

ADC Accutrac[®] 4000

Service Manual



Edge/Center Limit/Height Gauge PN 47-1008 (30-777-1961)

Instructions For Use

EDGE LIMIT CHECK

- A. Place gauge on turntable spindle and position calibration of gauge in line with cartridge stylus.
- B. Hold Turntable to prevent rotation.
- C. Turn Power "On".
- D. Depress Buttons 33, 12 inch, Track 1, and Play, in this order.
- E. Tonearm will position itself over starting edge of Track 1. Observe if stylus touchdown and calibration on gauge coincide. Push "Clear" Button to return Tonearm to rest.

EDGE LIMIT ADJUSTMENT

Edge limit adjustment screw is located below the tonearm mounting plate and is accessible through the hole in the mounting plate to the left of the tonearm base. Clockwise rotation of screw moves the tonearm towards center of record, and counterclockwise rotation of screw will move tonearm toward edge of record.

CENTER LIMIT CHECK

- A. Place gauge on turntable spindle and position gauge in line with cartridge stylus.
- B. Hold Turntable to prevent rotation.
- C. Turn Power "On".
- D. Observe indication of external AC Milliameter connected to line feeding Accutrac unit.
- E. Slowly move tonearm manually in towards the center of the record. As the stylus approaches the 56 MM calibration, observe the AC Milliameter reading; and as soon as there is an indication of a rise in A.C. current, note the position of the stylus in relation to the 56 MM calibration. A rise in A.C. current and coincidence of the stylus to the calibration on the gauge should occur simultaneously.

CENTER LIMIT ADJUSTMENT

With Power "Off", rotate the tonearm in toward the center of the record and while observing in the hole on the left side of the tonearm base, a second white slotted head adjustment screw will appear. The tonearm weight is effectively in line with the right corner of the wooden base when this adjustment screw is accessible.

NOTE: Approximate AC Current Readings Are As Follows:

120 VAC Input	45 MA Unit On	55 MA Synchronous Motor Running
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For 220/240 Volt Input, current is approximately one-half above values.

MECHANICAL ADJUSTMENT—CARTRIDGE HEIGHT

- A. Stylus Guard in position on Cartridge.
- B. Power "Off".
- C. Tonearm on Rest.
- D. Tonearm in "Cued Up" Position.
- E. Remove rubber mat from turntable platter.
- F. Move tonearm over turntable platter.
- G. Place height gauge under outermost portion of shroud.
- H. Adjust screw on cueing platform until shroud touches top of height gauge.

30.777-1001

ADC Accutrac

EDGE-CENTER &
HEIGHT GAGE

CENTER

EDGE

HEIGHT



SERVICE INFORMATION

MODELS

ACCUTRAC 4000/EW-1	120 VAC 50/60 Hz
ACCUTRAC 4000/EW-1/M	120 VAC 50/60 Hz
ACCUTRAC 4000/EW-2	240 VAC 50/60 Hz
ACCUTRAC 4000/T-2	240 VAC 50/60 Hz
ACCUTRAC 4000/EW-3	100 VAC 50/60 Hz
ACCUTRAC 4000/EW-4	220 VAC 50/60 Hz
ACCUTRAC 4000/EW-1/Q (QUADRAPHONIC)	120 VAC 50/60 Hz



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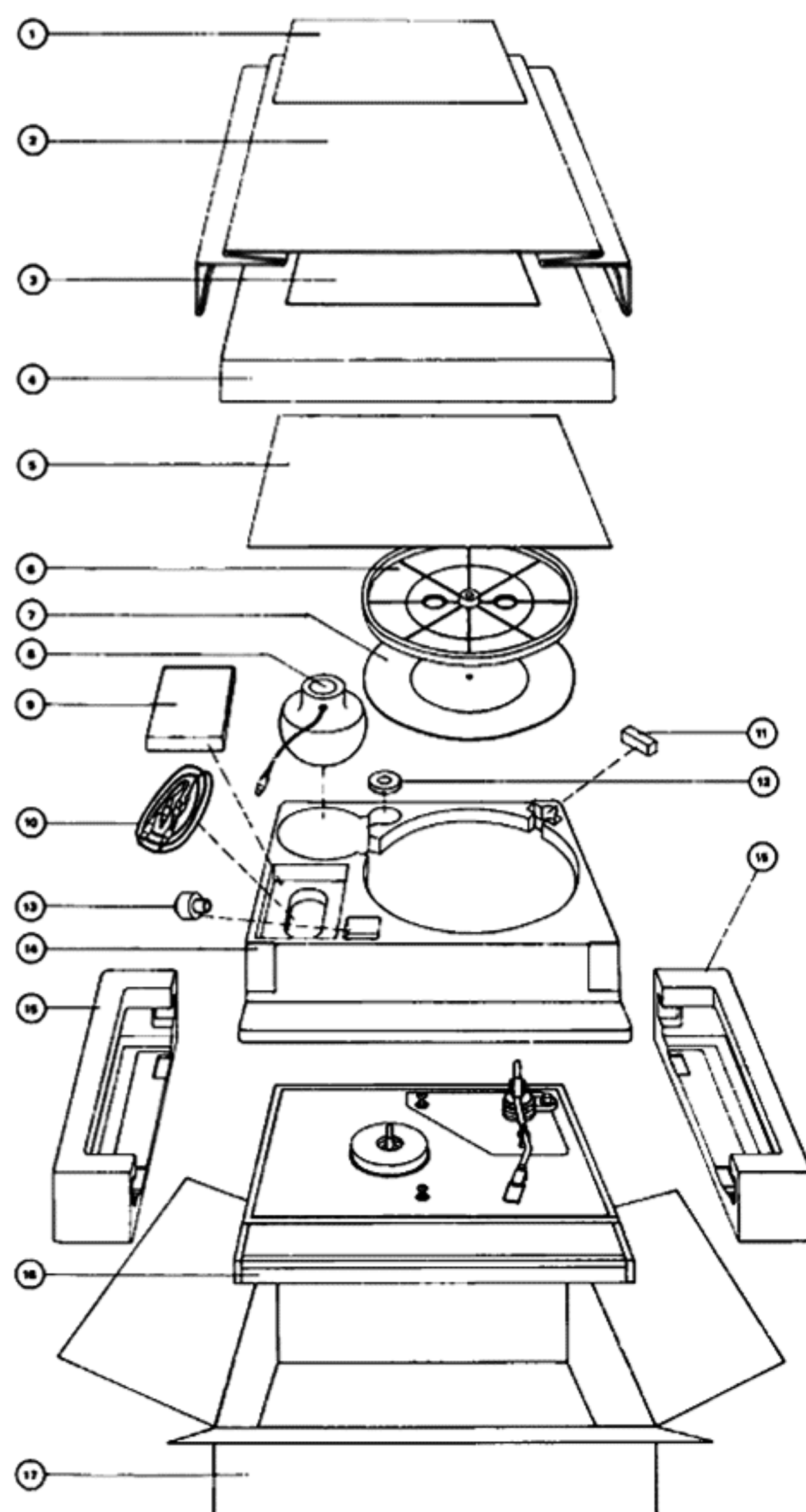
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PACKING SEQUENCE

FIG. 1

1. PACKING LIST.
2. CARDBOARD SPRING PAD.
3. PLASTIC WALLET, CONTAINING:-
 - a). OWNERS MANUAL
 - b). WARRANTY CARD
 - c). TURNTABLE MAT CENTRE TRIM DISC.
4. HINGED DUST COVER.
5. CARDBOARD PAD.
6. TURNTABLE.
7. TURNTABLE MAT.
8. REMOTE CONTROL RECEIVER.
9. REMOTE CONTROL TRANSMITTER.
10. AUDIO CABLE, SCREWDRIVER, STYLUS BRUSH.
11. REMOTE CONTROL TRANSMITTER BATTERY.
12. 45 R.P.M. RECORD ADAPTOR.
13. TONEARM COUNTERWEIGHT ASSEMBLY.
14. POLYFOAM CONTAINER.
15. POLYFOAM ENDCAP
16. UNIT AS SUPPLIED.
17. SHIPPING CARTON.



SECTION I

GENERAL INFORMATION

1.1 INTRODUCTION

The Accutrac Model 4000 is an advanced electronic turntable featuring random track selection, computerized memory bank and remote control operation.

The system consists of interrelated components that include electronic speed controlled direct drive turntable motor, electro-magnetically coupled tonearm, driven by a reversible synchronous motor, all controlled by a computer-logic memory bank for random programmed selection of recorded tracks from the control panel or by remote control.

1.2 DESCRIPTION

Direct Drive Motor

The D.C. Direct Drive Turntable Motor utilizes electronic speed sensing circuitry for accuracy; front panel controls for continuously variable pitch adjustment with a 5% range are provided for each of the available speeds (33 $\frac{1}{3}$ and 45 RPM).

Tonearm

A precision-balanced counter-weighted tonearm with, effectively, immeasurable vertical and lateral friction, employs the LMA series low mass electro-optical magnetic cartridge and elliptical stylus. It is driven by a reversible synchronous motor electro-magnetically coupled by a clutch mechanism which is totally decoupled in the playing mode.

Track Sensing

An infra-red LED (Light Emitting Diode) and photo-transistor located directly in front of the stylus responds to reflected light from the unrecorded bands separating the tracks on the record. This triggers the computer logic (MOS IC's) for track selection, stylus set-down and lift, in accordance with programmed information.

Computer Logic

MOS Integrated Circuits are used for programming and controlling the function of the Accutrac 4000 Turntable and Transmitter command information.

Receiver

This device receives the coded commands from the transmitter and activates the circuitry contained in the Accutrac accordingly. It is placed at a convenient line of sight. The interconnecting cable permits location of the receiver up to 12 feet away from the Accutrac Turntable, or may be increased an additional 10 feet, utilizing the extension cable available as an accessory.

Transmitter

The Transmitter is a hand-held cordless, battery-powered unit containing all the Control and Track functions available at the control panel of the turntable. The range is 30 feet. It transmits an encoded binary signal at 40 KHz to the Receiver. This in turn feeds the information into the control and command MOS integrated circuits of the Accutrac.

SECTION II

OPERATION

2.1 INSTALLATION

The Accutrac 4000 is electrically operational as shipped from the factory, except for the several simple assembly operations of turntable platter, tonearm counterweight, receiver connection, transmitter battery insertion, and dust cover installation.

2.1.1 LOCATION AND POWER REQUIREMENTS

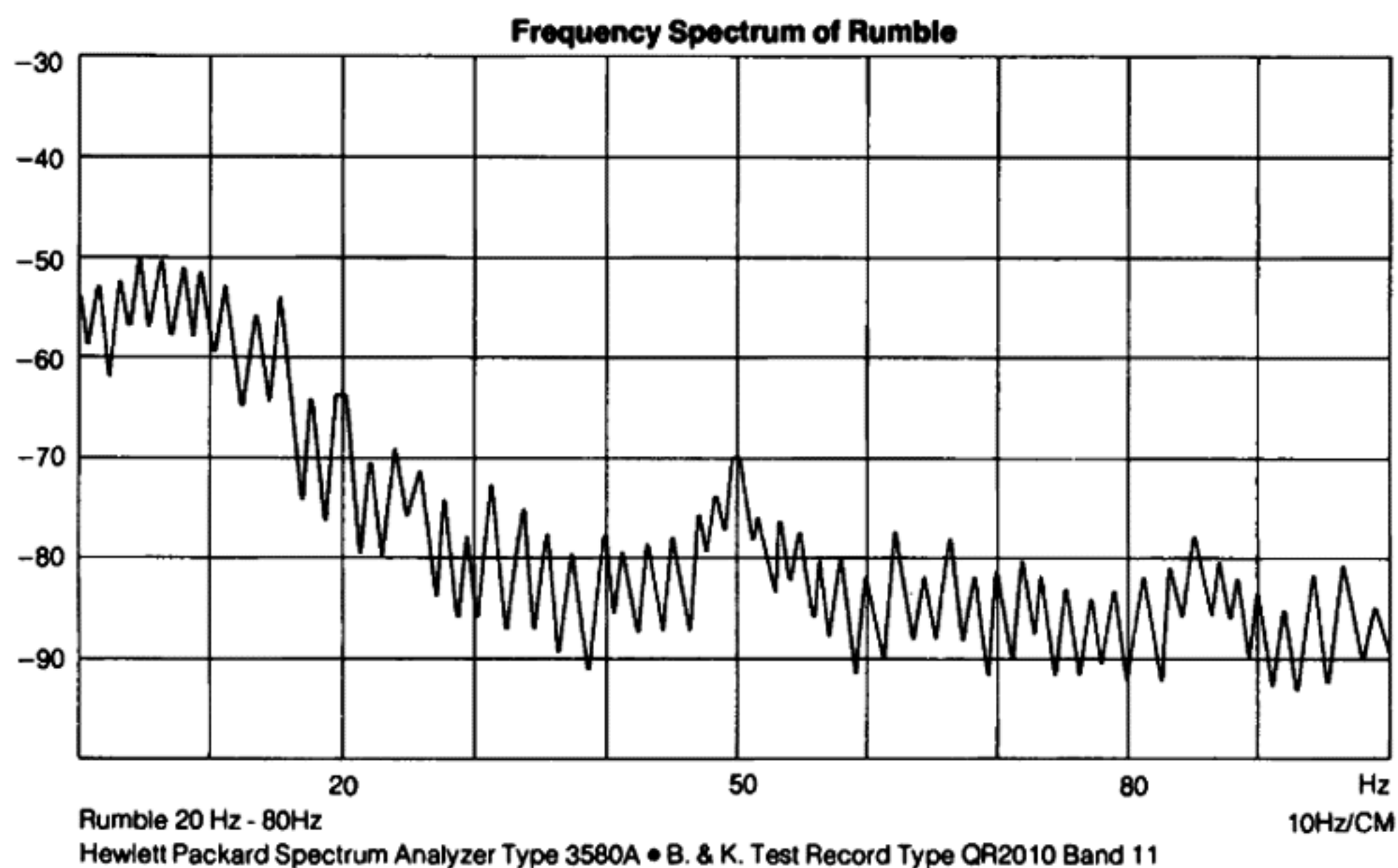
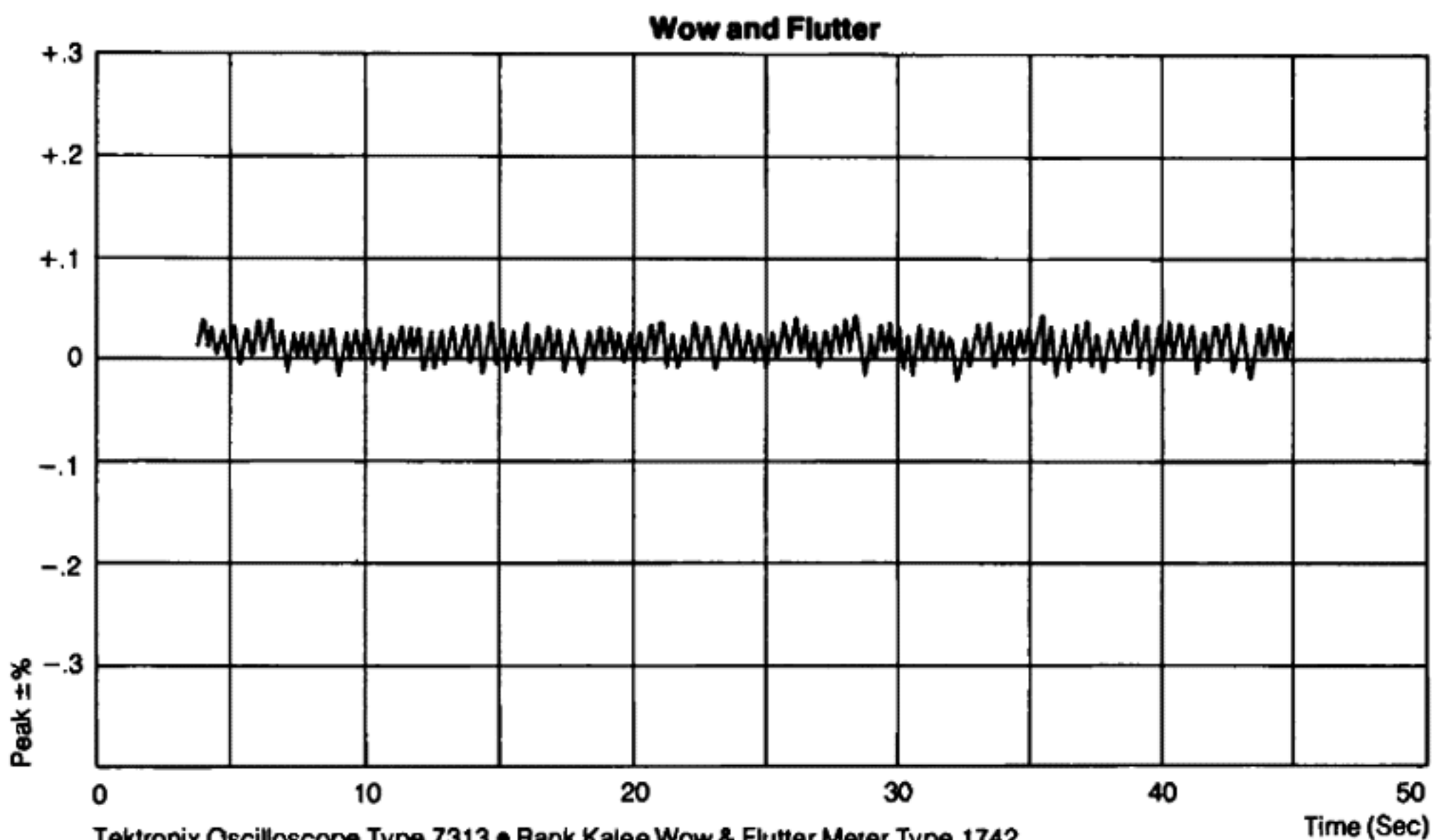
Place unit on a stable surface, well isolated from physical shock and vibration, accessible to a power outlet supplying proper voltage as indicated on the rear label.

WARNING—In keeping with standard safety practice, units supplied with three wire connector and adapted to two wire receptacle must have the short wire, provided on the adaptor, connected to ground.

2.1.2 TURNTABLE ASSEMBLY

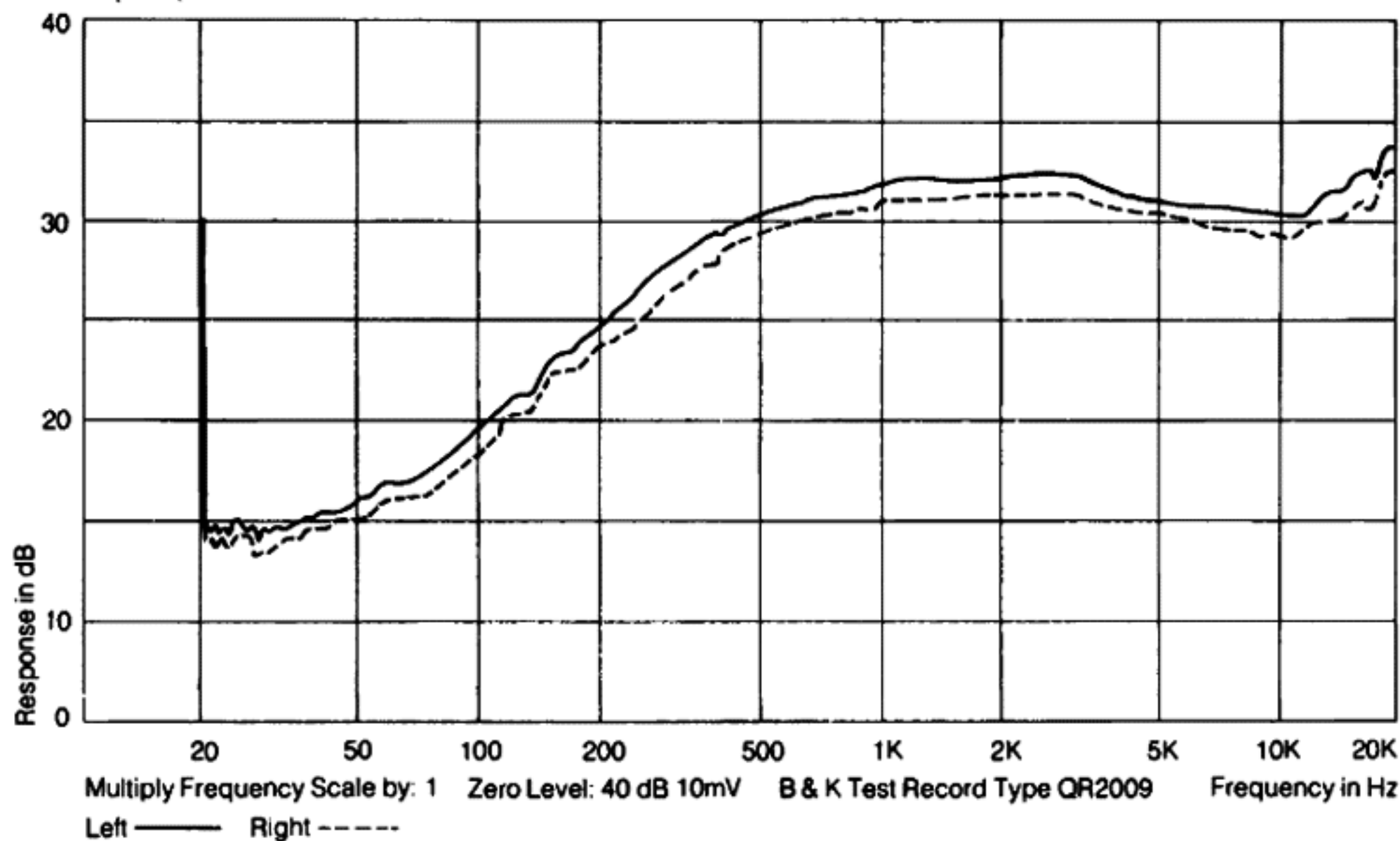
- A. Turn transit screws clockwise until fully recessed into motorboard.
- B. Place turntable platter on the motor shaft. (FIG. 2-9)
- C. Place rubber mat on turntable platter, ribbed side up, and drop small center trim disc onto its center. (FIG. 2, Item 10, 11)

1.3 SPECIFICATIONS



ADC LMA-1 Cartridge Frequency Response

Potentiometer Range: 50dB; Rectifier: RMS; Lower Lim. Freq.: 20Hz; Wr. Speed: 50/16 mm/sec.,
Paper Speed: 3 mm/sec.



