

**INSTRUCTION
MANUAL**

**SERIES 2000
TAPE CARTRIDGE
MACHINE**

June, 1985

IM No. 597-0200

BROADCAST ELECTRONICS, INC.



IMPORTANT INFORMATION

EQUIPMENT LOST OR DAMAGED IN TRANSIT

When delivering the equipment to you, the truck driver or carrier's agent will present a receipt for your signature. Do not sign it until you have (a) inspected the containers for visible signs of damage and (b) counted the containers and compared with the amount shown on the shipping papers. If a shortage or evidence of damage is noted, insist that notation to that effect be made on the shipping papers before you sign them.

Further, after receiving the equipment, unpack it and inspect thoroughly for concealed damage. If concealed damage is discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. This item should be unpacked and inspected for damage WITHIN 15 DAYS after receipt. Claims for loss or damage will not be honored without proper notification of inspection by the carrier.

TECHNICAL ASSISTANCE AND REPAIR SERVICE

Technical assistance is available from Broadcast Electronics by letter or prepaid telephone or telegram. Equipment requiring repair or overhaul should be sent by common carrier, prepaid, insured and well protected. Do not mail equipment. We can assume no liability for inbound damage, and necessary repairs become the obligation of the shipper. Prior arrangement is necessary. Contact Customer Service Department for a Return Authorization.

FOR TECHNICAL ASSISTANCE
Phone (217) 224-9600 Customer Service

WARRANTY ADJUSTMENT

Broadcast Electronics, Inc. warranty is included in the Terms and Conditions of Sale. In the event of a warranty claim, replacement or repair parts will be supplied F.O.B. factory. At the discretion of Broadcast Electronics, the customer may be required to return the defective part or equipment to Broadcast Electronics, Inc. F.O.B. Quincy, Illinois. Warranty replacements of defective merchandise will be billed to your account. This billing will be cleared by a credit issued upon return of the defective item.

RETURN, REPAIR AND EXCHANGES

Do not return any merchandise without our written approval and Return Authorization. We will provide special shipping instructions and a code number that will assure proper handling and prompt issuance of credit. Please furnish complete details as to circumstances and reasons when requesting return of merchandise. All returned merchandise must be sent freight prepaid and properly insured by the customer.

REPLACEMENT PARTS

Replacement and Warranty Parts may be ordered from the address below. Be sure to include equipment model and serial number and part description and part number.

Broadcast Electronics, Inc.
4100 N. 24th St., P.O. Box 3606
Quincy, Illinois 62305
Tel: (217) 224-9600
Telex: 25-0142
Cable: BROADCAST

PROPRIETARY NOTICE

This document contains proprietary data of Broadcast Electronics, Inc. No disclosure, reproduction, or use of any part thereof may be made except by prior written permission.

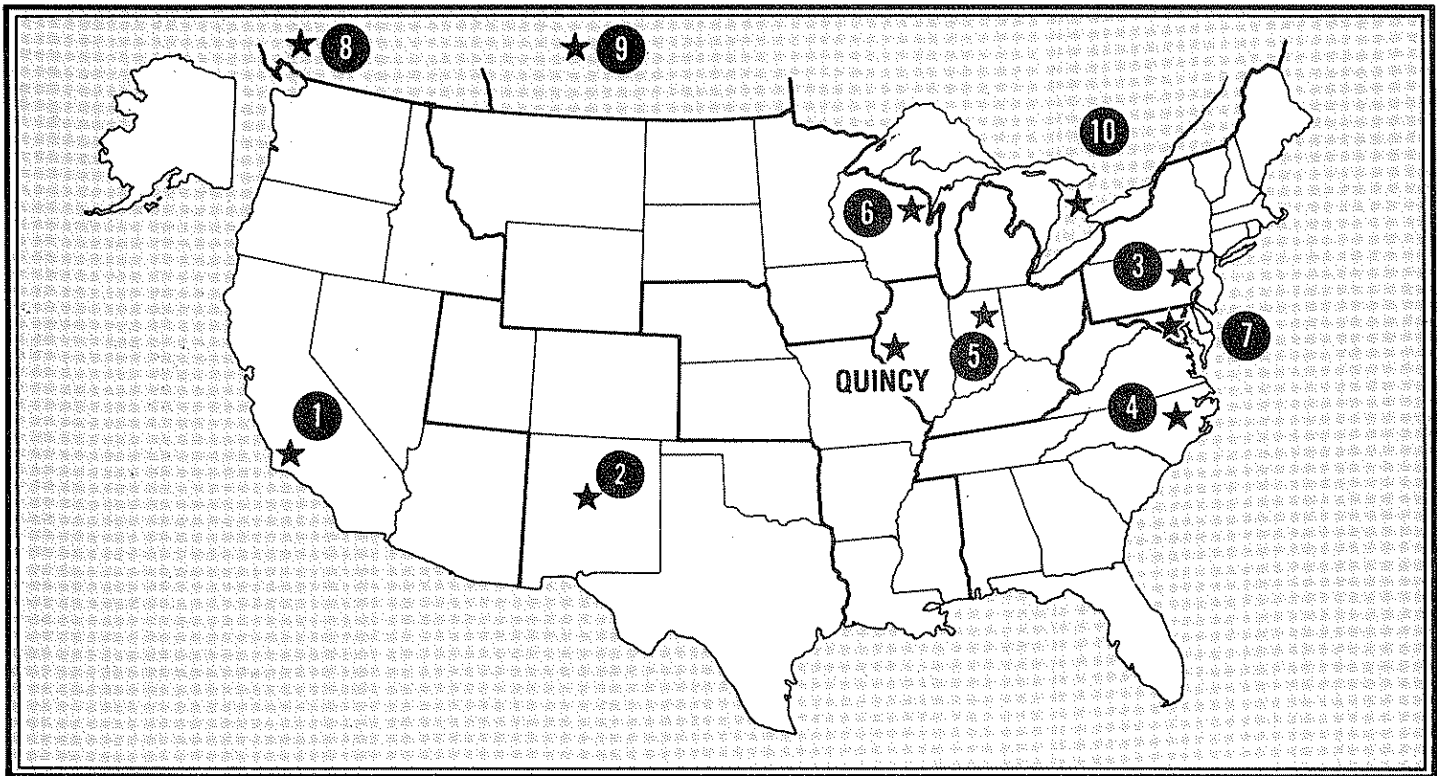
MODIFICATIONS

Broadcast Electronics, Inc. reserves the right to modify the design and specifications of the equipment in this manual without notice. Any modifications shall not adversely affect performance of the equipment so modified.

AUTHORIZED SERVICE CENTERS

• Equipped to serve you with Broadcast Electronics parts and repairs—both in and out of warranty

• Regional depots reduce parts delivery time and repair turn-around time



UNITED STATES

1. Riggins Electronics
3272 E. Willow Street
Long Beach, CA 90815
Ph: (213) 598-7007

States Covered:

Alaska
Arizona
California
Hawaii
Nevada
Oregon
Washington

2. Dyma Engineering
367 Main Street S.E.
Box 1535
Los Lunas, NM 87031
Ph: (505) 867-6700

States Covered:

Colorado
New Mexico
Oklahoma
Texas
Utah

3. Radio Systems Design
5131 West Chester Pike
Edgemont, PA 19028
Ph: (215) 356-4700

States Covered:

Connecticut
Maine
Massachusetts
New Hampshire
New Jersey
New York
Pennsylvania
Rhode Island
Vermont

4. Broadcast Services
Rt. #3, Box 45E
Four Oaks, NC 27524
Ph: (919) 934-6869

States Covered:

Alabama
Florida
Georgia
North Carolina
South Carolina
Tennessee
Virginia
West Virginia

5. Allied Broadcasting Equipment
635 South E. Street
Richmond, IN 47374
Ph: (317) 962-8596

States Covered:

Illinois
Indiana
Kentucky
Michigan
Ohio

6. Electronic Industries
19 East Irving Avenue
Oshkosh, WI 54902
Ph: (414) 235-8930

States Covered:

Iowa
Minnesota
Montana
North Dakota
South Dakota
Wisconsin
Wyoming

7. Midwest Telecommunications
4720-B Boston Way
Lanham (Wash., D.C.) MD 20801
Ph: (301) 577-4903

States Covered:

District of Columbia
Delaware
Maryland

CANADA

8. Nortec West, Ltd.
325 West Fifth Avenue
Vancouver V5Y 1J6,
B.C., Canada
Ph: (604) 872-8525

Provinces Covered:
British Columbia
Yukon Territory

9. Nortec West, Ltd.
705 B Farrell Road
Calgary, Alta., Canada
Ph: (403) 252-8141

Provinces Covered:
Alberta
Manitoba
NW Territory
Saskatchewan

10. J-Mar Electronics, Ltd.
6 Banigan Drive
Toronto M4H 1E9,
Ontario, Canada
Ph: (416) 421-9080

Provinces Covered:
New Brunswick
Nova Scotia
Ontario
Quebec



4100 N. 24th ST., P.O. BOX 3606, QUINCY, IL 62305 U.S.A., TELEX: 25-0142, CABLE: BROADCAST, PHONE: (217) 224-9600

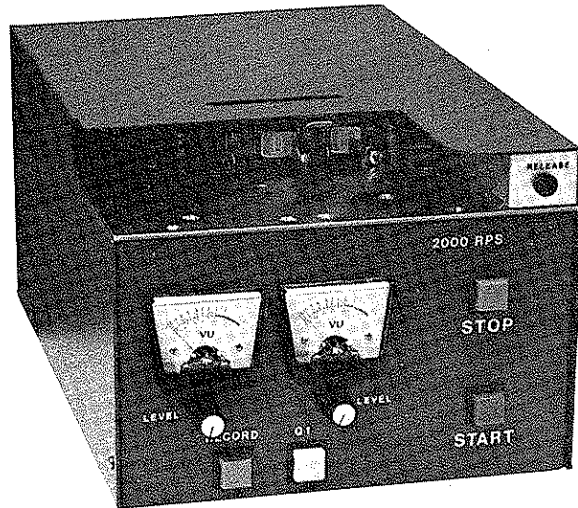
TECHNICAL MANUAL

597-0200

BROADCAST ELECTRONICS

SERIES 2000

TAPE CARTRIDGE MACHINE



597-0200-1

MODEL

STOCK NUMBER

2000P - MONAURAL PLAYBACK
2000RP - MONAURAL RECORD/PLAYBACK
2000PS - STEREOGRAPHIC PLAYBACK
2000RPS - STEREOGRAPHIC RECORD/PLAYBACK

906-2000
906-2001
906-2020
906-2021

OPTIONS

117V ac, 50 Hz Power Source
220/240V ac, 50 Hz Power Source
1.875 IPS Tape Speed
3.75 IPS Tape Speed

906-2004
906-2003
906-2007
906-2006

REFER TO PRICE LIST FOR AVAILABLE ACCESSORIES

TABLE OF CONTENTS

<u>PARAGRAPH</u>		<u>PAGE NO.</u>
SECTION I	INTRODUCTION	
1-1	General Description	1-1
1-5	Specifications	1-1
SECTION II	INSTALLATION	
2-1	Unpacking	2-1
2-3	Installation	2-1
2-4	Audio Output/Input Connections	2-1
2-8	Microphone Input	2-1
2-9	AC Power	2-2
2-11	Remote Control	2-3
SECTION III	OPERATION	
3-1	Introduction	3-1
3-3	Controls and Indicators	3-1
3-5	Operation	3-1
3-6	Playback	3-1
3-11	Record	3-3
3-19	Secondary Cue Tone	3-4
SECTION IV	THEORY OF OPERATION	
4-1	Introduction	4-1
4-3	Theory of Operation	4-1
4-5	Playback	4-1
4-6	Program Channel	4-1
4-7	Cue Channel	4-1
4-10	Start Switch	4-1
4-11	Stop Switch	4-4
4-12	Record	4-4
4-13	Program Channel	4-4
4-14	Record Flip-Flop	4-4
4-18	Bias Oscillator	4-4
4-19	Drive System and Power Supply	4-5
SECTION V	MAINTENANCE	
5-1	Introduction	5-1
5-3	First Level Maintenance	5-1
5-6	Heads	5-1
5-8	Cartridge Tapes	5-1
5-10	Second Level Maintenance	5-2
5-12	Mechanical Adjustments	5-2
5-14	Deck Adjustments	5-2
5-25	Tape Head Alignment	5-4
5-39	Electronic Adjustments	5-9
5-41	Required Equipment	5-9
5-42	Output Level	5-10

<u>PARAGRAPH</u>		<u>PAGE NO.</u>
SECTION V (Cont'd)		
5-44	Playback Equalization	5-10
5-46	Cue Tone Sensor Level	5-10
5-47	Bias Trap Tuning	5-10
5-49	Program Bias Level	5-11
5-50	VU Meter Calibration	5-11
5-51	Record Equalization	5-11
5-52	Cue Bias Level	5-11
5-53	Cue Tone Record Levels	5-12
5-55	Mechanical Parts Replacement	5-12
5-57	Pressure Roller Replacement	5-12
5-61	Head Replacement	5-12
5-66	Belt Replacement	5-14
5-71	Motor Replacement	5-15
5-77	Pressure Roller Latch Replacement	5-16
5-81	Pressure Roller Cross-Shaft Replacement	5-16
5-86	Electrical Parts Replacement	5-17
5-94	Integrated Circuits	5-18

SECTION VI	PARTS LIST	
6-1	Introduction	6-1
SECTION VII	DRAWINGS	
7-1	Introduction	7-1
SECTION VIII	APPENDIX	
8-1	Introduction	8-1

LIST OF TABLES

<u>TABLE NO.</u>	<u>DESCRIPTION</u>	<u>PAGE NO.</u>
1-1	Electrical and Physical Specifications	1-2
3-1	Controls and Indicators	3-2
6-1	Replaceable Parts List Index	6-1

LIST OF ILLUSTRATIONS

<u>FIGURE NO.</u>	<u>DESCRIPTION</u>	<u>PAGE NO.</u>
2-1	Output Connections	2-2
2-2	Input Connections	2-3
3-1	Controls and Indicators	3-1
4-1	Block Diagram	4-2
5-1	Tape Deck Adjustment Screws	5-3
5-2	Pressure Roller Parallelism	5-3
5-3	Underside of Tape Deck (Front)	5-5
5-4	Tracking/Azimuth Alignment	5-6
5-5	Lissajous Patterns for Stereo Phase Adjustments	5-8
5-6	Head Assembly	5-13
5-7	Tape Head Wiring Diagram	5-15

SECTION I
INTRODUCTION

1-1. GENERAL DESCRIPTION.

1-2. Broadcast Electronics Series 2000 Tape Cartridge Machines are designed with reliable performance and easy servicing in mind. A straight-forward design, good electrical specifications, and a wide range of available models make the Series 2000 practical studio equipment.

1-3. The equipment is designed to accept all standard NAB cartridges when operated in a table top mount situation. When dual rack mounted, the unit will accept type A, AA, B, and BB cartridges.

1-4. Standard features include NAB primary (1kHz) and secondary (150 Hz) cue tone circuitry, balanced transformer output assuring quality audio signals with minimal interference, solid-state circuitry, microadjust head brackets, and an indirect drive hysteresis synchronous motor. Full remote control is available through the rear panel connector.

1-5. SPECIFICATIONS.

1-6. Refer to Table 1-1 for electrical and physical specifications.

TABLE 1-1. Electrical and Physical Specifications
(Sheet 1 of 2)

PARAMETER	SPECIFICATIONS
POWER REQUIREMENTS: STANDARD	105 to 125V/210 to 230V; 60 Hz.
OPTIONAL	105 to 125V/210 to 230V; 50 Hz.
POWER CONSUMPTION	45 Watts
REMOTE CONTROL	24-Pin rear panel connector, STOP, START, 150 Hz cue tone logic, 40 mA contact to ground capability, and TELCO telephone answering accessory.
DIMENSIONS:	
WIDTH	8.5 inches (21.6 cm)
HEIGHT	5.625 inches (14.3 cm)
DEPTH	12 inches (30.5 cm)
WEIGHT	20 pounds (9.0 kg), packed.

