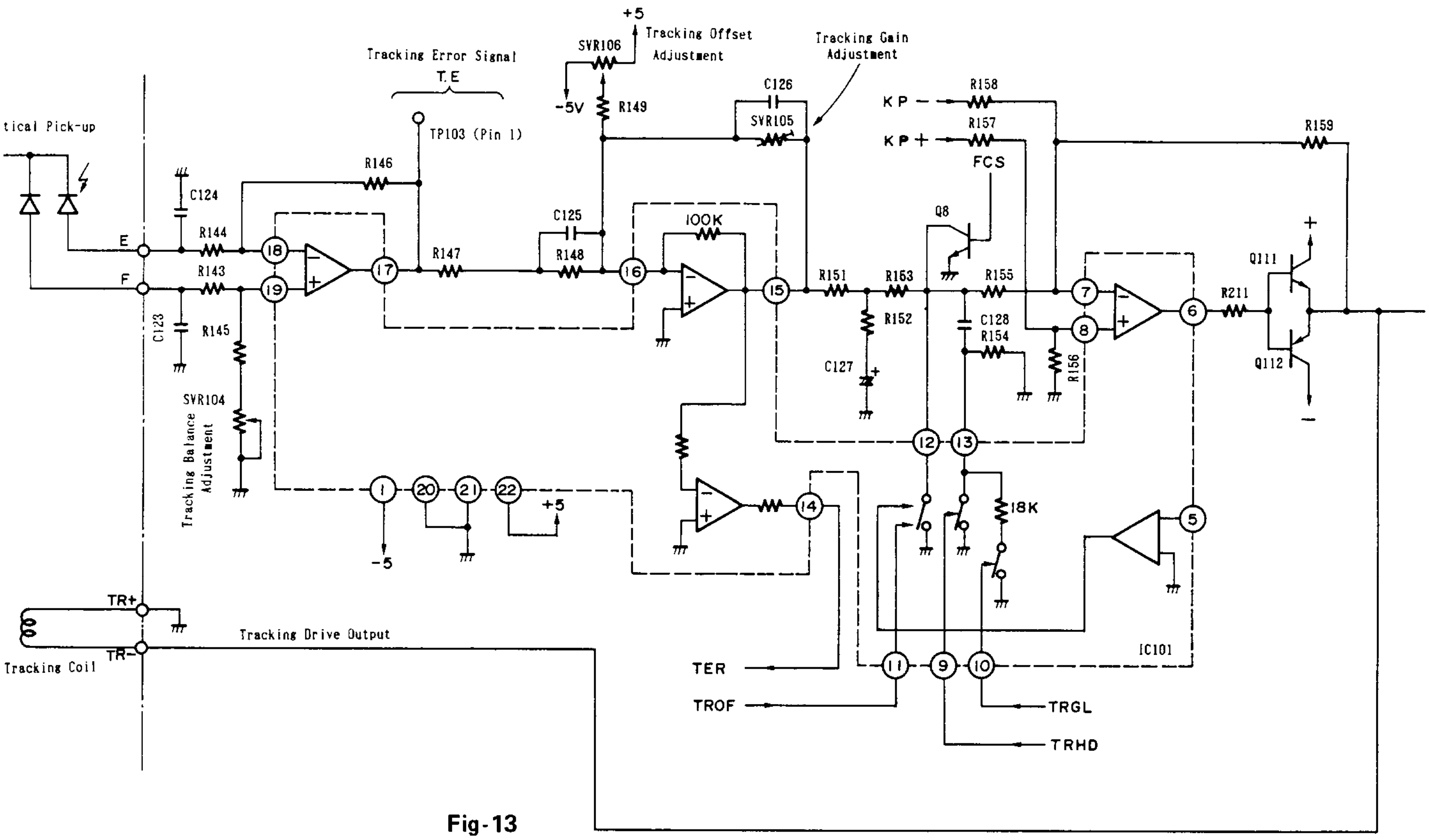


Fig-13

### 2-1. Tracking Error Sensor

This unit uses a three-beam laser pickup. The error signal is obtained from the difference between the E and F output from both sides of a four-section photodiode housed in the pickup.

T.E. (tracking error) = F − E

The E and F signals are input into pins 18 and 19 of IC101, the difference is obtained by an internal opamp, and the T.E. signal is output from pin 17.

### 2-2. Phase Correctors – Drivers

The tracking error signal is relayed from IC101 pin 17 to pins 16, 15, 7 and 6 in succession. After passing through drivers Q111 and Q112 it drives the tracking coil of the pickup. C125, C127 and C128 are capacitors which perform phase corrections. Balance, offset and gain are regulated by semi-fixed resistors SVR104, SVR106 and SVR105 respectively.

The switches incorporated in pins 12 and 13 of IC101 turn the servo on and off and switch the high frequency range loop gain on and off, thereby helping to stabilize transient operation during access times. The timing of these switches is determined by the input into pins 9 –11 of IC101. The commands are as follows:

TROF (tracking OFF) FEOF (feed OFF)
TRGL (tracking gain low) TRHD (tracking high down)

Signals are output from IC102 in response to commands from microprocessor IC 601.

### 2-3. TER circuit

The TER signal is one of the sensors that determines the switch timing mentioned above. It is produced by running the tracking error signal output from pin 15 through a comparator at the ground level and then output through pin 14.

### 2-4. Track Kick Circuit

This circuit is used to move the laser beam to a target pit over relatively short distances (approximately 1 – 100 tracks) during such operations as disc access and cue review. In conjunction with the on/off switching discussed above, it sends positive and negative "kick pulses" (KP+ and KP−) to pins 7 and 8, thereby shifting the tracking coil by the desired amount.

The timing is determined by signals such as the TER signal and the HFD signal (see below). Fig. 14 illustrates the timing during a typical "kick" operation (forward).

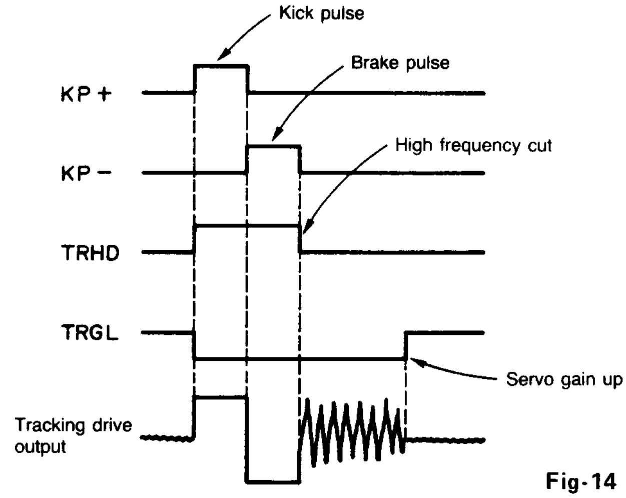



Fig-14

## 3. HF (RF) Amp

The HF (RF) amplifier block amplifies the HF (RF) data encoded on the disc (in other words the entire output from the four-section photodiode) and sends it to the processing circuit block. In addition, it constantly checks the status of the servo and detects the signals which determine timing.

H.F. (R.F.) = A + B + C + D ← Eye-Pattern

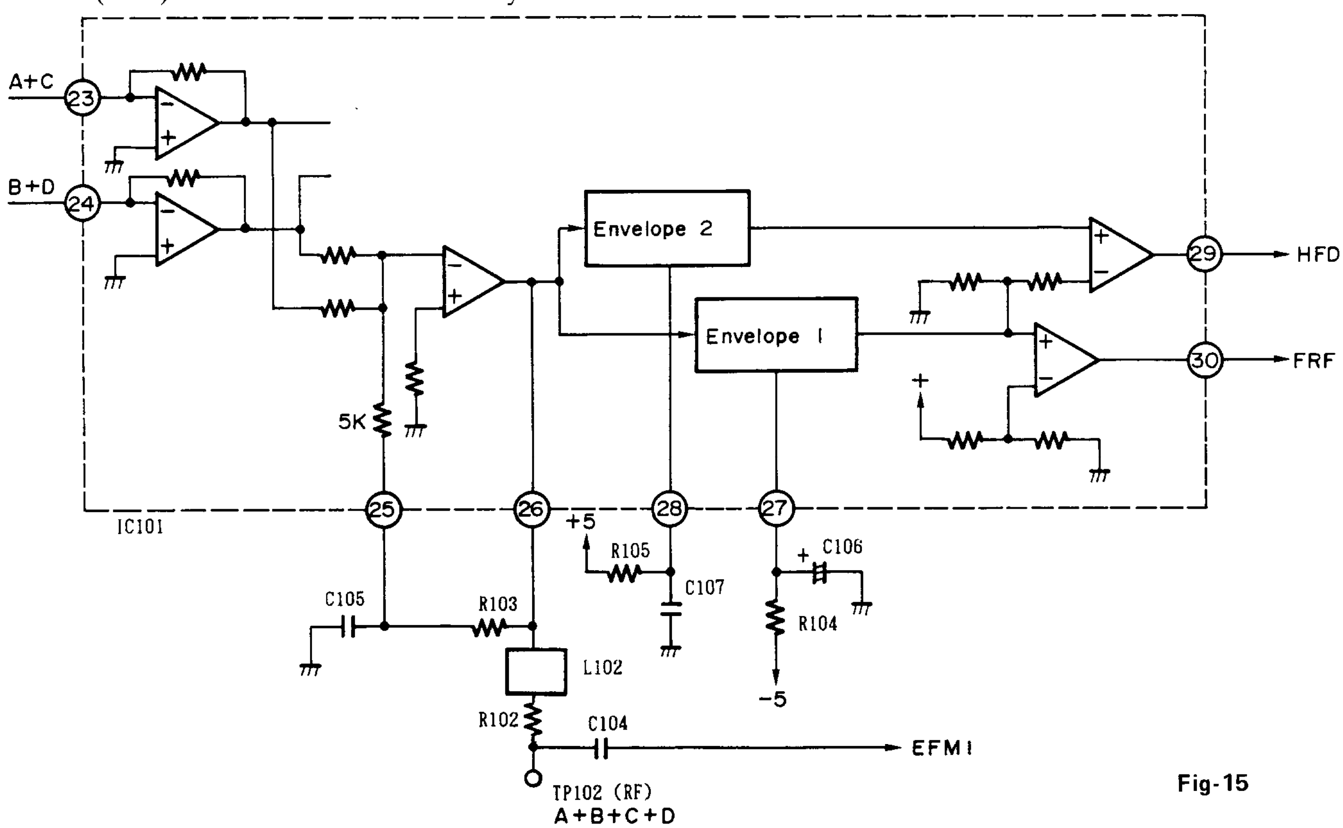
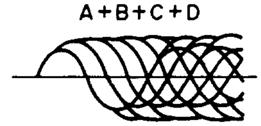



Fig-15



### 3-1. HF Amp

The A + C and B + D signals are input from pins 23 and 24 of IC101. They are added together by an opamp and the resulting signal (the HF signal) appears at pin 26. The HF signal is then passed through C104 and sent to the EFMI terminal of IC102 for signal processing.

### 3-2. HFD and FRF Signals

The HF signal is input into C106 and C107, two envelope detection circuits with different time constants. The output is put through a comparator at a certain level and the HFD and FRF signals are then output via pins 29 and 30. The FRF signal indicates that focus in on; it is HIGH when focus is on. The HFD (HF detector) detects such things as the flat sections between pits and scratches on the disc surface. Together with the TER signal, it determines switching timing during disc access, etc.

## 4. Slide Motor (Feed Motor) Circuit

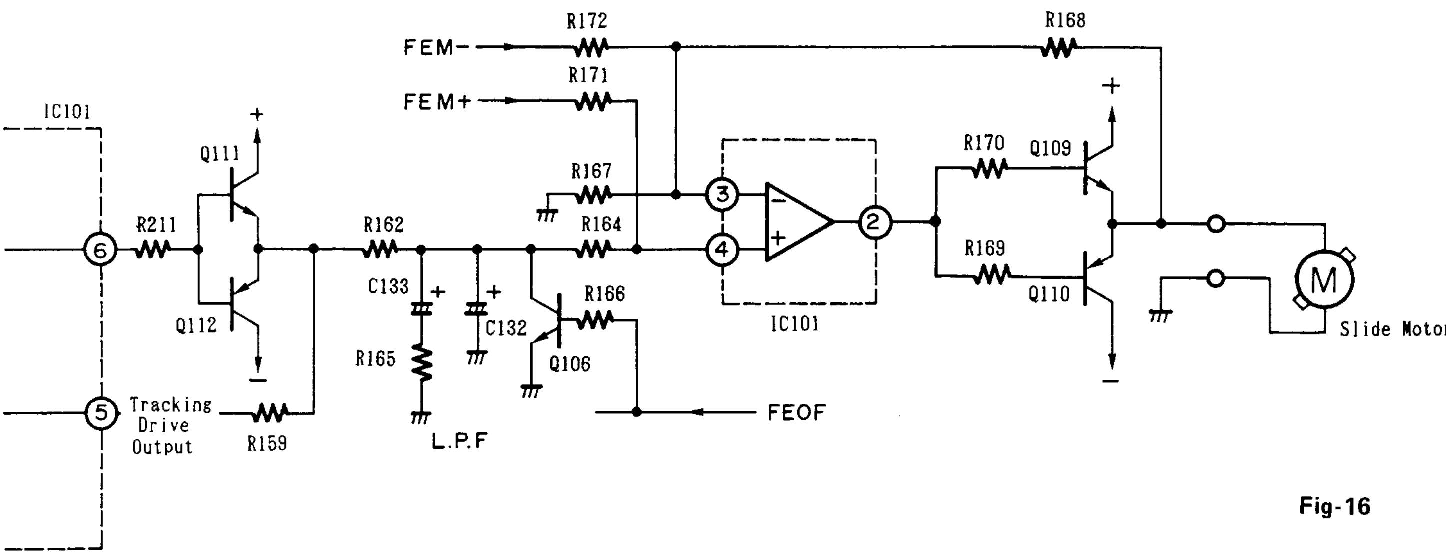



Fig-16

This servo circuit moves the entire pickup assembly from the disc's hub to its outer edge, ensuring that the objective lens stays close to the optical axis.