ACCUTRAC 4000 TECHNICAL SPECIFICATIONS TURNTABLE SYSTEM

TYPE: Two-Speed Direct Drive

MOTOR DRIVE SYSTEM:

Low Speed, Electronically Controlled, D.C.
Brushless Direct Drive Motor

SPEEDS:

33⅓ and 45 rpm (Electronic Speed Change)

BUILD UP TIME: Within 2 Seconds To Full Speed

VARIABLE PITCH CONTROLS:

5% Range (Individual Control For Each Speed)

TURNTABLE PLATTER:

Die-Cast Aluminum Alloy, Dynamically Balanced
Diameter 306.4mm (12 1/16")

Weight 1.4 kg (3 lb 2 oz)

WOW AND FLUTTER: Less Than 0.03% W.R.M.S.
(DIN 45507) ± 0.042% Weighted Zero To Peak

RUMBLE: Better than — 70 dB (DIN 45539B)

— 50 dB (DIN 45539A)

TONARM/CARTRIDGE SYSTEM

TONARM

TYPE: Tubular "S" Shaped, Statically-Balanced Arm

Direct Readout, Decoupled Counter-Weight

Electronically Controlled Cue, Pause and Muting
Operation

Anti-Skate Control

EFFECTIVE LENGTH:

237mm (9 5/16") Pivot To Stylus Tip

OVERHANG: 15mm (9/32")

FRICTION:

5 to 7 Milligrams Horizontally And Vertically

OFFSET ANGLE: 21°

SYSTEM RESONANCE:

8-10 Hz (With ADC LMA-1 Cartridge Supplied)

TRACKING FORCE RANGE:

0-4 Grams (With ADC LMA-1 Cartridge Supplied,
Operate at ¾-1 ½ Grams)

WIRE CAPACITANCE: Less Than 20 pf Per
Channel. Compatible With CD-4

CARTRIDGE

TYPE: ADC LMA-1 Low Mass, Induced Magnet

(U.S. Patent 3294405)

Electro-Optical Sensing System

High Energy Magnet Structure

OUTPUT: 3.5 mV/5.5 cm./sec

TRACKING FORCE RANGE: ¾ to 1 ½ Grams

FREQUENCY RESPONSE: 10 Hz to 24 kHz ± 2 dB

CHANNEL SEPARATION: 28 dB

LOAD RESISTANCE: 47K OHMS

STYLUS TIP:

Nude .0003" x .0007" Elliptical Diamond

GENERAL

POWER REQUIREMENTS:

Model 4000/EW-1 120 V.A.C. 50/60 Hz

Model 4000/EW-2 240 V.A.C. 50/60 Hz

Model 4000/EW-3 100 V.A.C. 50/60 Hz

Model 4000/EW-4 220 V.A.C. 50/60 Hz

POWER CONSUMPTION: 12 Watts

ACCESSORIES INCLUDED:

ADC TX-1 Remote Control Transmitter
with 9 V Battery

ADC SX-1 Remote Control Receiver
with Connecting Cable

Removeable Hinged Dust Cover

Wood Veneer Cabinet

45 rpm Record Spindle Adaptor

48" Dual Phono Cables

DIMENSIONS:

UNIT:

Left To Right = 470mm (18 1/2")

Front To Back = 441mm (17 3/8")

Height = 152mm (6")

All Dimensions With Dust Cover Down

CARTON:

260mm (10 1/4") x 530mm (20 7/8") x 510mm (20")

WEIGHT:

9 kg (20 lbs 4 oz) Net

10 kg (22 lbs 8 oz) Packed

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

2.1.3 TONEARM ASSEMBLY

- A. Holding the counterweight behind the tonearm with calibrated scale and "0" marking upper most towards the pivot housing, push the assembly on the shaft all the way until it touches the tonearm barrel. (FIG. 3-A)

B. With the calibration "0" still facing up, pull the counterweight assembly back slowly until you feel a gentle click. (FIG. 3-B) Continue until a second click is felt. Refer to FIG. 3-C.

C. Remove the stylus guard. (FIG. 3-F)

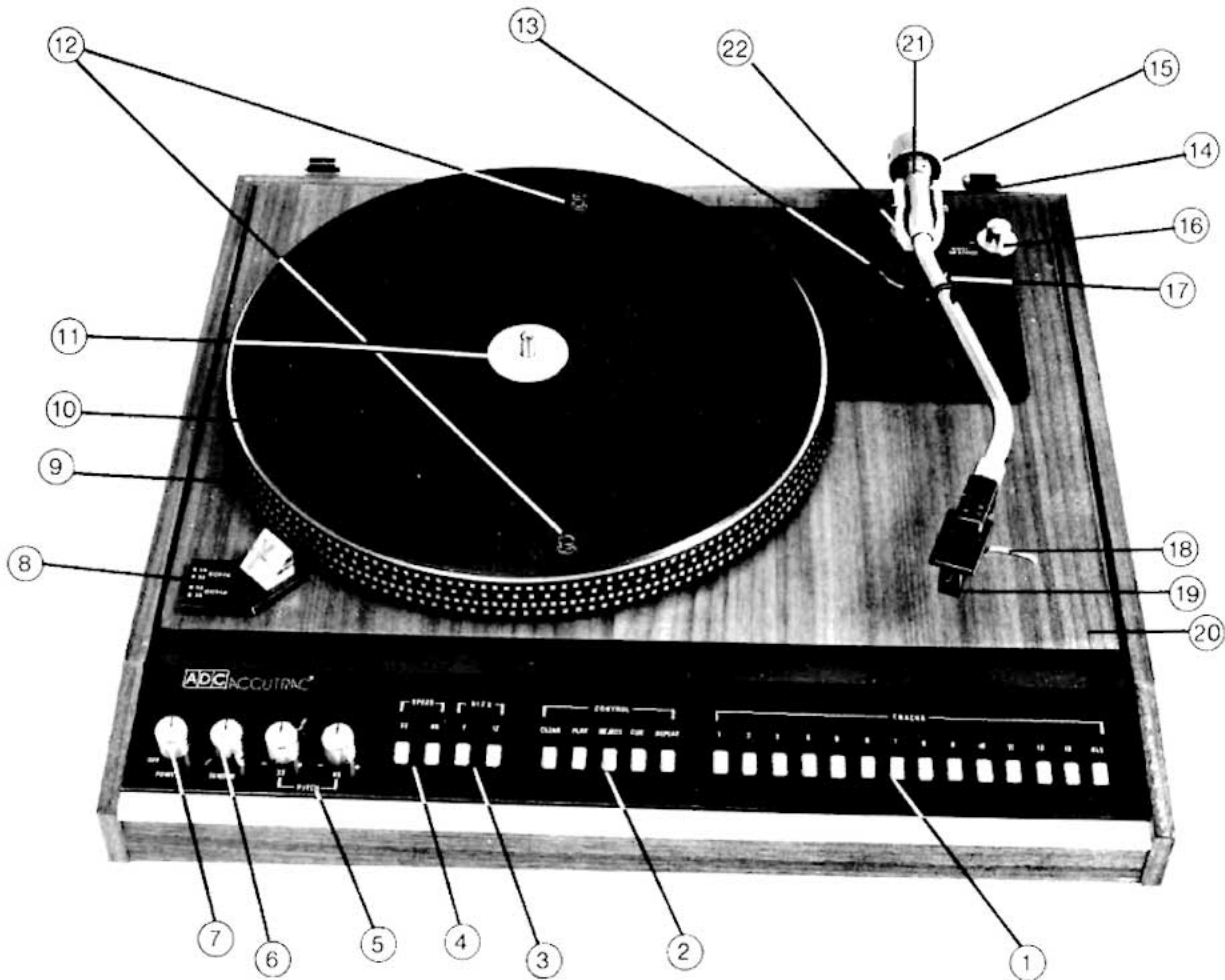
D. Release the tonearm lock. (FIG. 2-17)

E. Swing tonearm off arm rest (FIG. 2-17) and position between arm rest and turntable platter. Slight
- resistance or lateral drag is normal and is explained under "Principle of Operation" heading.

F. Depress "Cueing Platform" (FIG. 2-13) with finger. This will allow tonearm to float freely and should balance in a parallel position to the motorboard when calibration "0" is referenced to index line on tonearm shaft.

G. Set counterweight to read between 1.0 to 1.5 grams. Rotate anti-skate (FIG. 2-16) knob to equivalent reading.
- NOTE:** Refer to FIG. 4 for adjustment procedure if tonearm fails to balance.

ADC Accutrac® 4000



1. TRACK SELECTION BUTTONS

2. FUNCTION CONTROL BUTTONS

3. SIZE CONTROL BUTTONS

4. SPEED CONTROL BUTTONS

5. PITCH CONTROLS

6. SENSOR ADJUSTMENT CONTROL

7. POWER SWITCH
8. STROBE-LIGHT INDICATOR

9. TURNTABLE

10. TURNTABLE MAT

11. CENTER TRIM DISC

12. TRANSIT SCREWS

13. CUEING PLATFORM

14. DUST COVER HINGES

15. COUNTERWEIGHT ASSEMBLY
16. ANTI-SKATE KNOB

17. TONEARM REST POST AND LOCK

18. FINGER LIFT

19. STYLUS POSITIONING LEVER

20. MOTOR BOARD

21. TONEARM BARREL

22. PIVOT HOUSING

FIG. 2 ASSEMBLY DESIGNATION

TONEARM ASSEMBLY COUNTER-WEIGHT INSTALLATION



A. *Insert Counter-Weight on arm fully until it touches Tonearm Barrel.*



B. *Slide Counter-Weight back to first click stop.*



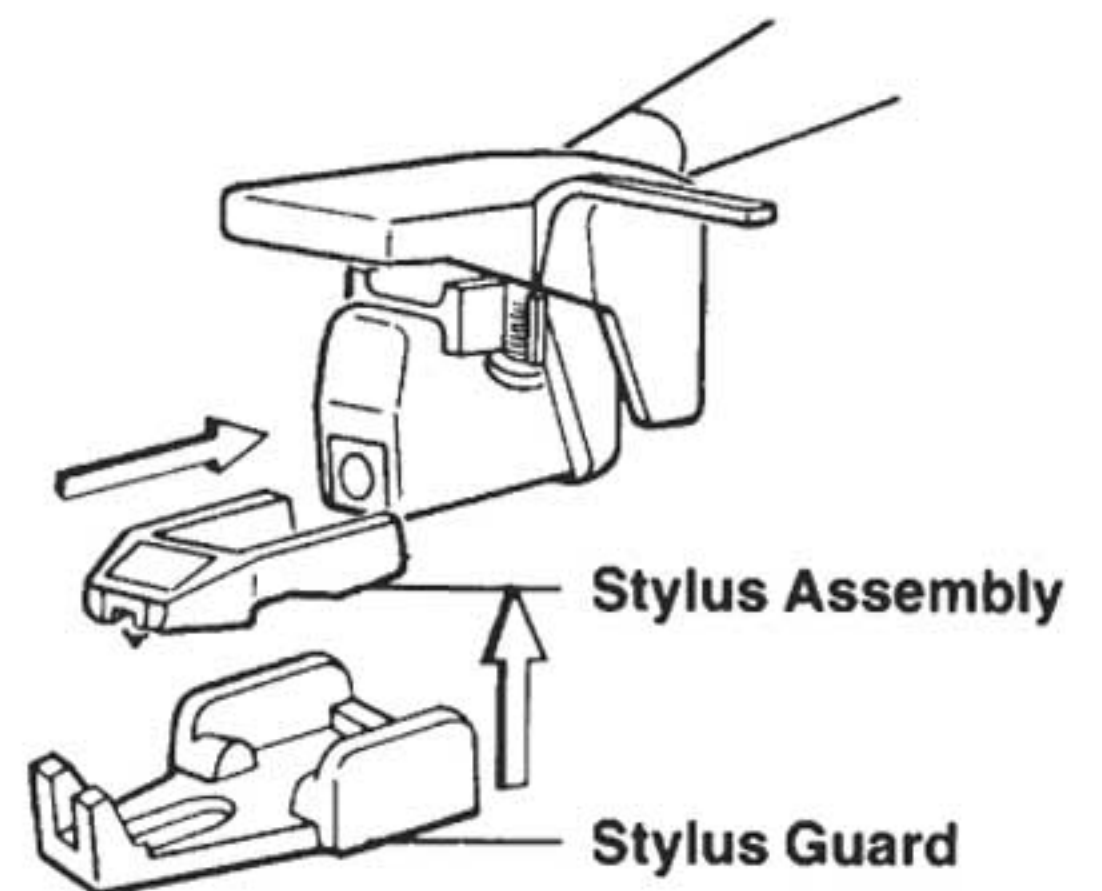
C. *Continue sliding Counter-Weight to second click stop.*



D. *With "O" Calibration facing up depress Cue-Bar and check arm balance. Refer to FIG. 4 (Tonearm Balancing).*



E. *Rotate Counter-Weight to Numeral 1 Indexed to Reference Line.*

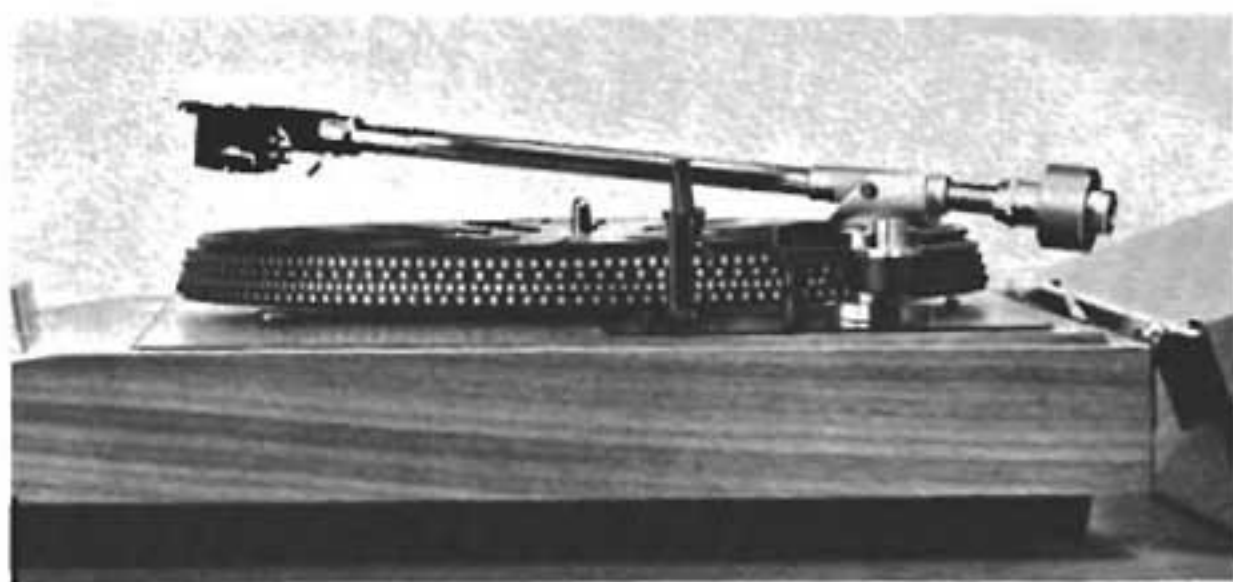


F. *Stylus & Guard Assembly.*

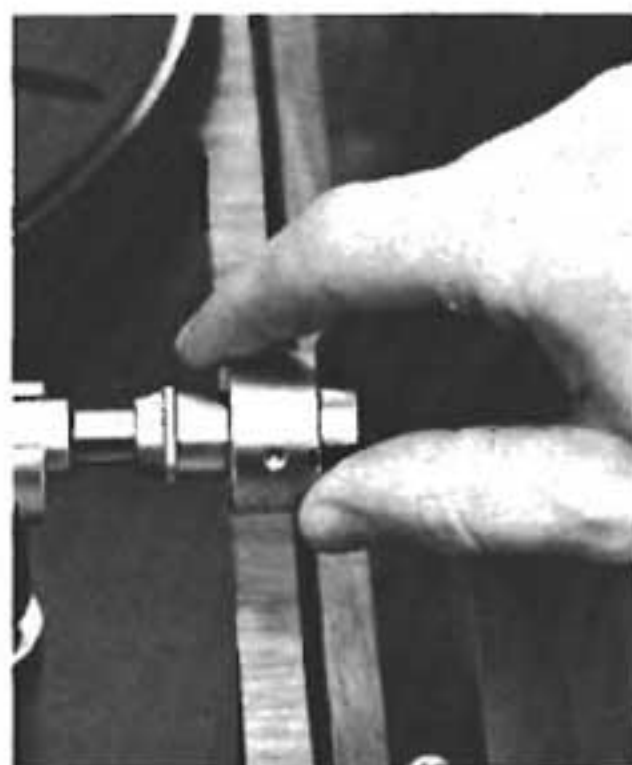
FIG. 3

TONEARM BALANCING

Tonearm head too high:

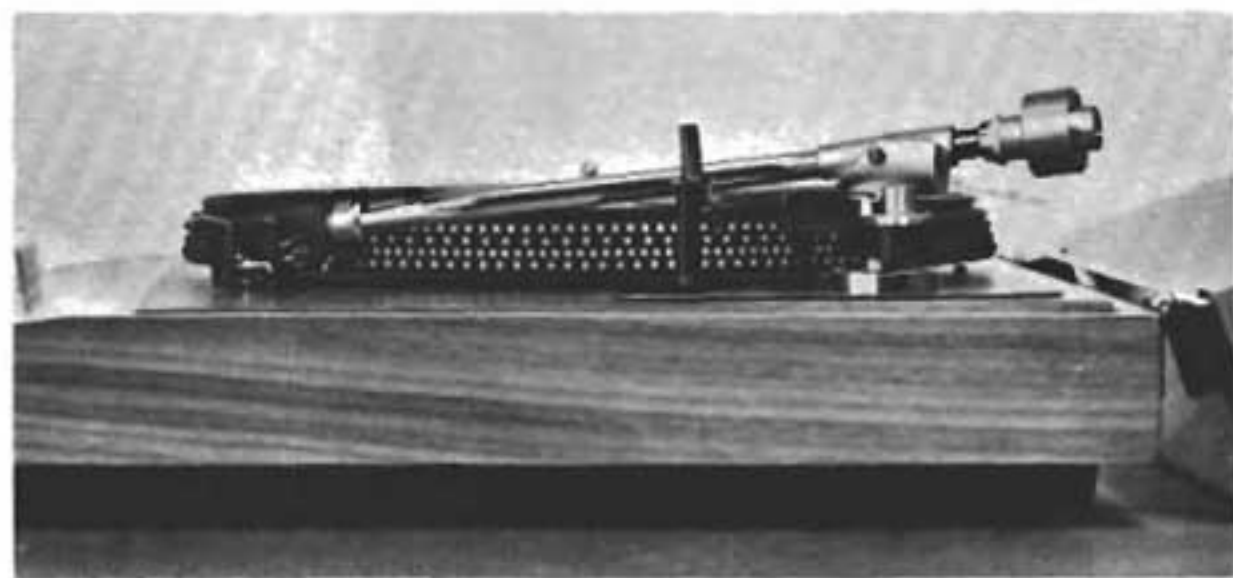


- a. Be sure that you have moved the counterweight assembly to the proper position.