TABLE 1-1. Electrical and Physical Specifications
(Sheet 2 of 2)

PARAMETER	SPECIFICATIONS
MOTOR	Hysteresis synchronous, indirect drive.
TAPE SPEED	7.5 in/s (19.05 cm/s) $\pm 0.2\%$.
TAPE START TIME	80 milliseconds maximum to reach rated speed.
TAPE STOP TIME	80 milliseconds maximum from rated speed.
EQUALIZATION	NAB, IEC, CCIR as specified.
FREQUENCY RESPONSE	50 Hz to 15 kHz ± 2 dB, exclusive of head contour effect.
DISTORTION	2% or less at rated output.
NOISE (REPRODUCER): MONOPHONIC	62 dB or better below reference of 400 Hz at 3% THD; 54 dB below 160 nWb/m at 1kHz.
STEREOPHONIC	60 dB or better below reference of 400 Hz at 3% THD; 52 dB below 160 nWb/m at 1kHz.
WOW AND FLUTTER	0.15% DIN weighted.
CROSSTALK	50 dB (magnetic head limited).
AUDIO OUTPUT	Maximum adjustable level +8 dBm from 185 nWb/m at 700 Hz; 600 Ohm transformer balanced.
PEAK OUTPUT LEVEL	+16 dBm before clipping.
RECORDER INPUT LEVELS: MICROPHONE	-70 to -25 dBm
LINE	-32 to +18 dBm
CUE TONES	1kHz (Stop, Re-cue) 150 Hz (Secondary, End-of-Message)

SECTION II
INSTALLATION

2-1. UNPACKING.

2-2. The equipment becomes the property of the customer when it is delivered to the carrier. Carefully unpack the cartridge machine. Inspect it to determine if any damage was incurred during shipment. All shipping materials should be retained until it is determined that the unit sustained no damage. Claims for damaged equipment must be filed with the carrier immediately.

2-3. INSTALLATION.

<u>CAUTION</u>	BEFORE CONNECTING THE UNIT TO A POWER
<u>CAUTION</u>	SOURCE, BE SURE TO REMOVE AND DISCARD
<u>CAUTION</u>	THE CLEAR PLASTIC TY-RAP USED TO SECURE
	THE MOTOR TO THE BOTTOM PANEL DURING
	SHIPMENT AND THE CARDBOARD PACKING
	MATERIAL UNDER THE FLYWHEEL.

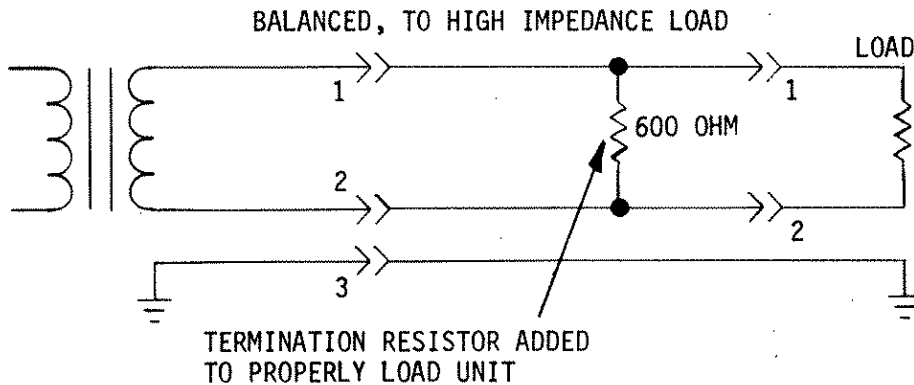
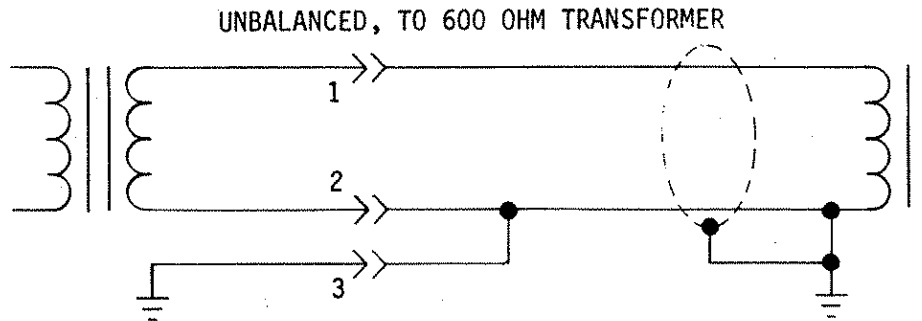
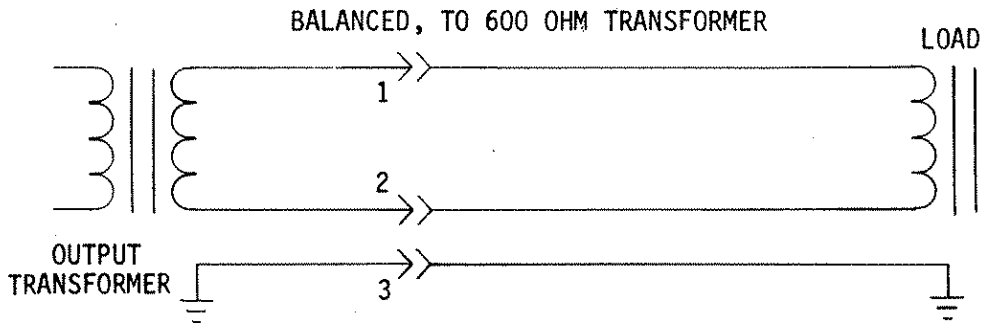
2-4. AUDIO OUTPUT/INPUT CONNECTIONS.

2-5. The rear panel 24-Pin connector (J5) provides audio output and input. The mating plug (P5) may be wired for either balanced or unbalanced operation as shown in Figure 2-1.

2-6. The output level is set for a nominal +8 dBm level and is designed to be connected to a 600 Ohm load. If connected to a higher impedance load, a termination must be provided in the form of a 560 or 620 Ohm resistor across the output to ensure proper frequency response (refer to Figure 2-1 as needed).

2-7. The recorder input channel provides high impedance for high level (-32 to +18 dBm) line signals. If a 600 Ohm source is being recorded, a 600 Ohm terminating resistor as shown in Figure 2-2 must be installed to insure proper frequency response.

2-8. MICROPHONE INPUT. The record input is set at the factory for line level recording. Microphone recording may be done after making the following adjustments to the record circuit board. Refer to schematics C914-1393 and C906-2102 for monaural models and to schematics D914-1397 and D906-2128 for stereo models. For both stereo and monaural machines, jumper pin 11 to pin 12 and pin 10 to pin 13. Stereo machines require an additional jumper from pin 26 to pin 27 and pin 28 to pin 29.



597-0200-2

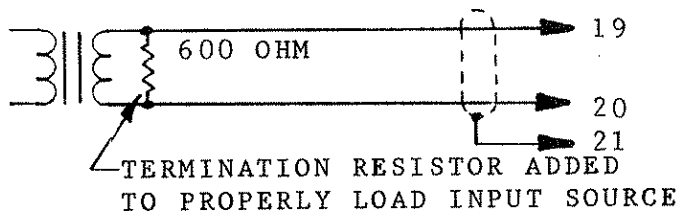
FIGURE 2-1. OUTPUT CONNECTIONS

2-9. AC POWER.

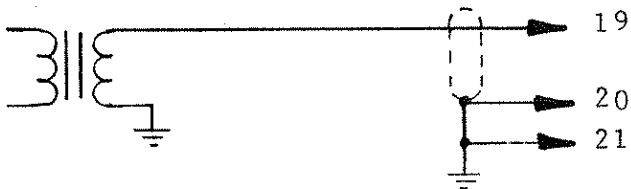
2-10. The standard 2000 cartridge machine operates on 60 Hz ac power at either 105 to 125V or 210 to 230V ac through internal strapping of the power transformer primary. Power supplies for 50 Hz operation on the same voltage ranges or for a 220-240V voltage range are optionally available. Operating voltage requirements are indicated on the rear panel identification plate of the machine.

SCHEMATIC CONNECTIONS

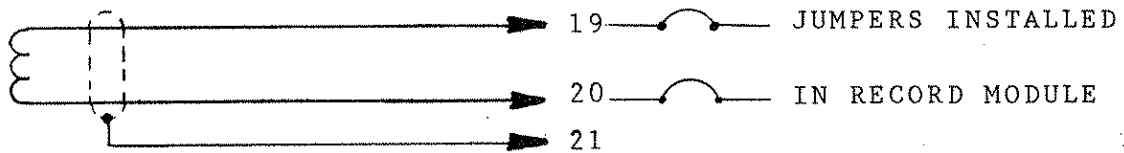
BALANCED LINE FROM 600 OHM TRANSFORMER



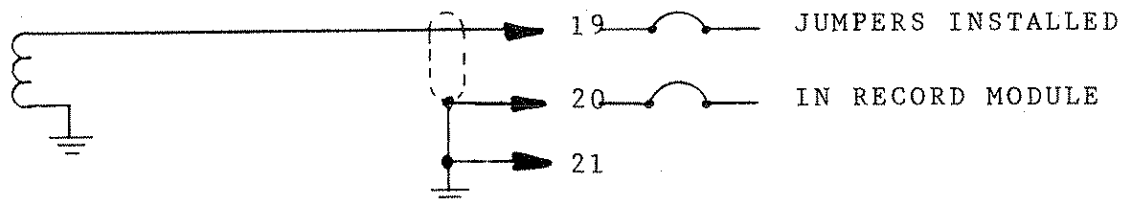
UNBALANCED LINE FROM 600 OHM TRANSFORMER



BALANCED MICROPHONE



UNBALANCED MICROPHONE



597-0200-3

FIGURE 2-2. INPUT CONNECTIONS

2-11. REMOTE CONTROL.

2-12. Remote control capabilities are provided through the rear panel connector J5 to parallel the front panel START/STOP switches and the logic ground output of the 150 Hz (Q1) auxiliary cue sensor. If remote start or stop lamps are used, a 28V dc lamp with a maximum current drain of 40 mA or less should be used. The remote stop lamp will illuminate in the run mode during playback to indicate Q1 presence. Wiring for the rear panel connector is shown in schematic B906-2115.

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. This section provides operating procedures and identifies all controls and indicators associated with the operation of the Series 2000 cartridge machine.

3-3. CONTROLS AND INDICATORS.

3-4. Refer to Figure 3-1 for the location of controls and indicators associated with the unit. The function of each control is described in Table 3-1.

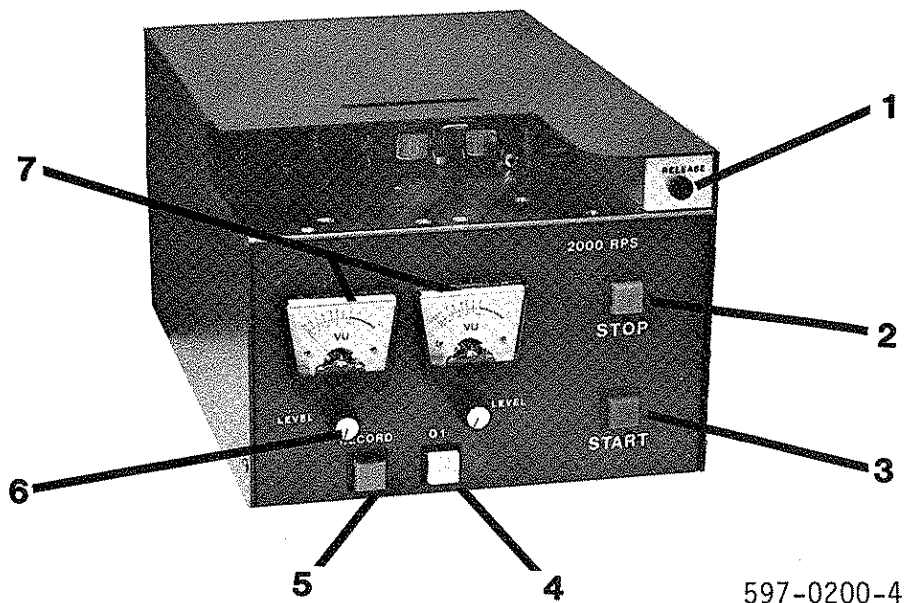


FIGURE 3-1. CONTROLS AND INDICATORS

3-5. OPERATION.

3-6. PLAYBACK.

3-7. Operate the rear panel ON/OFF switch to ON. The STOP switch/indicator will illuminate and the tape drive capstan will begin to rotate. Insert the tape cartridge.

3-8. Momentarily depress the START switch/indicator to place the tape in motion. When the START switch is depressed the STOP indicator will go out and the START indicator will illuminate.

TABLE 3-1. CONTROLS AND INDICATORS

INDEX NO.	NOMENCLATURE	FUNCTION
1	RELEASE Mechanism	Lowers pressure roller so that the cartridge may be removed from the deck.
2	STOP Switch/ Indicator	<p>Switch: Stops tape motion. Cancels playback and record mode.</p> <p>Indicator: Illuminates when power is applied to the unit through the rear panel ON/OFF switch indicating the unit is in the stop mode. Illuminates when a 150 Hz cue tone is detected.</p>
3	START Switch/ Indicator	<p>Switch: Initiates tape motion for the playback and recording processes. In the record mode, inserts a 1kHz stop tone on the tape cue track as tape motion begins.</p> <p>Indicator: Illuminates to indicate the tape is in motion.</p>
4	QI Switch	Inserts a 150 Hz tone on the tape cue track when the unit is in the record mode.
5	RECORD Switch/ Indicator	<p>Switch: Initiates the record mode when depressed.</p> <p>Indicator: Illuminates to indicate that the unit is in the record mode.</p>
6	LEVEL Controls (Potentiometers)	Allows gain level changes of the record amplifiers.
7	VU Meters	Provides level monitoring of the record signal.

3-9. If a 150 Hz (secondary) cue tone is detected during playback, the STOP indicator will momentarily illuminate, however, tape motion will not be affected.

3-10. The tape will automatically stop when a 1kHz stop tone is detected. The START indicator will go out and the STOP indicator will illuminate. The tape may also be stopped prior to the automatic stop by depressing the STOP switch. After the tape has stopped, the cartridge may be removed by pressing the RELEASE mechanism.

3-11. RECORD.

3-12. Operate the rear panel ON/OFF switch to ON. Insert a bulk erased tape into the deck. Select a cartridge at least two seconds longer than the program material to be recorded. Run the tape in the playback mode until the splice travels two or three inches past the head assembly. Avoid recording over the splice, since the audio will drop out or bump on most splices.

3-13. Place the unit in the record mode by depressing the RECORD switch/indicator. The RECORD indicator will illuminate. This action does not effect the STOP indicator which remains illuminated.

NOTE THE UNIT CAN BE PLACED IN THE RECORD MODE ONLY WHEN THE STOP SWITCH/INDICATOR IS ILLUMINATED. THE UNIT WILL NOT ENTER THE RECORD MODE IF THE GREEN START INDICATOR IS ILLUMINATED. CANCEL THE PLAYBACK/RUN MODE BY DEPRESSING THE STOP SWITCH.

3-14. Before starting the recording process, adjust the record gain control. This is accomplished by adjusting the front panel LEVEL controls so that the VU meters, which are active only in the record mode, indicates a maximum 0 VU (100) on peaks.

3-15. After the level is set, re-cue the material to be recorded, and return the unit to the record mode.

NOTE IN THE RECORD MODE, A 1KHZ STOP TONE OF THE PROPER AMPLITUDE AND DURATION WILL AUTOMATICALLY BE RECORDED ON THE TAPE CUE TRACK WHEN THE START SWITCH IS DEPRESSED.

3-16. Start the recording process by depressing the front panel START switch/indicator. The STOP indicator will go out, the START indicator will illuminate, and the 1kHz stop tone will be recorded. Start the material to be recorded allowing a 1/2 second pause after starting the tape.

3-17. The recording may be manually stopped at any point by depressing the STOP switch/indicator. This action cancels the record mode. The RECORD and START indicators will go out and the STOP indicator will illuminate.

3-18. When the recording has been completed, allow the machine to run until it stops automatically. This cues the tape to the beginning of the program and also switches the equipment back to the stop mode.

3-19. SECONDARY CUE TONE.

3-20. The secondary cue tone (150 Hz) is recorded by depressing the white QI switch on the front panel while the unit is in the record mode. The secondary tone is defined as the end-of-message cue and is generally used to automatically activate another device. If the cue tone will be used to start another unit, begin recording the tone just before the program material ends. Another machine can be wired to start at the beginning of the secondary cue tone.

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This section contains a generalized discussion of the theory of operation of the Series 2000 cartridge machine.

4-3. THEORY OF OPERATION.

4-4. Refer to the block diagram in Figure 4-1 for the following description.

4-5. PLAYBACK.

4-6. PROGRAM CHANNEL. The left and right program channels are identical, therefore, only the left channel will be described. The signal from the head assembly is fed into a playback amplifier. The playback amplifier is divided into two stages. The first stage is an integrated circuit preamplifier with high and low frequency equalization. In stereo units, audio from the preamplifier is muted by an FET circuit and applied to an output level control. In mono units, muting is not used. The signal then enters the second stage amplifier. The driver amplifier increases the signal to line level. Lastly, the output of the playback amplifier is transformer coupled to provide balanced line output.

4-7. CUE CHANNEL. Cue audio passes through two stages of amplification which provides NAB equalization. Cue audio is fed to both the 150 Hz and 1kHz adjust controls and then to the cue sensors. The 1kHz sensor assures that only the 1kHz cue tone will be processed. The 150 Hz sensor does the same for the 150 Hz signal, blocking all other signals.