C132, C133, etc. remove low-frequency elements from the tracking drive's output. It then passes successively through pins 4 and 2 of IC101 and then drives the motor via drivers Q109 and Q110.

Q106 is the transistor that turns the slide servo on and off. It is controlled by the FEOF (feed off) signal sent from IC102.

Motor' fast forward and reverse are initiated by FEM− (feed motor −) and FEM+ (feed motor +) signals input into pins 3 and 4 of IC101 for smooth disc access.

## 5. Spindle Motor Servo

This servo consists of a PLL circuit which extracts the clock signal from the HF signal the pickup reads from the disc and a circuit which controls the spindle motor based on this clock signal.

### 5-1. PLL Circuit

The PLL circuit consists of VCO, LPF and a phase comparator in IC102 as shown in fig. 17.

The 8.64MHz VCO oscillator output is divided in half inside IC102. The phase of the HF signal and the waveformshaped EFM signal edge are compared and the result output through pin 4.

When this signal is added to the VCO, the synchronous signal detected by the EFM is matched to the synchronous signal of the internal counter of IC102.

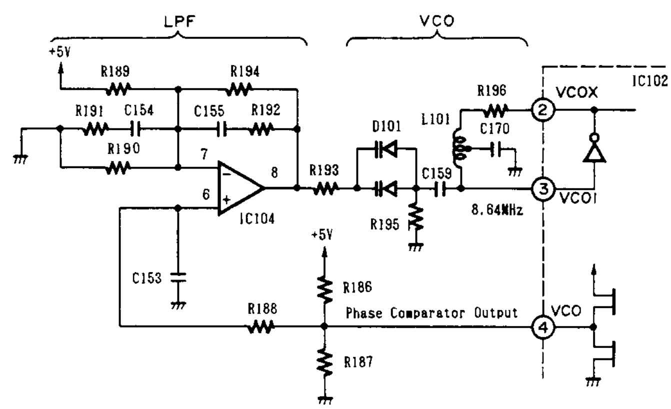



Fig-17

### 5-2. Spindle Motor Circuit

The spindle motor is controlled by DM+ (disc motor +) and DM− (disc motor −) commands output from pins 11 and 12 of IC102. Two opamps perform phase correction and amplify the signals which are then sent to the spindle motor via driver Q107 and Q108.

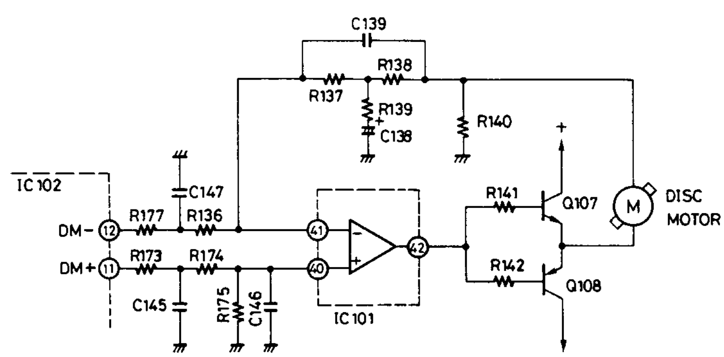



Fig-18

## 6. HF Signal Waveform-shaping Circuit

This circuit shapes the HF signal and converts it into a binary value. However, since asymmetry (i.e. lack of symmetry between the top and bottom of the HF signal which can adversely affect the DC balance) caused by dispersion during disc manufacture cannot be eliminated by AC linking alone, DC components from the EFM (eight to fourteen modulation) signal are fed back after shaping for slice level processing. The slice level output from Q210 pin 1 is approximately 2.5V during normal operation.

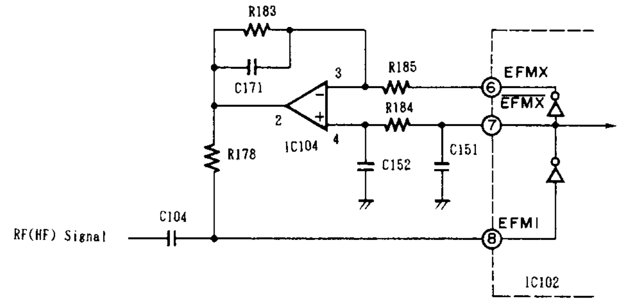



Fig-19

## 7. Microcomputer Peripheral Circuit

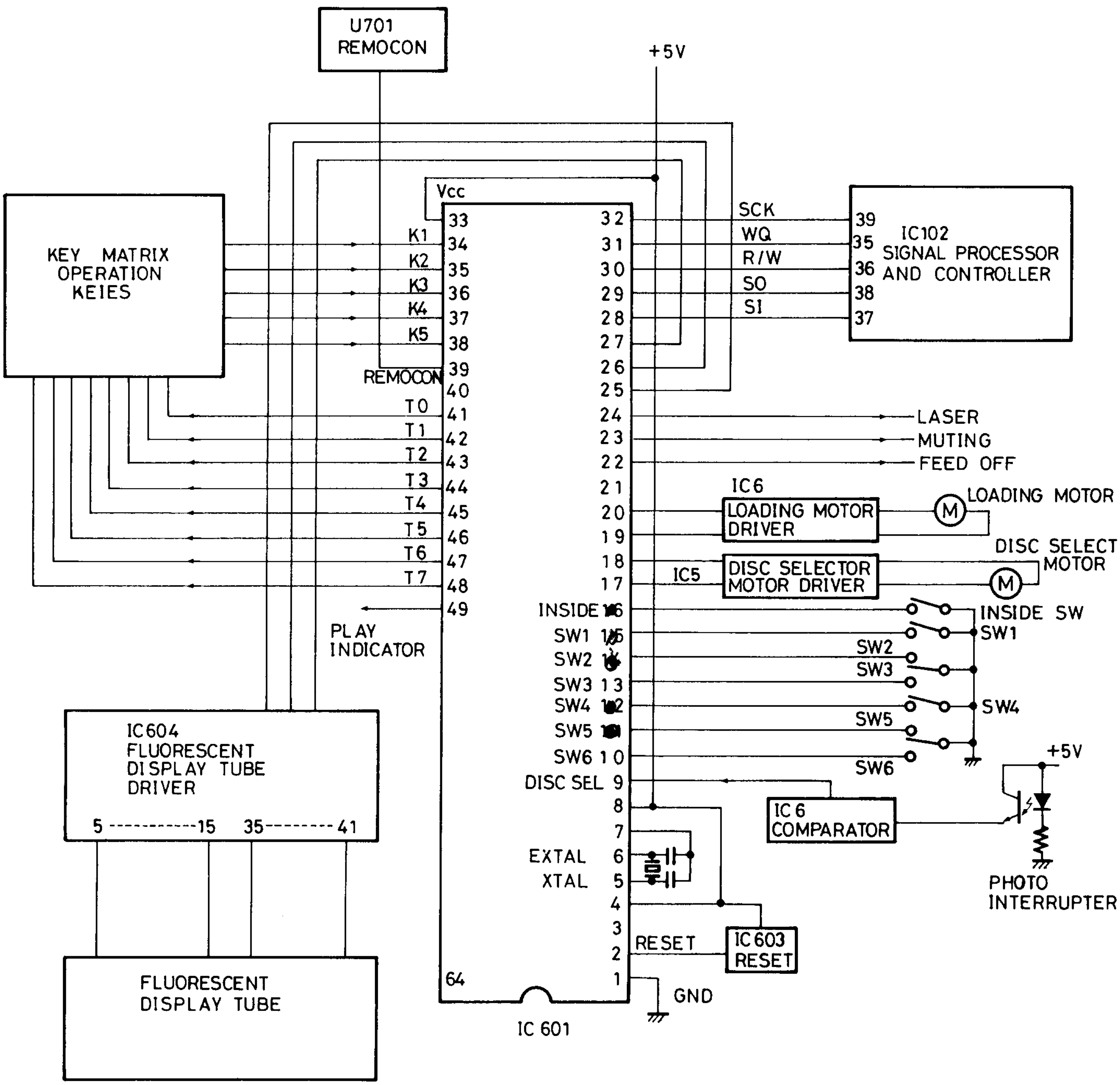



Fig-20

## 7. Microcomputer Peripheral Circuit (IC601)

### 7-1. Display Control (IC604)

When data is sent from microcomputer (IC601) pins 25 ~ 27, display operations take place through the micro-computer (IC604) which is used for driving the fluorescent character display tube. Seven-digit data is output by IC604 pins 35 ~ 41, and 11-segment data is output by pins 5 ~ 15 (dynamic scan method). One digit is approximately 1ms.

### 7-2. Key Input Operation

The timing pulse is output by IC601 pins 41 ~ 48, while an 8 x 5 matrix structure for key input is made up of IC601 pins 34 ~ 37.

### 7-3. Remote Control Operation

When the output of the Optical Reception Module U701 is received by the 39 pin of IC601, data code operation takes place internally.

### 7-4. Servo System Control and Sub-Code Demodulation (IC601)

Commands to the servo as well as information and subcode data, etc. are transmitted serially between IC601 and IC102.

SO . . . . Communicates command data from the microcomputer to the servo system. 8-bit configuration.
SI. . . . . Communicates servo system conditions and sub-code data to the microcomputer. 8 ~ 88-bit configuration.
SCK . . . Serial data clock. Downshift.
R/W . . . When sending commands from the microcomputer, the signal becomes high-level.
WQ. . . . When sending information to the microcomputer, the signal becomes high.

### 7-5. Changer Mechanism Control

IC601 pins 9 ~ 15 and 17 ~ 20 are for mechanism control input and output. SW1 15 pin detects with LOW/HIGH whether there is a magazine or not. SW2 14 pin (when LOW) and SW3 13 pin (where HIGH) input whether the disc is on the turntable or in the magazine (not on the turntable). SW4 12 pin tells the microcomputer with LOW/HIGH whether or not there is a disc. SW5 11 (when LOW) and SW6 10 (when HIGH) inform the computer that the trigger is at its lowest level, or, in the opposite case, at the EJECT level. Also, a detection signal from the photo interrupter is reshaped by IC602 and sent to the DISC SEL pin no. 9. The INSIDE switch is LOW when the PICKUP is at its innermost circumference (16 pin). Pin 17 and 18 are ACTIVE LOW with the reverse control signal of the disc select motor. At STOP they are both high. Pins 20 and 19 are ACTIVE LOW with the control signal of the disc load motor. With STOP, they are both HIGH.

### 7-6. Other Controls

24 pin . . . . . With the laser diode control signal, HIGH and LASER ON.
23 pin . . . . . . With the audio muting signal, ACTIVE HIGH At LOW, there is output.
22 pin . . . . . Turns the feed circuit of FOCUS to OFF. ACTIVE HIGH.

## 8. Mechanism Operation

### 1. Disc Loading Operation

1. Take out the designated disc from the magazine.
2. Put the selected disc on the turntable for chucking. With the above steps, the disc loading process is completed. This operation launches a series of operations set in motion by the gear ring operation of plate side A and plate side B, which are attached at the left and right of the mechanism.
   This series of operations is driven by the DC motor. When the DC motor is running, plate side A operates, and lever gear ring is introduced, upon which plate side B also begins gear ring operation. When plate side A operates in the direction shown in Figure 21, the disc is loaded.

   When the gear ring operation is taking place on plate side A, the lever mechanism of the selected disc in the magazine moves, and the selected disc is brought out of the magazine and is sent to a designated position. (A-Operation of Figure 22) Next, the disc is lowered to the turntable of the CD mechanism section and is chucked. (B-Operation) With this, the loading operation of the disc is finished.

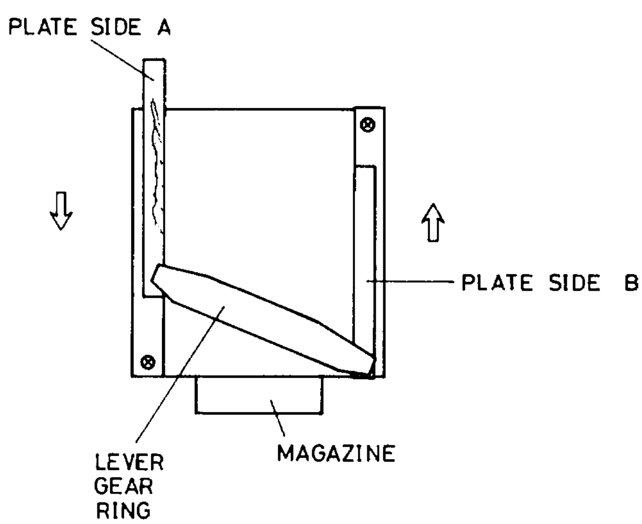



Fig-21

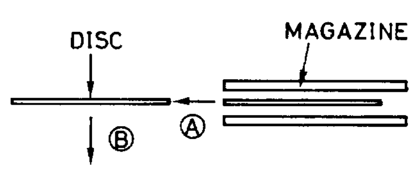



Fig-22

## 2. Disc Eject Operation

If plate side A and plate side B are operating in the opposite direction of the disc loading operation, disc eject operation takes place.

When the disc chucking is cancelled, the disc is raised, and returns to a designated slit in the magazine. With this action, the disc eject operation is finished.