- b. The counterweight is too far back on the counterweight sleeve. Loosen the small screw on the counterweight and move the counterweight very slowly a hairs breadth toward the pivot housing. Carefully tighten the counterweight screw and repeat steps under Arm Assembly.

Tonearm head too low:



- a. Be sure you have molded the counterweight assembly to the proper detent position. Recheck steps 3, 4 and 5 under Arm Assembly.
- b. The counterweight is too far forward on the counterweight sleeve. Loosen the small screw on the counterweight and move the counterweight very slowly a hairs breadth away from the pivot housing. Carefully tighten the counterweight screw and repeat steps under Arm Assembly.

FIG. 4

2.1.4 AUDIO CONNECTIONS

- A. Using shielded phono cables terminated with RCA phono type plugs, connect corresponding left and right channel output jacks of Accutrac unit (FIG. 5) to magnetic phono input jacks on the preamplifier, integrated amplifier, or integrated receiver.
- B. Connect ground wire (Green or Green-Yellow Wire) to amplifier ground terminal. (FIG. 5)

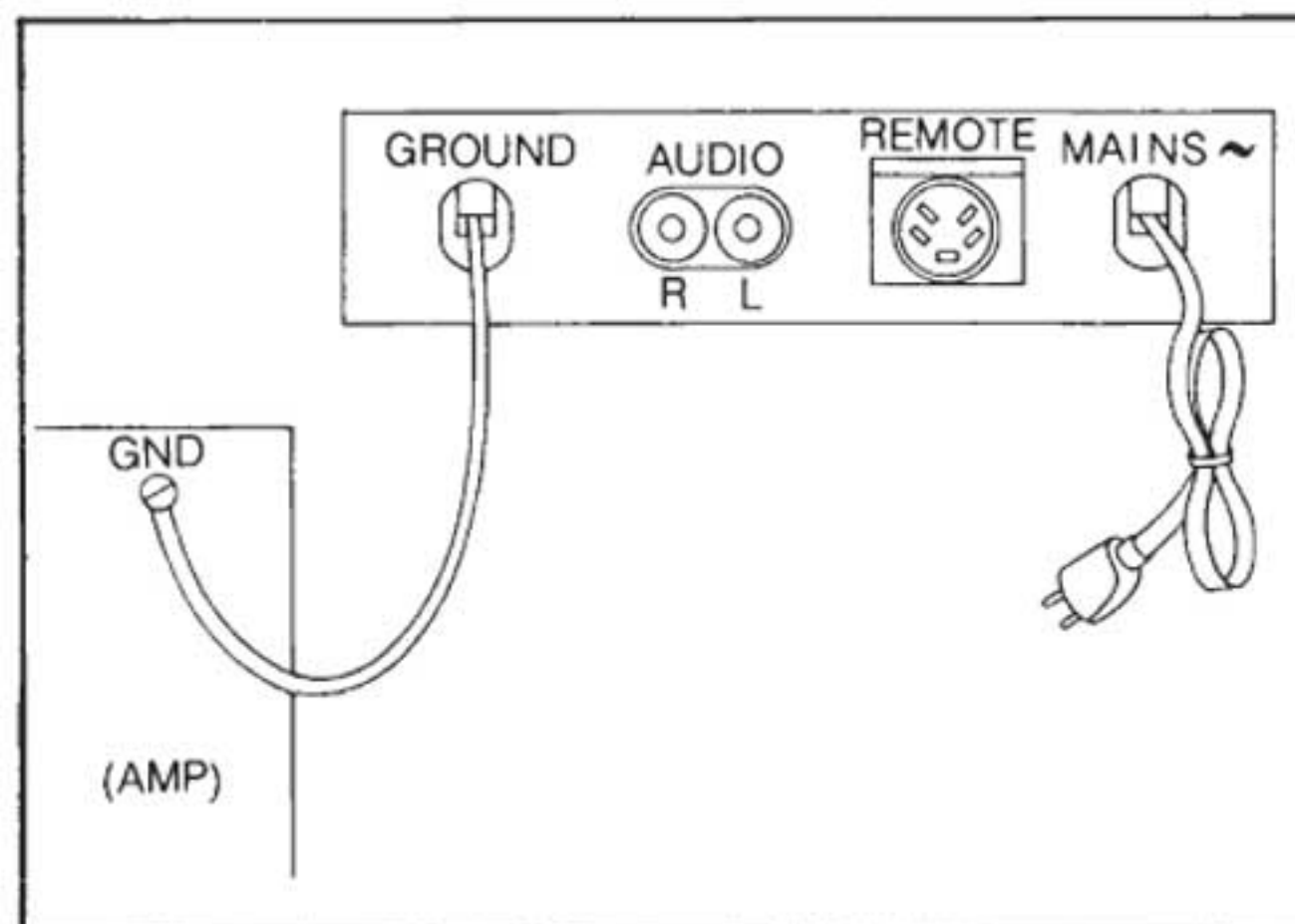


FIG. 5

2.1.5 REMOTE RECEIVER (SX-1)

- A. Insert DIN plug of remote receiver into DIN receptacle located on rear panel of Accutrac unit. (FIG. 5)

2.1.6 REMOTE TRANSMITTER (TX-1)

- A. Remove battery compartment cover, snap connector on battery terminals, insert battery, and replace cover.

2.1.7 DUST COVER INSTALLATION (OPTIONAL)

- A. Raise hinges on rear of unit to vertical position and insert into mating fittings on dust cover.
- B. For hinge tension adjustment refer to FIG. 6.



FIG. 6 DUST COVER HINGE TENSION ADJUSTMENT.

2.2 OPERATING PROCEDURE

- A. Insert power plug into AC receptacle of appropriate voltage.
- B. Power unit by turning power switch to "On".
- C. Strobe light lights.
- D. Place 12" 33 $\frac{1}{3}$ RPM record, having a series of tracks, on turntable.
- E. Unlock arm.

- F. Select series of tracks (bands) at random sequence, by actuating "Tracks" Buttons on control panel or remote transmitter.
- G. Motor starts rotating.
- H. Press Play Button.
- I. Arm scans and stops at first selection programmed.
- J. Arm lowers to start of selection.
- K. At completion of selection, arm lifts and returns to rest position and again scans to next selection. This continues until all programmed tracks have been played.
- L. At completion of programmed commands, arm returns to rest and turntable motor stops.
- M. Power remains on and must be turned off manually.

Exception:

If program includes two consecutive tracks to be played, the tonearm will continue into the next selection without lifting, e.g. if program included tracks 4 and 5 (in sequence) track 4 would play and continue into 5 without tonearm lifting. After 5 has been completed, the tonearm will search for the next selection or return to the arm rest if no further commands are stored in the memory circuit.

2.3 CONTROLS AND FUNCTION

On-Off

Rotary control applies power to unit and the strobe light illuminates the edge of the turntable, a segment of which is used for setting the desired speed.

Sensor

Adjusts the sensitivity of the scanning system that counts the tracks. Rotating the control counter-clockwise increases the sensitivity to detect narrow bands separating the tracks. Clockwise rotation will decrease the sensitivity and is also used to eliminate set down of the arm in areas exhibiting heavy modulation.

Pitch

Separate pitch controls provide accurate setting of 33 $\frac{1}{3}$ and 45 RPM speed. Clockwise rotation increases speed and counter-clockwise rotation will decrease it. Range of each control is 5%.

2.4 PUSHBUTTONS AND FUNCTION

Speed

Two separate pushbuttons pre-set the turntable speed desired (33 $\frac{1}{3}$ or 45 RPM). The unit automatically resets itself for 33 $\frac{1}{3}$ RPM and 12" record when power is applied. Selection of 45 RPM and 7" size requires actuating the appropriate pushbuttons, and restoration of the system to 33 $\frac{1}{3}$ and 12" record is again done manually unless the system is turned off. Upon turn-on the system will reset to 33 $\frac{1}{3}$ and 12" record size.

Size

Record size selection is independent of speed selection, thus permitting the system to respond to record size; for example, to play 7" records recorded at 33 $\frac{1}{3}$ speed.

Clear

This button returns the arm to rest, shuts off the turntable motor, and clears the command memory circuit.

Play

Starts the turntable motor and prepares the Accutrac to play on commands of a tracks program or play at once if track commands have already been programmed.

Reject

Interrupts play and advances the tonearm to the next programmed command. If no further commands have been programmed, the arm will return to rest, and the turntable motor will shut off.

Cue

Raises and lowers the tonearm electronically. When the tonearm is down on the record, pressing "Cue" will raise the arm, and pressing the button again will lower it onto the record.

Repeat

Programs the turntable to repeat the selection being played before proceeding to the next programmed selection. Additional repeat function can be activated only while the selection is being played. For multiple repeat of selection, programming the "Tracks" Button accordingly is suggested.

Tracks

Permits the selection of any track on the record, in any sequence, and repeated as many times desired up to 24 commands. The selection of a track number beyond the number of available tracks on the record will cause the tonearm to search and return to rest or continue on to additional programmed commands. A total of 13 tracks are provided and can be programmed to a total of 24 commands allowing repeating of tracks as desired. "All" programs the Accutrac to play the record from start to finish as many times as desired up to 24 commands.

NOTE: Turntable motor starts when any "Tracks" Button or function buttons (Play, Cue, and Repeat) are actuated.

2.5 REMOTE OPERATION

The Transmitter keyboard contains all "Control" and "Tracks" functions. By pointing the Transmitter towards the Receiver, remote operation of the Accutrac 4000 is achieved. The red light located at the Receiver will flash each time a command is programmed from either the keyboard or remote Transmitter acknowledging all Control and Track commands.

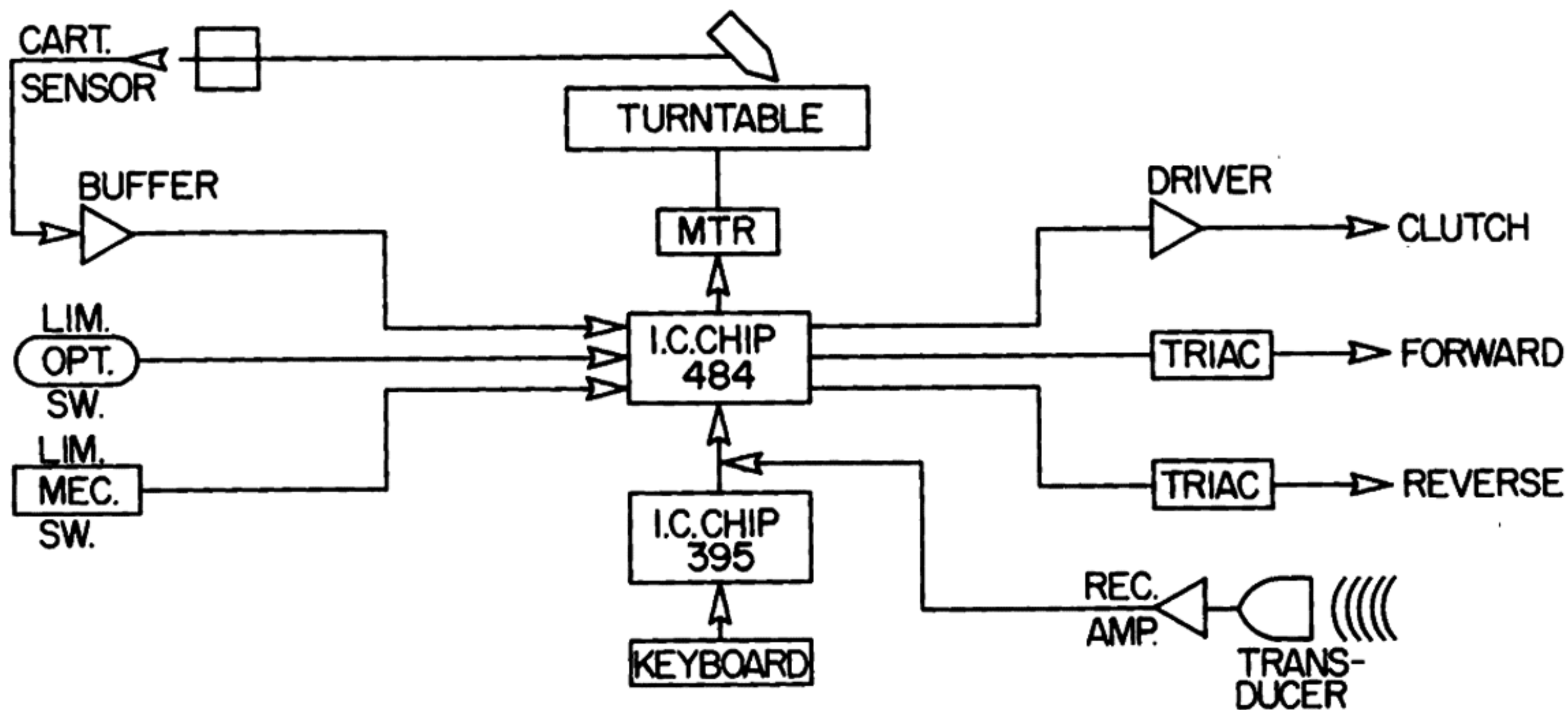


FIG. 2.6.A FUNCTION SEQUENCE

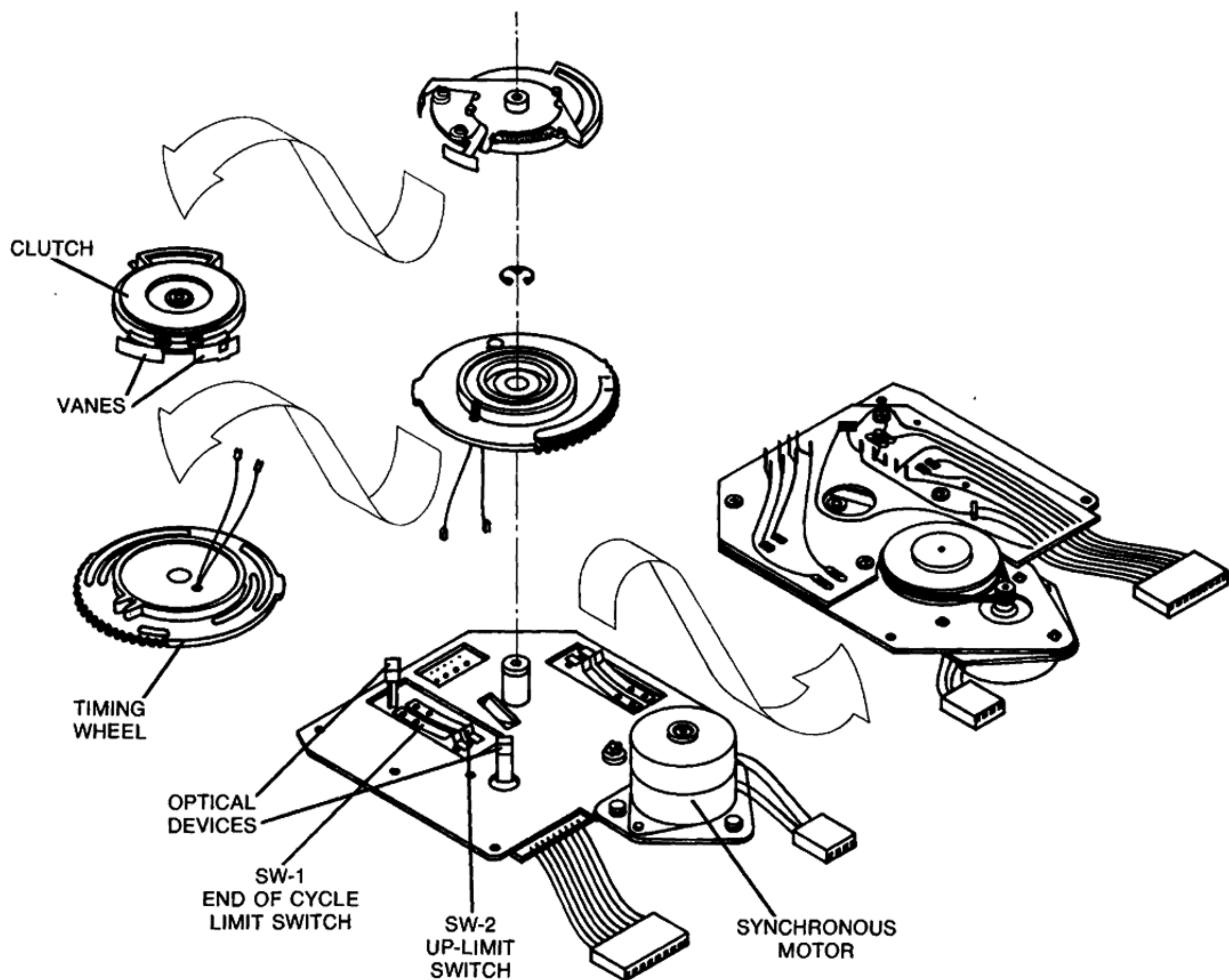


FIG. 2.6.B TONEARM COMPONENTS

2.6 PRINCIPLE OF OPERATION

2.6.1 The Accutrac Model 4000 utilizes two (2) separate integrated circuits to interpret the program and command information entered into the system from the main keyboard. (FIG. 2.6.A)

The integrated circuit (Chip No. 395) on the Main P.C. Board in the unit receives and encodes the program from the keyboard on the unit. The encoded signal is then fed through the serial data highway into the integrated circuit (Chip No. 484) which decodes the signal and stores the information in its memory circuit. Both program and command functions are encoded by integrated circuit (Chip No. 395) when the information has been received from the keyboard on the unit.

Programming of one or more track selections or activating any of the function buttons (Play, Cue, or Reject), will energize the direct drive turntable motor as a function of the decoded signal received by the integrated circuit (Chip No. 484).

Two paths for providing information into the integrated circuit control and memory (Chip No. 484) are employed. One path is from the main keyboard into the integrated circuit (Chip No. 395) and onto the serial data highway. The second path is from the remote control transmitter via the remote amplifier in the receiver onto the same serial data highway, since the remote transmitter incorporates its own encoding integrated circuit (Chip No. 140).

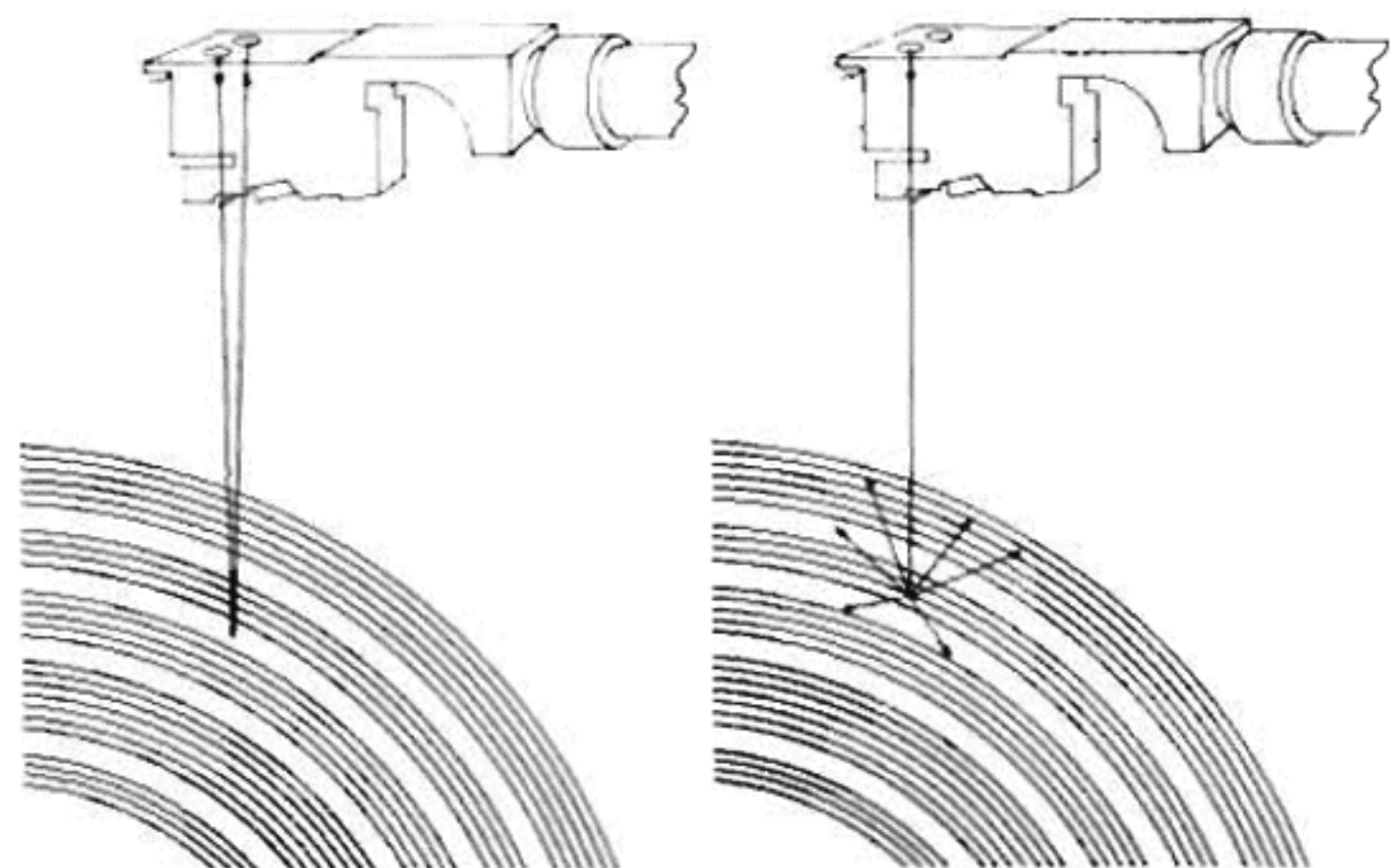
2.6.2 ESSENTIAL CONDITIONS AND ELEMENTS OF OPERATION

2.6.2.1 BASIC CONDITIONS OF THE TONEARM

1. Tonearm in its rest position
2. Tonearm at the 12" record start position
3. Tonearm at the 7" record start position
4. Tonearm at the center trip position

To determine any of these conditions (positions), two (2) reflective vanes are secured to the tonearm shaft (FIG. 2.6.B). The first reflective vane is notched to distinguish between a 12" record and a 7" record stylus set down position. The second reflective vane indicates the center limit end of the record.