4-8. The 150 Hz signal is routed to the rear panel output connector for external use. Also when sensed, the 150 Hz signal momentarily illuminates the front panel STOP indicator without affecting the operation of the machine.

4-9. The 1kHz signal is disabled at the start of playback by the stop cue mute FET. From the 1kHz cue sensor, the signal is routed to the rear panel connector, to the record circuit board, and to the run flip-flop on the playback board. When the machine is running, the output of the 1kHz cue sensor will reset the run flip-flop, halt the machine, and illuminate the STOP indicator on the front panel.

4-10. START SWITCH. Depressing the START switch sets the run flip-flop for the playback mode and starts the tape in motion. The run flip-flop illuminates the front panel START indicator as the STOP indicator goes out. A ground from the run flip-flop energizes the play solenoid.

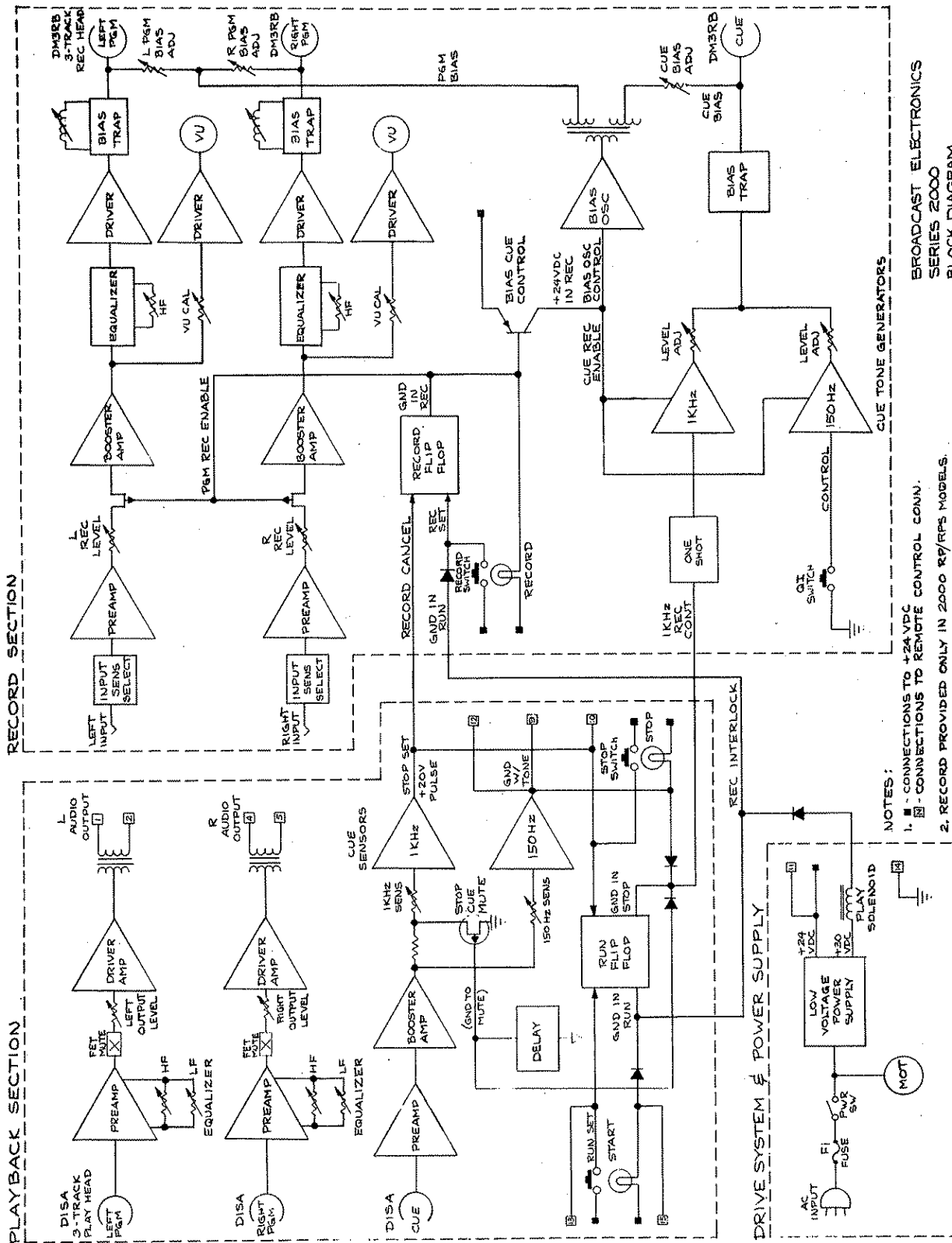


FIGURE 4-1. BLOCK DIAGRAM

4-11. STOP SWITCH. Depressing the STOP switch resets the run flip-flop to the stop mode, halting the tape motion. A signal from the run flip-flop also illuminates the front panel STOP indicator while causing the START indicator to go out.

4-12. RECORD.

4-13. PROGRAM CHANNEL. As the left and right recording channels are identical, only the left channel will be described. The audio input is fed through an input sensitivity selector resistor and the record preamplifier. Amplified audio applied to the front panel record LEVEL control is routed through a FET switch to the input of the booster amplifier which provides additional amplification. The output of the booster amplifier is applied to the record high frequency equalization network, and is also routed to the VU meter circuit consisting of a calibration control, a driver amplifier, and a VU meter. The signal from the high frequency equalizer is applied to the head driver which supplies the required current to drive the record head. The bias trap prevents bias from affecting amplifier operation.

4-14. RECORD FLIP-FLOP. The record flip-flop enables the record electronics when the unit is in the record mode and disables the record electronics at all other times. The record flip-flop is reset to the playback mode when power is first applied to the machine, by a 1kHz cue tone, or by depressing the front panel stop switch.

4-15. When the RECORD switch is depressed, a pulse is applied to the record flip-flop that sets the flip-flop to record. The record flip-flop illuminates the RECORD indicator, activates the bias oscillator, and enables the 1kHz and 150 Hz cue tone generators.

4-16. When the record flip-flop is in the record mode, depressing the START switch on the front panel starts the recording process. As the start switch is depressed, a ground from the run flip-flop energizes the play solenoid. The run flip-flop applies a signal to the one shot timing circuit to record a 1kHz cue tone of set length on the tape cue track.

4-17. QI Switch. When the record flip-flop is set to record and the tape is in motion, a 150 Hz tone can be recorded on the tape cue track by depressing the QI front panel switch. The length of the cue tone is determined by the length of time the switch is depressed, as the 150 Hz cue tone generator is energized only when the QI switch is depressed.

4-18. BIAS OSCILLATOR. The 100 kHz bias oscillator is transformer coupled to the program and cue channels of the record head. The record bias is individually adjusted for each head by individual level controls. Bias traps prevent the record bias from interfering with the recording circuitry.

4-19. DRIVE SYSTEM AND POWER SUPPLY.

4-20. AC is input through fuse F1 which provides overload protection and a power switch which provides control of the primary voltages. Primary ac voltage is applied to the motor and the power transformer. The output of the power transformer is full-wave rectified. A +30 volt potential is applied to the play solenoid and flip-flop circuitry, placing the unit in the stop mode.

4-21. A second output from the power supply is regulated into a +24 volt potential. The regulator is a three-terminal, fixed positive 24 volt regulator, containing internal thermal overload protection and short-circuit limiting features.

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides general maintenance information, mechanical and electrical adjustment procedures, and component replacement procedures for the Series 2000 cartridge machines.

5-3. FIRST LEVEL MAINTENANCE.

5-4. First level maintenance consists of routine cleaning and preventive maintenance procedures which help to maintain high performance from the unit.

WARNING DISCONNECT POWER PRIOR TO SERVICING

5-5. Use of a soft cloth moistened with a mild household cleaner to clean fingerprints and marks from the machine chassis and other surfaces. Remove dust from the interior with a soft brush.

WARNING MOST SOLVENTS WHICH WILL REMOVE TAPE RESIDUE
WARNING ARE VOLATILE AND TOXIC BY THEIR NATURE AND
WARNING SHOULD BE USED ONLY IN SMALL AMOUNTS IN A
WELL VENTILATED AREA, AWAY FROM FLAME,
CIGARETTES, OR HOT SOLDERING IRONS.

WARNING OBSERVE THE MANUFACTURER'S CAUTIONARY
INSTRUCTIONS.

5-6. HEADS.

5-7. At least once a day, heads, pressure roller tape path, guides, and capstan should be cleaned with a suitable cleaning solution to remove accumulated oxide. Demagnetize the heads and other ferrous material in the tape path frequently, about once a week. Use an appropriate degausser, following the directions supplied with the unit. Use care not to scratch the heads during this operation.

5-8. CARTRIDGE TAPES.

5-9. As an inserted cartridge is part of the machine system, a defective cartridge will have adverse affects on machine performance. Before placing a cartridge in service, check the cardridge for cleanliness, mechanical defects, and tape wear. The appendix provides additional information on tape and cartridge maintenance.

5-10. SECOND LEVEL MAINTENANCE.

5-11. Second level maintenance consists of procedures required to restore the unit to proper operation after a fault has occurred. Mechanical and electrical adjustments as well as replacement procedures will be found in this section.

5-12. MECHANICAL ADJUSTMENTS.

5-13. Instructions are provided for the following adjustment procedures:

A. Deck Adjustments

1. Pressure Roller Parallelism Adjustment
2. Push Link Assembly Screw Adjustment
3. Capstan Pressure Adjustment

B. Tape Head Alignment

1. Tracking Height
2. Azimuth
3. Stereo Phasing
4. Penetration

5-14. DECK ADJUSTMENTS. Refer to Figure 5-1 as required for the following procedures.

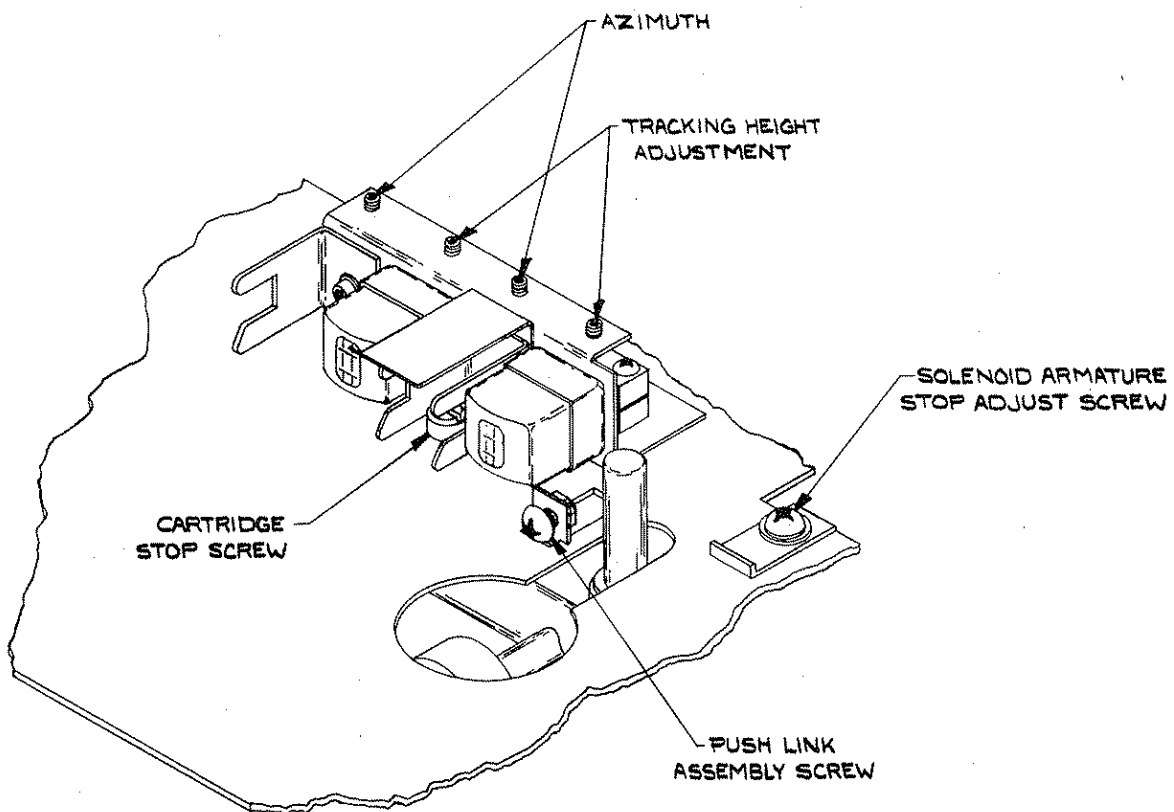
5-15. Required Equipment. A 5 1/2 to 10 minute cartridge, a 7/64 inch (0.3 cm) hex wrench, and a No. 1 Phillips screwdriver are required to perform the deck adjustments.

5-16. Pressure Roller Parallelism. Manually raise the pressure roller by pushing on the push link assembly screw (refer to Figure 5-1). Apply a slight back pressure to the pressure roller until it latches into place. Determine if the pressure roller is parallel to the capstan. When properly adjusted, the surface of the pressure roller will be parallel to the capstan shaft and slightly indented by the capstan shaft (refer to Figure 5-2). If the pressure roller is not parallel to the capstan, an adjustment to the pressure roller latch must be made (refer to Figure 5-3).

CAUTION

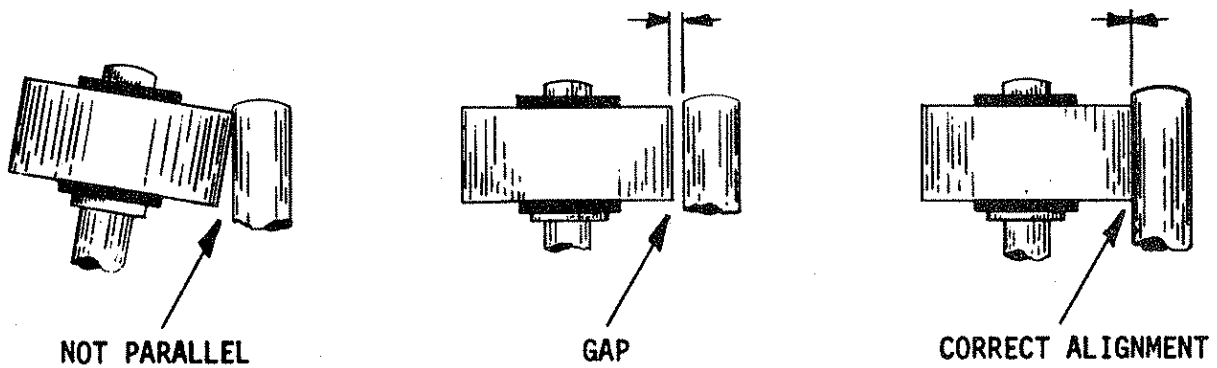
DO NOT REMOVE THE TWO CENTER SCREWS IN THE FRONT OF THE DECK.

5-17. Disconnect ac power, remove the machine cover, and unplug the record head lead jacks from the underside of the deck. To gain complete access to the underside of the deck remove the two flat head screws on the extreme right and left in front, and remove the two pan head screws in the rear of the deck. Lift the tape deck and unplug the two pin motor plugs from the power supply board. Carefully set the deck to the right of the unit.



597-0200-6

FIGURE 5-1. TAPE DECK ADJUSTMENT SCREWS



597-0200-7

FIGURE 5-2. PRESSURE ROLLER PARALLELISM

5-18. Loosen the two latch mounting screws (see Figure 5-3). The latch may be moved forward or backward, as required, to achieve pressure roller parallelism. After each adjustment of the latch, check the pressure roller for the correct alignment. Continue to make slight adjustments of the latch until the pressure roller and the capstan are parallel.

5-19. Before returning the unit to service reconnect the motor/power supply plug and the head lead jacks. Also, be sure that the tape deck is securely fastened to the chassis.

5-20. Push Link Assembly Screw Adjustment. Check the push link assembly screw by slowly inserting a cartridge and noting when the pressure roller latch engages. The latch should engage just as the cartridge comes into contact with the cartridge stop.