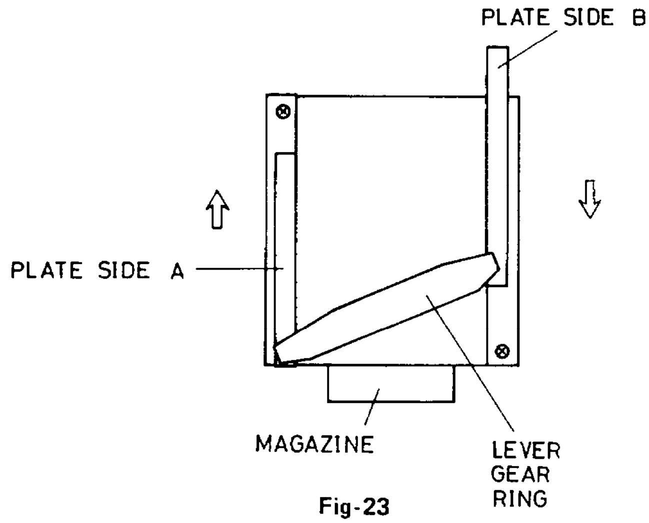



Fig-23

## 3. Disc Select Operation

Disc selection occurs when the base trigger is moved up and down by the DC motor operation. There are six slits corresponding to Nos. 1 ~ 6 of the base trigger. When the DC motor is driven and the special screw rotates, the base trigger is moved up and down. When the sensor find the designated disc slit, the base trigger is brought to the designated disc position.
When this has taken place, disc selection is finished.

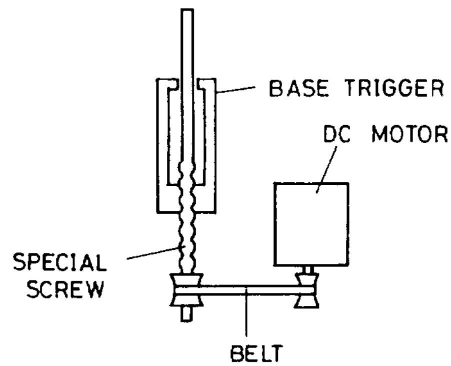



Fig-24

## 4. Magazine Eject Operation

The magazine is held inside the mechanism by a stopper. When the base trigger has been lowered to its lowest position,( When the sensor find the slit for eject) the stopper is pushed down, and the stopper is detached from the magazine. The magazine pops up by means of a spring. When this occurs, the magazine eject operation is finished.

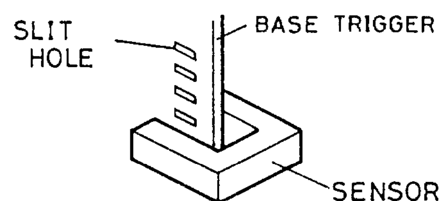
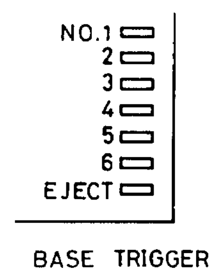



Fig-25



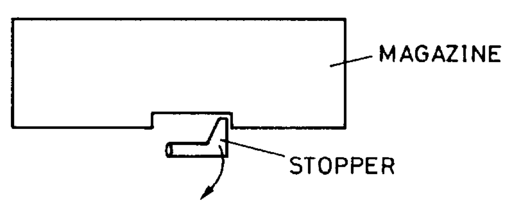




Fig-26

# BLOCK DIAGRAM

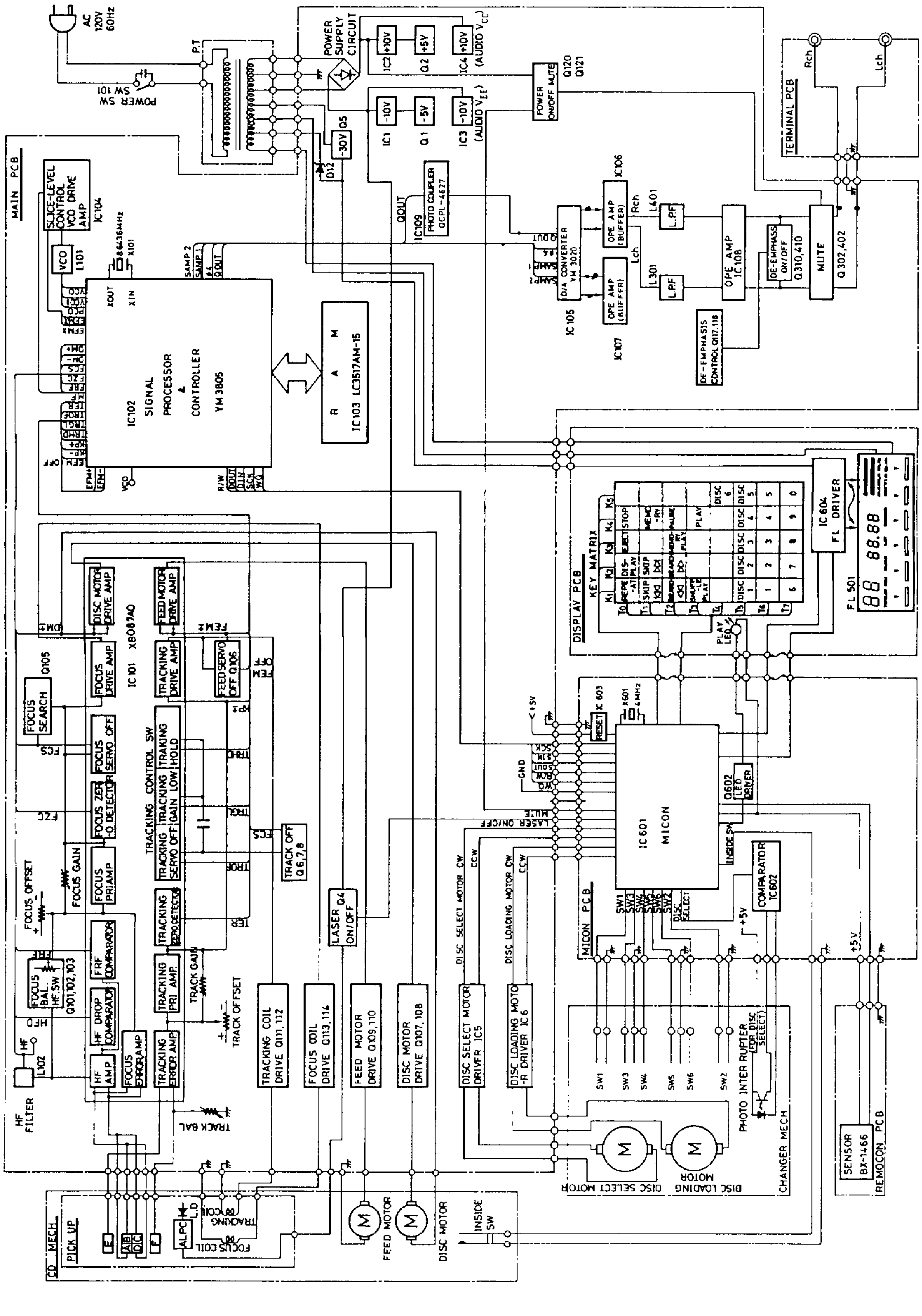
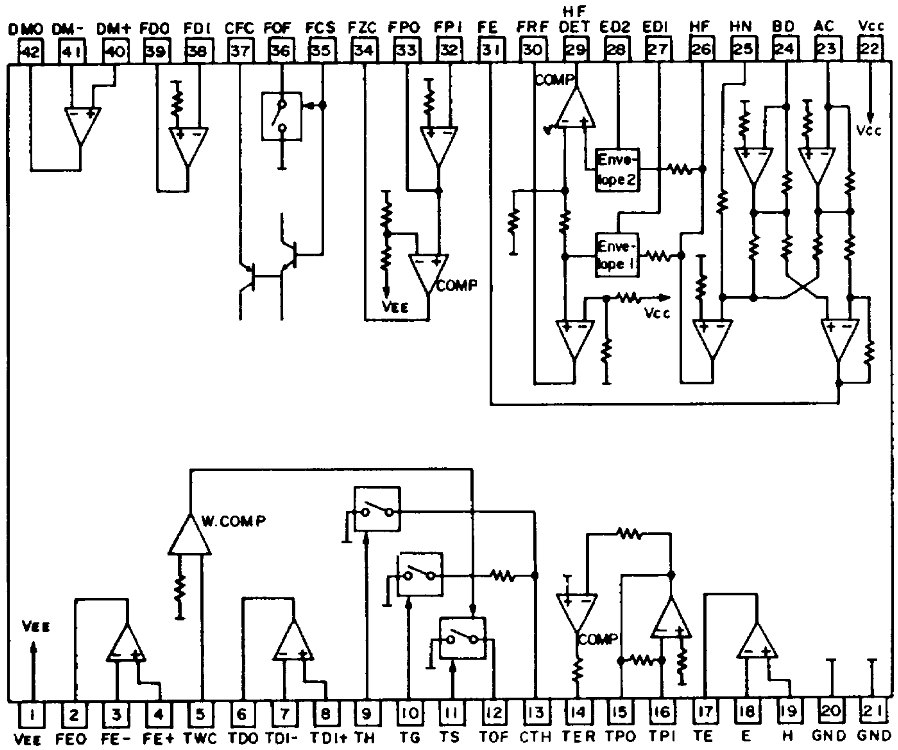



Fig-27

# IC DESCRIPTIONS

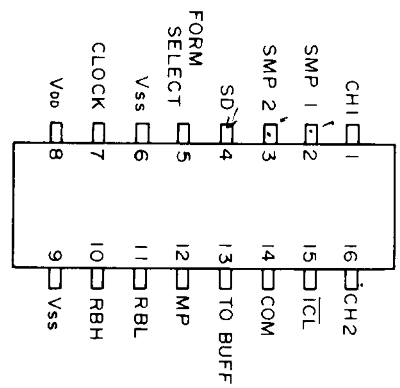
## XB087A0(Servo Linear Circuit)




| Pin No. | Designation | Function |
|---|---|---|
| 2~4 | FEO, FE–, FE+ | Feed drive amplifier dvives the feed power amplifier and is rotated the feed motor. |
| 5 | TWC | Terminal of tracking drive limiter to tracking coil.<br>The reference voltage of this circuit is about ±0.67V. |
| 6~19 | | Tracking servo system terminals. |
| 6~8 | TDo, TDi–, TDi+ | Tracking drive amplifier drives the tracking power amplifier and actuates the tracking actuator. |
| 9~11 | TH, TG, TS | Tracking jump control switches. TH: Tracking hold switch TG: Gain control switch TS: Tracking offset switch |
| 12~13 | TOF, CTH | These terminals are controlled the tracking loop by TH,TG and TS (pins 9,10,and 11). |
| 14 | TER | The output terminal of comparator of tracking zero cross. |
| 15~16 | TPo, TPi | Input/Output terminals of tracking preamplifier. |
| 17~19 | TE, E, F | This circuit is constituted by I-V conversion and differential amplifier. The reflected sub beams are converted into electric signals by the E and F, and the mutual differnces are obtained as a tracking error signal. |
| 23~39 | | Focus servo system terminals. |
| 23~24 | AC, BD | Input terminals from main spot of photo diode. |
| 25~26 | HN, HF | Feedback terminal and output terminal of HF (RF) signal. |
| 27~28 | ED1, ED2 | Terminals for peak hold (pin 27) and bottom hold (pin 28)of HF (RF) signal. |
| 29, 30, 34 | | Output terminals of servo IC to control the focus tracking. |
| 29 | HF | HF output is L level on the track of disc and H level on mirror section. |
| 30 | FRF | This circuit is the focus servo to on when comes the focus point from focus search condition. |

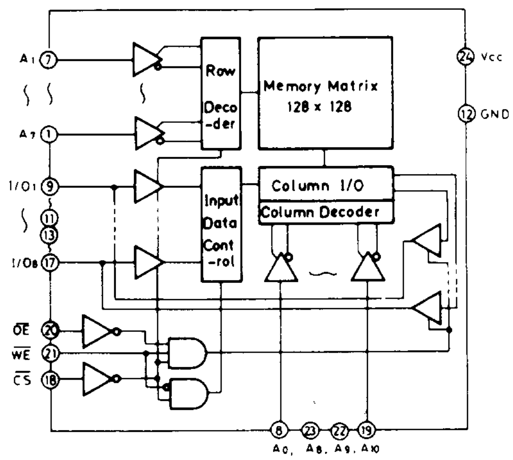
| Pin No. | Designation | Function |
|---|---|---|
| 34 | FZC | Use when the focus search. Same as FRF |
| 35 | FCS | Signal input terminal to pull the focus. |
| 36 | FOF | Attenuator terminal. |
| 37 | CFC | Terminal to make the ramp waveform of focus search ramp circuit. |
| 38~39 | FDi, FDo | Input/output terminals of focus drive amplifier. |
| 40~42 | DM+, DM–, DMo | Input/output terminals of disc drive amplifier. |