Two (2) optical devices are used to detect the position of the reflective vanes which provide signals to the integrated circuit (Chip No. 484).



Since the position of the timing wheel must be also determined, two (2) mechanical limit switches are used for physically sensing its position relative to the tonearm position.

2.6.2.2 ESSENTIAL ELEMENTS OF OPERATION

1. Tonearm, cartridge assembly, and cartridge sensor
2. Electro-magnetic clutch and timing wheel
3. Sensing switches (optical)
4. Sensing switches (mechanical)
5. Reversible synchronous motor
6. Electronics
7. Direct drive motor and turntable platter
8. Keyboard
9. Receiver
10. Remote transmitter

2.6.3 EXAMPLE OF OPERATIONAL SEQUENCE

To illustrate the interrelationship and function of the essential elements, the following sequence is programmed at the keyboard as an example:

1. "Tracks" button number 3 is programmed into the integrated circuit (Chip No. 395).
2. The signal is encoded and is received by the integrated circuit (Chip No. 484) where it is decoded and stored into the memory circuit. At this time the direct drive turntable motor is energized. This is a stable state condition of the integrated circuit (Chip No. 484), and it is awaiting further track entries and/or command.
3. The function or command "Play" is now entered into the integrated circuit (Chip No. 395) via the keyboard which in turn provides the appropriate encoded signal to the integrated circuit (Chip No. 484).
4. Integrated circuit (Chip No. 484) decodes and controls the following sequence of events:
 - A. The synchronous motor is powered in a forward direction.
 - B. Simultaneously, the electro-magnetic clutch is engaged.
 - C. The tonearm moves toward the record and when it reaches the 12" record edge the track sensor circuitry in the tonearm cartridge assembly is activated to count the reflective tracks of the record. (FIG. 2.6.C)

FIG. 2.6.C

TONEARM SENSOR OPERATION

Light emitting diode (led) and detector located within the cartridge assembly focuses light on the surface of the record. Reflective surface of bands that separate the recorded tracks, reflect the light beam back to the detector providing signal information to the interacted circuit (Chip No. 484).

- D. The waveform detected by the cartridge sensor and sensor amplifier, collector of T4 transistor, is represented by FIG. 2.6.D (typical).
- E. When the tonearm has reached track 3, the integrated circuit (Chip No. 484) will de-energize the clutch. The tonearm will stop. At this time both optical switches are in the high state. (FIG. 2.6.E)
- F. The timing wheel continues to rotate to cue the tonearm down until the end of cycle limit switch SW-1 is low. Up-limit switch SW-2 changed level at start of cue-down. (FIG. 2.6.F)
- G. When end of timing wheel cycle signal is received by integrated circuit (Chip No. 484), the synchronous motor is de-energized. This condition remains in a stable state while the selected track is being played.
- H. At the end of the track the cartridge sensor will generate a tonearm lift signal as result of the next reflective surface preceding the following track. (FIG. 2.6.G)
- I. When the tonearm lift signal is received by the integrated circuit (Chip No. 484), the synchronous motor is reversed in direction of rotation, driving the timing wheel until the up-limit switch (SW-2) closes. This permits the clutch to engage and return the tonearm to its rest position. At this time both optical limit switches are returned to low state condition and the clutch is disengaged.
- J. The timing wheel continues to reverse until the cycle limit switch (SW-1) closes and the synchronous motor turns off. This condition remains in a stable state awaiting further programming and command.

The above sequence described is representative of any track selection.

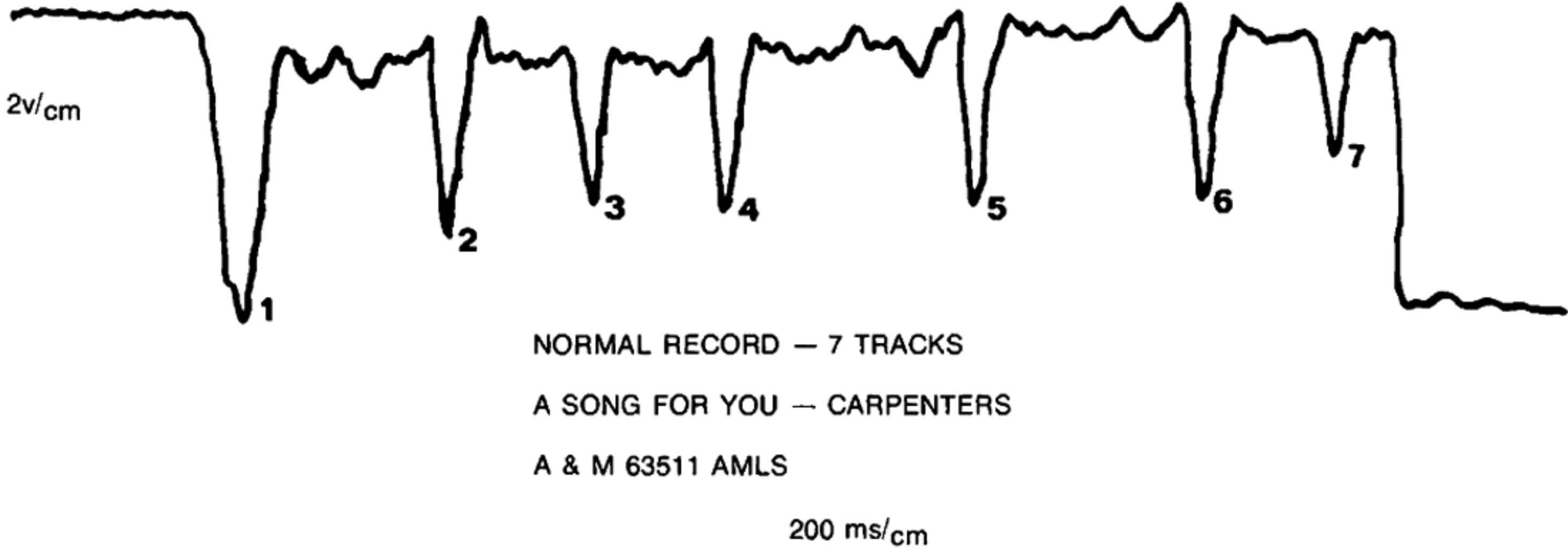


FIG. 2.6.D TYPICAL SENSOR RESPONSE CURVE

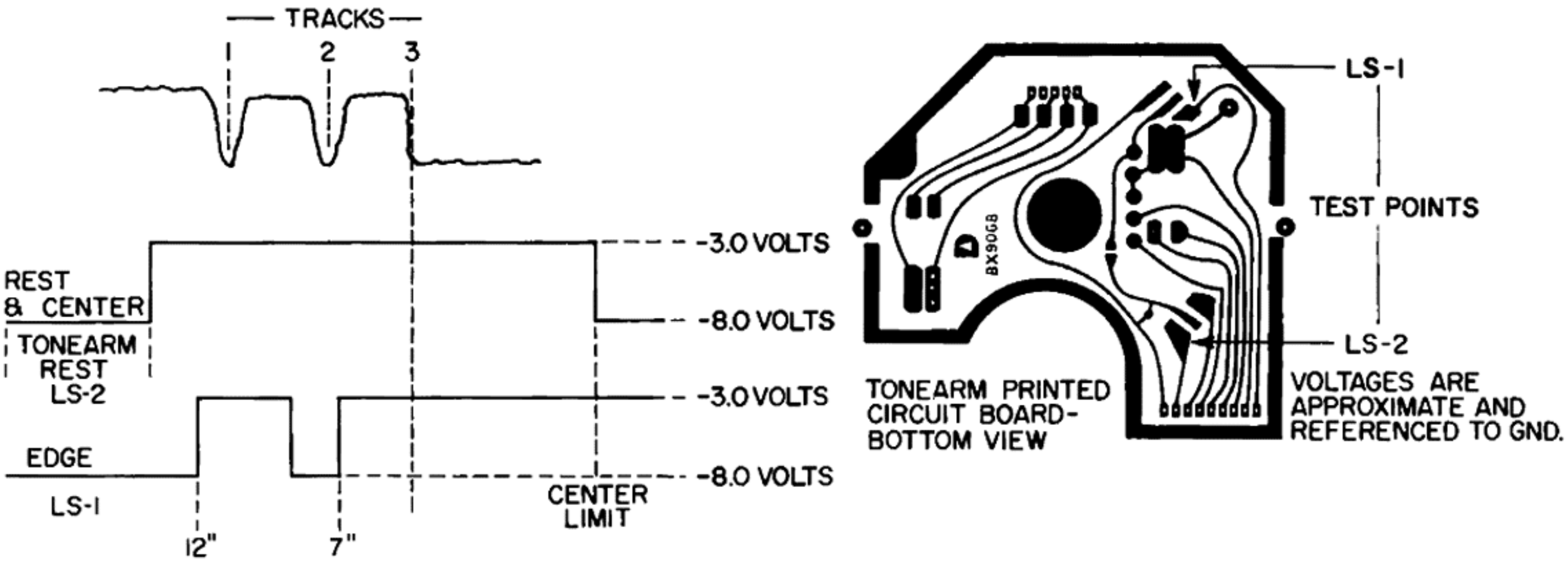


FIG. 2.6.E TONEARM PRINTED CIRCUIT BOARD BOTTOM VIEW

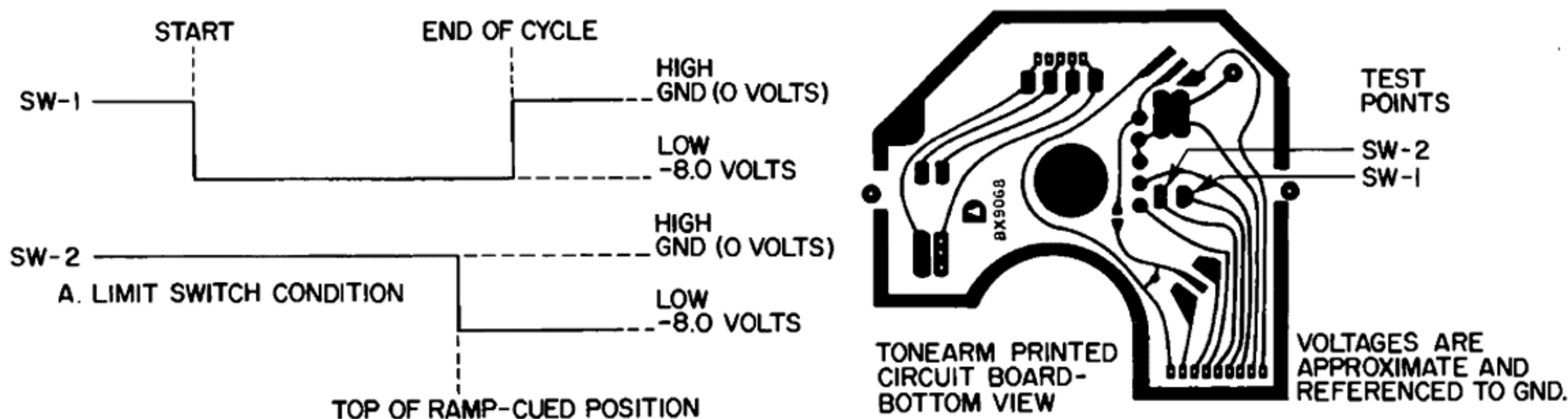


FIG. 2.6.F

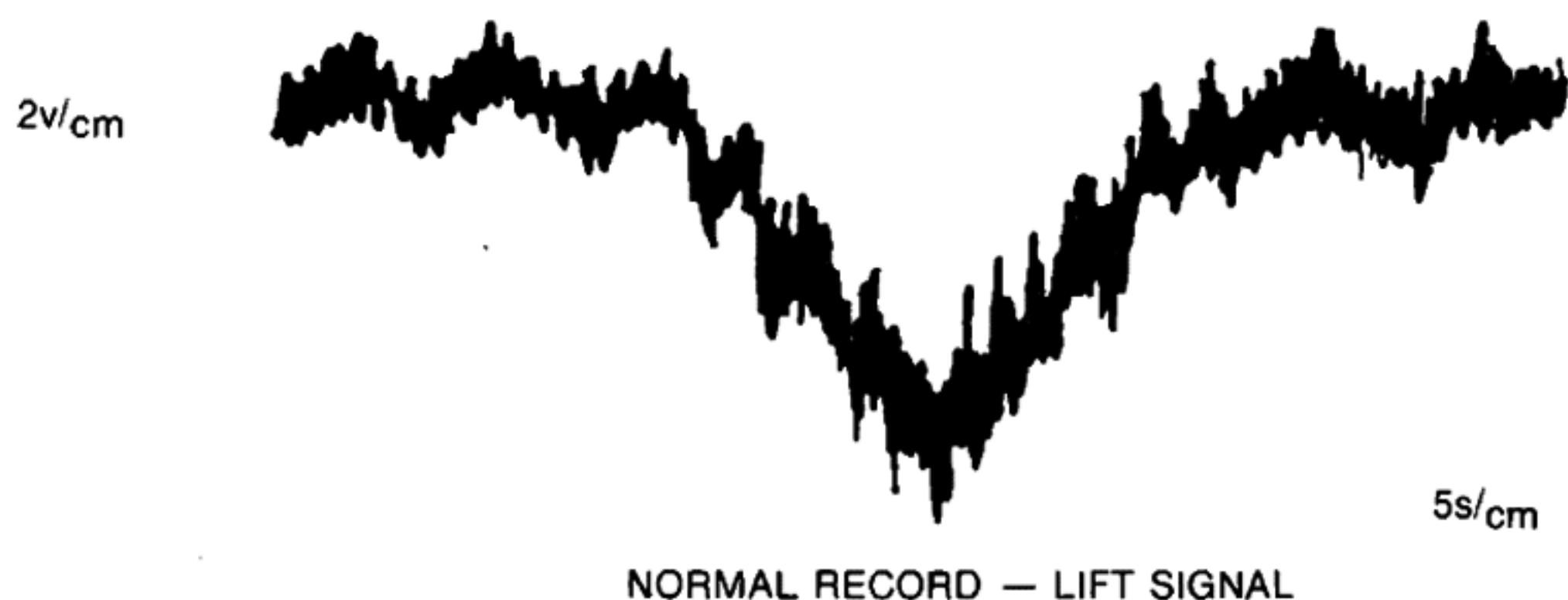


FIG. 2.6.G

SECTION III MAINTENANCE

3.1 INTRODUCTION

This section describes recommended test and adjustment procedures to verify that the unit meets its performance specifications. Included is a Symptom and Cause/Cure Chart with repair information.

Refer to Section V for Schematic, Block Diagrams and X-Ray Views of Printed Circuit Boards.

3.2 RECOMMENDED TEST FIXTURES AND EQUIPMENT

- 3.2.1 Cartridge Height, Edge & Center Limit Gauge P/N 47-1008
- 3.2.2 DC Voltmeter (VTVM)
- 3.2.3 AC Milliammeter 0-150 MA AC
- 3.2.4 Allen Wrench 1.5 MM (Xcelite 99 — 72 MM or equivalent).
- 3.2.5 Sensor Reflectivity Gauge P/N 47-1009
- 3.2.6 Thickness Gauge (Feeler) .015"

3.3 PRELIMINARY MECHANICAL ADJUSTMENT — CARTRIDGE HEIGHT

Before attempting to trouble shoot or operate the unit, the Cartridge Height above the record must be

checked to avoid damage to the stylus. Proceed as follows:

- A. Stylus Guard in position on Cartridge.
- B. Power "Off".
- C. Tonearm on Rest.
- D. Tonearm in "Cued Up" position. Verify by releasing hold down clip and observe if Tonearm rises above Tonearm Rest (17) and is resting on cueing platform (13) as illustrated in FIG. 2. If in doubt, power unit by turning power knob to "On". Depress "Cue" button and observe arm motion. If Tonearm descends, then depress "Cue" button again for arm to rise to Cued-Up position. Wait 3 to 4 seconds for completion of the cycle and turn power switch to "Off".
- E. Remove rubber mat from turntable platter.
- F. Move tonearm over turntable platter.
- G. Place height gauge under outermost portion of shroud.
- H. Adjust screw (FIG. 15, Item 10) until shroud touches top of height gauge.
- I. Restore the mat on the turntable platter and proceed with trouble-shooting using the following chart:

TROUBLE SHOOTING PROCEDURES

SYMPTOM

CAUSE/CURE

3.4.1 Strobe (power) light does not turn on.

- 1) Check A.C. socket (outlet) for power.
- 2) Check Molex "H" connector and wiring (FIG. 7).
- 3) Check Slo-Blo fuse inside plastic cover (FIG. 11) of transformer unit.
- 4) Check solder joints on neon light and printed circuit board.
- 5) Check power switch with ohmmeter for continuity.
- 6) Replace neon bulb.

3.4.2 No power — Turntable or Tonearm does not operate.

- 1) Recheck all above.
- 2) Move tonearm to center trip position. Arm should return to rest.
- 3) Check Molex "A" connector (FIG. 7), and wiring from transformer to main board.
- 4) Check fuse (250 MA/250V) on transformer secondary, 6 volts A.C. winding.
- 5) Check Molex "G" from DIN receptacle for shorted pins (FIG. 7).
- 6) Unplug Molex "G" and repeat step 5.
- 7) Check voltages on Molex "A" (FIG. 7).
- 8) Replace main board if voltages are correct. Replace transformer if secondary voltages are incorrect.

3.4.3 Turntable speed incorrect.

- 1) If speed cannot be properly adjusted by front panel pitch control(s), carefully adjust the speed control(s) on the bottom of the motor. Note that several minutes of running are required for the motor to stabilize.
- 2) If one speed is correct but the other is not, check the pitch control pots (2.2K) at Molex "D" (FIG. 7).
- 3) If pots are O.K. check Molex "E" (FIG. 7).
- 4) If both connectors are good, substitute motor. If motor problem still exists, replace main board. NOTE: Motor will not rotate without platter fitted on motor spindle.

3.4.4 Unit will not respond to any commands, but turntable rotates when track(s) button is depressed.

- 1) Release tonearm lock. Move tonearm to center trip position. Arm should return to rest. Check for excessive friction. If so, refer to Tonearm Adjustments, Section III.
- 2) If tonearm does not return to rest, check all Molex connectors going to tonearm board and check solder connections (FIG. 7).
- 3) If after tonearm returns to rest and (tonearm) motor is still rotating but (black) round drive belt is not, the problem may be the (beryllium copper) limit switches. A slight bend may be necessary to adjust limit switches for proper contact. Refer to Section III, Paragraph 3.5.7.
- 4) If tonearm moves back from trip position correctly but does not respond to keyboard commands, replace main board (FIG. 10).
- 5) Substitute keyboard.

3.4.5 Tonearm does not move, however, a click is heard.

- 1) Release tonearm lock.
- 2) Refer to Tonearm Adjustments, Section III. Check for:
 - a) Excessive clutch gap.
 - b) Stiff or clogged gears.
 - c) Audio wires fouling clutch.

3.4.6 Does not respond to certain track selection(s).

- 1) Substitute keyboard to determine if problem is keyboard or electronics. If problem is corrected by substituting keyboard, continue as follows:
- 2) Check underside of front keyboard to see if all screws are in and tight.
- 3) Check feel of track buttons for clicking action.
- 4) Replace chip #395 (FIG. 10).