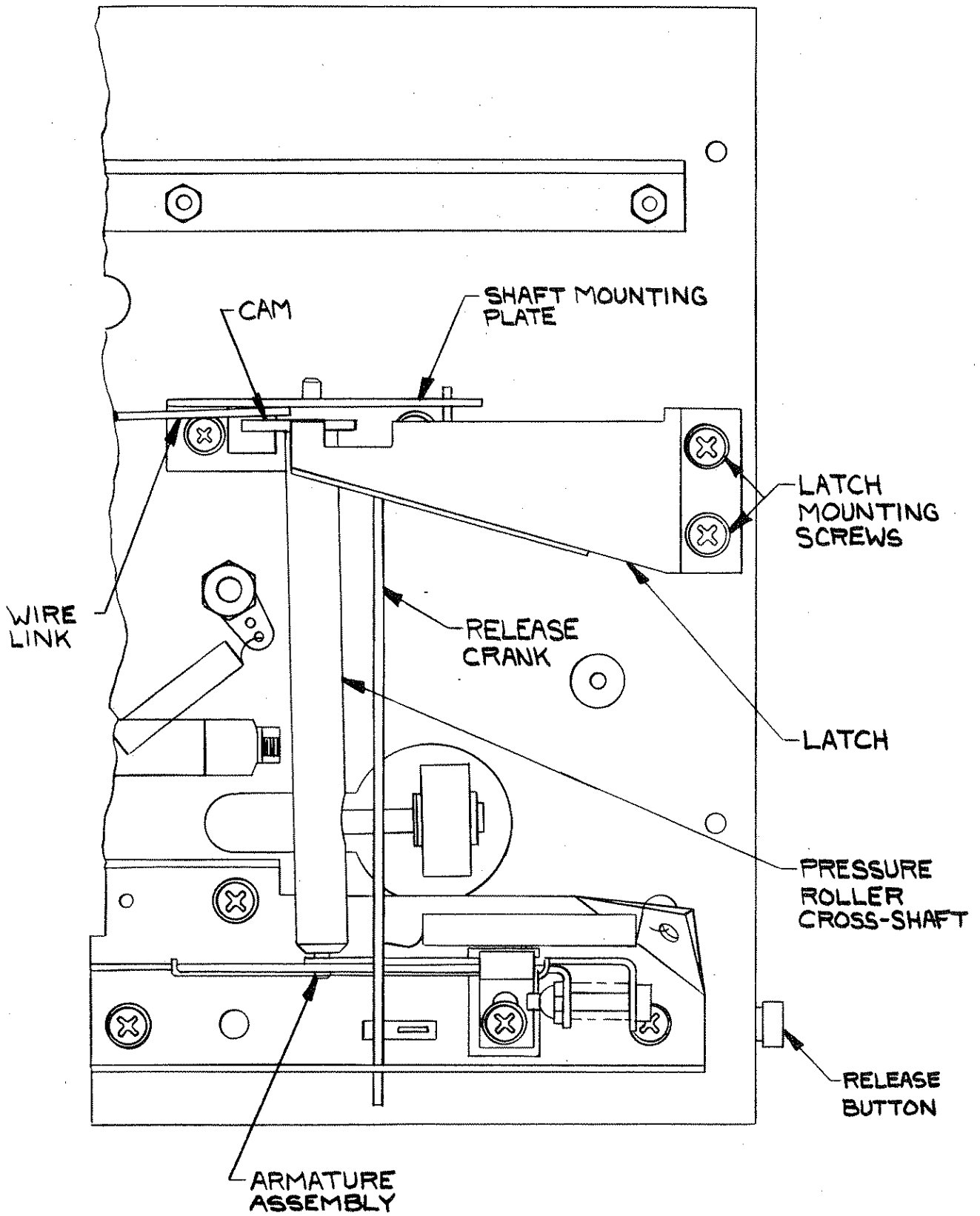
5-21. If the pressure roller latches into place before the tape comes into contact with the stop, adjust the push link screw clockwise. If the pressure roller has not latched into place when the cartridge is against the stop, adjust the push link screw counterclockwise.

5-22. If the tape creeps when the right hand corner of the cartridge is pushed, turn the push link screw 1/4 turn clockwise. If the tape still creeps after this adjustment, check for an excessive gap between the solenoid armature assembly and the solenoid. The gap should be no greater than the thickness of a dime. The distance between the solenoid and the armature assembly can be adjusted by loosening the armature stop screw (see Figure 5-1) and moving the stop mechanism closer to the solenoid.

5-23. Optimum adjustment of the push link assembly screw will vary depending on the cartridge manufacturer. If different brands of cartridges are used, each brand should be tested, and an acceptable compromise setting established.

5-24. Capstan Pressure Adjustment. Insert a cartridge at least 5 1/2 inches in length and start the unit. Insert the 7/64 inch hex wrench through the access opening in the front panel (just below the RELEASE button). Turn the wrench counterclockwise until the tape stops moving. After the tape motion has stopped, turn the wrench approximately 3/4 turn in the opposite direction, or until the tape runs smoothly.

5-25. TAPE HEAD ALIGNMENT. The alignment of a new head or the re-alignment of the present head requires two adjustments, tracking height and azimuth. Stereo machines also require a phasing adjustment. Equipment that functions both as a playback and a record unit requires alignment of the playback head before the record head is aligned.



597-0200-8

FIGURE 5-3. UNDERSIDE OF TAPE DECK (FRONT)

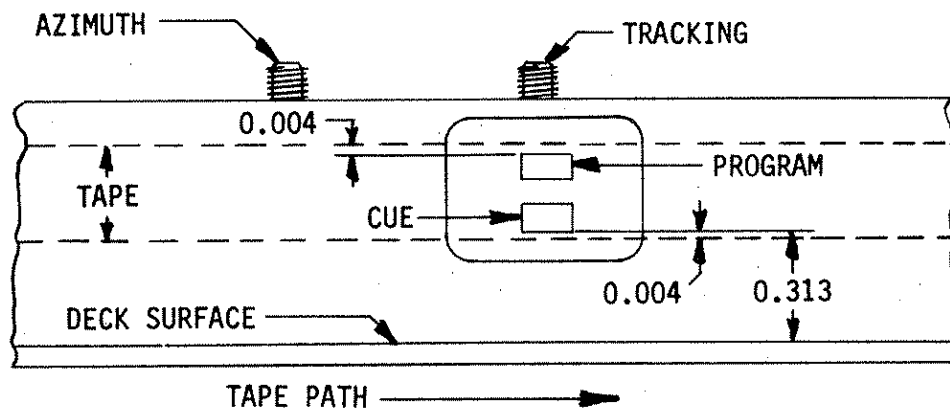
WARNING: DISCONNECT POWER PRIOR TO SERVICING

5-26. Required Equipment. The following equipment is required to complete the head alignment procedure:

- A. 0.05 inch (0.127 cm) hex wrench (included with machine).
- B. A tracking cartridge. (A tracking cartridge may be fabricated from a standard cartridge of approximately 70 seconds in length. The cover and pressure pads must be removed so that the tape travel path across the head may be easily observed. The wire guide should be taped in place at each end to prevent accidental movement of the tape guide.)
- C. Reproduce Alignment Test Tape (BE P/N 808-0004).
- D. Signal Generator (Audio range 20 Hz to 20 kHz).
- E. Bulk-erased Cartridge.
- F. External VU Meter.

5-27. Playback Head Tracking Height. Refer to Figure 5-1 for the location of the tracking adjustment screws. A coarse adjustment of head tracking should be made by measurement. With the 0.05 inch hex wrench, adjust the tracking screw to obtain a spacing of 0.313 inches (0.79 cm) between the deck surface and the lower edge of the head pole pieces (see Figure 5-4).

5-28. Place the tracking cartridge in the deck and set the tape in motion. Hold the cartridge firmly against the deck surface with finger pressure. Observe the tape travel path across the head. Adjust the tracking screw so that the top and bottom pole pieces are equidistant from the top and bottom edges of the tape. The lower edge of the tape guides on the head bracket should be flush against the deck surface.



597-0200-9

FIGURE 5-4. TRACKING/AZIMUTH ALIGNMENT

NOTE WHEN ALIGNING A NEWLY INSTALLED HEAD, IT MAY NOT BE POSSIBLE TO GET CORRECT AZIMUTH READINGS IF THE BRASS CLAMPING NUT HAS BEEN INCORRECTLY TIGHTENED. THIS SITUATION CAN BE CORRECTED BY FIRST LOOSENING THE CLAMPING BLOCK SCREW AND THEN TIGHTENING OR LOOSENING THE CLAMPING NUT SO THAT THE HEAD CAN MOVE FREELY IN A VERTICAL PLANE, BUT DOES NOT MOVE IN THE HORIZONTAL PLANE. RETIGHTEN THE CLAMPING BLOCK SCREW BEFORE CONTINUING.

5-29. Playback Head Azimuth Adjustment. Remove the tracking cartridge and place the response alignment tape in the deck. Set the tape in motion and adjust the azimuth screw (see Figure 5-4) for peak output level at 15 kHz, as observed on an external VU meter. Remove and reinsert the cartridge to verify the adjustments.

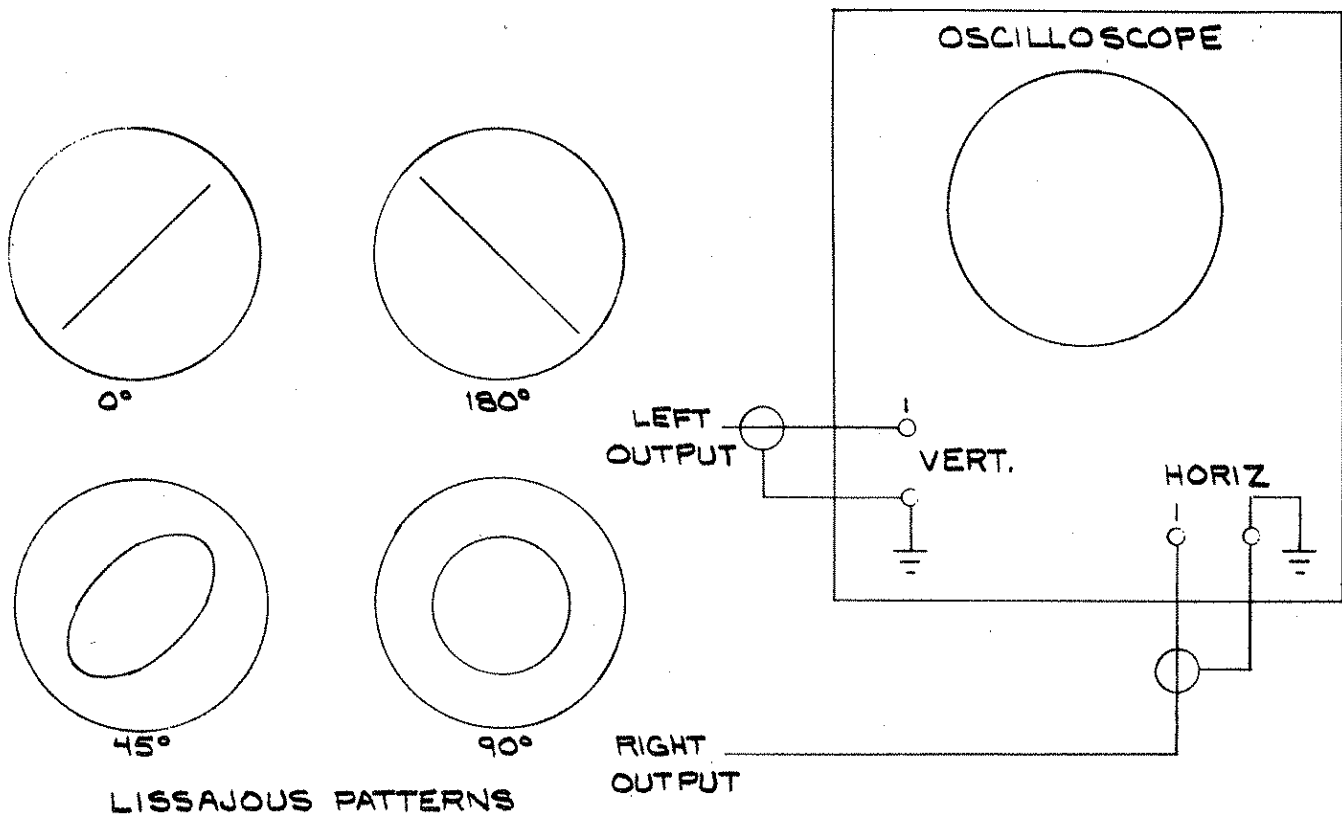
5-30. When the azimuth adjustments are completed, reinsert the tracking cartridge to confirm the tracking height adjustment. If the adjustment has changed, readjust the tracking screw and then check the azimuth adjustment. Continue to reference the two test cartridges against each other until correct head placement is established.

NOTE ADJUST THE OSCILLOSCOPE FOR EQUAL HORIZONTAL AND VERTICAL SENSITIVITY. CONNECT THE SAME SIGNAL SOURCE TO BOTH THE HORIZONTAL AND VERTICAL INPUTS BEFORE PROCEEDING TO ASSURE A ZERO DEGREE PHASE SHIFT IS PRODUCED BY THE OSCILLOSCOPE.

5-31. Phase Adjustment, Playback (Stereo Models). Connect the left output to the vertical channel and the right channel to the horizontal channel of the oscilloscope as illustrated in Figure 5-5. Playback the azimuth adjustment section of the reproduce alignment test tape. Trim the azimuth screw to yield a zero degree Lissajous pattern (see Figure 5-5) at the position nearest the present setting. Remove and reinsert the cartridge to verify the adjustment.

5-32. Record Head Tracking Height. Refer to Figure 5-1 for the location of the record head tracking and azimuth screws. Complete the tracking adjustments as described in paragraphs 5-27 and 5-28.

5-33. Record Head Azimuth Adjustment. Remove the tracking cartridge and place an erased cartridge in the deck. Operate the RECORD switch to ON and feed a 15 kHz signal into the record input of the rear panel REMOTE connector. Adjust the line level control for a program level indication of -10 VU on the front panel VU meter.



597-0200-10

FIGURE 5-5. LISSAJOUS PATTERNS FOR STEREO PHASE ADJUSTMENTS

5-34. Start the tape in motion and adjust the azimuth screw for peak output level at 15 kHz, as observed on an external VU meter. Repeat the procedure to verify adjustments.

5-35. When the azimuth adjustment is completed, verify the tracking adjustment as described in paragraph 5-30.

5-36. Phase Adjustment, Record (Stereo Models). Adjust the oscilloscope for equal horizontal and vertical sensitivity. Connect the left output to the vertical channel of the oscilloscope, and the right output to the horizontal channel as illustrated in Figure 5-5. Connect a 15 kHz signal to the record input. Trim the azimuth screw to yield a zero degree Lissajous pattern (see Figure 5-5) at the position nearest the present setting. Repeat the procedure to verify the adjustment.

5-37. Head Penetration. The head bracket on which the head is mounted is adjustable forward and backward in a horizontal plane. This permits proper penetration of the head into the cartridge and allows compensation for the various types of pressure pads in common use. The bracket is factory adjusted for use with Fidelipac brand cartridges equipped with teflon coated foam pads, but may be changed for use with other pads as required. Generally, the factory adjustment is adequate for most cartridges.

5-38. By loosening the two head assembly retaining screws, the head bracket may be moved forward or backward as desired. The best adjustment is obtained when the head penetration into the cartridge is approximately 9/32 inch (0.71 cm) when measured from the leading edge of the cartridge to the face of the head. Essentially, this is equal to half depression of the foam pads on a cartridge. Correct adjustment is important in order to prevent excessive head wear and loss of high frequency response.

5-39. ELECTRONIC ADJUSTMENTS.

5-40. Access to all electronic components is achieved by removing the machine cover. Before performing any electronic adjustment, the tape heads should be properly aligned, cleaned and demagnetized. Instructions are provided for the following adjustments:

- A. Output Level
- B. Playback Equalization
- C. Cue Tone Sensor Level
- D. Bias Trap Tuning
- E. Program Bias Level
- F. VU Meter Calibration
- G. Record Equalization
- H. Cue Bias Level
- I. Cue Tone Record Levels

NOTE

PLAYBACK ELECTRONICS SHOULD BE ADJUSTED
BEFORE RECORD ELECTRONICS.

5-41. REQUIRED EQUIPMENT. The following equipment is necessary to perform electronic adjustments:

- A. Reproduce Alignment Test Tape (BE P/N 808-0004).
- B. Cue Tone Test Cartridge (Ordering Information Available on Request).
- C. Audio Signal Generator (Range 20 Hz to 20 kHz).
- D. High Impedance Voltmeter.
- E. Miniature Tip Non-metallic Flat Blade Screwdriver.
- F. A Bulk-Erased Cartridge.
- G. External VU Meter.

5-42. OUTPUT LEVEL. Refer to the playback circuit board assembly diagram, C914-1390 (mono) or D914-1400 (stereo), as required for information pertaining to the following adjustment.

NOTE AUDIO OUTPUT IS FACTORY ADJUSTED FOR +8
dBm INTO A 600 OHM BALANCED TRANSFORMER
NOTE AND REFERENCED AT 160 nWb/m.

5-43. Connect an external VU meter to the output terminals of the rear panel REMOTE connector. Insert the reproduce alignment test tape into the deck. While reproducing the NAB operating level tone, adjust the output level control on the playback board for the desired output as measured on the external meter.