## YM3020 (D/A CONVERTER)

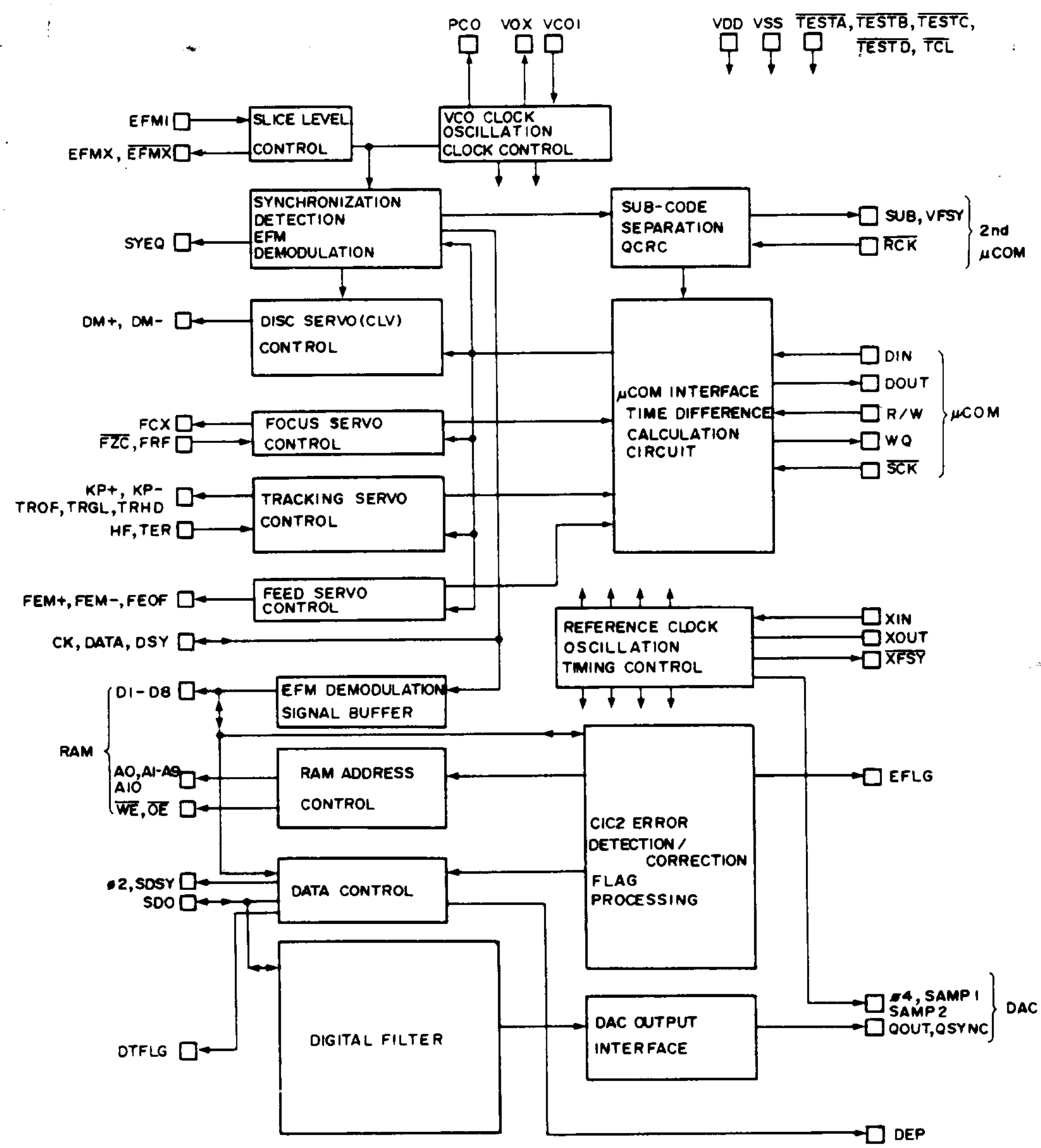


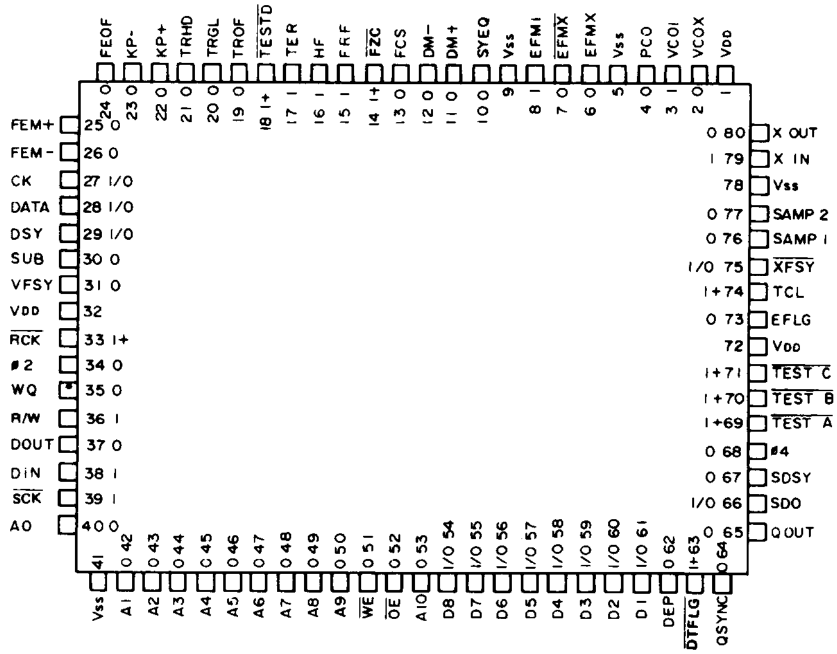

| Pin No. | Designation | Function (Assignment) |
|---|---|---|
| 1. | V OUT CH1 | Sample-hold analog switch output for Channel 1. |
| 2. | SMP 1 | Interval of signal at state "1" will be the sampling time of CH1. |
| 3. | SMP 2 | Interval of signal at state "1" will be the sampling time of CH2. The rising edge of SMP 1 and SMP 2 is used to generate the internal signal to latch the serial data. The level frequency characteristics will be improved as the signal time of SMP 1 and SMP 2 becomes longer. |
| 4. | SD | Serial input of converted digital signal. |
| 5. | FORM SELECT | Corresponds to binary input at state "1", and corresponds to 2's complement input at state "0". |
| 6. | $V_{SS}$ | Low-potential side power (GND). |
| 7. | CLOCK | Clock to drive shift-resistor and time-generator ($\phi 4$). |
| 8. | $V_{DD}$ | High-potential side reference power. |
| 9. | $V_{SS}$ | Low-potential side reference power (GND). |
| 10. | RBH | Since the same resistance is inserted between the RBH pin and the internal $V_{DD}$ power supply and between the RBL pin and the internal $V_{SS}$ (GND) power supply, a high precision voltage of $1/2\ V_{DD}$ can be obtained when both pins are connected. This voltage is applied on the MP pin through the buffer operational amplifier. |
| 11. | RBL | As in the case of the basic circuit, the drift from $1/2\ V_{DD}$ can be corrected by providing an appropriate external resistance on either one of the two pins. |
| 12. | MP | An exponential analog shift is executed with the potential applied on MP as the reference. Normally, bias is appoied for $1/2\ V_{DD}$. |
| 13. | TO BUFF | Analog output of DAC is input to buffer operational amplifier. |
| 14. | COM | Common input of analog switch for CH1 and CH2. |
| 15. | ICL | "1": Normal operation.<br>"0": Will become no-signal output regardless of D signal. |
| 16. | $V_{OUT}$ CH2 | Sample-hold analog switch output for CH2. |

## LC3517AM15 (16bit RAM)




## YM3805 (Signal Processor & Controller)






| Pin No. | Designation | Function |
|---|---|---|
| 79, 80 | 79 x IN and 80 x OUT | Clock Oscillator (8.6436MHz) |
| 6~8 | 8 EFMI, 7 $\overline{\text{EFMX}}$, and 6 EFMX | EFM External Circuit |
| 2~4 | 4 PCO, 3 VCO1, 2 VCOX | Clock Regeneration Circuit |
| 10 | SYEQ | WYNC Match Signal |
| 27~29 | 27 CK, 28 DATA, and 29 DSY | FM Demodulation Signal Check Output |
| 30, 31, 33 | 30 SUB, 31 VFSY, and 33 $\overline{\text{RCK}}$ | Sub-code Output |
| 35~37, 39 | 35 WQ, 36 R/W, 37 DOUT, and 39 $\overline{\text{SCK}}$ | Q-code Output related Pins |
| 36, 38, 39 | 36 R/W, 38 DIN, and 39 $\overline{\text{SCK}}$ | μ COM Command related Pins |
| 13~15 | Input 14 $\overline{\text{FZC}}$ – 15 FRF, and Output 13 FCS | Focus Servo-mechanism related Pins |
| 11, 12 | 11 DM+, and 12 DM– | Disc Servo-mechanism Pins |
| 16, 17<br>19~23 | Input 16 HF, and 17 TER<br>Output 19 TROF, 20 TRGL,<br>21 TRHD, 22 KP+, and 23 KP– | Tracking Servo-mechanism related Pins |
| 24~26 | 24 FEOF, 25 FEM+, and 26 FEM– | Feed Servo-mechanism related Pins |
| 40, 42~61 | 40A0–53A10, 51 $\overline{\text{WE}}$, 52 $\overline{\text{OE}}$, and 54D8–61D1 | RAM Connection |
| 75 | 75 $\overline{\text{XFSY}}$ | Crystal Clock SYNC Signal |
| 73 | 73 EFLG | C1 and C2 Error Correction Check Signal |
| 34, 66, 67<br>69, 71, 63 | 34 $\phi 2$, 66 SDO, SDSY, 63 DTFLG<br>69 $\overline{\text{TEST A}}$, and 71 $\overline{\text{TESTC}}$ | DATA Control Circuit-Serial Signal Output |
| 64, 65<br>68, 76, 77 | 65 Q OUT, 64 Q SYNC, 76 SAMP1, 77 SAMP, 2<br>and 68 $\phi 4$ | DAC Interface |
| 62 | 62 DEP | De-emphasis Signal |
| 8, 18<br>69~71 | 69 $\overline{\text{TEST A}}$, 70 $\overline{\text{TEST B}}$, 71 $\overline{\text{TEST C}}$, 18 $\overline{\text{TEST D}}$,<br>and 8 $\overline{\text{TCL}}$ | Test Pins |