SYMPTOM

3.4.7 Does not sense properly.

CAUSE/CURE

- 1) Check stylus for dust accumulation.
- 3) Check Molex "F" wiring and 1 meg sensor pot for poor soldering. Check with ohmmeter for smooth operation, i.e., no "bad" spots (FIG. 7)
- 4) Use Sensor Reflectivity Gauge. Section III, Item **SENSOR REFLECTIVITY GAUGE P/N 47-1009** and paragraph **SETTING SENSOR SENSITIVITY ADJUSTMENT**. Check for approximately: $-19V \pm 2$ Volts reflective;
 -6 Dull ± 2 Volts at TP-1.
- 5) If $-19VDC$ cannot be obtained with pot in extreme position, replace sensor in cartridge head. Readjust voltage.
- 6) If $-19V$ still not obtained, replace main board (FIG. 10).
- 7) Check tonearm head wiring for shorts.

3.4.8 Tonearm will not pick up at end of track (runs into next track and plays through). Minimum track length of 50 seconds playing time for test.

- 1) Refer to **DOES NOT SENSE PROPERLY**.
- 2) Replace main board (FIG. 10).

3.4.9 Tonearm does not set down or trip properly (12" or 7" and center limit).

- 1) Adjustment can be made by adjusting screws visible through hole located on left on tonearm base (FIG. 9-K).
- 2) If adjustments are in extreme position and tonearm still does not set down or pick up properly, refer to Tonearm Adjustments, Section III, Paragraph **TONEARM ADJUSTMENTS**.

3.4.10 Tonearm does not stop at initial set-down point (clutch drag).

Refer to Tonearm Adjustments, Section III. Clutch gap adjustment too close; open gap slightly. Paragraph **CLUTCH SPACING ADJUSTMENT**.

3.4.11 Tonearm rises and lowers when a track has been selected but does not move laterally.

Refer to Tonearm Adjustments, Section III.

- 1) Clutch gap too wide: lower tonearm to close gap slightly. Paragraph **CLUTCH SPACING ADJUSTMENT**.
- 2) Clutch coil open: check coil for 200 ohms (nominal).
- 3) Defective transistor 2N3904.
- 4) Replace main PC board.

3.4.12 Lateral or vertical friction.

Refer to Tonearm Adjustments, Section III.

Lateral: Tonearm housing causing friction, Paragraph 3.5.2.

Vertical: Pivot Points too tight, Paragraph 3.5.1.

3.4.13 Tonearm senses tracks, but upon set down on record, shifts inward or outward.

If tonearm shifts towards center, clutch gap is too close. If it shifts away from center, *cue height* is too high due to brake releasing too soon and anti-skate mechanism causing shift of tonearm to the right.

3.4.14 Muting does not operate properly:

- a) mutes permanently:
- b) muting releases early:
- c) both channels do not mute/release simultaneously.

- 1) Reset beryllium copper contacts, Section III, Paragraph 3.5.7.

3.4.15 Hum or noise.

NOTE: Existence of hum may be due to a "floating ground" (inherent design) condition of some equipment. It is suggested that an additional ground wire be connected from the Integrated Receiver or Audio Amplifier ground point to the wall cover plate screw. This, in effect, terminates both Amplifier system and Accutrac to a common ground.

- 1) Check Molex "J" from cartridge wires and also wires on cartridge.
- 2) Check for bad ground connections.
- 3) Check audio cables to amplifier and also check for an earth ground.
- 4) Check wiring from muting switch to audio phono jacks.
- 5) Check for tonearm ground (Black) wire.
- 6) Check Black wire continuity.

SYMPTOM**CAUSE/CURE**

- 3.4.16 Unit does not operate with remote receiver plugged in, however, operates properly without it.**
- 1) Check for broken wire in DIN plug, especially ground.
 - 2) Check continuity of receiver Molex "G". NOTE: Ultra Sonic Alarm systems can jam the Accutrac's remote receiver and cause the keyboard to become inoperative. Placement of the remote receiver so that it is out of direct line of the ultra sonic alarm field will usually correct the jamming.
- 3.4.17 Receiver LED does not light, however, receiver functions properly.**
- 1) Check for broken wires.
 - 2) Substitute LED.
 - 3) Replace Receiver P.C. Board.
- 3.4.18 Receiver LED lights when programmed from panel, but does not respond to transmitter signal.**
- 1) Check transmitter by holding to ear and depress (any) button for low frequency buzz.
 - 2) Check for broken wires, especially red one in receiver.
 - 3) Replace P.C. Board in receiver (FIG. 13).
- 3.4.19 Transmitter range insufficient.**
- 1) Substitute battery.
 - 2) Open transmitter by removing four head screws in back and adjust pot located at bottom right corner for peak response at 30 feet from receiver.
- 3.4.20 Receiver range insufficient.**
- 1) Replace capacitor C-5
 - 2) Replace P.C. Board (FIG. 13).
- 3.4.21 No audio.**
- 1) Check muting switch for proper operation (Refer to Tonearm Adjustments, Section III, Paragraph 3.5.7.2).
 - 2) Check audio cables and connections.
- 3.4.22 Unit pops when turned on or off.**
- 1) Check Molex Connector "H", Pop Filter, and AC Power Switch (FIG. 7).
 - 2) Replace pop filter inside plastic box on transformer chassis.
 - 3) Replace "Power" switch.
- 3.4.23 No anti-skate.**
- Refer to Tonearm Adjustments, Section III, Paragraph 3.5.6 (G). Friction due to misadjusted tonearm housing. Paragraph 3.5.6 — G.
- 3.4.24 Tonearm movement erratic.**
- 1) Refer to Tonearm Adjustments, Section III, Paragraph 3.5.1 on Vertical Friction. Pivot points too loose (FIG. 9-H).
 - 2) Rough brake. Replace brake wheel assembly, (FIG. 15, Item 25).
 - 3) Loose tonearm in pivot bushing.
 - 4) Rough cueing platform (FIG. 15, Item 12). Replace cueing platform.
 - 5) Defective motor drive belt. Replace. (FIG. 12)
- 3.4.25 No 7" set down, but 12" set down normal.**
- 1) Reflector in tonearm not shaped 90°. Carefully re-shape by bending (FIG. 9-T).
 - 2) Tilted LS1. (FIG. 9-Z). Re-heat three (3) solder connections and seat LS1 properly on P.C. Board.
 - 3) Replace keyboard.
- 3.4.26 Unit does not function logically.**
- 1) Replace main P.C. Board (FIG. 10).
- 3.4.27 Tonearm goes to middle and sets down. Will not return when TRACK #1 is played.**
- 1) Check solder joints on LS1. (FIG. 9-Z, CC).
 - 2) Check cartridge sensor socket for proper contact.
 - 3) Replace head sensor.
 - 4) Replace bad P.C. Board sensor. See Section III, Paragraph 3.5.7.2 and 3.5.8.1.
 - 5) Check black wire from tonearm P.C. Board to head sensor for continuity.
- 3.4.28 Motor runs at very high speed.**
- 1) Ground side of (large) capacitor — C16 broken on P.C. Board.
 - 2) Replace main P.C. Board (FIG. 10).

SYMPTOM

3.4.29 Clutch drag.

CAUSE/CURE

- 1) Reset clutch gap, Section III, Paragraph 3.5.6.
- 2) If problem is still apparent, check for audio wires fouling clutch faces.
- 3) Check timing wheel (FIG. 9-X). Check if circlip (FIG. 9-HH) is seated in slot correctly.

TEST FOR CLUTCH DRAG

Set tonearm counterweight beyond "0" so tonearm will unbalance causing cartridge to rise.

Depress Clear, Play, Track 1. The tonearm should move to the set-down point of the 12" record, then move to the right (anti-skate set at 1-1/2). An abrupt movement to the left indicates clutch drag. Refer to 3.5.6 for proper clutch spacing adjustment.

3.4.30 Totally illogic command and/or programming functions.

- 1) Replace main printed circuit board.

NOTE: Replacement of main printed circuit and/or cartridge and limit switch sensors will require the re-setting of the voltage. Refer to Section III, Paragraph 3.4.7 and 3.6.

3.5 TONEARM ADJUSTMENTS

Refer to FIG. 9 (Isometric View) for location of adjustments.

3.5.1 VERTICAL FRICTION

Vertical Friction is caused by excessive pressure of the 2 pivots (FIG. 9, Item H) located on the yoke. Loosen the outer locking nuts on the pivot points and with a small screwdriver back off in extremely small increments either one or both set screws located within the locking nuts until the arm floats freely. In tightening the locking nuts, the inner screws must be restricted from turning.

3.5.2 ERRATIC LATERAL MOVEMENT (Vibration Of Tonearm During Scan Across Record)

This may be attributed to several faults.

- A. The pivot adjustment detailed in Paragraph 3.5.1 must be rechecked. The pivots may require adjustment, whereby, vertical friction and end play (loose pivots in bearings) is eliminated.
- B. The brake assembly (FIG. 9-M) braking service in contact with the brake pad, Item E, may exhibit flash on its surface.
 1. Remove the dust cover from the unit.
 2. Lock the tonearm to the arm rest with stylus guard in position.
 3. Remove the turntable platter with its mat.
 4. Invert the unit and carefully support it above the work area to preclude damage or undue pressure on the tonearm.
 5. Remove the six (6) screws from the plastic base and set the base aside.
 6. Unplug Molex Connectors B, C, and J from P.C. Board and rear panel respectively.
 7. Unsolder the seven (7) small wires from the tonearm P.C. Board.

8. Do not unsolder the two (2) heavy wires from their terminals.

9. Remove four (4) screws holding metal plate (FIG. 15, Item 26) to plastic housing (outer perimeter).

10. Lift plate (Motor Assembly) straight up carefully allowing thin cartridge wires to feed through bushing.

11. Examine surface of plastic cam (FIG. 9-M) in contact with brake pad (FIG. 9-E) for flash, debris, or dirt contamination.

12. Using an "Exacto" knife or similar tool lightly scrape surface to remove flash.

13. Remove all loose particles from housing.

14. Clean braking area with isopropyl alcohol and cue-tip.

15. Reassemble by twisting the seven (7) small wires and inserting through bushing.

16. Secure plate (FIG. 15, Item 26) with four (4) screws and resolder wires to proper terminals. Reference FIG. 7 for proper wire location and color identification.

17. Replace Molex Connectors to their respective locations.

- C. Examine the cue platform top surface (FIG. 15, Item 12) for dirt, grease, or foreign matter. Wipe with alcohol and clean cloth. Surface must be free of contamination, since tonearm movement across record is always in contact with top surface of cue bar.

3.5.3 LATERAL FRICTION

- A. Check Paragraph 3.5.2 (B) and (C).

- B. Locate two (2) set screws on chrome base (FIG. 9-WW) of tonearm.

- C. Grasp tonearm at yoke, and anti-skate housing, with tonearm locked on rest and loosen one set

screw and then retighten **SNUGLY**. *Do Not Apply Excessive Pressure*. Repeat same adjustments on second set screw (located 90 degrees away).

1. Recheck for lateral friction by offsetting counterweight towards rear of tonearm.
 2. Release tonearm lock. Arm should lift off cue platform.
 3. Power the unit.
 4. Push Clear Button, Track Button 1, and Play — in this sequence.
 5. Observe that cue platform lowers and with anti-skate knob set on "1" the Tonearm should slowly return towards rest. Should this fail, repeat adjustment of set screws again as outlined above.
 6. Restore counterweight to 1–1½ grams.
- D. Push "Clear" Button. Turn power switch to "Off". Using gram gauge (0–15) grams, applied to cartridge or shroud, push tonearm towards center of record and observe reading. Reading should be between 5 to 12 grams. If in excess, recheck Paragraph 3.5.2, Items B, C and Paragraph 3.5.3, Items A, B, C and examine underside of tonearm P.C. Board to ensure wiring of tonearm leads have adequate slack to allow freedom of Tonearm through its turning radius. If defect still exists, replace tonearm assembly by unplugging Molex Connectors B, C and J. Remove 5 Hex Nyloc Nuts and Washers, FIG. 15, Item 16 and lift tonearm assembly off motorboard. Reverse procedure to replace new tonearm assembly.

3.5.4 EDGE AND CENTER LIMIT ADJUSTMENT

The Edge Limit is the dimensional distance from the center of the spindle (motor shaft) to the outer set-down limit of the stylus. This dimension is 146.5 millimeters and falls into the lead-in spiral of the start of the record Track 1.

Center Limit is the dimensional distance from the center of the spindle (motor shaft) to the inner lift limit of the tonearm. This dimension is 56 millimeters and occurs on the lead-out spiral of the record between the last groove of the last track and the locked groove.

NOTE: Edge and Center Limit Adjustments require the use of an Edge & Center Limit Gauge. (P/N 47-1008.)

3.5.4.1 EDGE LIMIT CHECK

- A. Place gauge on turntable spindle and position calibration of gauge in line with cartridge stylus.
- B. Hold Turntable to prevent rotation.
- C. Turn Power "On".
- D. Depress Buttons 33, 12 inch, Track 1 and Play, in this order.
- E. Tonearm will position itself over starting edge of Track 1. Observe if stylus touchdown and calibration on gauge coincide. Push "Clear" Button to return Tonearm to rest.

3.5.4.2 EDGE LIMIT ADJUSTMENT

Edge limit adjustment screw is located below the tonearm mounting plate and is accessible through the hole in the mounting plate to the left of the tonearm base, (FIG. 9-K).

- A. Power "Off".
- B. Rotate tonearm to edge of tonearm rest.
- C. A white slotted head adjustment screw will be visible below the hole in the tonearm mounting plate.
- D. Turn this screw in small increments in the direction the tonearm should move to correct for edge set-down and recycle unit as per Paragraph 3.5.4.1. Clockwise rotation of screw moves the tonearm towards center of record and counter-clockwise rotation of screw will move tonearm toward edge of record. *Push "Clear" Button after each check to return tonearm to rest before attempting further adjustment of edge limit adjusting screw.* **NOTE: IF ADJUSTMENT CANNOT BE ACHIEVED WITHIN THE RANGE OF THIS ADJUSTMENT SCREW, SEE PARAGRAPH 3.5.5 FOR INTERNAL ADJUSTMENTS OF EDGE AND CENTER LIMIT ADJUSTMENT.**

3.5.4.3 CENTER LIMIT FUNCTION

Center limit checking requires the use of an AC Milliammeter connected in series with one leg of the power line to detect the increased current drawn by the unit.

The purpose of center limit (56 MM Dimension measured from the center of the turntable motor spindle [motor shaft] to the inner lift limit of the tonearm) is to initiate the start of a sequence of functions that occur at the completion of a record.

1. The reversible synchronous motor must start and cue the Tonearm to the "UP" position.
2. Muting of the cartridge as stylus lifts off record.
3. Electro-Magnetic Clutch remains inoperative until arm is cued "UP".
4. Apply brake pressure on tonearm controlling lateral motion.
5. Reverse the direction of rotation of the synchronous motor.
6. Engage the clutch as soon as the tonearm has been cued "UP" to drive the tonearm to the tonearm rest and shut down the system or continue the selection cycle if additional commands have been programmed into the logic circuitry.

3.5.4.3.1 CENTER LIMIT CHECK

- A. Place gauge on turntable spindle and position gauge in line with cartridge stylus.
- B. Hold turntable to prevent rotation.
- C. Turn Power "On".
- D. Observe indication on AC Milliammeter.
- E. Slowly move tonearm manually in towards the center of the record. As the stylus approaches the

56 MM calibration, observe the AC Millimeter reading. As soon as there is an indication of a rise in A.C. current, note the position of the stylus in relation to the 56 MM calibration. A rise in A.C. current and coincidence of the stylus to the calibration on the gauge should occur simultaneously.

3.5.4.3.2 CENTER LIMIT ADJUSTMENT

With Power "Off", rotate the tonearm in toward the center of the record and while observing the hole on the left side of the tonearm base (FIG. 9-K), a second white slotted head adjustment screw will appear. The tonearm weight is effectively in line with the right corner of the wooden base when this adjustment screw is accessible.

- A. Turn the screw in small increments clockwise to correct for center limit if the A.C. current increases before the stylus coincides with the calibration on the gauge. Turn the screw in small increments counterclockwise if the stylus had moved beyond the calibration before the A.C. current increased.

NOTE: Approximate AC Current Readings Are As Follows:

120 VAC Input	45 MA Unit On	55 MA
Synchronous Motor Running		
For 220/240 Volt Input, current is approximately one-half above values.		

3.5.4.3.2.1 ALTERNATE METHOD OF DETERMINING START OF SYNCHRONOUS MOTOR WITHOUT USE OF AC MILLIAMETER

- A. Remove base from unit (6 screws).
- B. Locate a mirror directly below drive pulley under tonearm mechanism. Observe for start of rotation and coincidence of stylus to calibration on Center Limit Gauge.

3.5.5 METHOD OF ADJUSTING FOR EDGE AND CENTER LIMIT (INTERNAL ADJUSTMENT)

Failure to achieve set-down or tonearm lift within the range of screw adjustments described above will necessitate the following internal adjustment.

- A. Refer to Paragraph 3.5.2 for procedure in gaining access to brake assembly (FIG. 15, Item 25).
- B. Protect the stylus by installing the stylus guard before proceeding with adjustment.
- C. Two (2) screws are used to secure the brake assembly to the shaft of the tonearm and are accessible through the port hole in the control box housing (FIG. 15, Item 17). The first screw is accessible with the tonearm on the tonearm rest and the second by rotating the tonearm turned in toward the center. Loosen both screws sufficiently yet allowing some friction or binding action. **IMPORTANT — CARE MUST BE EXERCIZED IN PREVENTING THE BRAKE ASSEMBLY FROM MOVING UP OR DOWN ON THE TONEARM SHAFT.** (FIG. 9-I)

- D. With the tonearm locked on the tonearm rest, rotate the brake assembly $\frac{1}{32}$ " clockwise (viewed from underside). If the external set-down (edge limit) adjustment prohibited the stylus from setting down in towards the starting groove of Track 1 (146.5 MM calibration), a counter-clockwise adjustment of $\frac{1}{32}$ " should be made if the tonearm was setting down too far into the record.
- E. Lock the first screw securely and rotate the tonearm inward for access to the second screw.
- F. Before re-assembly of the motor assembly base plate (FIG. 15, Item 26), examine the position of the brake assembly bushing and tonearm shaft. They should be *flush* (same level).
- G. Twist the seven (7) small wires from the Tonearm and feed them through the base plate assembly bushing. (FIG. 15, Item 26)
- H. Secure the base plate assembly to the control box housing and check the spacing of the clutch plate (FIG. 9-Q) to electro-magnetic clutch (FIG. 9-U) using a Feeler Gauge inserted through port hole in housing. Spacing should be .015 inches. For clutch spacing adjustment, refer to Paragraph 3.5.6. For wiring color code, refer to FIG. 7.
- I. Reassemble by reversing procedure outlined in Paragraph 3.5.2 (B), 5 through 10.

3.5.6 CLUTCH SPACING ADJUSTMENT

- A. Remove dust cover, turntable mat and platter.
- B. Lock tonearm in tonearm rest.
- C. Invert unit to remove plinth base (FIG. 15, Item 97).
- D. Unplug Molex Connectors B, C, J and ground wires (green wires). See FIG. 7.
- E. Support motorboard and remove plinth (FIG. 15, Item 88).
- F. Check spacing of clutch plate to electro-magnetic clutch (FIG. 9-Q and U) with Feeler Gauge.
- G. Loosen two (2) Allen Screws (FIG. 9-WW) on base of tonearm and lift or lower tonearm until spacing is .015 inches and retighten both Allen Screws. Screws must be seated *snugly*. *Do not overtighten* since this can affect lateral movement of the tonearm due to possible distortion of tonearm shaft. Check by anti-skate test, Paragraph 3.5.11.
- H. Reassemble unit by reversing procedure.
- I. *Before Operating*, Check CARTRIDGE HEIGHT WITH GAUGE P/N 47-1008 and readjust if necessary — refer to Paragraph 3.3 for procedure. For wiring and molex connector location, refer to FIG. 7.

3.5.7 LIMIT AND MUTING SWITCHES (FIG. 9-BB, GG)

Limit and muting switches are part of the base plate (FIG. 15, Item 26) assembly located between the printed circuit board and timing wheel, part of the tonearm housing assembly (FIG. 15, Item 17).

3.5.7.1 FUNCTIONAL DESCRIPTION OF LIMIT AND MUTING SWITCHES

Riveted to the tonearm printed circuit board are two (2) sets of paired beryllium copper leaf springs and silver contacts, actuated by Ramped Bosses molded on the timing wheel (FIG. 9-X). The limit switches operate at separate intervals as the timing wheel is driven by the synchronous motor. Limit Switch #1 (Outer Switch) controls the range of travel of the timing wheel. The contact is closed at the extreme of travel.

Switch Contact No. 2 (Inner Switch) relates to the position of the tonearm and when open prevents the clutch from engaging since the tonearm is in the cued-down position. When the contacts are closed it indicates the tonearm is in the cued-up position.

The Muting Switches also actuated by Ramped Bosses on the timing wheel remain shorted during the tonearm cycle and release at touchdown of the tonearm stylus. It is important that closing and opening of these contacts occurs simultaneously since this is audible and care must be exercised in adjusting both contacts accurately.