5-44. PLAYBACK EQUALIZATION. While reproducing the 50 Hz tone from the reproduce alignment test tape, adjust the low end equalization control on the playback board for -10 VU (10 dB below the audio output level setting) as measured on an external VU meter.

5-45. Reproduce the 10 kHz test tone and adjust the high end equalization control for -10 VU (10 dB below the audio output level setting) as measured on an external VU meter.

NOTE THE 1 KHZ STOP TONE IS DISABLED FOR THREE
SECONDS WHEN THE START SWITCH IS DEPRESSED.
NOTE DO NOT ATTEMPT TO ADJUST THE SENSOR LEVEL
CONTROL UNTIL THREE SECONDS HAVE ELAPSED
NOTE AFTER THE TAPE IS PUT INTO MOTION.

5-46. CUE TONE SENSOR LEVEL. Both the 150 Hz and 1kHz cue tone sensor controls, located on the playback circuit board, can be adjusted while reproducing a cue tone test cartridge. As the 1kHz stop tone is reproduced, adjust the 1kHz sensor so that the cue tone just stops the tape motion. As the 150 Hz tone is reproduced, adjust the 150 Hz sensor so that the cue tone momentarily illuminates the front panel STOP indicator. The tape motion should not be effected by the 150 Hz tone, and the START indicator should remain illuminated.

5-47. BIAS TRAP TUNING. This adjustment is required on record models only. Refer to the record circuit board assembly diagram, C914-1393 (mono) or D914-1397 (stereo), for information pertaining to the following adjustments.

5-48. Connect the voltmeter between the bias trap test point and ground. Depress the RECORD switch. Do not supply any signal to the record input. With a non-metallic screwdriver, tune the bias trap for a minimum reading on the voltmeter.

NOTE

THE BIAS SUPPLIED TO THE RECORD HEAD IS MOST IMPORTANT IN PROVIDING OPTIMUM FREQUENCY RESPONSE. BIAS REQUIREMENTS VARY BETWEEN BRANDS OF TAPE AND EVEN BETWEEN SERIES OF ONE BRAND. IF MORE THAN ONE TYPE OF TAPE IS TO BE USED IN A MACHINE, CHECK THE PERFORMANCE OF EACH TYPE AT ITS OPTIMUM BIAS LEVEL AND ADJUST AS REQUIRED FOR INDIVIDUAL NEEDS. WHERE OLD AND NEW TAPES ARE BOTH IN USE, A BIAS LEVEL JUST LESS THAN THE OPTIMUM FOR THE NEWER TAPE WILL USUALLY PROVIDE AN ACCEPTABLE COMPROMISE.

NOTE

NOTE

NOTE

NOTE

NOTE

NOTE

5-49. PROGRAM BIAS LEVEL. Insert a bulk-erased cartridge into the tape deck. Connect an audio signal generator to the rear panel REMOTE connector record input terminals and set the generator for 700 Hz at a level of 0.5 Volt. Adjust the front panel LEVEL control(s) for -10 VU as measured by the front panel meter(s). Connect an external VU meter to the output terminals of the rear panel connector. Begin recording the 700 Hz tone. Observe the external meter and adjust the program bias adjust control for peak output. When this adjustment is complete, recheck the bias trap tuning adjustment.

5-50. VU METER CALIBRATION. While recording a 700 Hz tone, adjust the VU meter calibration control on the record circuit board until the front panel meter indicates 0 VU.

NOTE

DO NOT ADJUST THE FRONT PANEL LEVEL CONTROL DURING THE RECORD EQUALIZATION ADJUSTMENT.

NOTE

5-51. RECORD EQUALIZATION. Set the signal generator for 15 kHz. Adjust the generator output for 10 dB below the signal generator output level used in the VU meter calibration procedure. While recording the 15 kHz tone, adjust the high frequency adjust control on the record board for -10 VU on the external VU meter (10 dB below the established output level).

5-52. CUE BIAS LEVEL. Refer to the record circuit board assembly diagram as required. Connect the voltmeter to terminals 1 and 2 on the record circuit board. Do not load a cartridge into the deck but depress the RECORD switch and then the START switch. Wait three seconds to avoid the 1kHz sensor delay and then adjust the cue bias adjust control for 5 volts as measured on the voltmeter.

5-53. CUE TONE RECORD LEVELS. Refer to the playback circuit board diagram, C914-1390 (mono) or D914-1400 (stereo), as required. Connect the voltmeter to the cue head input. Load a bulk-erased cartridge in the deck and depress the RECORD switch. Do not depress the START switch. Instead, manually put the tape in motion by pressing the solenoid play armature against the solenoid. While holding the armature in place, record a continuous 1kHz stop tone and adjust the 1kHz level adjust control, on the record circuit board, for a reading of 0.45 mV on the voltmeter. Release the solenoid/armature.

5-54. Depress the START switch, wait approximately three seconds and then depress and hold the QI switch, to continuously record a 150 Hz cue tone. While recording this tone, adjust the 150 Hz level adjust control, on the record circuit board, for a reading of 0.3 mV on the voltmeter.

5-55. MECHANICAL PARTS REPLACEMENT.

WARNING DISCONNECT POWER PRIOR TO SERVICING.

5-56. Instructions are provided for the following replacement procedures:

- A. Pressure Roller Replacement
- B. Head Replacement
- C. Belt Replacement
- D. Motor Replacement
- E. Pressure Roller Latch Replacement
- F. Pressure Roller Cross-Shaft Replacement

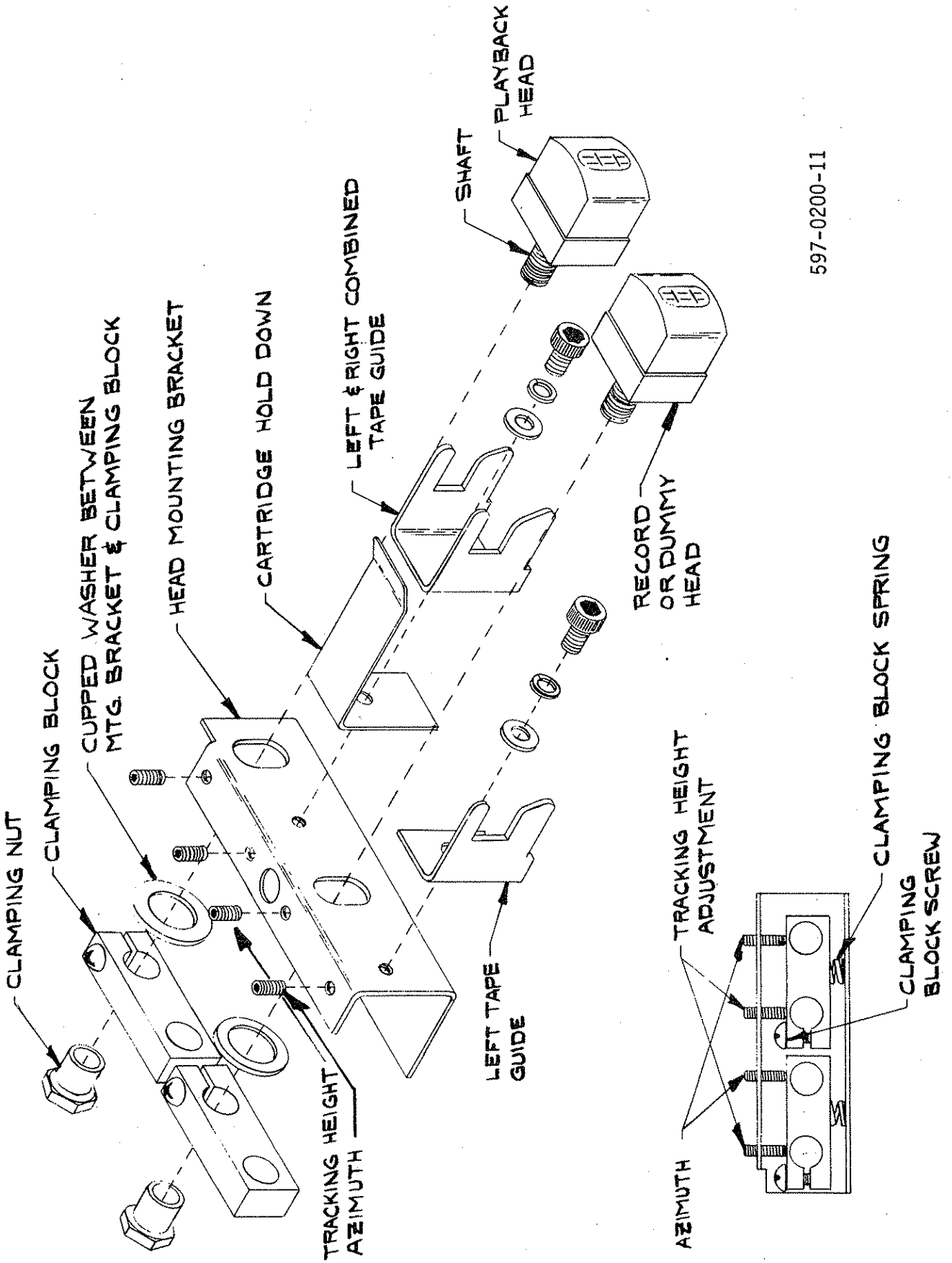
5-57. PRESSURE ROLLER REPLACEMENT. Manually raise the pressure roller above the deck surface by pushing on the push link assembly screw (refer to Figure 5-1). Apply a slight back pressure on the roller until it latches into place.

5-58. Use a small pair of needlenose pliers to remove the E-ring from the top of the pressure roller shaft. Using care not to lose any of the parts, remove the nylon washer, the roller, and the metal washer. Clean the pressure roller shaft with alcohol to remove any residue from the surface.

5-59. Replace the metal washer, the new roller, and the nylon washer on the shaft. Finally, seat the E-ring on the end of the shaft. When the E-ring is properly seated it will snap onto the shaft.

5-60. Before returning the unit to service, perform the three deck adjustment procedures described in paragraph 5-14.

5-61. HEAD REPLACEMENT. Refer to Figure 5-6 as required for the following procedure.



597-0200-11

FIGURE 5-6. HEAD ASSEMBLY

WARNING: DISCONNECT POWER PRIOR TO SERVICING

5-62. To remove the old head, first unsolder the head leads from the connector terminals on top of the deck (refer to Figure 5-7). Loosen the clamping block screw and unscrew the clamping nut. Pull the old head and leads free from the mounting bracket.

5-63. Remove the hex nut and two washers from the replacement head assembly. This hardware may be discarded.

NOTE AS THE OLD HEAD WAS PULLED FREE OF THE MOUNTING BRACKET, THE BELLEVILLE (CUPPED) WASHER LOCATED IN FRONT OF THE CLAMPING BLOCK PROBABLY MOVED OUT OF POSITION.

NOTE WHEN INSERTING THE NEW HEAD, MAKE SURE THE WASHER IS CORRECTLY ALIGNED WITH THE REST OF THE ASSEMBLY.

NOTE

5-64. Insert the replacement head through the mounting bracket, Belleville washer, and the clamping block. Replace the clamping nut, adjusting it so that the head is able to move in a vertical plane but not in a horizontal plane. Tighten the clamping block screw. Solder the head lead wires to the appropriate connector terminals as shown in Figure 5-7.

5-65. Before returning the unit to service, a complete head alignment is required. Refer to paragraph 5-23 for the procedure.

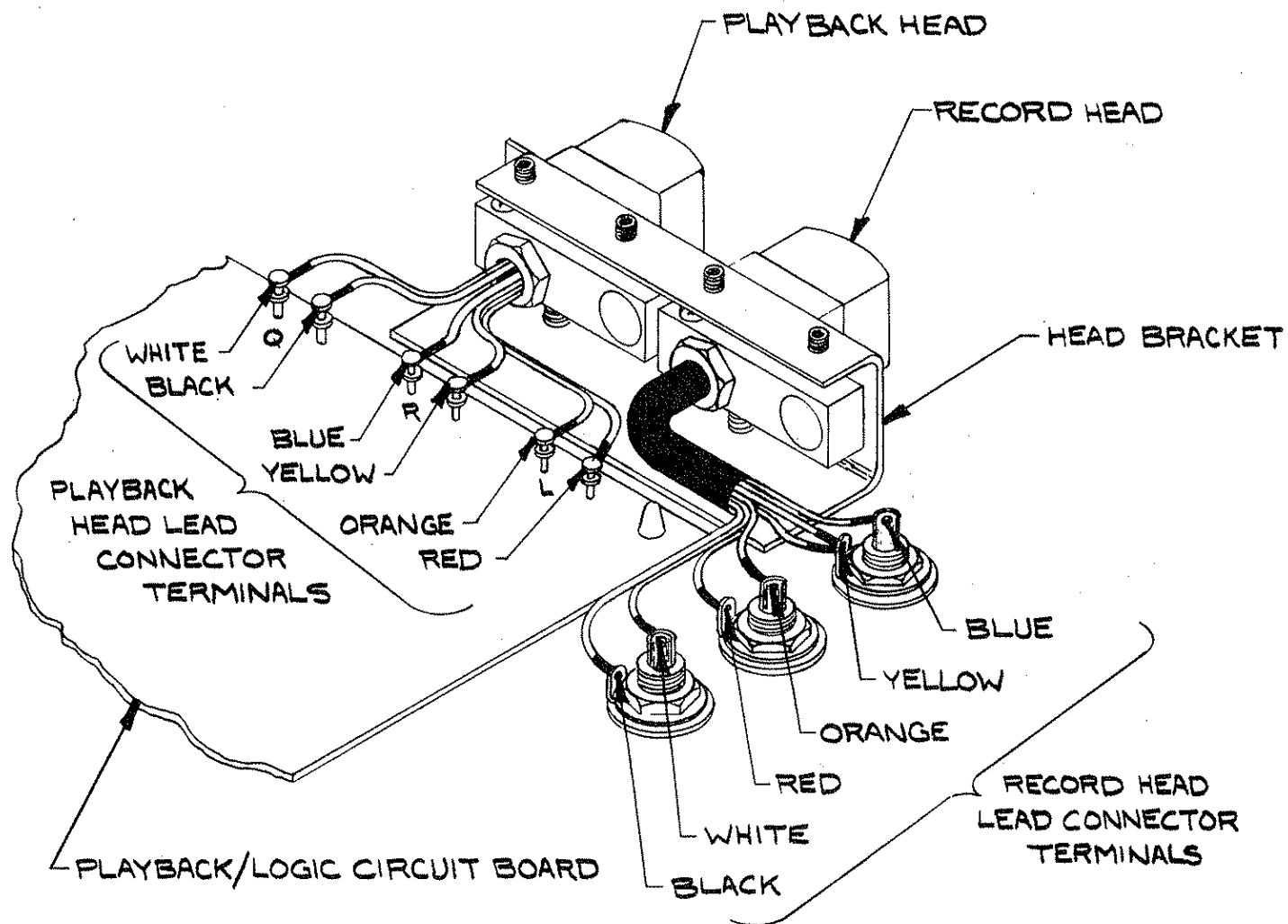
5-66. BELT REPLACEMENT. Refer to drawing C906-2105 in Section VII as required.

5-67. Disconnect ac power and remove the machine cover. On record units, unplug the record head lead jacks from the underside of the deck plate. Remove the four deck mounting screws located on the extreme right and left in the front and rear of the deck. Lift the deck and unplug the two-pin motor plug from the power supply circuit board. Carefully lay the deck plate to the right of the machine.

5-68. Hold the motor and remove the three mounting support screws. Remove the belts from the pulley and pull the motor away from the deck. Remove the three flywheel support bracket screws. Lift the bracket away from the flywheel and remove the belts.

5-69. Before replacing the belts, clean the flywheel and pulley belt surfaces with a non-residue type cleaner such as alcohol. It is also recommended that the thrust bushing on the flywheel support bracket be regreased to extend the life of the thrust bushing.

5-70. Put the new belts on the flywheel and replace the support bracket. Next place the belts on the pulley and replace the motor assembly. Set the deck plate in place after connecting the motor plug. Also, replace the record head lead jacks. Align the belts in whatever combination of grooves is necessary, so that the belts run as near to horizontal as possible.



597-0200-12

FIGURE 5-7. TAPE HEAD WIRING DIAGRAM

5-71. MOTOR REPLACEMENT. Refer to drawing C906-2105 in Section VII as required. Follow the procedures in paragraph 5-67 to gain access to the motor.

5-72. Remove the plastic ties on the yellow and black wire casings. Unsolder the wire connections from the capacitor and the brown wire from the motor plug. Make a note of the location of these wires for re-wiring purposes.