# EXPLODED VIEW

## CHNAGER MECHANISM

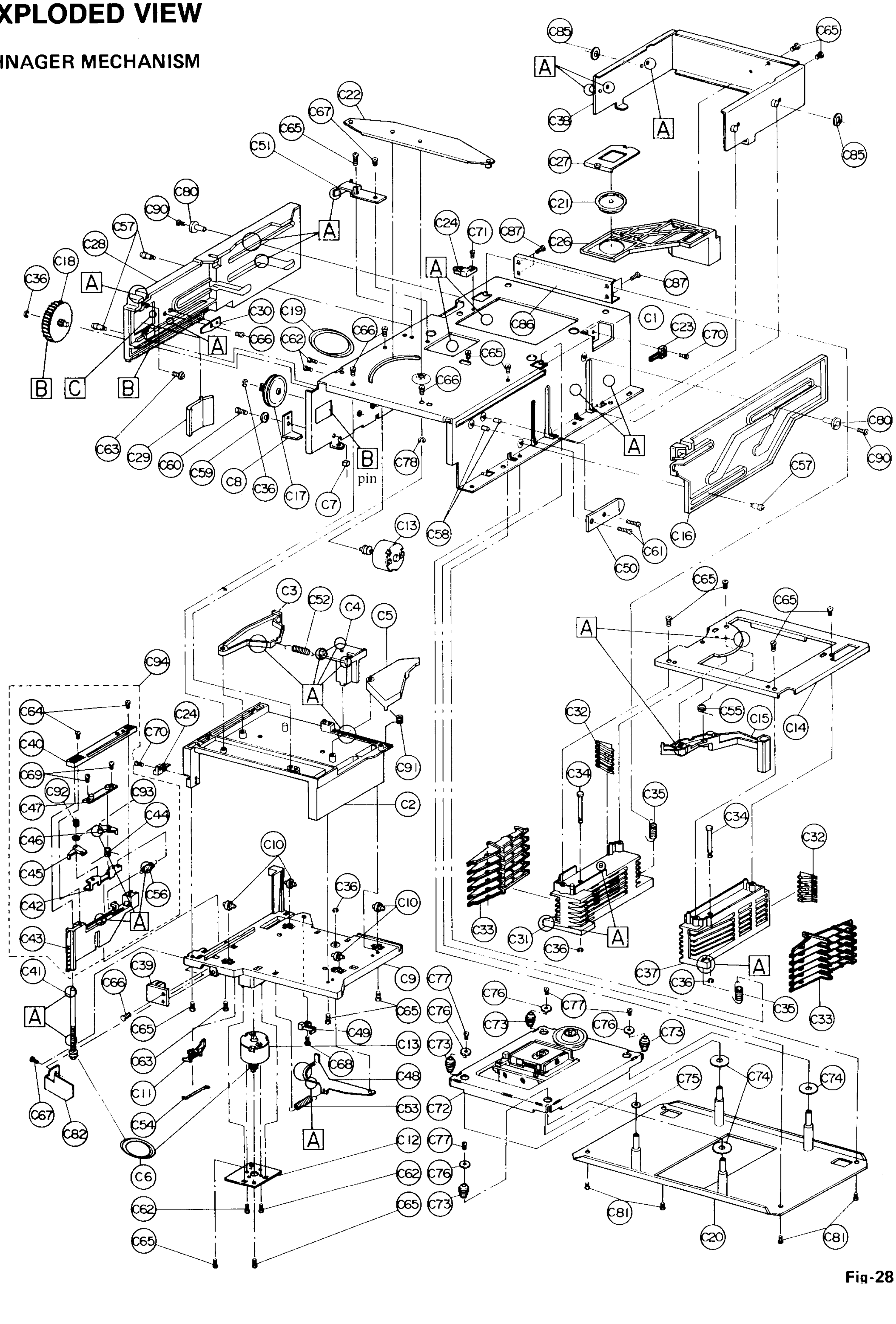


Fig-28

## PARTS LIST

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| C1 | 27100142 | Chassis |
| C2 | 27262450 | Plate, upper |
| C3 | 27300951 | Lever |
| C4 | 27300952 | Arm, slide |
| C5 | 27300953 | Lever |
| C6 | 27300954 | Belt |
| C7 | 27260234 | Bracket, shaft |
| C8 | 27300955 | Stopper, thrust |
| C9 | 27262451 | Plate, lower |
| C10 | 27300956 | Roller |
| C11 | 27300957 | Stopper |
| C12 | 24502220 | Bracket, motor |
| C13 | 24502221 | DC motor |
| C14 | 27262452 | Plate |
| C15 | 27300958 | Lever, reset |
| C16 | 27262453 | Plate, side R |
| C17 | 27300959 | Pulley |
| C18 | 27300960 | Gear |
| C19 | 27300961 | Belt |
| C20 | 27130485 | Bracket, mechanism CD |
| C21 | 27301013 | Flange |
| C22 | 27300962 | Lever, gear |
| C23 | 24505183 | Leafswitch |
| C24 | 24505184 | Leafswitch |
| C26 | 27255002 | Clamper |
| C27 | 27262455 | Plate |
| C28 | 27262454 | Plate, side A |
| C29 | 27300963 | Lever |
| C30 | 27180342 | Plate spring |
| C31 | 27301014 | Case, lift B |
| C32 | 27180343 | Plate spring |
| C33 | 27300964 | Lever, disc center |
| C34 | 27300965 | Pin |
| C35 | 27180344 | Coil spring |
| C36 | 24506740 | Special washer |
| C37 | 27301015 | Case, lift A |
| C38 | 27130495 | Frame |
| C39 | 27300966 | Sensor |
| C40 | 27262456 | Plate |
| C41 | 24506741 | Special screw |
| C42 | 27300967 | Lever, trigger |
| C43 | 27300968 | Base, trigger |
| C44 | 27180345 | Torsion spring |
| C45 | 27300969 | Lever A |
| C46 | 27300970 | Lever B |
| C47 | 27262457 | Plate |
| C48 | 27300971 | Lever, eject |
| C49 | 24505185 | Leafswitch |
| C50 | 27130486 | Bracket B |
| C51 | 27130487 | Bracket A |
| C52 | 27180346 | Coil spring |
| C53 | 27180347 | Coil spring |
| C54 | 27180348 | Wire spring |
| C55 | 27180349 | Torsion spring |
| C56 | 27180350 | Coil spring |
| C57 | 24506742 | Special screw |
| C58 | 24506743 | Spacer |
| C59 | 24506744 | Special washer |
| C60 | 24506745 | Special screw |
| C61 | 82143015 | 3P+15FN(BC), Pan head screw |
| C62 | 82142604 | 2.6P+4F(BC), Pan head screw |
| C63 | 830430068 | 3STC+6B(BC), Tapping screw |
| C64 | 833430080 | 3TTP+8P(BC), Tapping screw |
| C65 | 838430088 | 3TTB+8B(BC), Tapping screw |
| C66 | 838430068 | 3TTB+6B(BC), Tapping screw |
| C67 | 82143004 | 3P+4FN(BC), Pan head screw |
| C68 | 838426088 | 2.6TTB+8B(BC), Tapping screw |

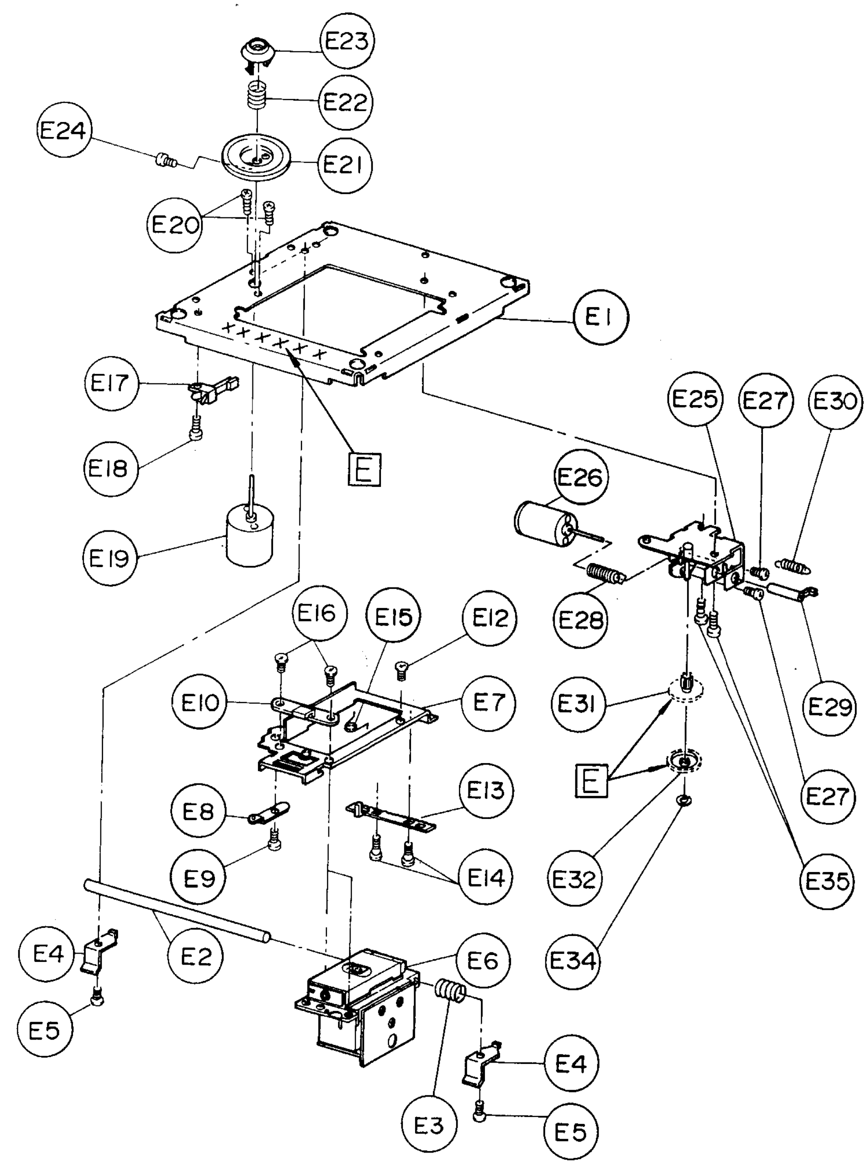
| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| C69 | 833426060 | 2.6TTP+6B(BC), Tapping screw |
| C70 | 833420080 | 2TTP+8B(BC), Tapping screw |
| C71 | 833420068 | 2TTP+6B(BC), Tapping screw |
| C72 | 24506734 | DM-12, CD mechanism |
| C73 | 24505198 | Cushion, damper |
| C74 | 8761401610 | W4x16F, Washer |
| C75 | 8761400810 | W4x8F, Washer |
| C76 | 8761201005 | W2x10F, Washer |
| C77 | 82142004 | 2P+4F(BC), Pan head screw |
| C78 | 8930201S | ES-2S, Ring E |
| C80 | 27270231 | Collar |
| C81 | 838430068 | 3TTB+6B(BC), Tapping screw |
| C82 | 27130511 | Bracket |
| C85 | 27270232 | Special washer |
| C86 | 27130512 | Bracket |
| C87 | 82142604 | 2.6P+4F(BC), Pan head screw |
| C90 | 82143012 | 3P+12F(BC), Pan head screw |
| C91 | 24503161 | Torsion spring |
| C92 | 24503162 | Compression spring |
| C93 | 27270233 | Special washer |
| C94 | 27301080 | Trigger |
| E1 | 27100145 | Chassis |
| E2 | 27260235 | Shaft, pick-up |
| E3 | 27180354 | Compression spring |
| E4 | 27180355 | Plate spring |
| E5 | 82142604 | 2.6P+4F(BC), Pan head screw |
| E6 | 24505187 | Optical pick-up |
| E7 | 27130492 | Bracket, pick-up |
| E8 | 27180356 | Plate spring |
| E9 | 82142604 | 2.6P+4F(BC), Pan head screw |
| E10 | 27130493 | Bracket |
| E12 | 82142604 | 2.6P+4F(BC), Pan head screw |
| E13 | 27301017 | Rack |
| E14 | 24506736 | Special screw |
| E15 | 27180357 | Torsion spring |
| E16 | 82142606 | 2.6P+6F(BC), Pan head screw |
| E17 | 24505186 | Leafswitch |
| E18 | 834426068 | 2.6TTS+6B(BC), Tapping screw |
| E19 | 24502218 | DC motor |
| E20 | 24506737 | Special screw |
| E21 | 27300983 | Turntable platter |
| E22 | 27180358 | Compression spring |
| E23 | 27300984 | Adjuster, disc |
| E24 | 24506738 | Special screw |
| E25 | 27130494 | Bracket |
| E26 | 24502219 | DC motor |
| E27 | 82142003 | 2P+3F(BC), Pan head screw |
| E28 | 27300985 | Worm |
| E29 | 27300988 | Stopper, thrust |
| E30 | 27180359 | Coil spring |
| E31 | 27300986 | Gear, sled |
| E32 | 27300987 | Gear, worm |
| E34 | 24506739 | Special washer |
| E35 | 82142604 | 2.6P+4F(BC), Pan head screw |
| | 24505208 | 2P, Socket |
| | 24505209 | 4P, Socket |

**Lubrication**

A: DYNAMAX EP-2
B: MOLIKOTE EM50L
C: FLOIL GP-670
D: FLOIL G-3470A
E: FLOIL G-31KB

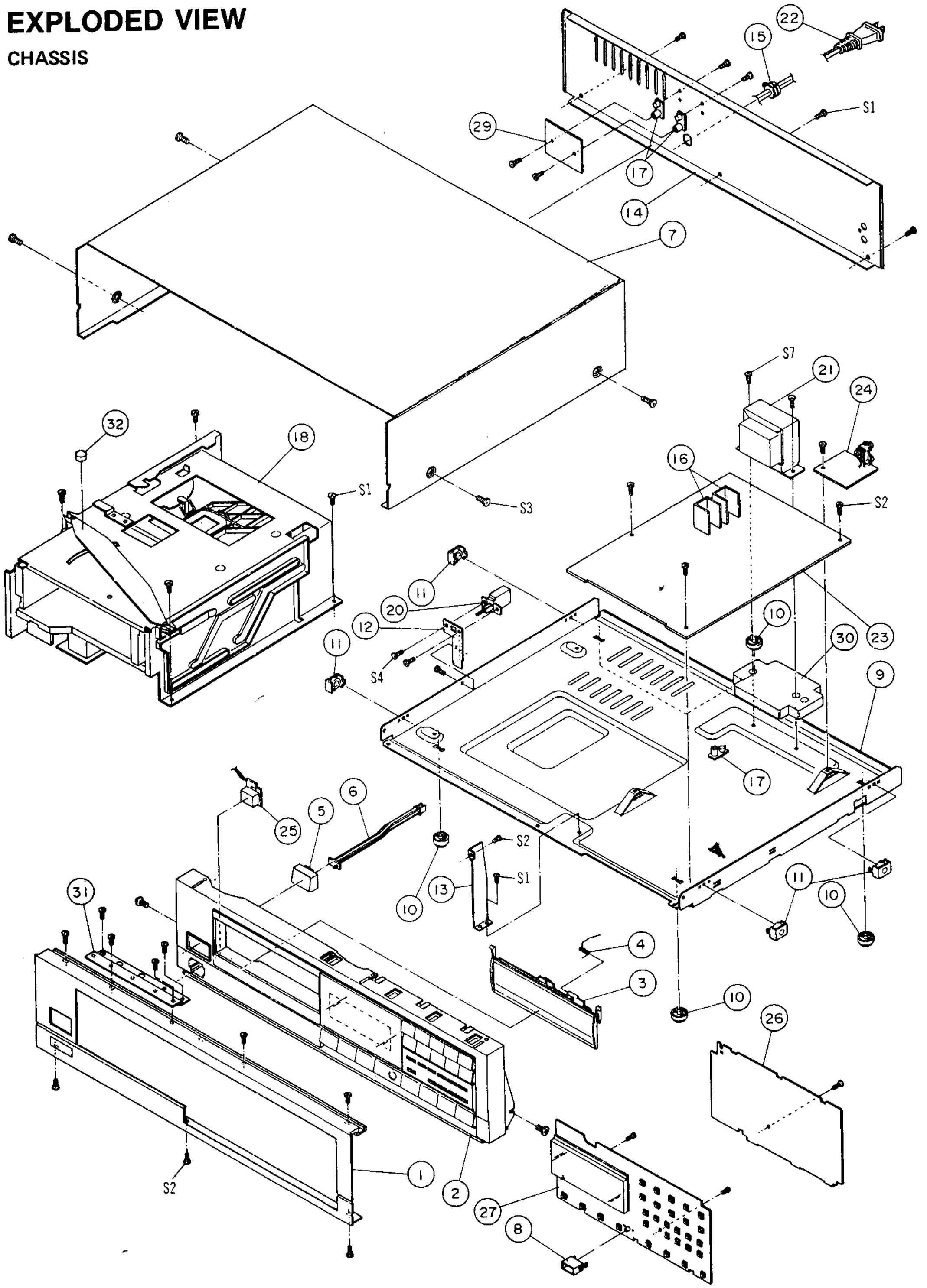


## CD MECHANISM



# EXPLODED VIEW

## CHASSIS






# PARTS LIST

| REF.NO. | PART NO. | DESCRIPTION |
|---|---|---|
| 1 | 27210891 | Front panel ass'y |
| 2 | 27100143 | Front bracket ass'y CG050 |
| 3 | 27301007 | Door ass'y |
| 4 | 27180353 | Torsion spring |
| 5 | 27301009 | Knob |
| 6 | 27273080 | Joint |
| 7 | 27301011 | Top cover |
| 8 | 27190551 | Holder, LED |
| 9 | 27301012 | Bottom board |
| 10 | 27301010 | Base |
| 11 | 27130488 | Bracket |
| 12 | 27130489 | Bracket |
| 13 | 27130490 | Bracket |
| 14 | 27121026 | Back panel <D> |
| | 27121027 | Back panel <U> |
| 15 | 270280 | ⚠SR-4K-4, Strainrelief |
| 17 | 27130491 | Bracket |
| 18 | 24506733 | CDM-500, CD mechanism |
| 19 | 24506732 | Magazine CD |
| 20 | 25035295 | ⚠Push switch (SW101) |
| | 24505210 | ⚠Voltage selector switch <U> |
| | 27130523 | Bracket for voltage selector switch <U> |
| 21 | 2300257 | ⚠NPT-971D, Power transformer <D> |
| | 2300258 | ⚠NPT-971ADGQ, Power transformer <U> |
| 22 | 253112A | ⚠AS-UC-4, Power supply cord |
| 23 | 24505199 | Main circuit pc board ass'y R4178216B |
| 24 | 24505203 | Terminal pc board ass'y |
| 25 | 24505202 | Remote control cicuit pc board ass'y |
| 26 | 24505200 | Microcomputer pc board ass'y |
| 27 | 24505201 | Display pc board ass'y |
| 29 | 24505207 | Filter pc board ass'y |
| 30 | 27270214 | Base |
| 31 | 27130522 | Bracket |
| 32 | 28140788 | Base |
| C1 | 3500065A | ⚠IS capacitor |
| C1a | 27300601 | Cover for C1 |
| S1 | 838430068 | 3TTB+6B(BC), Tapping screw |
| S2 | 838430088 | 3TTB+8B(BC), Tapping screw |
| S3 | 834430168 | 3TTS+16B(BC), Tapping screw |
| S4 | 82143006 | 3P+6FN(BC), Pan head screw |
| S5 | 83143008 | 3P+8FN(BC), Pan head screw |
| S6 | 863430 | N-3F-N(BC), Nut |
| S7 | 838440068 | 4TTB+6B(BC), Tapping screw |
| | 260208 | Binder for lead wire |