3.5.7.2 LIMIT AND MUTING SWITCH ADJUSTMENT

- A. Remove dust cover, turntable and mat.
- B. Lock tonearm in tonearm rest.
- C. Invert unit, properly supported to prevent damage to tonearm.
- D. Remove plinth base (6 screws).
- E. Unsolder tonearm wiring, seven (7) small wires, from printed circuit board. (Do not unsolder two (2) heavy wires from clutch coil.) Unplug Molex Connectors B, C and J.
- F. Remove four (4) screws from base plate assembly (Synchronous motor, timing wheel and printed circuit board are integral part of base plate).
- G. Rotate large drive pulley and observe action of muting and/or limit switches.
- H. Examine silver contacts and beryllium copper leaf springs for foreign matter or contamination. Clean springs and contacts with isopropyl alcohol.
- I. Check visually and electrically with Ohmmeter for positive closing of all contacts and simultaneous closing and opening of muting contacts.
- J. Reform or dress spring contacts with relay contact adjusting tool or long nose pliers with switches in normally open position. Dress leaf springs for parallelism by bending near riveted area and/or contact area. Do not attempt to redress inverted "V" section of springs that are actuated by molded bosses on timing wheel.

3.5.8 CARTRIDGE SENSOR, EDGE AND CENTER LIMIT SENSOR TEST

3.5.8.1 CARTRIDGE SENSOR TEST

- A. Remove plinth base to gain access to tonearm printed circuit board.

- B. Connect voltmeter to TP-1 and ground.
- C. Using sensor reflectivity gauge P/N 47-1009 check for voltage change as outlined in Section III, Paragraph 3.6.

3.5.8.2 EDGE AND CENTER LIMIT SENSOR TEST

- A. Remove plinth base to gain access to tonearm printed circuit board.
- B. Connect voltmeter to LS-1 test point and ground as shown in Section II, FIG. 2.6.E.
- C. *DO NOT* depress any function or track buttons.
- D. Move tonearm manually in towards center of record slowly and observe the voltage change as indicated by Graph LS-1.
- E. Connect voltmeter to test point LS-2 and ground and observe voltage change by moving tonearm toward center, slowly, as indicated by Graph LS-2.

Failure to achieve the results outlined above from either one of the sensors will necessitate replacement and also resetting of the Potentiometer VR-2, as outlined in Section III, Paragraph 3.6.

3.5.9 CLUTCH COIL CONTINUITY TEST

- A. Refer to Paragraph 3.5.8 for access to tonearm printed circuit board.
- B. Remove Molex Connector "B" from electronics printed circuit board.
- C. Check for resistance of 200 OHMS nominal across two (2) heavy wires on tonearm printed circuit board. Trace printed wiring to Molex Connector and recheck at terminal pins for continuity.
- D. If faulty, disassemble base plate assembly (FIG. 15, Item 26) and remove circlip (FIG. 9-II) and shoulder washer (HH) to remove timing wheel.
- E. Unsolder two (2) clutch wires from tonearm printed circuit board terminals and install new timing wheel.
- F. Reverse procedure to reassemble.

3.5.10 CUE PLATFORM ADJUST

- A. Tonearm in cued-up position, depress cue platform and release slowly several times to ensure travel is smooth and cue platform returns to full extension. Tendency towards stickiness or hang-up requires removal as follows:
 1. Remove screw (FIG. 15, Item 10).
 2. Extract cue platform by moving tonearm toward center exerting slight pressure. (FIG. 15, Item 12).
 3. Remove spring (FIG. 15, Item 11).
 4. Examine for dirt accumulation on all items and possible "flash" on cue platform or inside support post. Scrape and wipe clean of particles and reassemble.
 5. Wipe cue platform clean to remove dirt or grease accumulation.
 6. Reassemble and check for smooth operation. Replace assembly if necessary.

7. Readjust by using cartridge height gauge P/N 47-1008.

3.5.11 ANTI-SKATE MECHANISM CHECK

(Ensure that unit is on level surface.)

- A. Power "On".
- B. Tonearm unlocked.
- C. Counterweight rotated towards end of tonearm causing arm to tilt up.
- D. Depress "Track 1" and "Play" Buttons.
- E. Anti-Skate dial setting "0".
- F. Manually swing tonearm half-way into the record.
- G. Rotate anti-skate dial to "1".
- H. Tonearm should slowly rotate towards tonearm rest.

NOTE: Failure to respond to anti-skate check may be due to:

- 1. Weak anti-skate spring (FIG. 9-UU).
 - 2. Lateral friction due to overtightened set screws on base of tonearm.
- Recheck Paragraph 3.5.6 (G).

3.5.11.1 ANTI-SKATE SPRING REPLACEMENT

- A. Install stylus guard.
- B. Lock tonearm in tonearm rest.
- C. Remove turntable and mat.
- D. Invert unit and support carefully.
- E. Remove plinth base.
- F. Unplug three (3) Molex Connectors from tonearm printed circuit board.
- G. Unsolder tonearm, seven (7) small wires, from tonearm printed circuit board.
- H. Remove base plate final assembly (FIG. 15, Item 26).
- I. Remove brake wheel assembly (FIG. 15, Item 25) by loosening two (2) screws accessible through port hole in control box housing (FIG. 15, Item 17). (Swing tonearm in toward center for access to second screw.)
- J. Remove three (3) screws holding control box and tonearm.
- K. Lift tonearm off mounting plate (FIG. 15, Item 13).
- L. Remove cover from underside of tonearm anti-skate housing (FIG. 9-VV).
- M. Observe position of spring wire.
- N. One end of wire is cemented to lever arm. Carefully remove and clean cemented area.
- O. Replace with new spring wire and re-cement with drop of Eastman 910 or Loctite Superbonder.
- P. Reverse procedure and reassemble up to but not including brake wheel assembly (FIG. 15, Item 25). Refer to Paragraph 3.5.12.
- Q. After brake wheel assembly has been installed as per Section III, Paragraph 3.5.12. reverse disassembly procedure to complete assembly of tonearm.

3.5.12 BRAKE WHEEL ASSEMBLY PROCEDURE

- A. Lock tonearm in tonearm rest.
- B. Rotate white screw adjustments on brake wheel to minimum (Full Clockwise).
- C. Feed seven (7) cartridge wires through Brake Wheel Assembly Bushing.
- D. Insert Brake Wheel Assembly over tonearm shaft while holding brake pad (FIG. 15, Item 19) away from brake wheel.
- E. With Tonearm locked in tonearm rest, adjust height of Brake Wheel Bushing to same level as tonearm shaft.
- F. Rotate the Brake Wheel until the edge of the braking surface and an imaginary line drawn through the center of the bushing aligns itself with the edge of the port hole in the control box housing (Item 17).
- G. Tighten screw on Brake Wheel Assembly snugly and rotate Tonearm for access to second screw and tighten.
- H. Follow procedure as outlined in Paragraph 3.5.6, Item F through I.

3.6 SETTING SENSOR SENSITIVITY ADJUSTMENT

Replacement of the cartridge sensor or edge and center limit sensors (FIG. 9 — Z, CC) on the tonearm printed circuit board requires re-adjustment of the internal sensitivity potentiometer to the proper operating voltage due to minor variations in sensor sensitivity.

- A. Remove plinth base (FIG. 15, Item 97).
- B. Connect voltmeter positive side to ground (green wire — common Bus connecting turntable motor to tonearm mounting plate, rear terminal plate, power transformer chassis and control panel).
- C. Connect negative side of voltmeter to TP-1 on Electronics Printed Circuit Board. (TP-1 is Bus Wire Jumper adjacent to 100 MFD 25 Volt Electrolytic Capacitor C 14).
- D. Remove stylus and replace with reflectivity gauge P/N 47-1009.
- E. Set slider on reflectivity gauge for reflective (polished surface) in line with infra-red source.
- F. Adjust potentiometer (VR-2) for -19 Volts reading on voltmeter.
- G. Reposition slider on reflectivity gauge for dull surface in line with infra-red source. Reading should drop to approximately one-quarter ($\frac{1}{4}$) reading on voltmeter.
- H. Failure to achieve this approximate ratio is an indication one of the three (3) sensors in the circuit being faulty. Check each individually as outlined in Paragraph 3.5.8.1 to locate fault.

3.6.1 CARTRIDGE SENSOR OPTICAL ADJUSTMENT

- A. Connect Accutrac to amplifier and speaker system.

- B. Set Sensor Control Knob on Control Panel to 12:00 o'clock and fine adjustment (FIG. 9-OO) to center of cartridge shroud.

IMPORTANT: The exact Sensor Control setting depends on the actual characteristics of the record. The center, or 12:00, position is designed for (EIA) standard recordings. However, commercially available records may vary considerably requiring adjustment of the Sensor Control. For example, records with very narrow spaces between tracks will require turning the control counterclockwise; for records with unusually heavy modulation turn the control clockwise. It is considered quite normal to adjust the control between the 9 and 3 o'clock positions for most of the available records and in more extreme positions for unusual recordings.

Therefore, when following Step E be sure to try different Sensor Control settings.

- C. Power unit.
- D. Select several tracks other than Track 1 on standard record.
- E. Note "Set-Down and Lift" of stylus for set-down at start of record and lift of tonearm after completion of recorded selection. (No obvious lateral shift of tonearm should occur. If lateral movement is present refer to Paragraph 3.4.13.) If stylus sets down into music, move fine adjustment toward right of center of shroud in small increments and recycle turntable to same track selection. Proper adjustment of optical adjustment should set-down before start of music and lift should occur after completion of recorded selection. If fine adjustment of optical sensor occurs at extreme of range, check perpendicularity of cartridge to shroud and parallelism of top of shroud to record.

NOTE: Select a record that is silent on spiral-out groove leading into next track.

3.6.2 SENSOR REPLACEMENT PROCEDURE

- A. Faulty edge and center limit sensors (LS-1, LS-2) located on the tonearm printed circuit board require the replacement of the printed circuit board assembly. Removal requires the unsoldering of the seven (7) small wires and two (2) heavy wires, unplugging the three (3) Molex Connectors and removing four (4) screws that secure the printed circuit board to the base plate. Reverse procedure to assemble.
- B. REMOVE STYLUS BEFORE ATTEMPTING THE FOLLOWING REPLACEMENT PROCEDURE.
Cartridge Assembly Sensor replacement is achieved by loosening and removing the two (2) screws located on the top of the Shroud to release the Cartridge and Finger Lift.
 - a. Unplug three (3) prong plug from Sensor (FIG. 9-XX).

- b. Ease Sensor (FIG. 9-PP) carefully off cartridge body working each end upward in small increments.
- c. Replace with new sensor and snap into position. Plug three (3) prong connector onto sensor.
- d. Locate fingerlift over cartridge mounting holes and insert screws through top of shroud through fingerlift holes and into cartridge mounting holes.
- e. Tighten screws almost snug.
- f. Slide cartridge to rear of slotted holes in shroud and tighten.
- g. Check squareness of cartridge in shroud and re-adjust if necessary.
- h. Replace stylus.
- i. Reset proper operating voltage as instructed in Paragraph 3.6.

3.7 LUBRICATION

The Accutrac 4000 has been factory lubricated and should require no further attention.

Should it become necessary to clean, adjust, or replace the timing wheel (FIG. 9-X), it is recommended that a moderate coating of Dow Corning #111 or equivalent low bleed factor silicone grease be applied to the following areas:

- A. Top Side — Cueing Ramp (FIG. 9-Y).
- B. Toothed Gear Segment.
- C. Underside — Bosses controlling muting and limit switches.

3.8 FUSE REPLACEMENT

CAUTION—UNPLUG UNIT FROM POWER MAINS (LINE) BEFORE SERVICING THIS ASSEMBLY.

Access to the fuses requires the removal of the plinth base (FIG. 15, Item 97).

- A. Fuse 250 MA 250 V is in the ground side of the low voltage secondary transformer winding protecting the reversible synchronous motor and other low voltage circuitry.
- B. The fuse (SLO-BLO Type) in the primary winding of the power transformer provides protection to the overall system and is located within the grey plastic housing on the transformer mounting plate assembly (FIG. 15, Item 67). Component location see FIG. 11.
 - 1. Remove Molex Power Connector "H".
 - 2. Remove two (2) slotted head screws securing cover to assembly.

NOTE: REPLACE EITHER FUSE WITH SAME TYPE AND RATING.

SECTION IV

MISCELLANEOUS

4.1 QUADRAPHONIC CD-4 CONVERSION

- A. Protect stylus by affixing stylus guard to stylus assembly.
- B. Loosen and remove two (2) screws supporting cartridge assembly to shroud.
- C. Set fingerlift aside.
- D. Remove optical sensor molex plug.
- E. With tweezers or long nose pliers carefully remove four (4) color-coded wires from pins on cartridge.
- F. Remove sensor assembly (FIG. 9-PP) from top of cartridge housing by easing sensor upward, working each end in small increments.
- G. Fit sensor on Quad Cartridge and Stylus assembly Model No. LMA-Q and snap into position.
- H. Connect molex connector to sensor assembly.
- I. Reconnect four (4) wires to cartridge pins. Observe color coding of wires and match with color dots adjacent to pins on cartridge assembly.
- J. Locate fingerlift over cartridge mounting holes and insert two (2) screws through slotted holes on top of shroud through fingerlift holes and into cartridge mounting holes.
- K. Tighten screws almost snug.
- L. Slide Cartridge to rear of slotted holes in Shroud and tighten.
- M. Check Cartridge for squareness in Shroud.
- N. Discard pair of audio cables originally supplied with Accutrac 4000 and replace with low capacity audio cables supplied with conversion kit.

SECTION V

SCHEMATICS AND PRINTED CIRCUIT BOARDS

5.1 PLINTH WIRING (FIG. 7)

5.2 SYSTEM SCHEMATIC (FIG. 8)

5.3 MAIN PRINTED CIRCUIT BOARD AND PARTS LIST (FIG. 10)

5.4 POWER SUPPLY ASSEMBLY (FIG. 11)

5.5 RECEIVER SCHEMATIC, PRINTED CIRCUIT BOARD AND PARTS LIST (FIG. 13)

5.6 TRANSMITTER PRINTED CIRCUIT BOARD AND PARTS LIST (FIG. 14)

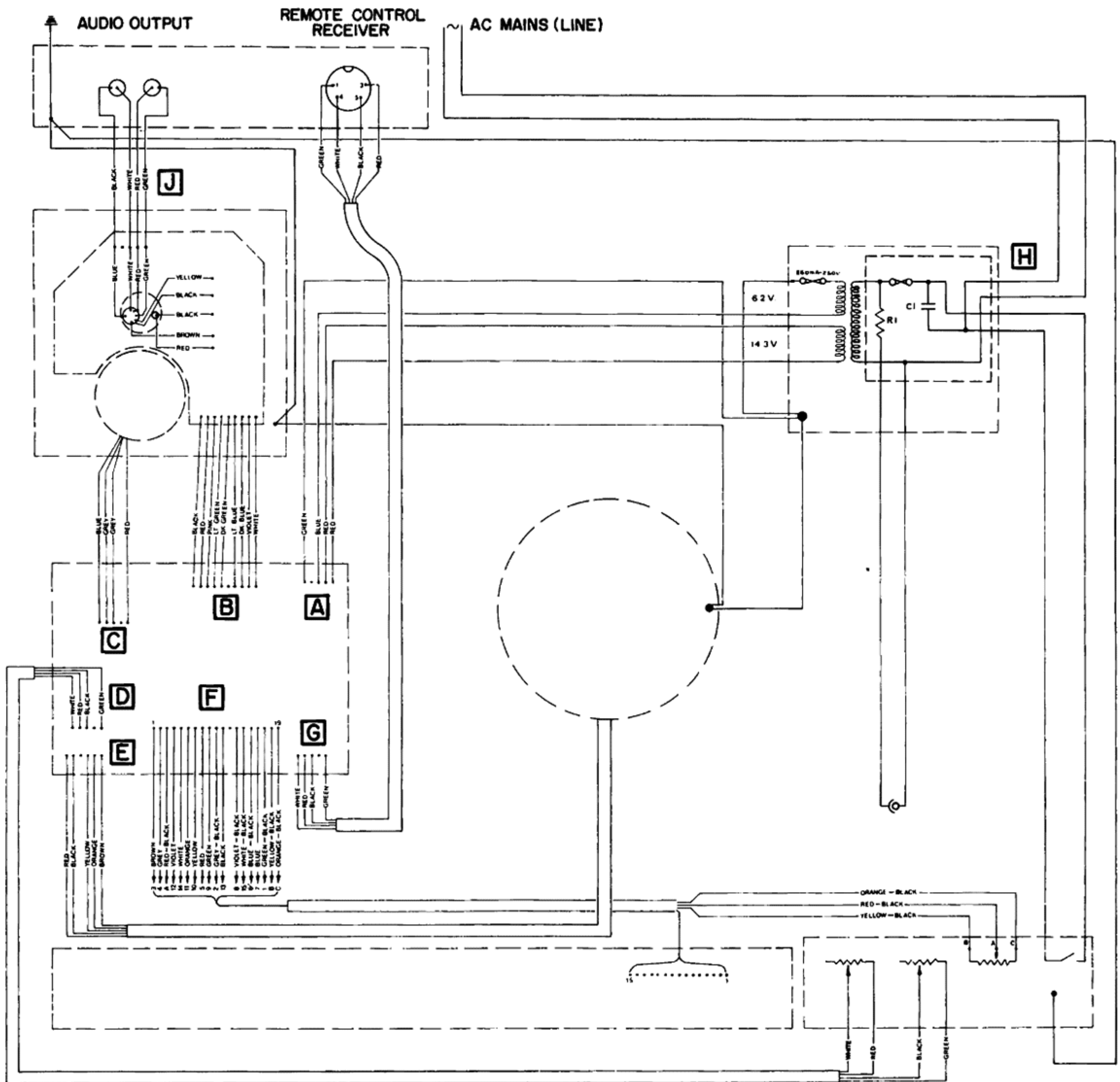
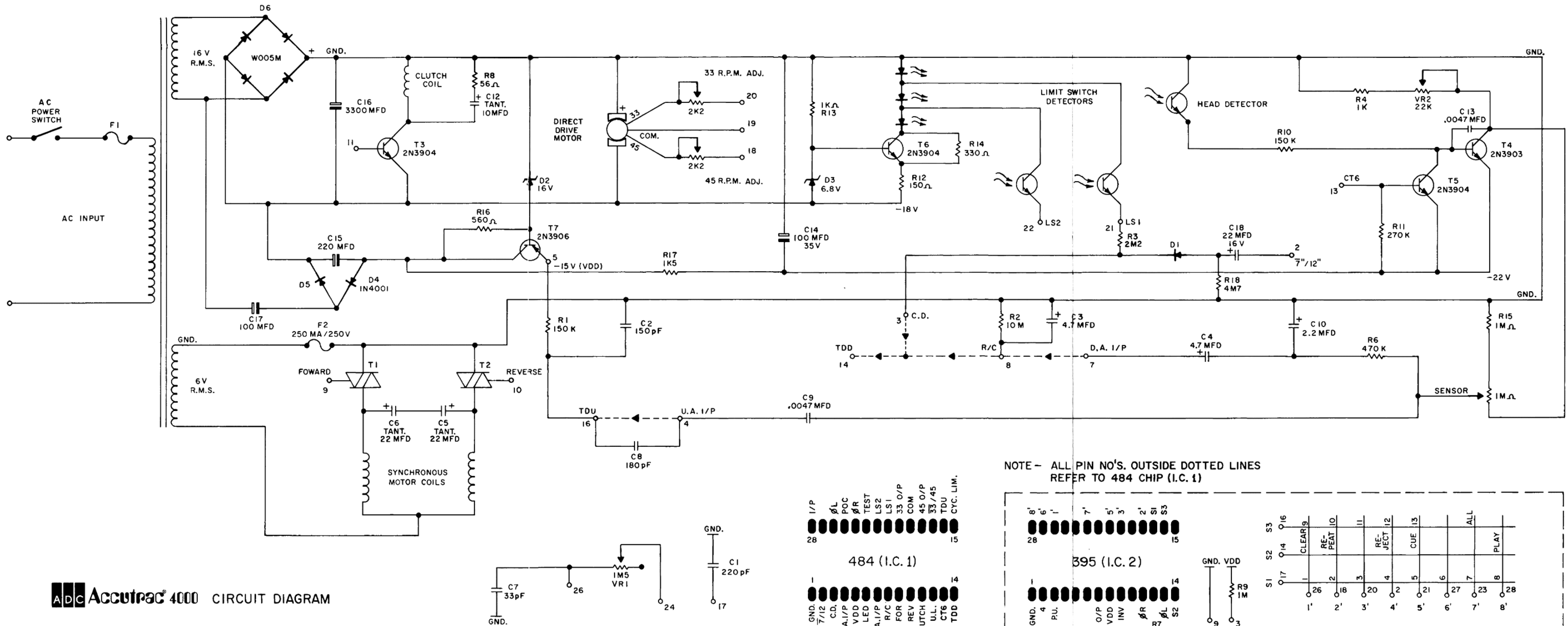