- 5-73. Remove the three motor support screws and remove the belts from the pulley. Carefully pull the motor free from the machine. Loosen the Allen head set screw on the pulley to free the pulley from the motor.
- 5-74. Put the pulley on the new motor and replace the belts. Connect the motor to the support plate. When the three mounting screws have been tightened, check for 0.0010 inches of end play allowance in the rotor. If there is no end play, adjust the thrust bushing on the motor U-bracket so the thrust bushing does not exert pressure on the motor.
- 5-75. Solder the capacitor connection wires and the motor plug lead wire into place. Tie the black and yellow wire casings together and out of the way of any moving parts.
- 5-76. Reconnect the motor plug to the power supply circuit board, replace the deck plate, and reconnect the record head lead jacks. Check for proper belt alignment as described in paragraph 5-70.
- 5-77. PRESSURE ROLLER LATCH REPLACEMENT. Refer to Figure 5-3 as required. Follow the procedures in paragraph 5-67 to gain access to the pressure roller latch.
- 5-78. Loosen the two latch mounting screws. Slide the latch towards the rear of the deck and out from under the mounting screws.
- 5-79. Slide the new latch into place. The latch should not extend beyond the edge of the slot in the cam. Follow the pressure roller parallelism adjustment procedure to align the latch (paragraph 5-18).
- 5-80. Reconnect all plugs and replace all parts before returning the unit to service.
- 5-81. PRESSURE ROLLER CROSS-SHAFT REPLACEMENT. Refer to Figure 5-1 and drawing C906-2105 as required. Follow the procedures in paragraph 5-57 to remove the pressure roller. Remove the deck plate as described in paragraph 5-67.
- 5-82. Remove the flywheel support bracket screws. Lift the support bracket off and remove the belts. Using a pair of needlenose pliers, remove the E-ring from the capstan shaft and slide the flywheel out.
- 5-83. Remove the pressure roller latch (refer to paragraph 5-78). Unscrew the two mounting plate screws to the right of the latch. Remove the wire link and move the mounting plate off to the side. Remove the other end of the cross-shaft from its support hole in the armature assembly.

5-84. Insert the new cross-shaft into the armature assembly making sure the wire running next to the armature is beneath the cross-shaft peg when you insert the shaft. On the opposite side, attach the wire link to the mounting plate, set the cross-shaft in place and secure the mounting plate into position. There should be approximately 0.0020 of an inch of end play in the cross-shaft, and the cam should be able to rotate freely.

5-85. Replace the pressure roller latch and the flywheel. Put the belts back on the flywheel and remount the support bracket. Replace the pressure roller as described in paragraph 5-59 and perform the deck adjustments listed in paragraph 5-13. Finally check the belt alignment (refer to paragraph 5-70) and reconnect all leads and plugs before securing the deck plate.

5-86. ELECTRICAL PARTS REPLACEMENT.

5-87. The circuit boards used in the series 2000 are double-sided boards with plated through-holes. Because of the plated through-holes, solder fills the holes by capillary action. These conditions require that defective components be removed carefully to avoid damage to the board.

5-88. On all circuit boards, the adhesion of the copper trace to the board fails at almost the same temperature as solder melts. A circuit board trace can be destroyed by excessive heat or lateral movement during soldering. Use of a small iron with steady pressure is required for circuit board repairs.

5-89. To remove a component from a board such as the type used in the 2000, cut the leads from the body of the defective component while the device is still soldered to the board.

5-90. Grip each component lead, one at a time, with long nose pliers. Turn the board over and touch the soldering iron to the lead at the solder connection. When the solder begins to melt, push the lead through the back side of the board and cut off the clinched end of the lead. Each lead may now be heated independently and pulled out of each hole. The holes may be cleared of solder by carefully re-heating with a low wattage iron and removing the residual solder with a soldering vacuum tool.

5-91. Install the new component and apply solder from the bottom side of the board. If no damage has been done to the plated through-holes, soldering of the top side is not required.

WARNING

MOST SOLVENTS WHICH WILL REMOVE ROSIN FLUX ARE VOLATILE AND TOXIC BY THEIR NATURE AND SHOULD BE USED ONLY IN SMALL AMOUNTS IN A WELL VENTILATED AREA, AWAY FROM FLAME, CIGARETTES, OR HOT SOLDERING IRONS.

WARNING

WARNING

WARNING

OBSERVE THE MANUFACTURER'S CAUTIONARY INSTRUCTIONS.

5-92. After soldering, remove residual flux with a cotton swab moistened with a suitable solvent. Rubbing alcohol is highly diluted and is not effective. Solvents are available from electronic supply houses which are useful.

5-93. The board should be checked to ensure the flux has been removed and not just smeared about. Rosin flux is not normally corrosive, but it will absorb enough moisture in time to become conductive and cause problems.

5-94. INTEGRATED CIRCUITS. Extra care should be exercised with integrated circuits. All integrated circuits must be oriented so that its notch matches the notch on the socket for replacement. Do not attempt to remove an integrated circuit with your fingers. Use a circuit puller to lightly pry the circuit from its socket.

SECTION VI
PARTS LIST

6-1. INTRODUCTION.

6-2. This section provides descriptions and part numbers of parts and assemblies required for maintenance of the Series 2000 cartridge machine. Table entries in this section are indexed by the reference designators of the applicable schematic diagram.

6-3. Table 6-1 indexes all tables listing assemblies and sub-assemblies having replaceable parts, the table number listing the parts, and the page number of the applicable table.

NOTE BASIC PARTS THAT ARE COMMON TO ALL MODELS OR ALL VERSIONS OF A CIRCUIT BOARD ASSEMBLY ARE LISTED AT THE BEGINNING OF A PARTS TABLE.
NOTE PARTS UNIQUE TO A PARTICULAR MODEL OR VERSION OF THAT CIRCUIT BOARD ASSEMBLY ARE LISTED UNDER A SPECIAL HEADING WHICH FOLLOWS THE BASIC PARTS
NOTE IN THE SAME TABLE.
NOTE

TABLE 6-1. REPLACEABLE PARTS LIST INDEX

TABLE NO.	DESCRIPTION	PART NO.	PAGE
6-2	2000 SERIES CARTRIDGE MACHINE (Chassis Mounted and Deck Assembly Components)	906-2000 906-2001 906-2020 906-2021 906-2003 906-2004 906-2006 906-2007	6-2
6-3	POWER SUPPLY CIRCUIT BOARD ASSEMBLY	914-1391	6-5
6-4	2000 RP RECORD MODULE	906-2012	6-6
6-5	RECORD CIRCUIT BOARD ASSEMBLY MONAURAL AND STEREO	914-1393 914-1397	6-6
6-6	MONAURAL PLAYBACK/LOGIC CIRCUIT BOARD ASSEMBLY	914-1390	6-11
6-7	STEREO PLAYBACK/LOGIC CIRCUIT BOARD ASSEMBLY	914-1400	6-13

Table 6-2. 2000 Series Cartridge Machine
 906-2000/-2001/-2020/-2021/-2003/-2004/-2006/-2007

(Sheet 1 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
<u>ALL MODELS</u>			
B1	Motor, Hysteresis, Synchronous 117V, 60 Hz, 7.5 IPS	384-1052	1
C1	Capacitor, Motor, 6 uF ±10%, 250V	029-6064	1
DS1,DS2	Lamp, No. 85, Incandescent, Subminiature Wedge Base, 28V, 0.04 Ampere (for START/STOP switch/indicator)	321-0085	2
F1	Fuse, 3AG, 0.5 Ampere, Slow-Blow	334-0050	1
J1	Receptacle, 24-Pin (REMOTE)	418-0303	1
L1	Solenoid, 24V dc, 130 Ohms, 0.2 Ampere	289-0033	1
P1	Plug, 24-Pin (REMOTE)	418-0306	1
P5	Plug, 12-Pin (Power Supply to Power Transformer)	418-1271	1
P6	Plug, 2-Pin (Power Supply to Motor Capacitor)	418-0701	1
S1	Switch, Power, Miniature Toggle, SPDT, 2 Amperes @ 250V ac or 3 Amperes @ 120V ac (ON/OFF Switch)	348-7101	1
S2,S3	Switch, Illuminated, SPST, Normally Open, Momentary Contact, Push, 10 mA @ 5V dc (START and STOP switch/ indicator)	343-0009	2
T1	Transformer, Power Dual Primary: 108-115V ac, 50/60 Hz Secondary: 21V @ 1.3 Ampere 23V @ 500 mA	376-7656	1
T2	Transformer, Audio Output 1:1 ratio, 600 Ohm, 30 Hz to 20 kHz ±2 dB +15 dBm level	371-0009	1
XF1	Fuse Holder, 3AG	415-2012	1
----	Capstan, Flywheel Assembly	444-0335	1
----	Steel Ball, 0.25 inch (pressed onto end of flywheel shaft)	442-0772	1
----	Pulley, Motor (60 Hz machine)	389-0100	1
----	Drive Belt, Motor, O-ring	405-0438	1
----	Thrust Bearing (beneath flywheel)	420-0080	1
----	Pad, Thrust Bearing	406-0074	1
----	Switch Cap, Red, (STOP switch/indicator)	343-0176	1
----	Switch Cap, Green, (START switch/ indicator)	343-0017	1
----	Rubber Foot	403-0001	4
----	Head Mounting Bracket	470-0049	1
----	Conical Washer (one per head, between head mounting bracket and clamping block)	436-0052	1/2
----	Head Clamping Block (one per head)	449-0050	1/2
----	Line Cord, N.E.M.A. 3-Wire Standard Plug	681-1723	1

Table 6-2. 2000 Series Cartridge Machine
 906-2000/-2001/-2020/-2021/-2003/-2004/-2006/-2007

(Sheet 2 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Clamp Nut, Brass (one per head)	421-0003	1/2
----	Clamping Block Spring (one per head, between deck and clamping block)	430-0053	1/2
----	Cartridge Spring Lock (on head mounting bracket)	459-0002	1
----	Cartridge Guide, Left	452-2101	1
----	Cartridge Guide, Combined Left-Right	452-0103	1
----	Pressure Roller	404-0001	1
----	Plug Bumper (between deck plate and solenoid bracket)	403-0038	1
----	Shaft Assembly (pressure roller)	446-1113	1
----	Shaft Return Spring (on pivot lever)	432-0045	1
----	Wire Link (pivot lever to shaft assembly)	429-0016	1
----	Spring (shaft pivot strap)	430-0046	1
----	Cartridge RELEASE Button	442-4200	1
----	Latch, Cartridge Release, Brass (underside of deck)	459-4107	1
----	Release Crank	429-4101	1
----	Spring Armature Return	432-0044	1
----	Power Supply Circuit Board Assembly	914-1391	1
ADDITIONAL PARTS FOR 906-2000 MACHINE ONLY (MODEL 2000P)			
----	Head, Playback, 2-Channel, Model DM1B Inductance: 400 mH Impedance at 1kHz: 255 k Ohm DC Resistance: 410 Ohms per channel	252-0001	1
----	Monaural Playback/Logic Circuit Board Assembly	914-1390	1
ADDITIONAL PARTS FOR 906-2001 MACHINE ONLY (MODEL 2000RP)			
J3,J4	Jack, Phone (record head lead cable to record circuit board)	417-0135	2
J7	Receptacle, 10-Pin Card Edge (to record circuit board)	417-1002	1
----	Head, Playback, 2-Channel, Model DM1B Inductance: 400 mH Impedance at 1kHz: 2.55 k Ohm DC Resistance: 410 Ohms per channel	252-0001	1
----	Head, Record, 2-Channel, Model DM2RB Inductance: 50 mH Impedance at 1kHz: 330 Ohms DC Resistance: 115 Ohms per channel	252-0003	1
----	Record Module Assembly	906-2012	1
----	Monaural Playback/Logic Circuit Board Assembly	914-1390	1

Table 6-2. 2000 Series Cartridge Machine
 906-2000/-2001/-2020/-2021/-2003/-2004/-2006/-2007

(Sheet 3 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	ADDITIONAL PARTS FOR 906-2020 MACHINE ONLY (MODEL 2000PS)		
T3	Transformer, Audio Output 1:1 ratio, 600 Ohm, 30 Hz to 20 kHz ±2 dB +15 dBm level	371-0009	1
----	Head, Playback, 3-Channel, Model D1SA Inductance: 350 mH Impedance at 1kHz: 2.2 k Ohms DC Resistance: 800 Ohms per channel	253-0002	1
----	Stereo Playback Circuit Board Assembly	914-1400	1
	ADDITIONAL PARTS FOR 906-2021 MACHINE ONLY (MODEL 2000RPS)		
DS3	Lamp, No. 85, Incandescent, Sub-miniature, Wedge Base, 28V, 0.04 A, (for RECORD switch/indicator)	321-0085	1
J2,J3, J4	Jack, Phone (record head lead cable to record circuit board)	417-0135	3
M1,M2	VU Meter, 1.5 inch (3.81 cm) dc Microammeter Type, 200 uA Movement, 225 Ohm resistance	319-0134	2
P2	Plug, Phone, Record Board/Record Head Right Channel Connection (yellow cable)	680-0722	1
P3	Plug, Phone, Record Board/Record Head Left Channel Connection (red cable)	680-0723	1
P4	Plug, Phone, Record Board/Record Head Cue Channel Connection (gray cable)	680-0720	1
R73,R110	Potentiometer, 10 k Ohm ±10%, 1/2W (record LEVEL control)	191-1053	2
S4,S5	Switch, Illuminated, SPST, Normally Open, Momentary Contact, Push, 10 mA @ 5V dc (RECORD and QI switch/ indicator)	343-0009	2
T3	Transformer, Audio Output 1:1 ratio, 600 Ohm, 30 Hz to 20 kHz ±2 dB +15 dBm level	371-0009	1
----	Switch Cap, Red (RECORD switch/ indicator)	343-0176	1
----	Switch Cap, White (QI switch/ indicator)	343-0156	1
----	Head, Playback, 3 Channel, Model D1SA Inductance: 350 mH Impedance at 1kHz: 2.2 k Ohms DC Resistance: 800 Ohms per channel	253-0002	1

Table 6-2. 2000 Series Cartridge Machine
906-2000/-2001/-2020/-2021/-2003/-2004/-2006/-2007

(Sheet 4 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Head, Record, 3 Channel, Model DM3RB Inductance: 50 mH Impedance at 1kHz: 400 Ohms DC Resistance: 100 Ohms per channel	253-0001	1
----	Knob, (LEVEL control)	482-2392	1
----	Record Circuit Board Assembly	914-1397	1
----	Stereo Playback Circuit Board Assembly	914-1400	1
	ALTERNATE PARTS FOR 906-2003 220V ac, 50 Hz Motor Option		
C1	Capacitor, Motor, 8 uF, 220V	029-8064	1
----	Pulley, Motor	389-0200	1
----	Line Cord, CEE 7/7 3-Wire European Plug	681-0001	1
	ALTERNATE PARTS FOR 906-2004 117V ac, 50 Hz Motor Option		
----	Pulley, Motor	389-0200	1
	ALTERNATE PARTS FOR 906-2006 3.75 IPS Tape Speed, 50 Hz		
C1	Capacitor, Motor, 8 uF, 220V	029-8064	1
----	Pulley, Motor	389-0201	1
	3.75 IPS Tape Speed, 60 Hz		
----	Pulley, Motor	389-0102	1
	ALTERNATE PARTS FOR 906-2007 1 7/8 IPS Tape Speed		
----	Pulley, Motor	389-0204	1

Table 6-3. Power Supply Circuit Board Assembly
914-1391

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1,C2	Capacitor, Electrolytic, 1000 uF, 50V	014-1094	2
C3	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
D1	Bridge Rectifier, Single Phase, Full Wave, 200V, 4 Amperes	239-0003	1
D2,D3	Diode, 1N4005, Silicon, 600V, 1 Ampere	203-4005	2
IC1	Integrated Circuit, MC7824CK, Fixed Positive 24V Regulator, 1.5 Ampere, TO-3 Case	227-7824	1
J5	Receptacle, 12-Pin (to Power Transformer)	417-1276	1
J6	Receptacle, 2-Pin (to Motor Capacitor)	417-0700	1
----	Blank Circuit Board	514-1391	1

Table 6-4. Record Module 2000RP - 906-2012

REF. DES.	DESCRIPTION	PART NO.	QTY.
DS3	Lamp, No. 85, Incandescent, Subminiature Wedge Base, 28V, 0.04 Ampere (for RECORD switch/indicator)	321-0085	1
M1	VU Meter, 1.5 inch (3.81 cm) dc Microammeter Type, 200 uA movement, 750 Ohm resistance	319-0134	1
P3	Plug, Phone, Record Board/Record Head Cue Channel Connection (Yellow cable)	680-0722	1
P4	Plug, Phone, Record Board/Record Head Program Channel Connection (red cable)	680-0723	1
R73	Potentiometer, 10 k Ohm $\pm 10\%$, 1/2W (record LEVEL control)	191-1053	1
S4,S5	Switch, Illuminated, SPST, Normally Open Momentary Contact, Push, 10 mA @ 5V dc (RECORD and QI switch/indicator)	343-0009	2
----	Knob (LEVEL control)	482-2392	1
----	Switch Cap, Red (RECORD switch/indicator)	343-0176	1
----	Switch Cap, White (QI switch/indicator)	343-0156	1
----	Record Circuit Board Assembly	914-1393	1