NOTE: THE COMPONENTS IDENTIFIED BY MARK ⚠ ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE ONLY WITH PART NUMBER SPECIFIED.

## MAGAZINE

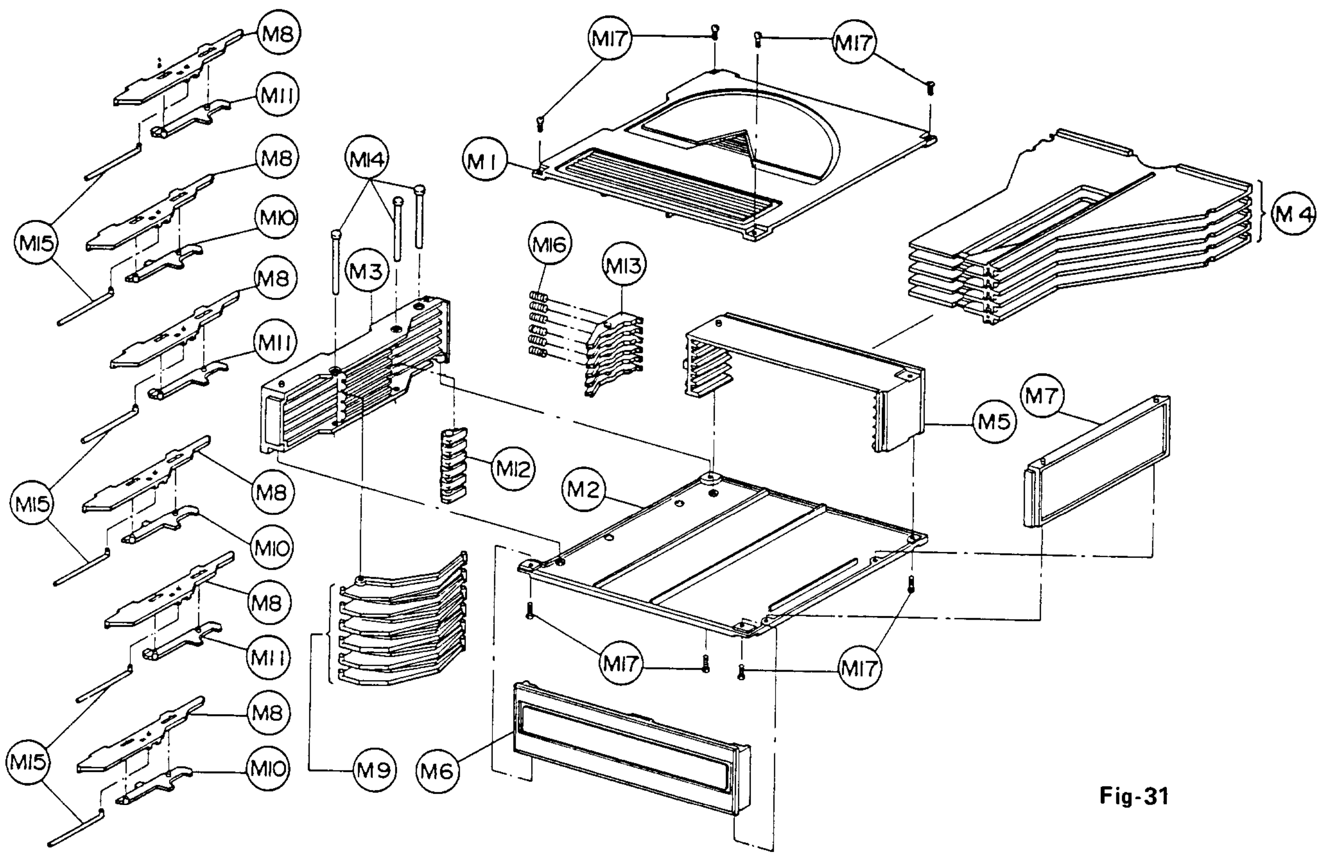



Fig-31

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| M1 | 27300972 | Cover, top |
| M2 | 27300973 | Cover, bottom |
| M3 | 27301016 | Case, lever |
| M4 | 27267510 | Guide |
| M5 | 27130496 | Frame |
| M6 | 27300974 | Cover, front |
| M7 | 27300975 | Cover, side |
| M8 | 27300976 | Lever, mechanical |
| M9 | 27300977 | Lever, eject |
| M10 | 27300978 | Lever, manual A |
| M11 | 27300979 | Lever, manual B |
| M12 | 27300980 | Cam |
| M13 | 27300981 | Stopper |
| M14 | 27300982 | Pin |
| M15 | 27180351 | Wire spring |
| M16 | 27180352 | Compression spring |
| M17 | 833420068 | 2TTP+6B(BC), Tapping screw |
| M18 | 830430068 | 3STC+6B(BC), Tapping screw |
| | 29360935 | Label, top |
| | 27262447 | Plate |

# PACKING VIEW

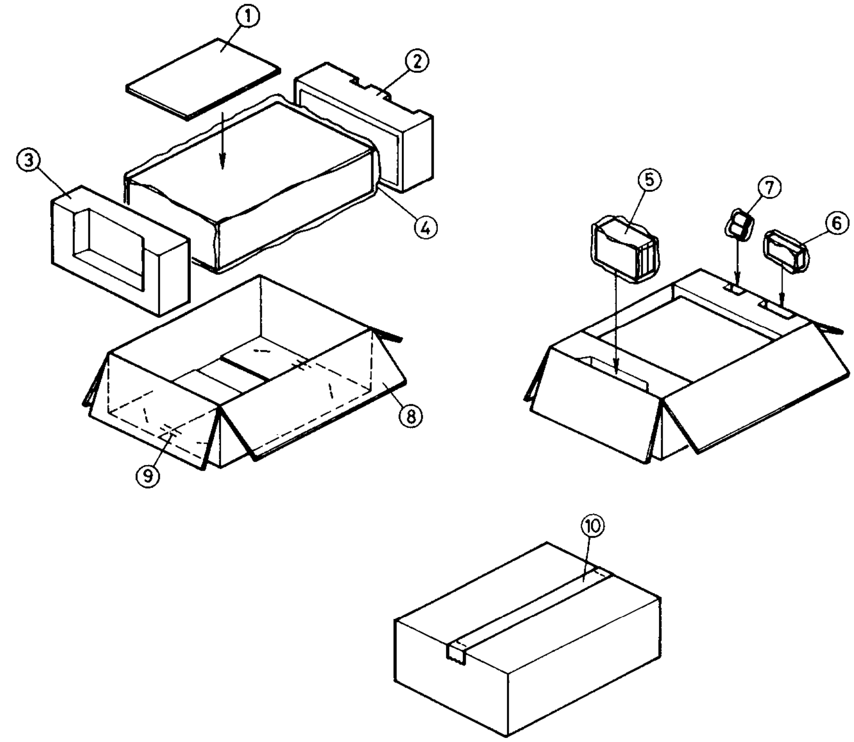



Fig-32

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| 1 | 29341174 | Instruction manual |
| | 29365019 | Warranty card <D> |
| | 29365021 | Warranty card <U> |
| | 29358002E | Service station list |
| | 2010098 | Connection cord |
| | 29360936 | Label INDEX for magazine |
| | 25055251 | CV-CP, Conversion plug <U> |
| | 29100005A | 240x320mm, Poly bag |
| 2 | 29091191 | Pad R |
| 3 | 29091192 | Pad L |
| 4 | 29100049 | 620x640mm, Poly bag |
| 5 | | Magazine |
| 6 | 24140012 | RC-109C, Remote controller |
| 7 | 3010054 | UM-3, Two batteries |
| 8 | 29051573 | Master carton box <D> |
| | 29051593 | Master carton box <U> |
| 9 | 282301 | Sealing hook |
| 10 | 260012 | Damplon tape |

# DISASSEMBLING PROCEDURES

## Changer Mechanism

Remove the top cover.
Remove the bracket on the front panel.
Detach the 7 connectors leading to the PC board from the mechanism.
Remove screws A and B.
Pull plate side A forward and remove screws C and D.
If plate side A is facing the opposite direction, remove it from screws C and D.

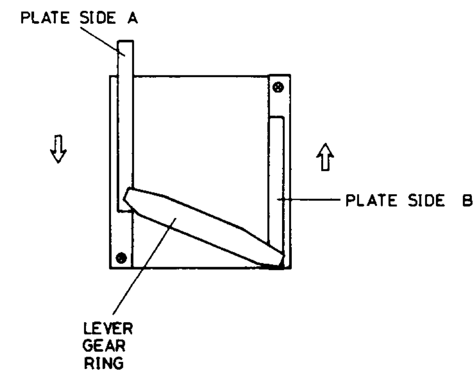



Fig-33

## CD Mechanism

Remove the changer mechanism.
Remove the 4 screws holding the bracket mechanism and CD mechanism to the underside of the changer mechanism section.

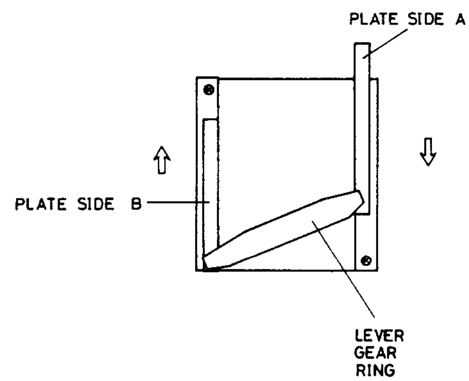



Fig-34

# ADJUSTMENT PROCEDURES

| Step | Item | Mode | Adjust | Adjust for | Connection | Output Indication |
|---|---|---|---|---|---|---|
| 1 | VCO | STOP | L101 | 4.322MHz±5kHz | Fig. 36 | Frequency counter |
| 2 | FOCUS BALANCE | PLAY | SVR103 | Maximum output | Fig. 37 | Oscilloscope |
| `3 | FOCUS GAIN | PLAY | SVR101 | TP105-TP104 = 7dB | Fig. 38 | 2 ch AC voltmeter |
| 4 | FOCUS OFFSET | STOP | SVR102 | Within ±25mV | Fig. 39 | Osilloscope |
| 5 | TRACKING BALANCE | PLAY | SVR104 | Center . . GND level | Fig. 40 | Oscilloscope |
| 6 | TRACKING GAIN | PLAY | SVR105 | TP105-TP103 = 7dB | Fig. 41 | 2 ch AC voltmeter |
| 7 | TRACKING OFFSET | STOP | SVR106 | Within ±25mV | Fig. 42 | Oscilloscope |

### Instrument required

Oscilloscope, Two channel AC voltmeter, Oscillator
Frequency counter and DC power supply.

### Disc/jig

Disc YEDS-18 (TYPE 4)
Jig Two B.P.Fs (Refer Fig.35)
Resistors 22kohm and 220kohm
Ceramic capacitor 0.047$\mu$F
Shorted clip

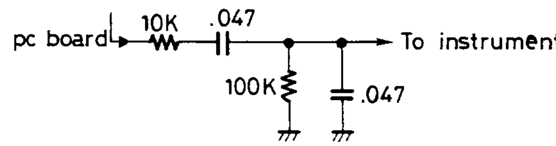



Fig-35 B. P. F

## 1. VCO frequency adjustment

Connect the ceramic capacitor 0.047$\mu$F between TP102 and ground.
Connect the frequency counter to TP101.
Adjust L101 until the frequency counter reading 4.322 ±0.005MHz.