FIG. 7 PLINTH WIRING



ADC Accutrac 4000 CIRCUIT DIAGRAM

FIG. 8 SYSTEM SCHEMATIC



TONEARM ASSEMBLY (ISOMETRIC EXPLODED VIEW)

LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
A	BRAKE WHEEL SCREWS (2)	AA	CLUTCH WIRES
B	7" EDGE LIMIT ADJ	BB	LIMIT SWITCHES
C	HOUSING ACCESS HOLE	CC	SENSOR LS2
D	BRAKE SPRING	DD	MOLEX CONNECTOR "B"
E	BRAKE PAD	EE	REVERSIBLE SWITCH MOTOR
F	TONEARM BASE SCREWS (3)	FF	MOLEX CONNECTOR "C"
G	TONEARM COUNTERWEIGHT	GG	MUTING SWITCHES
H	TONEARM NUT & PIVOT SCREWS	HH	SHOULDER WASHER
I	TONEARM SHAFT	II	CIRCLIP
J	TONEARM WIRE HARNESS	JJ	DRIVE PULLEY
K	ACCESS HOLE EDGE & CENTER LIMIT ADJ	KK	DRIVE BELT
L	TONEARM MTG PLATE	LL	CARTRIDGE ASSEMBLY
M	BRAKE WHEEL	MM	STYLUS ASSEMBLY
N	EDGE LIMIT ADJ SCREW	NN	STYLUS GUARD
O	CENTER LIMIT ADJ SCREW	OO	CARTRIDGE OPTICAL SENSOR ADJ
P	CUE SPINDLE SPRING	PP	CARTRIDGE SENSOR
Q	CLUTCH PLATE	QQ	TONEARM REST
R	CUE SPINDLE	RR	CARTRIDGE
S	CENTER LIMIT REFLECTOR	SS	FINGER LIFT
T	12" 7" EDGE LIMIT REFLECTOR	TT	CARTRIDGE SHROUD
U	ELECTRO-MAGNETIC CLUTCH	UU	ANTI-SKATE SPRING
V	TIMING WHEEL RAMP MUTING	VV	ANTI-SKATE COVER & SCREW
W	TIMING WHEEL RAMP LIMIT	WW	ALLEN SET SCREWS (2)
X	TIMING WHEEL	XX	CARTRIDGE SENSOR MOLEX CONN
Y	CUEING RAMP	YY	CUE BAR SPRING
Z	SENSOR LSI	ZZ	CUE BAR
		AAA	TONEARM HEIGHT ADJ SCREW

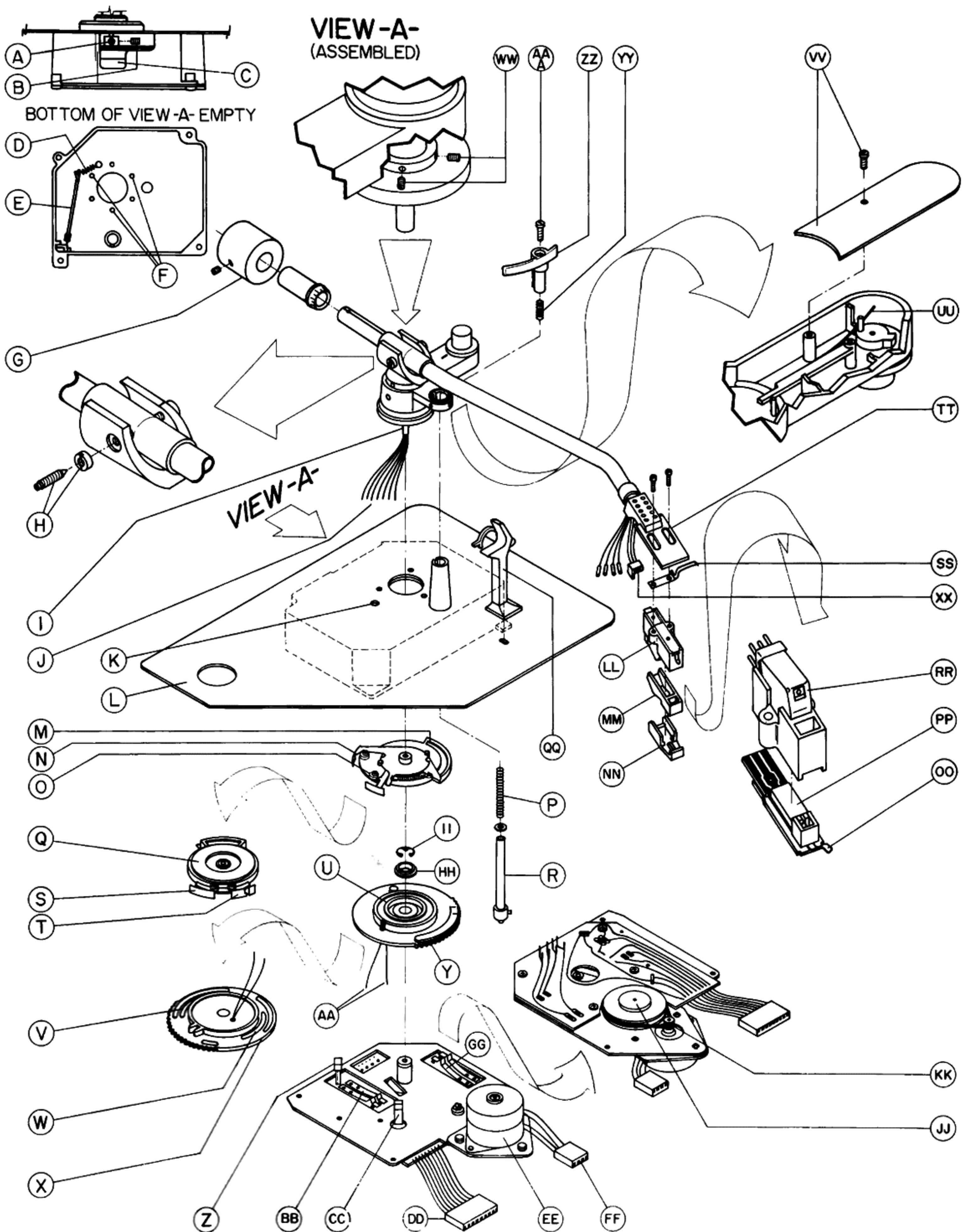
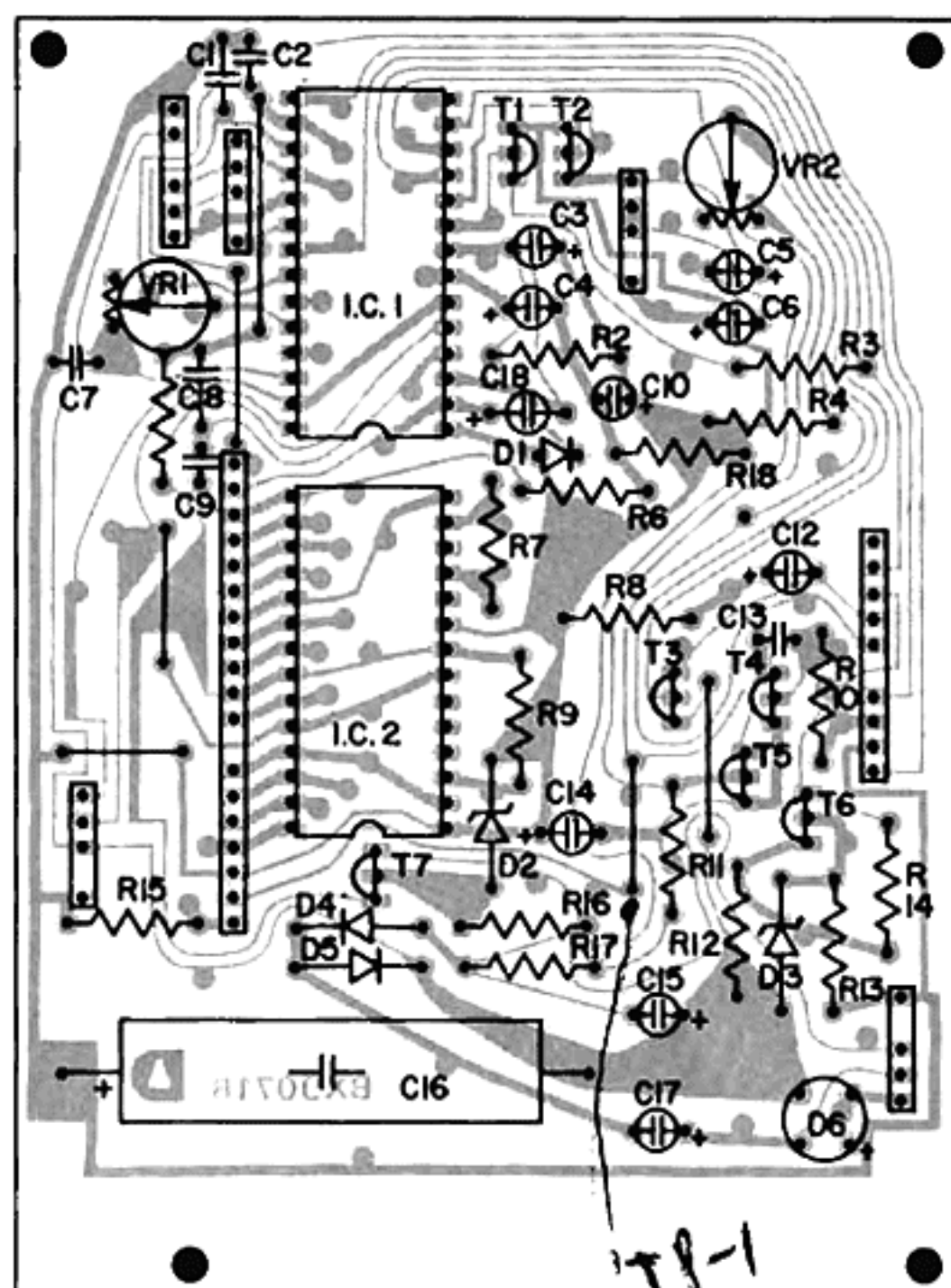


FIG. 9 TONEARM ASSEMBLY (EXPLODED VIEW)



C1	220pf	R1	150K	VR1	1M5
C2	150pf	R2	10M	VR2	47K
C3	4.7mf Tant 16V	R3	2M2	T1	TAG 92-3 MAC 92-3
C4	4.7mf Tant 16V	R4	1K	2	TAG 92-3 MAC 92-3
C5	22mf Tant 26V	R5	Delete	T3	2N3904
C6	22mf Tant 26V	R6	470K	T4	2N3903
C7	35pf 33/39	R7	4M7	T5	2N3904
C8	180pf	R8	56R	T6	2N3904
C9	4700pf	R9	1M	T7	2N3906
C10	2.2mf Tant 16v	R10	150k		
C11	Delete	r11	270K		
C12	10mf Tant 35V	R12	150R	D1	IN4148 or Equiv.
C13	4700pf	R13	1K	D2	16V Zener 1.0W
C14	100mf 35V	R14	330R	D3	6.8V Zener 400mW
C15	220mf 16V	R15	1M	D4	IN4001
C16	3300mf 25V	R16	560R	D5	IN4001
C17	100mf 25	R17	1K5	D6	W005M
C18	22uF 16V Tant	R18	4M7	I.C.1	484
				I.C.2	395

FIG. 10 MAIN PRINTED CIRCUIT BOARD AND PARTS LIST

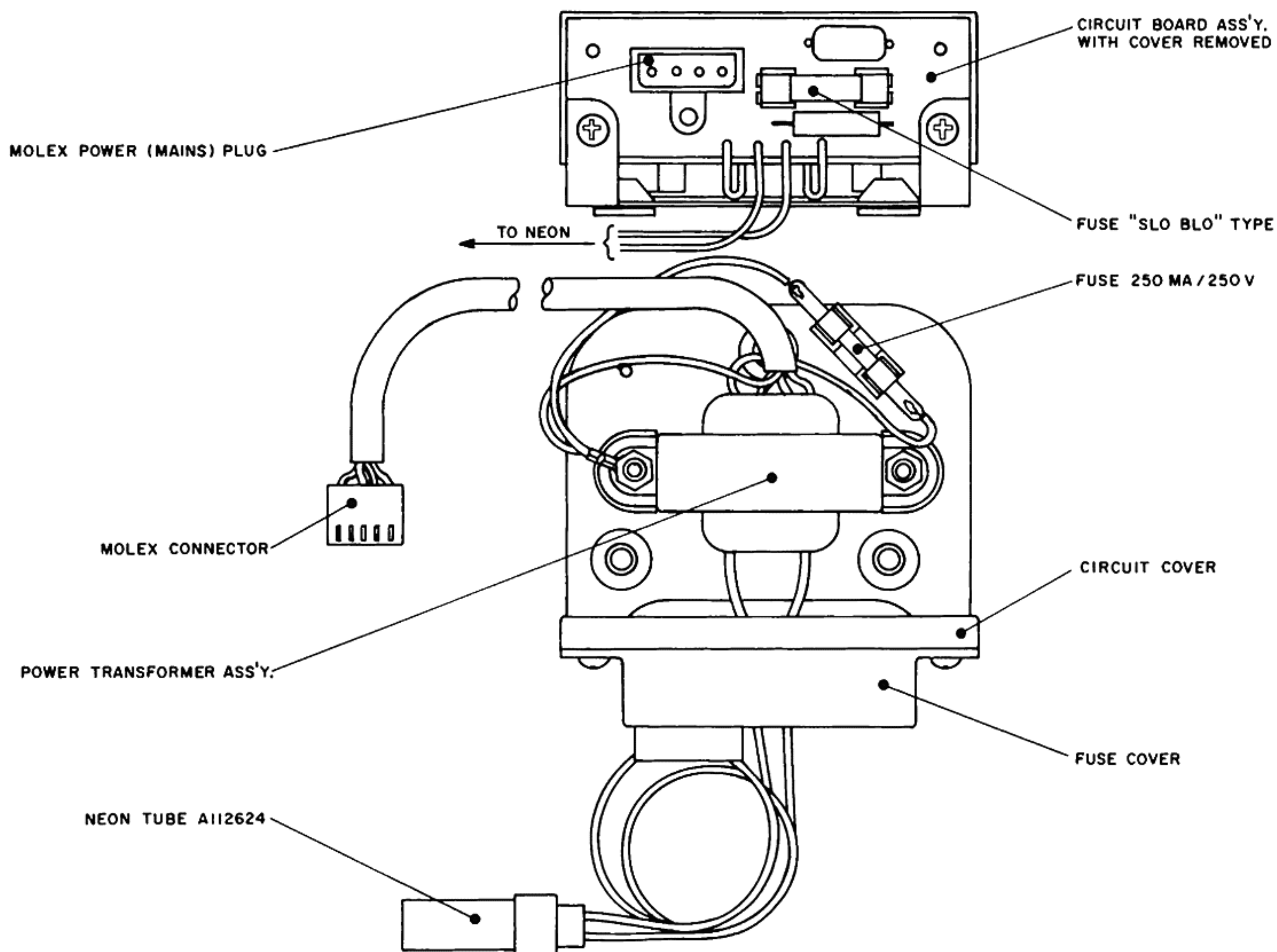


FIG. 11. POWER SUPPLY ASSEMBLY

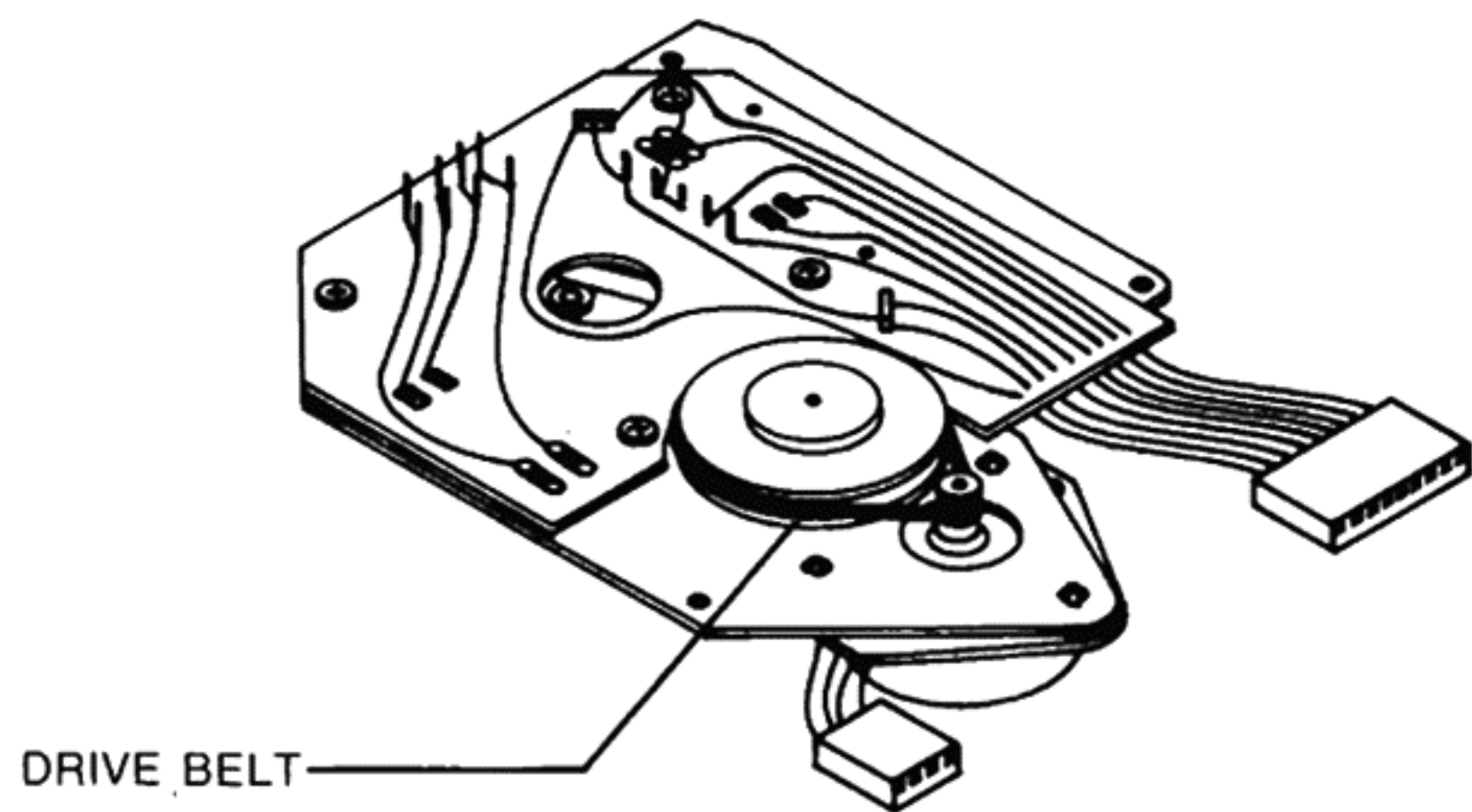
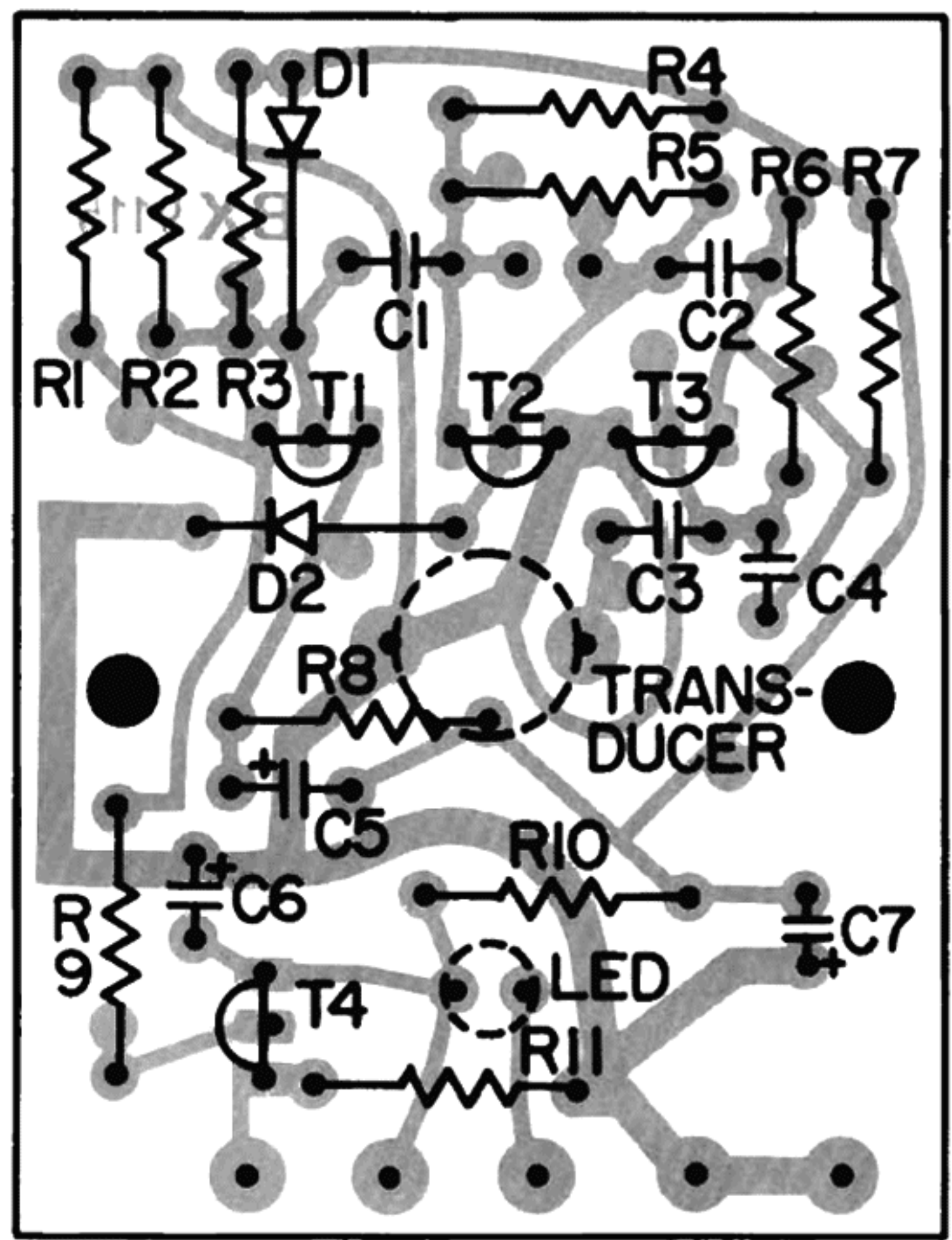