Table 6-5. Record Circuit Board Assembly
914-1393/-1397

(Sheet 1 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	<u>ALL MODELS</u>		
C1,C2	Capacitor, Electrolytic, 100 uF, 25V	023-1083	2
C4	Capacitor, Mica, 220 pF, 500V	040-2223	1
C5	Capacitor, Mica, 22 pF, 500V	040-2213	1
C6 THRU C8	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	3
C9	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C10	Capacitor, Poly Film, 0.0033 uF, 630V	030-3033	1
C11	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
C12,C13	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	2
C14	Capacitor, Mylar Film, 0.01 uF, 100V	030-1043	1
C15	Capacitor, Mica, 220 pF, 500V	040-2223	1
C16	Capacitor, Mica, 150 pF $\pm 5\%$, 500V	040-1522	1
C17,C18	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	2
C19	Capacitor, Mica, 500 pF, 500V	041-5023	1

Table 6-5. Record Circuit Board Assembly
914-1393/-1397

(Sheet 2 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C20	Capacitor, Electrolytic, 100 uF, 25V	023-1083	1
C21	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C22	Capacitor, Mylar Film, 0.01 uF, 100V	030-1043	1
C23	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C24 THRU C26	Capacitor, Mylar Film, 0.047 uF, 100V	030-4743	3
C27 THRU C29	Capacitor, Mylar Film, 0.22 uF, 100V	030-2253	3
C30,C31	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	2
C32	Capacitor, Mica, 220 pF, 500V	040-2223	1
C33	Capacitor, Mica, 240 pF, 50V	040-2422	1
C34	Capacitor, Mica, 500 pF, 500V	041-5023	1
C35,C36	Capacitor, Ceramic Disc, 0.0047 uF ±10%, 200V	032-4733	2
C37	Capacitor, Mylar Film, 0.01 uF, 100V	030-1043	1
C38	Capacitor, Mylar Film, 0.02 uF, 100V	030-2043	1
C39	Capacitor, Electrolytic, 1 uF, 35V	064-1063	1
CR1 THRU CR6	Diode, 1N4148, Silicon, 75V, 0.3 Ampere	203-4148	6
IC1	Integrated Circuit, MC1709C, Operational Amplifier, 8-Pin DIP	221-7091	1
IC2,IC3	Integrated Circuit, RC4558, Dual Operational Amplifier, 8-Pin DIP	221-4558	2
L1	Inductor, 8-20 uH, Adjustable	363-9061	1
L2	Choke, 10 uH	364-0670	1
Q1	Transistor, 2N5462, Silicon, P-Channel, JFET, TO-92 Case	212-5462	1
Q2	Transistor, MPS6566, Silicon, NPN, TO-92 Case	211-6566	1
Q3	Transistor, GES5817, Silicon, PNP, TO-18 Case	210-5817	1
Q4,Q5	Transistor, MPS6566, Silicon, NPN, TO-92 Case	211-6566	2
Q6	Transistor, 2N3053, Silicon, NPN, TO-5 Case	211-3053	1
Q7	Transistor, MPS6566, Silicon, NPN, TO-92 Case	211-6566	1
Q9,Q10	Transistor, 2N3053, Silicon, NPN, TO-5 Case	211-3053	2
R1,R2	Resistor, 56 k Ohm ±5%, 1/4W	100-5653	2
R3,R4	Resistor, 470 Ohm ±5%, 1/4W	100-4733	2
R5,R6	Resistor, 100 Ohm ±5%, 1/4W	100-1033	2
R7,R8	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	2
R9	Resistor, 1.5 k Ohm ±5%, 1/4W	100-1543	1
R10	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R11	Resistor, 4.7 k Ohm ±5%, 1/4W	100-4743	1
R12,R13	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	2
R14	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R15	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	1

Table 6-5. Record Circuit Board Assembly
914-1393/-1397

(Sheet 3 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R16	Resistor, 56 k Ohm $\pm 5\%$, 1/4W	100-5653	1
R17	Resistor, 39 k Ohm $\pm 5\%$, 1/4W	100-3953	1
R18,R19	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	2
R20	Potentiometer, 100 k Ohm $\pm 10\%$, 1/2W	176-1064	1
R21	Resistor, 270 k Ohm $\pm 5\%$, 1/4W	100-2763	1
R22	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	1
R23	Resistor, 2.2 k Ohm $\pm 5\%$, 1/4W	100-2243	1
R24	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R25	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R26,R27	Resistor, 2.7 k Ohm $\pm 5\%$, 1/4W	100-2743	2
R28	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R29	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R30	Potentiometer, 10 k Ohm $\pm 10\%$, 1/2W	176-1054	1
R31	Resistor, 220 k Ohm $\pm 5\%$, 1/4W	100-2263	1
R32	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	1
R33 THRU R37	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	5
R38	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R39	Resistor, 22 Ohm $\pm 5\%$, 1/4W	100-2223	1
R40,R41	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	2
R42,R43	Resistor, 3.9 k Ohm $\pm 5\%$, 1/4W	100-3943	2
R44	Resistor, 39 k Ohm $\pm 5\%$, 1/4W	100-3953	1
R45,R46	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	2
R47 THRU R50	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	4
R51	Resistor, 62 k Ohm $\pm 5\%$, 1/4W	100-6253	1
R52	Resistor, 330 Ohm $\pm 5\%$, 1/4W	100-3333	1
R53 THRU R55	Resistor, 15 k Ohm $\pm 5\%$, 1/4W	100-1553	3
R56	Resistor, 82 k Ohm $\pm 5\%$, 1/4W	100-8253	1
R57	Resistor, 6.8 k Ohm $\pm 5\%$, 1/4W	100-6843	1
R58	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	1
R59,R60	Potentiometer, 20 k Ohm $\pm 10\%$, 1/2W	176-2054	2
R61	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R62	Resistor, 6.8 k Ohm $\pm 5\%$, 1/4W	100-6843	1
R63	Potentiometer, 100 k Ohm $\pm 10\%$, 1/2W	176-1064	1
R64,R65	Resistor, 27 Ohm $\pm 5\%$, 1/4W	100-2723	2
R66,R67	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	2
R68,R69	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	2
R70	Potentiometer, 100 k Ohm $\pm 10\%$, 1/2W	176-1064	1
R71	Resistor, 820 k Ohm $\pm 5\%$, 1/4W	100-8263	1
R75	Resistor, 8.2 k Ohm $\pm 5\%$, 1/4W	100-8243	1
T1	Bias Oscillator Transformer, 100 kHz $\pm 5\%$, BE Manufactured	372-0095	1
XIC1 THRU XIC3	Socket, Integrated Circuit, 8-Pin DIP	417-0800	3

Table 6-5. Record Circuit Board Assembly
914-1393/-1397

(Sheet 4 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
XQ1 THRU XQ7, XQ9, XQ10	Socket, Transistor	417-0330	9
----	Blank Circuit Board, Mono	514-1393	1
----	Blank Circuit Board, Stereo	514-1397	1
ADDITIONAL PARTS FOR MONO RECORD CIRCUIT BOARD			
R74	Resistor, 15 k Ohm $\pm 5\%$, 1/4W	100-1553	1
ALTERNATE PARTS FOR STEREO RECORD CIRCUIT BOARD - 914-1397			
R48	Resistor, 15 k Ohm $\pm 5\%$, 1/4W	100-1553	1
ADDITIONAL PARTS FOR STEREO RECORD CIRCUIT BOARD			
C40	Capacitor, Mica, 220 pF, 500V	040-2223	1
C41, C42	Capacitor, Electrolytic, 100 μ F, 25V	023-1083	2
C43	Capacitor, Mica, 22 pF, 500V	040-2213	1
C44	Capacitor, Electrolytic, 4.7 μ F, 35V, Tantalum	064-4763	1
C45	Capacitor, Electrolytic, 33 μ F, 35V	024-3335	1
C46, C47	Capacitor, Electrolytic, 4.7 μ F, 35V, Tantalum	064-4763	2
C48	Capacitor, Poly Film, 0.0033, 630V	030-3033	1
C49, C50	Capacitor, Electrolytic, 4.7 μ F, 35V, Tantalum	064-4763	2
C51	Capacitor, Electrolytic, 1 μ F, 35V	064-1063	1
C52, C53	Capacitor, Electrolytic, 4.7 μ F, 35V, Tantalum	064-4763	2
C54	Capacitor, Mylar Film, 0.01 μ F, 100V	030-1043	1
C55	Capacitor, Mica, 220 pF, 500V	040-2223	1
C56	Capacitor, Mica, 150 pF, 500V	040-1522	1
C57	Capacitor, Electrolytic, 1 μ F, 35V	064-1063	1
C58	Capacitor, Mica, 500 pF, 500V	041-5023	1
CR7	Diode, 1N4148, Silicon, 75V, 0.3 Ampere	203-4148	1
IC4	Integrated Circuit, MC1709C, Operational Amplifier, 8-Pin DIP	221-7091	1
IC5	Integrated Circuit, RC4558, Operational Amplifier, 8-Pin DIP	221-4558	1
L3	Inductor, 8-20 μ H, Adjustable	363-9061	1
Q11	Transistor, 2N5462, P-Channel, JFET, 40V	212-5462	1
Q12	Transistor, MPS6566, Silicon, NPN, TO-92 Case	211-6566	1

Table 6-5. Record Circuit Board Assembly
914-1393/-1397

(Sheet 5 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R63,R70	Potentiometer, 1 Meg Ohm $\pm 10\%$, 1/2W	178-1074	2
R74	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R76	Potentiometer, 1 Meg Ohm $\pm 10\%$, 1/2W	178-1074	1
R77	Resistor, 1.5 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R78	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R79	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R80	Resistor, 56 k Ohm $\pm 5\%$, 1/4W	100-5653	1
R81,R82	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	2
R83	Resistor, 56 k Ohm $\pm 5\%$, 1/4W	100-5653	1
R84	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R85	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R86	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R87	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	1
R88	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R89	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	1
R90	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R91	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R92	Resistor, 2.2 k Ohm $\pm 5\%$, 1/4W	100-2243	1
R93	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	1
R94	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R95	Resistor, 2.7 k Ohm $\pm 5\%$, 1/4W	100-2743	1
R96	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R97	Resistor, 220 k Ohm $\pm 5\%$, 1/4W	100-2263	1
R98	Potentiometer, 10 k Ohm $\pm 10\%$, 1/2W	176-1054	1
R99	Resistor, 56 k Ohm $\pm 5\%$, 1/4W	100-5653	1
R100	Resistor, 39 k Ohm $\pm 5\%$, 1/4W	100-3953	1
R101	Potentiometer, 100 k Ohm $\pm 10\%$, 1/2W	176-1064	1
R102	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	1
R103	Resistor, 270 k Ohm $\pm 5\%$, 1/4W	100-2763	1
R104	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	1
R105	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R106	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R107	Resistor, 2.7 k Ohm $\pm 5\%$, 1/4W	100-2743	1
R108	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R109	Resistor, 8.2 k Ohm $\pm 5\%$, 1/4W	100-8243	1
XIC4, XIC5	Socket, Integrated Circuit, 8-Pin DIP	417-0800	2
XQ11, XQ12	Socket, Transistor	417-0330	2

Table 6-6. Monaural Playback/Logic Circuit Board Assembly
914-1390 (Sheet 1 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1,C2	Capacitor, Mica, 270 pF, 500V	041-2722	2
C3 THRU C5	Capacitor, Electrolytic, 1 uF, 35V,	064-1063	3
C6,C7	Capacitor, Electrolytic, 4.7 uF, 35V	015-5064	2
C8 THRU C13	Capacitor, Ceramic Disc, 0.0047 uF ±10%, 200V	032-4733	6
C14 THRU C16	Capacitor, Electrolytic, 4.7 uF, 35V	015-5064	3
C17	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C18	Capacitor, Electrolytic, 4.7 uF, 35V	015-5064	1
C19,C20	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	2
C21	Capacitor, Monolythic Ceramic, 2200 pF, 200V	030-2033	1
C22,C23	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	2
C24	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C26	Capacitor, Monolythic Ceramic, 0.0047 uF ±5%, 100V	003-4723	1
C27	Capacitor, Monolythic Ceramic, 0.0027 uF ±5%, 100V	003-2723	1
C28	Capacitor, Monolythic Ceramic, 0.0047 uF ±5%, 100V	003-4723	1
C29	Capacitor, Monolythic Ceramic, 0.01 uF ±5%, 100V	003-1013	1
C30	Capacitor, Monolythic Ceramic, 0.0056 uF ±5%, 100V	003-5623	1
C31	Capacitor, Monolythic Ceramic, 0.01 uF ±5%, 100V	003-1013	1
C32	Capacitor, Electrolytic, 100 uF, 40V	014-1084	1
C33	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
C34 THRU C36	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	3
C37	Capacitor, Electrolytic, 4.7 uF, 35V	015-5064	1
C38	Capacitor, Mylar Film, 0.047 uF, 100V	030-4743	1
C39	Capacitor, Mylar Film, 0.01 uF, 100V	030-1043	1
C41	Capacitor, Electrolytic, 470 uF, 25V	013-4783	1
D1 THRU D4	Diode, 1N4148, Silicon, 75V, 0.3 Ampere	203-4148	4
D5	Diode, 1N4005, Silicon, 600V, 1 Ampere	203-4005	1
D6	Diode, 1N4148, Silicon, 75V, 0.3 Ampere	203-4148	1
D7 THRU D9	Diode, 1N4005, Silicon, 600V, 1 Ampere	203-4005	3
IC1	Integrated Circuit, RC4739DP, Dual Low Noise Preamplifier, 14-Pin DIP	221-2310	1

Table 6-6. Monaural Playback/Logic Circuit Board Assembly
914-1390 (Sheet 2 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
IC2,IC3	Integrated Circuit, MC4558PI, Dual Operational Amplifier, 8-Pin DIP	221-4558	2
Q1	Transistor, 2N5462, P-Channel, JFET, TO-92 Case	212-5462	1
Q2 THRU Q6	Transistor, MPS6566, Silicon, NPN, TO-92 Case	211-6566	5
Q7,Q8	Transistor, GES5816, Silicon, NPN, TO-92 Case	211-5816	2
R1,R2	Resistor, 270 k Ohm $\pm 5\%$, 1/4W	100-2763	2
R3	Resistor, 56 k Ohm $\pm 5\%$, 1/4W	100-5653	1
R4,R5	Resistor, 820 Ohm $\pm 5\%$, 1/4W	100-8233	2
R6,R7	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R8	Resistor, 150 k Ohm $\pm 5\%$, 1/4W	100-1563	1
R9	Potentiometer, 1 Meg Ohm $\pm 20\%$, 0.1W	177-1074	1
R10	Potentiometer, 50 k Ohm $\pm 10\%$, 1/2W	177-5054	1
R11	Resistor, 330 k Ohm $\pm 5\%$, 1/4W	100-3363	1
R12	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R13	Resistor, 56 k Ohm $\pm 5\%$, 1/4W	100-5653	1
R14	Potentiometer, 10 k Ohm, 0.1W	177-1054	1
R15,R16	Resistor, 27 k Ohm $\pm 5\%$, 1/4W	100-2753	2
R17 THRU R20	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	4
R21	Resistor, 1.8 k Ohm $\pm 5\%$, 1/4W	100-1843	1
R22	Resistor, 220 k Ohm $\pm 5\%$, 1/4W	100-2263	1
R23	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R24,R25	Potentiometer, 10 k Ohm, 0.1W	177-1054	2
R26	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	1
R27	Resistor, 180 k Ohm $\pm 5\%$, 1/4W	100-1863	1
R28	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	1
R30	Resistor, 8.2 k Ohm $\pm 5\%$, 1/4W	100-8243	1
R31,R32	Resistor, 56.2 k Ohm $\pm 1\%$, 1/4W	103-5651	2
R33	Resistor, 6650 Ohm $\pm 1\%$, 1/4W	103-6641	1
R34,R35	Resistor, 178 k Ohm $\pm 1\%$, 1/4W	103-1761	2
R36	Resistor, 21.5 k Ohm $\pm 1\%$, 1/4W	103-2151	1
R37,R38	Resistor, 620 Ohm $\pm 5\%$, 1/4W	100-6233	2
R39,R40	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	2
R41,R42	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	2
R43,R44	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	2
R45	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	1
R46	Resistor, 2 Meg Ohm $\pm 5\%$, 1/4W	100-2073	1
R47,R48	Resistor, 3.9 k Ohm $\pm 5\%$, 1/4W	100-3943	2
R49,R50	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	2
R51,R52	Resistor, 2.7 k Ohm $\pm 5\%$, 1/4W	100-2743	2
R53	Resistor, 22 Ohm $\pm 5\%$, 1/4W	100-2223	1
R55	Resistor, 1.5 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R56	Resistor, 56 Ohm $\pm 5\%$, 2W, W/W	132-5623	1
R57	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	1