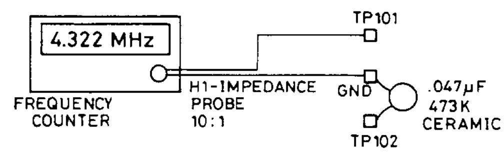



Fig-36

## 2. Focus balance adjustment

Load the test disc YEDS-18 and playback the track 2.
Connect the oscilloscope to TP102.
Adjust SVR103 until RF signal becomes the maximum output.
(Refer Photo 2)

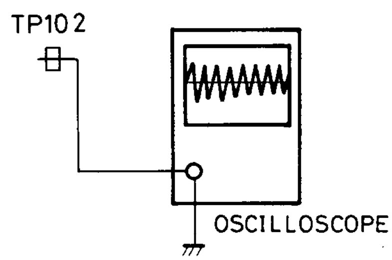



Fig-37

## 3. Focus gain adjustment

Load the test disc YEDS-18 and playback the track 2.
The filters are passed through and AC voltmeter is connected at the pin 3 of TP105 and pin 4 of TP104.
With an oscillator connected at pin 1 of TP104, 800Hz, 150mV is passed through 22kohm and input.
Adjust SVR101 until the output discrepancy between pin 3 of TP105 and pin 4 of TP104 is 7dB±1dB. TP105>TP104

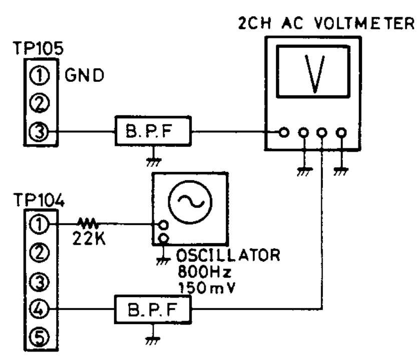



Fig-38

## 4. Focus offset adjustment

Connect the oscilloscope to pin 3 of TP105.
Adjust SVR102 until the waveform becomes within ±25mV of GND level.

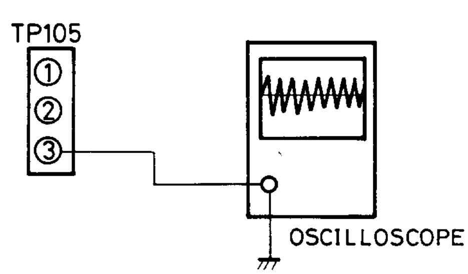



Fig-39

5. **Tracking balance adjustment**

Load the test disc YEDS-18 and playback the track 2.
Connect the oscilloscope to pin 1 of TP103.
Connect pins 3 and 5 of TP104 to the ground.
Adjust SVR104 until the waveform of pin 1 of TP103 becomes symmetrical with GND level.
(Refer photo 3)

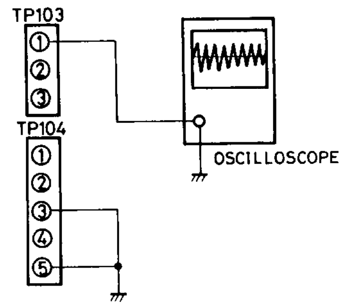



Fig-40

6. **Tracking gain adjustment**

Load the test disc YEDS-18 and playback the track 2.
The filters are passed through and AC voltmeter is connected at pin 3 of TP103 and pin 2 of TP105.
With an oscillator connected at pin 2 of TP104, 800Hz, 150mV is passed through 220kohm and input.
Adjust SVR105 until the output discrepancy between pin 2 of TP105 and pin 3 of TP103 is 7dB±1dB. TP105>TP103

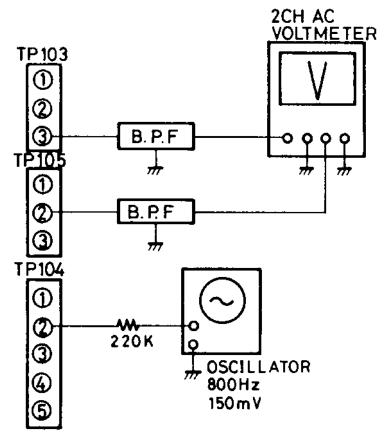



Fig-41

7. **Tracking offset adjustment**

Connect the oscilloscope to pin 2 of TP105.
Adjust SVR106 until the waveform becomes within ±25mV of GND level.

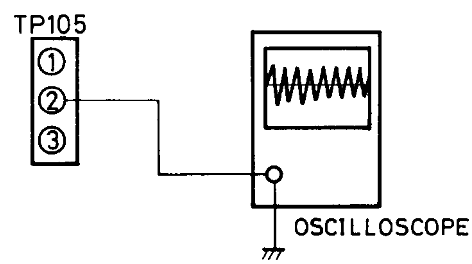



Fig-42

# MECHANISM ADJUSTMENT

Height of turntable platter
Adjust the adjustment screw so that the distance between the turntable platter and chassis becomes 9.1±0.1mm.

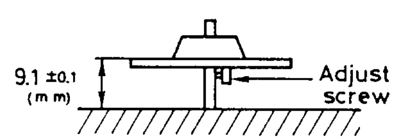



Fig-43

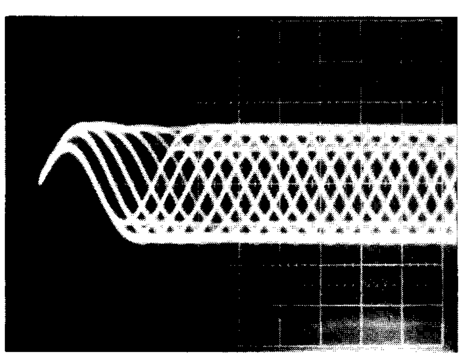


Photo 2

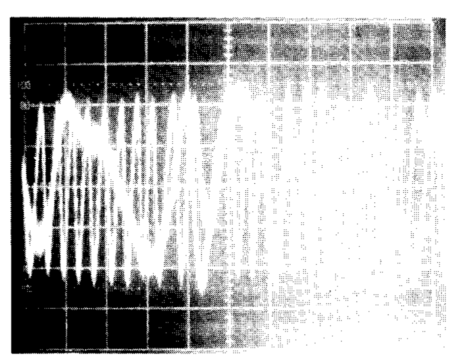


Photo 3

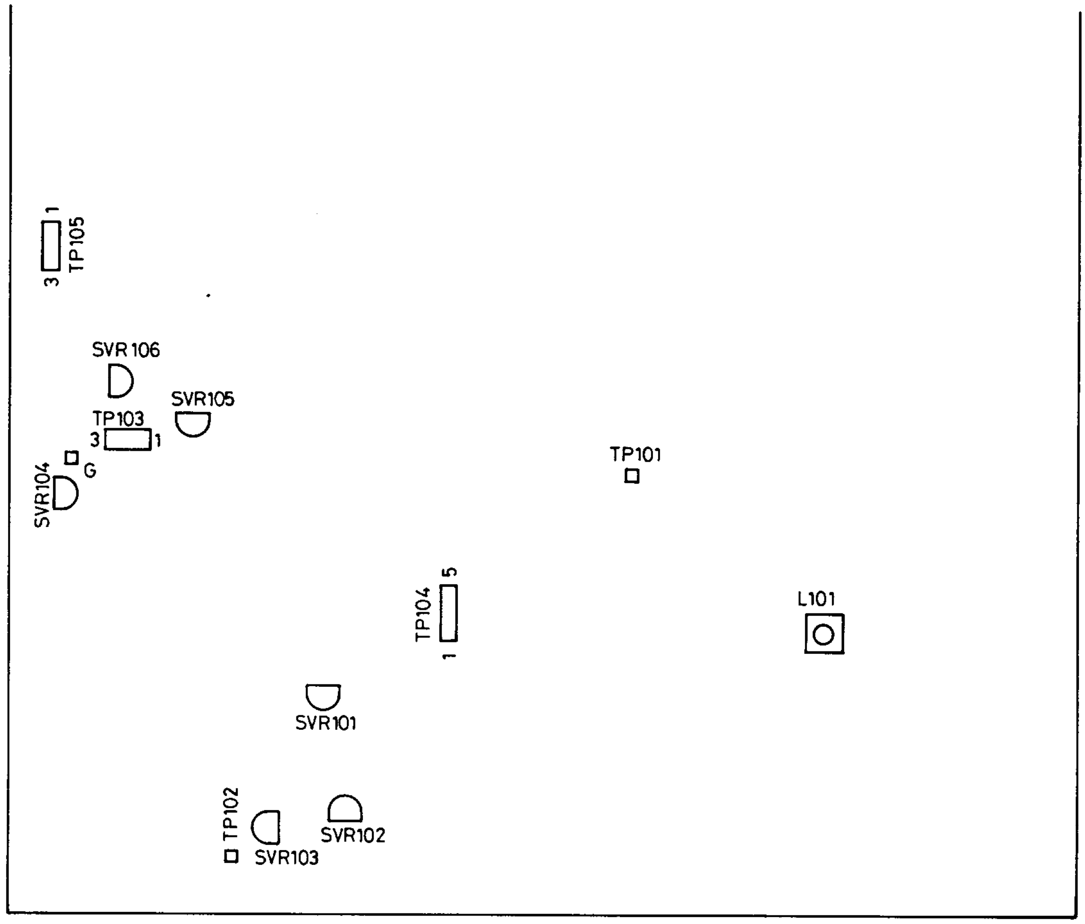



Fig-44

# GRATING ADJUSTMENT

Proceed the grating adjustment when the optical pick-up has been replaced.

1. Load the test disc YEDS-18.(Chucking condition)
2. Connect the DC power supply to pins 1 and 2 of CP104 (with the + side to pin 2) and move the pick-up to the outermost side.
3. Turn the inside switch (start switch) to ON.(Connect the shorted clip to CP601)
4. Turn the pick-up to ON.(Connect the shorted clip between the base of Q3 and the ground.)
5. Connect the DC power supply or battery to pin 3 of CP104.(Ground: pin 4)
6. Adjust the output of DC power supply until the disc motor rotates.(1V~2V)
7. Press the PLAY key.(Focus is ON)
8. Connect the oscilloscope to pin 3 of TP103.
9. Connect the pin 3 of TP104 and pin 2 of TP103.
10. While confirming the waveform of the pin 3 of TP103, move the pick-up manually to the outermost track of the disc and perform adjustment for the maximum amplitude of vibration at the grating adjustment point.

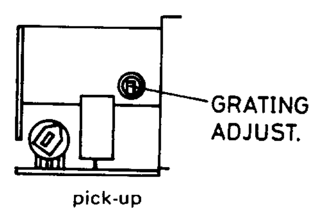



Fig-45

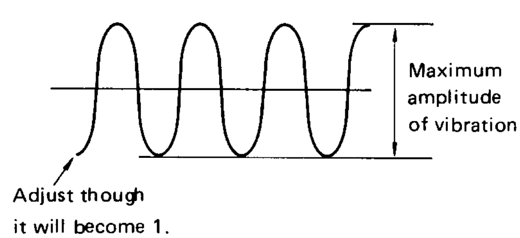
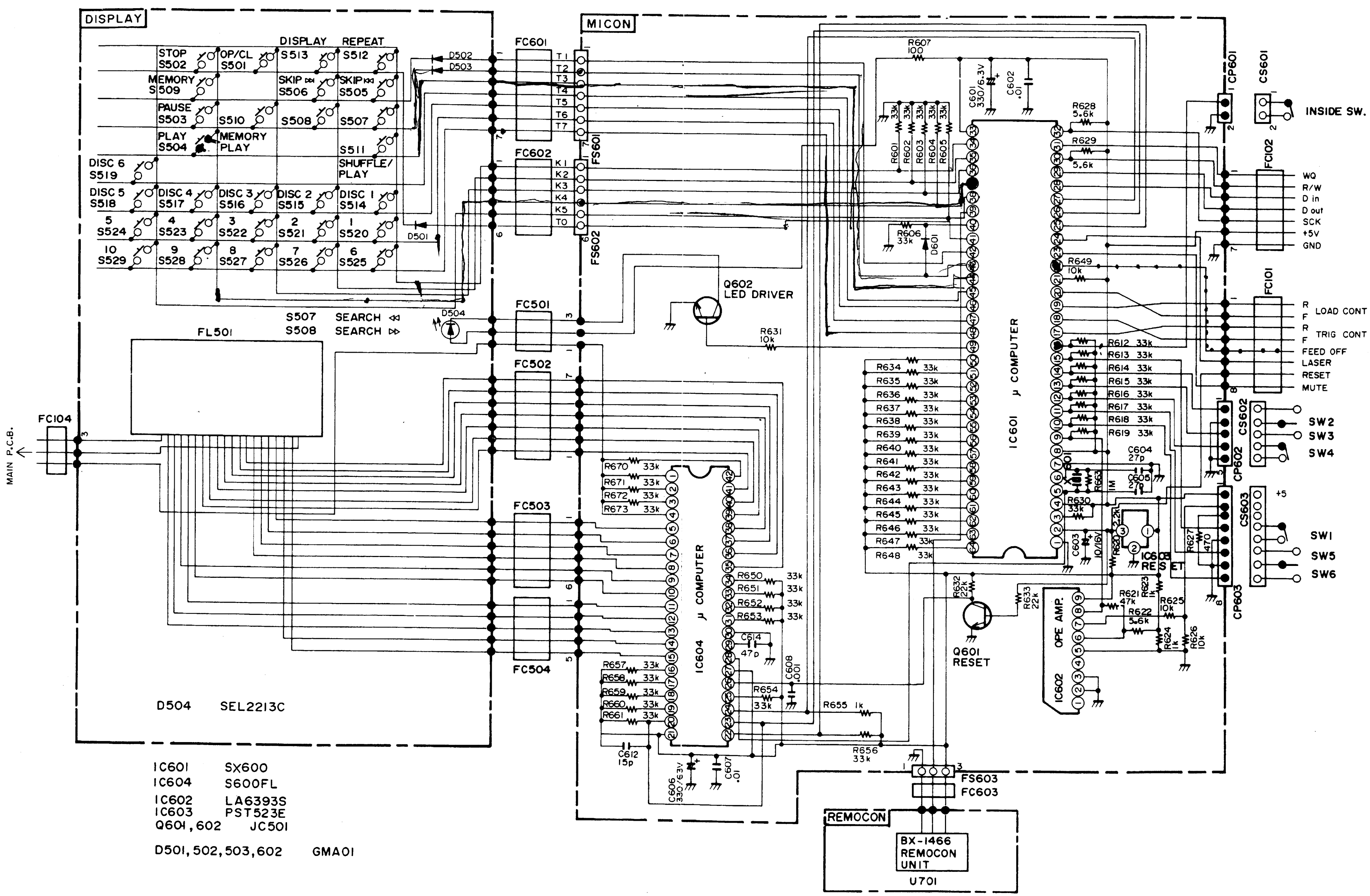