FIG. 12 TONEARM P.C. BOARD, BOTTOM VIEW



- | | | | |
|-----|-----------|------------|--------------|
| C1 | 2200pF | T1 | 2N3904 |
| C2 | 2200pF | T2 | 2N3906 |
| C3 | 2200pF | T3 | 2N3906 |
| C4 | 22pF | T4 | 2N3906 |
| C5 | 4.7uF 25V | D1 | 1N4148 |
| C6 | 10uF 25V | D2 | 1N4148 |
| C7 | 10uF 25V | L.E.D. | XC556R |
| R1 | 8k2 8.2K | Transducer | EFR-RSB-40K2 |
| R2 | 470K | Ring | |
| R3 | 150K | Screws (2) | 4-24-5/16" |
| R4 | 10K | P.B.C. | BX9115 |
| R5 | 1M | | |
| R6 | 1M | | |
| R7 | 10K | | |
| R8 | 33K | | |
| R9 | 10K | | |
| R10 | 1K | | |
| R11 | 1K | | |

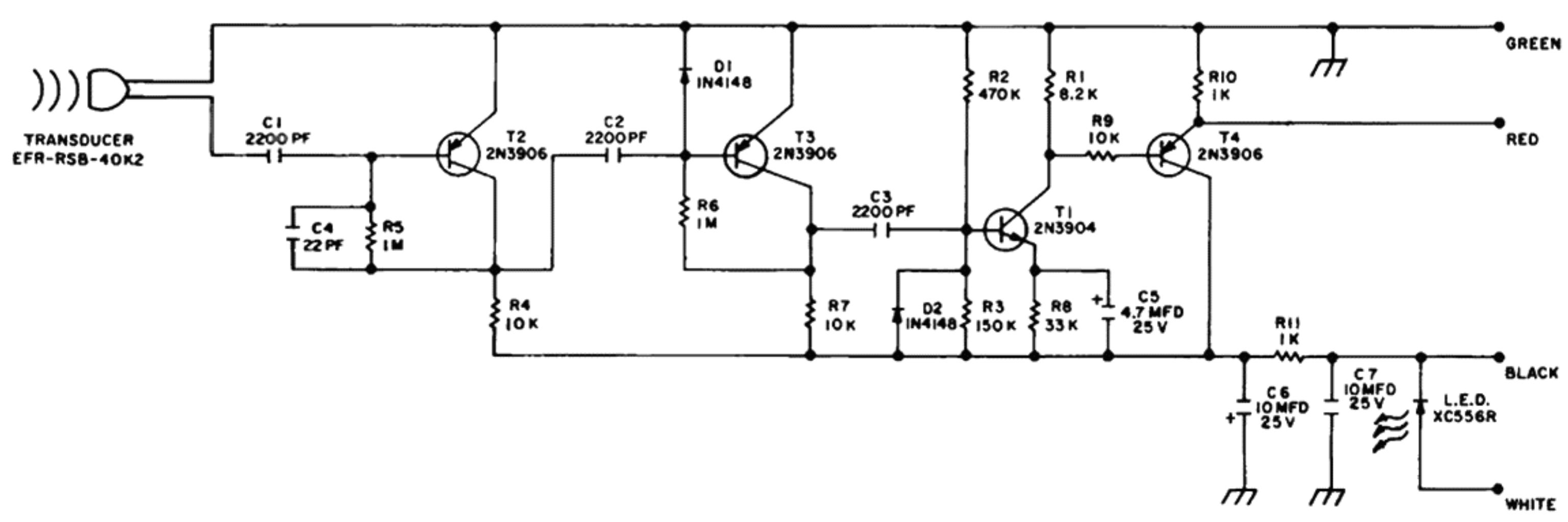
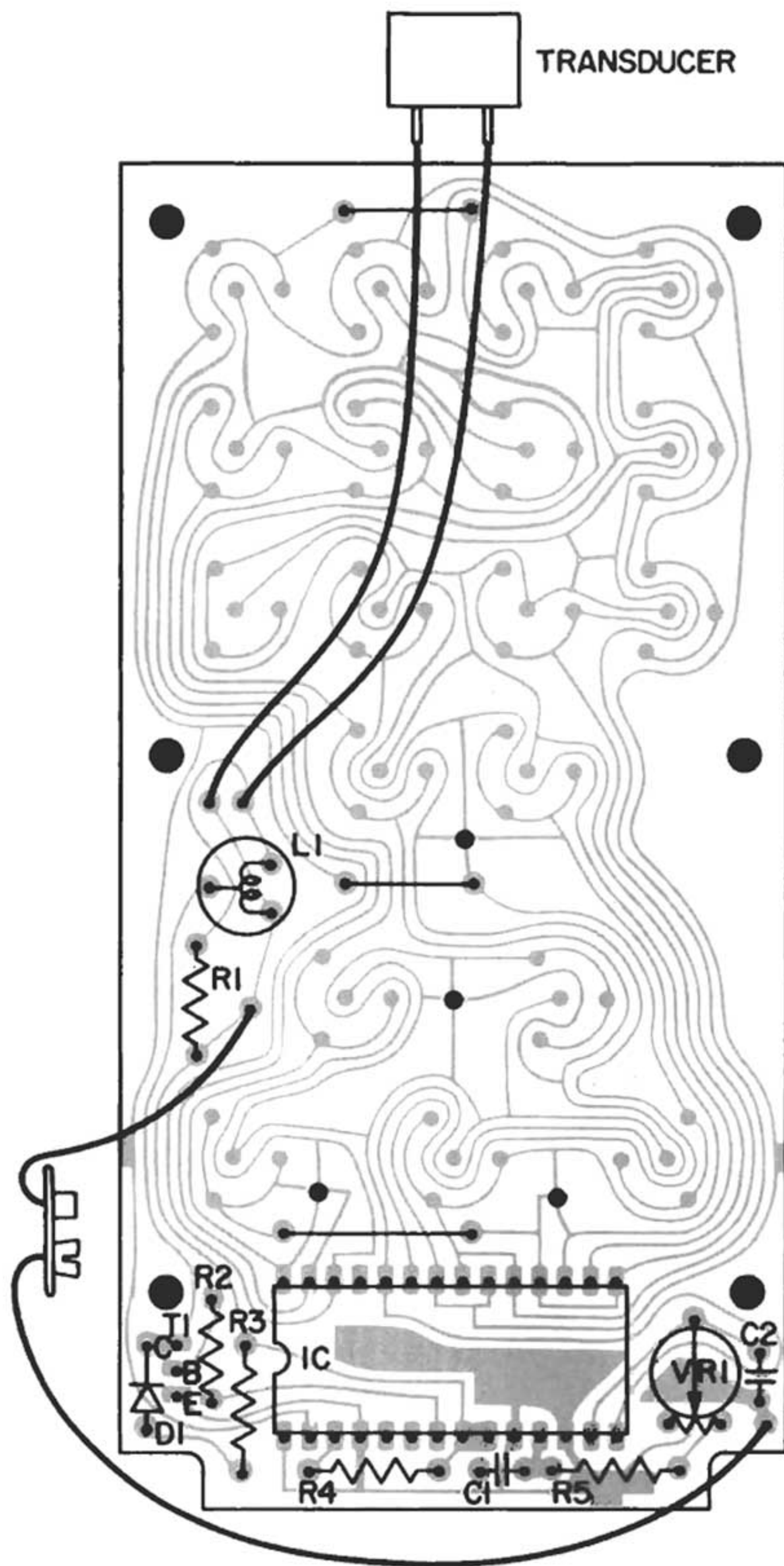
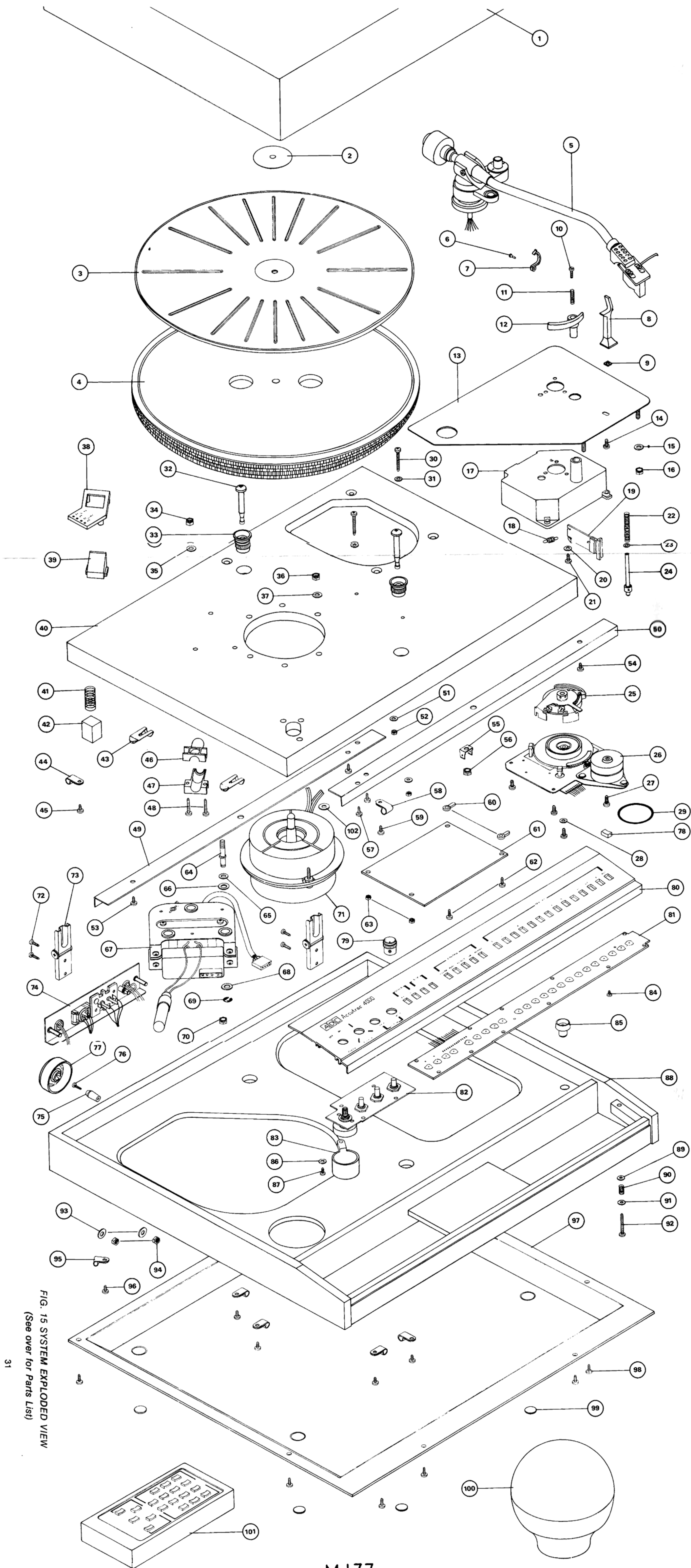


FIG. 13. RECEIVER SCHEMATIC, P.C. BOARD & PARTS LIST



C1	407pf	VR-1	220K
C2	22pf	D1	1N4148
R1	10K	1C	140
R2	10K	L1	Oscillator Coil
R3	330	Transducer	EFR OSB YOK2
R4	1M56	T1	Transistor PNP 71HT
R5	1M56		

FIG. 14 TRANSMITTER PRINTED CIRCUIT BOARD AND PARTS LIST



PARTS LIST (FIG. 15)

ITEM	PART NO.	DESCRIPTION	ITEM	PART NO.	DESCRIPTION
1.	C113043	Dust Cover Ass'y	67.	B112900	Transformer Mounting Plate Ass'y
2.	A111827	T.T. Centre Disc	68.	A101646	Washer (3 off)
3.	C112540	Turntable Mat	69.	A100762	Circlip (3 off)
4.	D112528	Turntable	70.	A113206	Hexagon Nut M4 Stl. N.P. with Nyloc Insert
5.	D112483	Pick-Up Arm	71.	C112873	Motor Ass'y
6.	A112531	Pick-Up Clip Pivot Pin	72.	A113211	Screw Type AB No. 6 x 3/8" Rec. Pan Hd. Brt. Zn. Plt. (4 off)
7.	A112530	Pick-Up Clip	73.	A112231	Friction Hinge (2 off)
8.	B112532	Pick-Up Rest	74.	C112958	Socket Plate Final Ass'y
9.	A113203	Square Pressed Nut 1SO M3 Stl. Pass. Zinc		C113167	Socket Plate Final Ass'y (U.K.)
10.	A113204	Screw 1SO M2.5 x 12 Sltd. Ch. Hd.		C113218	Socket Plate Final Ass'y (Europe)
11.	A112834	Cue Bar Spring	75.	A103544	Adaptor Clip
12.	B112867	Cue Bar	76.	A109849	Wood Screw No. 2 x 3/8" Round Hd.
13.	B112553	Mounting Plate Welding Ass'y	77.	A101371	Adaptor
14.	A113205	Screw 1SO M3 x 8 Rec. Pan Hd. Stl. N.P.	78.	B113374	Button (23 off)
15.	A112630	Washer	79.	A112849	Knob (4 off)
16.	A113206	Hexagon Nut M4 Stl. N.P. with Nyloc Insert	80.	D112636	Escutcheon
17.	D112705	Control Box	81.	D112913	Keyboard Ass'y
18.	A112734	Brake Spring	82.	B112912	Switch Mounting Bracket Ass'y
19.	B112832	Brake Moulding		B113170	Switch Mounting Bracket Ass'y (U.K.)
20.	A112629	Washer (3 off)		B113170	Switch Mounting Bracket Ass'y (Europe)
21.	A113205	Screw 1SO M3 x 8 Rec. Pan Hd. Stl. N.P. (3 off)	83.	B112911	Switch Cover
22.	A112735	Cue Spindle Spring		B113159	Switch Cover (U.K.)
23.	A113051	Washer		B113159	Switch Cover (Europe)
24.	A112842	Cue Spindle Ass'y	84.	A113212	Screw 1SO M3 x 4 Rec. Pan Hd. Stl. N.P. (14 off)
25.	B112881	Brake Wheel Ass'y	85.	A106089	Spring Cup (4 off)
26.	D113029	Base Plate Final Assembly	86.	A112629	Washer (4 off)
27.	A107509	Screw Type B.T.4-24 x 8 Rec. Pan Hd. Brt. Zn. Plt. (4 off)	87.	A113205	Screw 1SO M3 x 8 Rec. Pan Hd. Stl. N.P.
28.	A112629	Washer	88.	E112544	Plinth
29.	A112698	Drive Belt	89.	A112629	Washer (4 off)
30.	A113207	Screw 1SO M3 x 25 Rec. Pan Hd. Stl. N.P. (2 off)	90.	A100807	Spring
31.	A112629	Washer	91.	A112629	Washer (4 off)
32.	A104189	Transit Screw (2 off)	92.	A113207	Screw 1SO M3 x 25 Rec. Pan Hd. Stl. N.P. (4 off)
33.	A112529	Transit Bush (2 off)	93.	A112630	Washer (2 off)
34.	A113206	Hexagon Nut M4 Stl. N.P. with Nyloc Insert (3 off)	94.	A113206	Hexagon Nut M4 Stl. N.P. with Nyloc Insert (2 off)
35.	A112630	Washer (3 off)	95.	A108047	Cable Clamp (5 off)
36.	A113206	Hexagon Nut M4 Stl. N.P. with Nyloc Insert (3 off)	96.	A113208	Screw Type AB No. 6 x 1/4" Rec. Pan Hd. Brt. Zn. Plt. (5 off)
37.	A112630	Washer (3 off)	97.	C112541	Plinth Base
38.	A112550	Escutcheon Marking	98.	A113210	Auto Pilot Wood Screw No. 6 x 10 Rec. Pan Hd. (6 off)
39.	A112525	Prism	99.	A109748	Pad (4 off)
40.	D112543	Motor Board	100.	SX-1	Remote Control Receiver (S.X.1)
41.	A112073	Mounting Spring (4 off)	101.	TX-1	Transmitter
42.	A113127	Mounting Spring Pad	102.	A112630	Washer
43.	A102166	Retaining Clip (2 off)			
44.	A108047	Cable Clamp			
45.	A113208	Screw Type AB No. 6 x 1/4" Rec. Pan Hd. Brt. Zn. Plt.			
46.	A112526	Bulb Clamp			
47.	A112526	Bulb Clamp			
48.	A107418	Screw Type B.T.4.24 x 3/4" Rec. Pan Hd. Brt. Zn. Plt. (2 off)			
49.	B112552	Stiffener Welding Ass'y			
50.	B112552	Stiffener Welding Ass'y			
51.	A112629	Washer (2 off)			
52.	A113209	Hexagon Nut M3 Stl. N.P. (2 off)			
53.	A113208	Screw Type AB No. 6 x 1/4" Rec. Pan Hd. Brt. Zn. Plt. (2 off)			
54.	A113208	Screw Type AB No. 6 x 1/4" Rec. Pan Hd. Brt. Zn. Plt. (2 off)			
55.	A112981	Double Tab			
56.	A113206	Hexagon Nut M4 Stl. N.P. with Nyloc Insert			
57.	A107509	Screw Type BT 4.24 x 5/16" Rec. Pan Hd. Brt. Zn. Plt.			
58.	A108047	Cable Clamp			
59.	A113208	Screw Type AB No. 6 x 1/4" Rec. Pan Hd. Brt. Zn. Plt.			
60.	A112890	Spacer (2 off)			
61.	B113375	Control Board			
62.	A113210	Auto Pilot Wood Screw No. 6 x 10 Rec. Pan Hd. (2 off)			
63.	A113209	Hexagon Nut M3 Stl. N.P. (2 off)			
64.	A112786	Mounting Pillar (3 off)			
65.	A112630	Washer (3 off)			
66.	A101646	Washer (3 off)			

MISCELLANEOUS PARTS LIST

P/O ¹ 67	A112904	Fuse, 250 MA 250 Volt
	A113202	Fuse, 250 MA 250 Volt (U.K.)
	A113202	Fuse, 250 MA 250 Volt (Europe)
P/O ¹ 67	A112905	Fuse (Slo Blo)
	A113078	Fuse (Slo Blo) (U.K.)
	A113078	Fuse (Slo Blo) (Europe)
P/O ¹ 67	A112624	Neon Tube
P/O ² 82	A113410	Switch, Power
	A113169	Switch, Power (U.K.)
	A113169	Switch, Power (Europe)
P/O ²	A113180	Potentiometer — Speed
P/O ² 82	A113179	Potentiometer — Sensor
	B109572	Phono Lead Ass'y — DIN/Phono Plug
P/O ¹ 67	B112850	Transformer, Power
	B113038	Transformer, Power (U.K.)
	B113037	Transformer, Power (Europe)
	B113035	Transformer, Power (Japan)
P/O ³ 100	EX-1	Extension Cable, Receiver

¹See Item #67 (Fig. 15)

²See Item #82 (Fig. 15)

³See Item #100 (Fig. 15)

ADC Accutrac[®]4000

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