Fig-46

# SCHEMATIC DIAGRAM

CONTROL CIRCUIT SECTION

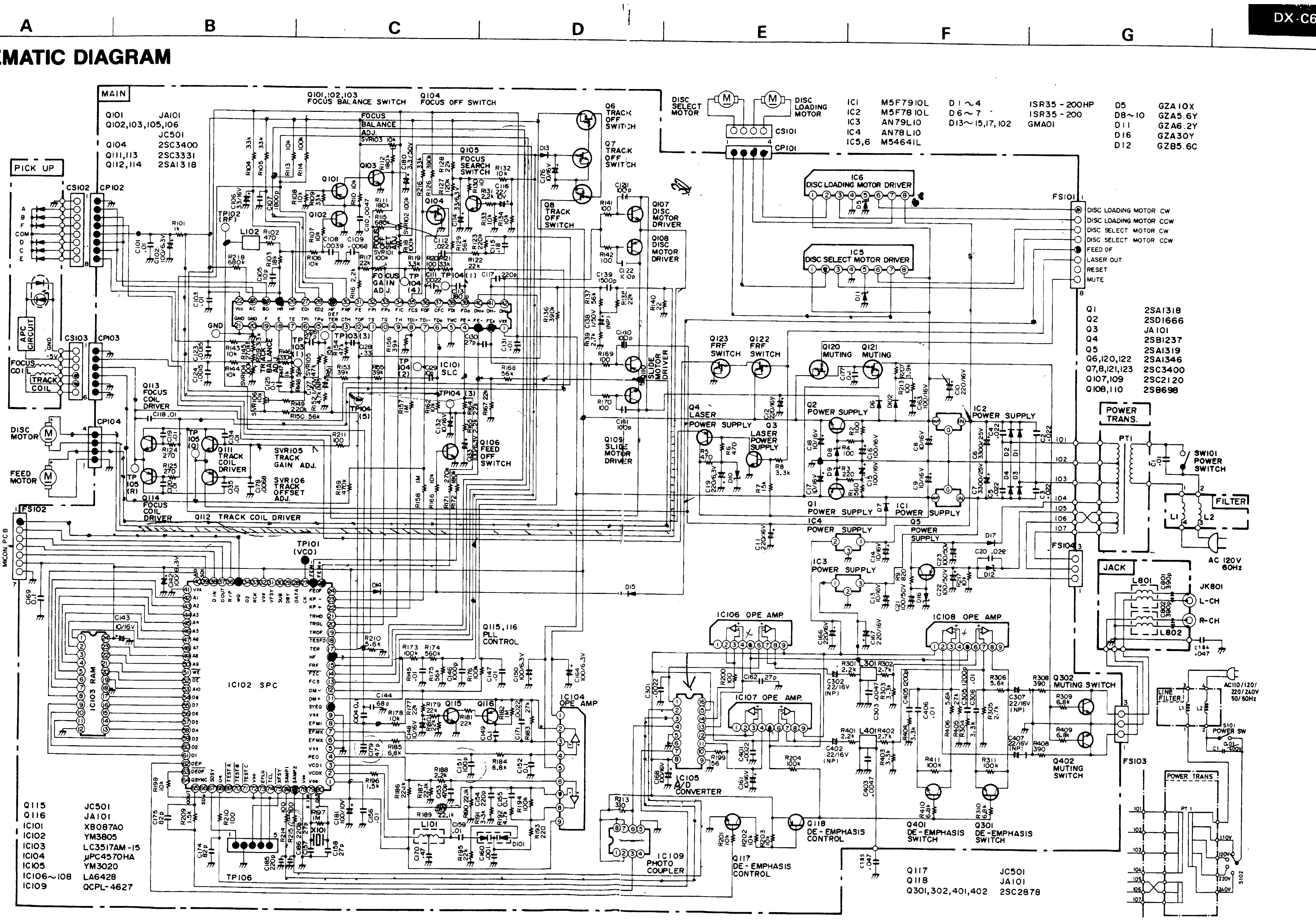



D504 SEL2213C

| | |
|---|---|
| IC601 | SX600 |
| IC604 | S600FL |
| IC602 | LA6393S |
| IC603 | PST523E |
| Q601, 602 | JC501 |
| D501, 502, 503, 602 | GMA01 |

ONKYO CORPORATION

# SCHEMATIC DIAGRAM




ONKYO CORPORATION

# PRINTED CIRCUIT BOARD – PARTS LIST

## MAIN CIRCUIT PC BOARD

| CIRCUIT NO. | PART NO. | DESCRIPTION |
|---|---|---|
| | **ICs** | |
| IC1 | 22240097 | M5F7910L |
| IC2 | 22240098 | M5F7810L |
| IC3 | 22240099 | AN79L10 |
| IC4 | 22240100 | AN78L10 |
| IC5, IC6 | 22240101 | M54641L |
| IC101 | 222984 | XB087A0 |
| IC102 | 222975 | YM3805 |
| IC103 | 22240032 | LC3517AM-15 |
| IC104 | 22240102 | μPC4570HA(MS) |
| IC105 | 222969 | YM3020 |
| IC106-IC108 | 22240103 | LA6462S |
| | **Photo coupler** | |
| IC109 | 226028 | QCPL-4627 |
| | **Transistors** | |
| Q1 | 2213206 | 2SA1318-T |
| Q2 | 2213315 | 2SD1666-S |
| Q3, Q101 | 2212496 or | JA101-R or |
| | 2211455 | 2SA1015-GR |
| Q4 | 2213224 | 2SB1237-R |
| Q5 | 2213325 | 2SA1319-S |
| Q6 | 221243 | 2SA1346 |
| Q7, Q8 | 2212570 | 2SC3400 |
| Q102, Q103 | 2211255, | 2SC1815-GR, |
| Q105, Q106 | 2212115 or | 2SC2458-GR or |
| Q115, Q117 | 2212485 | JC501-Q |
| Q104 | 2212570 | 2SC3400 |
| Q107, Q109 | 2211164 | 2SC2120-Y |
| Q108, Q110 | 2213246 | 2SB698-F |
| Q111, Q113 | 2213257 | 2SC3331-U |
| Q112, Q114 | 2213267 | 2SA1318-U |
| Q116, Q118 | 2212496 or | JA101-R or |
| | 2211455 | 2SA1015-GR |
| Q120, Q122 | 221243 | 2SA1346 |
| Q121, Q123 | 2212570 | 2SC3400 |
| Q301, Q302 | 2212286 | 2SC2878-B |
| Q401, Q402 | 2212286 | 2SC2878-B |
| | **Diodes** | |
| D1-D4 | 223176 or | DS135D-KB1 or |
| D14 | 223177 | 1SR35-200HP |
| D5 | 2241071 | GZA-10X, Zener |
| D6, D7 | 223178 or | DS135D or |
| | 223179 | 1SR35-200A |
| D8-D10 | 2240952 | GZA5.6Y, Zener |
| D11 | 2240972 | GZA6.2Y, Zener |
| D12 | 2240953 | GZA5.6Z, Zener |
| D13-D15 | 223163 or | 1SS133 or |
| D102 | 223180 | GMA01 |
| D16 | 2242752 | GZA30Y, Zener |
| D17 | 223176 or | DS135D-KB1 or |
| | 223177 | 1SR35-200HP |
| D101 | 223181 | SVC211SP-C, Variable capacitor |
| | **X'tal** | |
| X101 | 3010125 | KD1624F0A |
| | **Coils** | |
| L101 | 231135 | T-7TA |
| L102 | 232145 | P-7PAMN |
| L301, L401 | 231136 | FB-7G |

| CIRCUIT NO. | PART NO. | DESCRIPTION |
|---|---|---|
| | **Capacitors** | |
| C6, C7 | 354753329 | 3,300 μF, 25V, Elect. |
| C8, C9 | 354741009 | 10μF, 16V, Elect. |
| C10-C12 | 354742219 | 220 μF, 16V, Elect. |
| C13, C14 | 354741009 | 10μF, 16V, Elect. |
| C15, C16 | 354741019 | 100μF, 16V, Elect. |
| C17, C18 | 354741009 | 10μF, 16V, Elect. |
| C19 | 354722219 | 220 μF, 6.3V, Elect. |
| C21-C23 | 354781019 | 100 μF, 50V, Elect. |
| C24 | 354761019 | 100 μF, 35V, Elect. |
| C102 | 354721019 | 100 μF, 6.3V, Elect. |
| C106 | 354743309 | 33μF, 16V, Elect. |
| C114 | 354723319 | 330 μF, 6.3V, Elect. |
| C116 | 354732209 | 22μF, 10V, Elect. |
| C127, C138 | 352980106 | 1 μF, 50V, Non-polar elect. |
| C132 | 354741009 | 10μF, 16V, Elect. |
| C133, C142 | 354721019 | 100 μF, 6.3V, Elect. |
| C143, C148 | 354741009 | 10μF, 16V, Elect. |
| C150, C163 | 354741019 | 100 μF, 16V, Elect. |
| C153 | 370134704 | 47pF, 100V, APS |
| C161, C173 | 354741009 | 10μF, 16V, Elect. |
| C164 | 354721019 | 100 μF, 6.3V, Elect. |
| C166-C168 | 354742219 | 220 μF, 16V, Elect. |
| C180 | 354780339 | 3.3 μF, 50V, Elect. |
| C181 | 354731019 | 100 μF, 10V, Elect. |
| C302, C402 | 392884707 | 47μF, 50V, Low leakage elect |
| C307, C407 | 392884707 | 47μF, 50V, Low leakage elect |
| | **Resistors** | |
| R186, R187 | 4000114 | 22.1kohm, 1/4W, Metal |
| R189, R190 | 4000114 | 22.1kohm, 1/4W, Metal |
| SVR101,SVR102 | 5210070 | N06HR100KBD,Semi-fixed |
| SVR103 | 5210064 | N06HR10KBD, Semi-fixed |
| SVR104,SVR106 | 5210070 | N06HR100KBD, Semi-fixed |
| SVR105 | 5210068 | N06HR47KBD, Semi-fixed |
| | **Plugs** | |
| CP101, CP104 | 25055148 | NPLG-4P-132 |
| CP102 | 25055152 | NPLG-8P-136 |
| CP103 | 25055150 | NPLG-6P-134 |
| TP103, TP105 | 25055147 | NPLG-3P-131 |
| TP104 | 25055149 | NPLG-5P-133 |
| | **Sockets** | |
| FS101 | 24505194 | 8P |
| FS102 | 24505195 | 7P |
| FS103, FS104 | 24505196 | 3P |

## DISPLAY CIRCUIT PC BOARD

| CIRCUIT NO. | PART NO. | DESCRIPTION |
|---|---|---|
| FL501 | 212047 | CP2263GR, Fluorescent tube |
| D501-D503 | 223163 or | 1SS133 or |
| | 223180 | GMA01, Diodes |
| D504 | 225141 | SEL2213C, L. E. D |
| S501-S529 | 25035389 | NPS-111-S353, Push switches |

## MICROCOMPUTER PC BORAD

| CIRCUIT NO. | PART NO. | DESCRIPTION |
|---|---|---|
| | **ICs** | |
| IC601 | 22240136 | SX600 |
| IC602 | 22240104 | LA6393S |
| IC603 | 22240105 | PST523E-2 |
| IC604 | 22240137 | S600FL |
| | **Transistors** | |
| Q601, Q602 | 2212485, | JC501-Q, |
| | 2211255 or | 2SC1815-GR or |
| | 2212115 | 2SC2458-GR |
| | **Diode** | |
| D601 | 223163 or | 1SS133 or |
| | 223180 | GMA01 |
| | **OSC element** | |
| X601 | 3010126 | KBR-4. 0MS, Ceramic |
| | **Capacitors** | |
| C601, C606 | 354723319 | 330 μF, 6.3V, Elect. |
| C603 | 354741009 | 10μF, 16V, Elect. |
| | **Plugs** | |
| CP601 | 25055146 | NPLG-2P-130 |
| CP602 | 25055149 | NPLG-5P-133 |
| CP603 | 25055152 | NPLG-8P-136 |
| | **Sockets** | |
| FS601 | 24505195 | 7P |
| FS602 | 24505197 | 6P |
| FS603 | 24505196 | 3P |

## REMOTE CONTROL CIRCUIT PC BOARD

| CIRCUIT NO. | PART NO. | DESCRIPTION |
|---|---|---|
| U701 | 24130002 | BX1466, IC |

## OUTPUT TERMINAL PC BOARD

| CIRCUIT NO. | PART NO. | DESCRIPTION |
|---|---|---|
| JK1 | 25000003 | Terminal |
| L801, L802 | 231066 | NCH-1118, Choke coil |
| C801, C802 | 372523914 | 390pF ±5%, 50V, Styrole capacitor |

## LINE FILTER PC BOARD

| CIRCUIT NO. | PART NO. | DESCRIPTION |
|---|---|---|
| L1, L2 | 231142 | ⚠ 40μH, Choke coil |
| | 25108018 | Terminal |

NOTE: THE COMPONENT IDENTIFIED BY MARK ⚠ ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE ONLY WITH PARTS NUMBER SPECIFIED.