Table 6-6. Monaural Playback/Logic Circuit Board Assembly
914-1390 (Sheet 3 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R58	Resistor, 39 k Ohm $\pm 5\%$, 1/4W	100-3953	1
R59	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	1
XIC1	Socket, 14-Pin DIP	417-1400	1
XIC2, XIC3	Socket, 8-Pin DIP	417-0800	2
----	Blank Circuit Board	514-1390	1

Table 6-7. Stereo Playback/Logic Circuit Board Assembly
914-1400 (Sheet 1 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1,C2	Capacitor, Mica, 270 pF, 500V	041-2722	2
C3	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
C4	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C5	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
C6 THRU C8	Capacitor, Ceramic Disc, 0.0047 uF $\pm 10\%$, 200V	032-4733	3
C9,C10	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	2
C11	Capacitor, Electrolytic, 470 uF, 25V	013-4783	1
C12,C13	Capacitor, Mylar Film, 0.039 uF, 100V	030-3942	2
C14,C15	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	2
C16,C17	Capacitor, Ceramic Disc, 0.0047 uF $\pm 10\%$, 200V	032-4733	2
C18	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C19	Capacitor, Ceramic Disc, 0.0047 uF $\pm 10\%$, 200V	032-4733	1
C20	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C21	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C22	Capacitor, Electrolytic, 100 uF, 40V	014-1084	1
C23	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C24	Capacitor, Electrolytic, 100 uF, 40V	014-1084	1
C25	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C26	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
C27	Capacitor, Mylar Film, 0.01 uF, 100V	030-1043	1
C28	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C29	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1

Table 6-7. Stereo Playback/Logic Circuit Board Assembly
 914-1400 (Sheet 2 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C30	Capacitor, Monolythic Ceramic, 0.01 uF ±5%, 100V	003-1013	1
C31	Capacitor, Monolythic Ceramic, 470 pF ±5%, 200V	003-4713	1
C32	Capacitor, Monolythic Ceramic, 0.01 uF ±5%, 100V	003-1013	1
C33	Capacitor, Mylar Film, 0.01 uF, 100V	030-1043	1
C34	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C35	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
C36	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C38	Capacitor, Monolythic Ceramic, 0.047 uF ±5%, 50V	003-4733	1
C39	Capacitor, Monolythic Ceramic, 0.0068 uF ±5%, 100V	003-6823	1
C40	Capacitor, Monolythic Ceramic, 0.047 uF ±5%, 50V	003-4733	1
C41	Capacitor, Mylar Film, 0.01 uF, 100V	030-1043	1
C42 THRU C44	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	3
C45	Capacitor, Ceramic Disc, 0.0047 uF ±10%, 200V	032-4733	1
C46	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C47	Capacitor, Mica, 270 pF, 500V	041-2722	1
C48	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
C49	Capacitor, Poly Film, 0.047 uF ±5%, 100V	030-4743A	1
CR1 THRU CR5	Diode, 1N4005, Silicon, 600V, 1 Ampere	203-4005	5
CR6 THRU CR8	Diode, 1N4148, Silicon, 75V, 0.3 Ampere	203-4148	3
CR9, CR10	Diode, 1N4005, Silicon, 600V, 1 Ampere	203-4005	2
CR11, CR12	Diode, 1N4148, Silicon, 75V, 0.3 Ampere	203-4148	2
IC1	Integrated Circuit, RC4739DP, Dual Low Noise Preamplifier, 14-Pin DIP	221-2310	1
IC2 THRU IC4	Integrated Circuit, MC4558PI, Dual Operational Amplifier, 8-Pin DIP	221-4558	3
Q1	Transistor, GES5816, Silicon, NPN, TO-92 Case	211-5816	1
Q2, Q3	Transistor, MPS6566, Silicon, NPN, TO-92 Case	211-6566	2
Q4	Transistor, GES5816, Silicon, NPN, TO-92 Case	211-5816	1
Q5 THRU Q7	Transistor, MPS6566, Silicon, NPN, TO-92 Case	211-6566	3
Q8 THRU Q10	Transistor, 2N5462, P-Channel, JFET, TO-92 Case	212-5462	3
R1	Resistor, 820 Ohm ±5%, 1/4W	100-8233	1

Table 6-7. Stereo Playback/Logic Circuit Board Assembly
914-1400 (Sheet 3 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R2	Resistor, 150 k Ohm $\pm 5\%$, 1/4W	100-1563	1
R3	Potentiometer, 1 Meg Ohm, 0.1W	177-1074	1
R4	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	1
R5,R6	Resistor, 270 k Ohm $\pm 5\%$, 1/4W	100-2763	2
R7,R8	Resistor, 27 k Ohm $\pm 5\%$, 1/4W	100-2753	2
R9	Resistor, 1.5 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R10	Resistor, 27 k Ohm $\pm 5\%$, 1/4W	100-2753	1
R11,R12	Resistor, 270 k Ohm $\pm 5\%$, 1/4W	100-2763	2
R13	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	1
R14	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	1
R15	Resistor, 820 Ohm $\pm 5\%$, 1/4W	100-8233	1
R16	Potentiometer, 50 k Ohm, 1/2W	177-5054	1
R17	Resistor, 150 k Ohm $\pm 5\%$, 1/4W	100-1563	1
R18	Potentiometer, 1 Meg Ohm, 0.1W	177-1074	1
R19	Resistor, 27 k Ohm $\pm 5\%$, 1/4W	100-2753	1
R20	Potentiometer, 10 k Ohm, 0.1W	177-1054	1
R21 THRU R23	Resistor, 180 k Ohm $\pm 5\%$, 1/4W	100-1863	3
R24,R25	Resistor, 27 k Ohm $\pm 5\%$, 1/4W	100-2753	2
R26	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	1
R27	Resistor, 56 Ohm $\pm 5\%$, 2W	132-5623	1
R28	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	1
R29	Resistor, 3.9 k Ohm $\pm 5\%$, 1/4W	100-3943	1
R30	Resistor, 2.7 k Ohm $\pm 5\%$, 1/4W	100-2743	1
R31	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R32	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	1
R33	Resistor, 39 k Ohm $\pm 5\%$, 1/4W	100-3953	1
R34	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R35	Resistor, 3.9 k Ohm $\pm 5\%$, 1/4W	100-3943	1
R36	Resistor, 2.7 k Ohm $\pm 5\%$, 1/4W	100-2743	1
R37	Resistor, 2 Meg Ohm $\pm 5\%$, 1/4W	100-2073	1
R38,R39	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	2
R40	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	1
R41	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R42	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	1
R43	Resistor, 2.21 k Ohm $\pm 1\%$, 1/4W	103-2241	1
R44,R45	Resistor, 56.2 k Ohm $\pm 1\%$, 1/4W	103-5651	2
R46	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	1
R47,R48	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	2
R49	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	1
R50	Resistor, 620 Ohm $\pm 5\%$, 1/4W	100-6233	1
R51	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R52	Resistor, 180 k Ohm $\pm 5\%$, 1/4W	100-1863	1
R53,R54	Resistor, 56.2 k Ohm $\pm 1\%$, 1/4W	103-5651	2
R55	Resistor, 4640 Ohm $\pm 1\%$, 1/4W	103-4641	1

Table 6-7. Stereo Playback/Logic Circuit Board Assembly
 914-1400 (Sheet 4 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R56	Potentiometer, 10 k Ohm, 0.1W	177-1054	1
R57	Resistor, 24 k Ohm $\pm 5\%$, 1/4W	100-2453	1
R58,R59	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	2
R60	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	1
R61	Resistor, 120 k Ohm $\pm 5\%$, 1/4W	100-1263	1
R62	Resistor, 3.9 k Ohm $\pm 5\%$, 1/4W	100-3943	1
R63	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	1
R64	Resistor, 270 k Ohm $\pm 5\%$, 1/4W	100-2763	1
R65	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R66	Resistor, 330 k Ohm $\pm 5\%$, 1/4W	100-3363	1
R67	Resistor, 820 Ohm $\pm 5\%$, 1/4W	100-8233	1
R68	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	1
R69	Resistor, 180 k Ohm $\pm 5\%$, 1/4W	100-1863	1
R70	Resistor, 620 Ohm $\pm 5\%$, 1/4W	100-6233	1
R71	Potentiometer, 50 k Ohm, 1/2W	177-5054	1
R72,R73	Potentiometer, 10 k Ohm, 0.1W	177-1054	2
XIC1	Socket, 14-Pin DIP	417-1400	1
XIC2	Socket, 8-Pin DIP	417-0800	3
THRU XIC4 -----	Blank Circuit Board	514-1400	1

SECTION VII
DRAWINGS

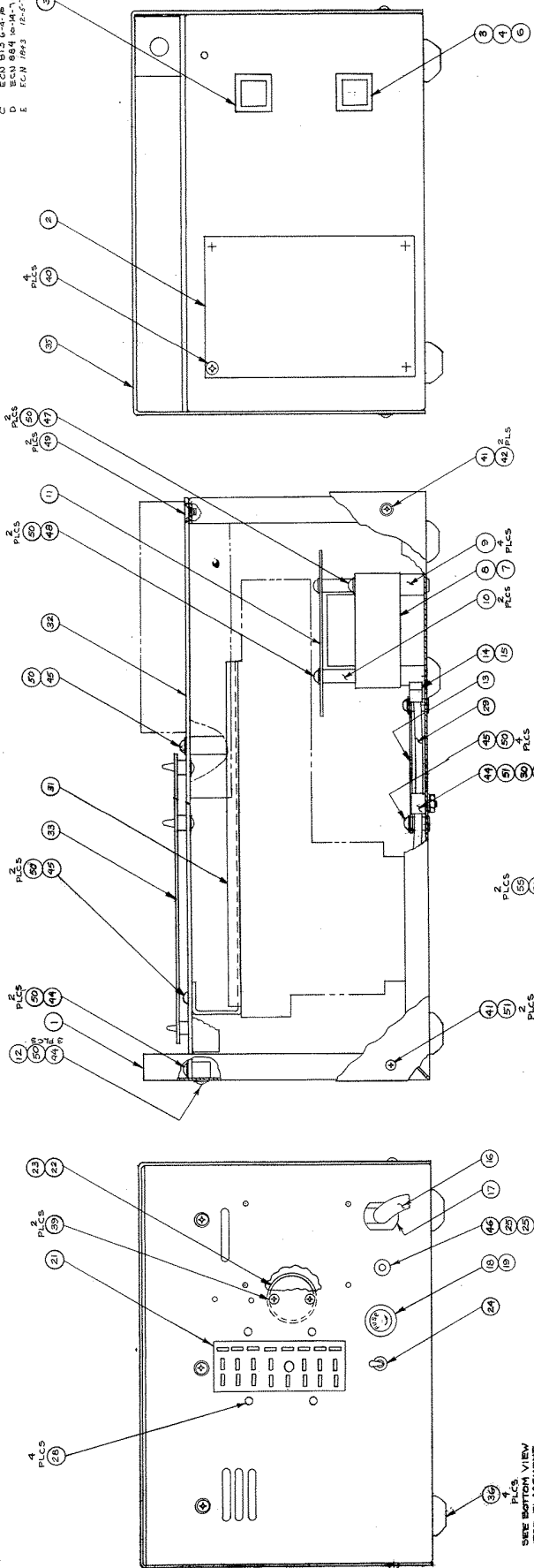
7-1. INTRODUCTION.

7-2. This section provides assembly drawings, schematic diagrams, and wiring diagrams as listed below.

NOTE THE ASSEMBLY DRAWINGS AND SCHEMATICS IN THIS SECTION SHOW THE MOST COMPLEX VERSION AVAILABLE. LESS COMPLEX VERSIONS OF THE MACHINE OR ITS COMPONENTS ARE COVERED BY THESE TOP LEVEL DRAWINGS.

<u>FIGURE</u>	<u>TITLE</u>	<u>NUMBER</u>
7-1	2000 SERIES MONO-PLAYBACK FINAL ASSEMBLY DRAWING	D906-2000
7-2	2000 SERIES RECORD MODULE FINAL ASSEMBLY AND WIRING DRAWING	C906-2012
7-3	2000 SERIES RECORD/PLAY STEREO FINAL ASSEMBLY DRAWING	D906-2021
7-4	DECK PLATE ASSEMBLY DRAWING	D906-2109
7-5	MOTOR MOUNTING SUB-ASSEMBLY DRAWING	C906-2105
7-6	PLAYBACK/LOGIC CIRCUIT BOARD SCHEMATIC DIAGRAM, MONO	C906-2100
7-7	PLAYBACK/LOGIC CIRCUIT BOARD ASSEMBLY DRAWING, MONO	C914-1390
7-8	PLAYBACK/LOGIC CIRCUIT BOARD SCHEMATIC DIAGRAM, STEREO	D906-2132
7-9	PLAYBACK/LOGIC CIRCUIT BOARD ASSEMBLY DRAWING, STEREO	C914-1400
7-10	RECORD MODULE CIRCUIT BOARD SCHEMATIC DIAGRAM	C906-2102
7-11	RECORD MODULE CIRCUIT BOARD ASSEMBLY DRAWING	C914-1393
7-12	RECORD CIRCUIT BOARD SCHEMATIC DIAGRAM, STEREO	D906-2128
7-13	RECORD CIRCUIT BOARD ASSEMBLY DRAWING, STEREO	C914-1397
7-14	POWER SUPPLY CIRCUIT BOARD SCHEMATIC DIAGRAM	B906-2114
7-15	POWER SUPPLY CIRCUIT BOARD ASSEMBLY DRAWING	C914-1391
7-16	WIRING DIAGRAM	D906-2130
7-17	REAR PANEL CONNECTOR WIRING DIAGRAM	B906-2115

REV A 04/09/75 ECN 463 Wm.
 B ECN 853 08/07/76 Wm.
 C ECN 854 10-14-76 Wm.
 D ECN 884 10-14-76 Wm.
 E ECN 1983 12-5-79 JPH



SEE BOTTOM VIEW FOR PLACEMENT OF FEET

ITEM	PART NUMBER	DESCRIPTION
22	370-0024	AUDIO OUTPUT XFMR
23	24-PIN CONNECTOR - C/NCH	
24	371-0000	AUDIO OUTPUT XFMR (SEE FIGURE 1)
19	334-0050	FUSE - 1/2 AMP
18	415-2012	FUSE POST
17	401-0006	STRAIN RELIEF
16	681-1723	LINE CORD, 3 WIRE
15	417-1001	KEY
14	417-1002	D-PIN CARD EDGE CONNECTOR
13	8-914-1391	POWER SUPPLY P.C. ASSY
12	D-470-0101	SUPPORT BRACKET, DECK
11	A-479-0012	SHIELD, XFMR
10	441-9205	STANDOFF, 5/8" LONG
9	441-9300	STANDOFF NYLON, 1/2"
8	376-7656	POWER TRANSFORMER
7	635-2111V	CONNECTOR
6	343-0077	GREEN SWITCH CAP
5	343-0076	RED SWITCH CAP
4	321-008F	LAMP, #25
3	343-0009	SWITCH, 5/16" PUSH BUTTON
2	A-530-0004	BLANK FRONT PANEL, SCREENED
1	D-530-0001	CHASSIS, STENCILED & SCREENED
	D-906-2000	MONO-PLAYBACK, FINAL ASSEMBLY

PARTS LIST

BROADCAST ELECTRONICS, INC.
 - A PHILIPPS COMPANY -

2000 SERIES
 MONO-PLAYBACK
 FINAL ASSEMBLY REV. E
 D-906-2000

DRAWN: _____
 CHECKED: _____
 SCALE: 1:1

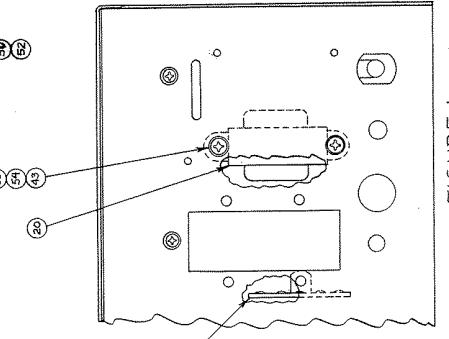
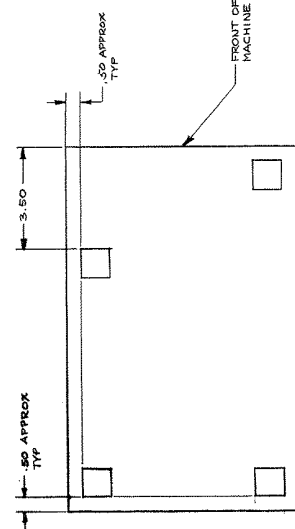
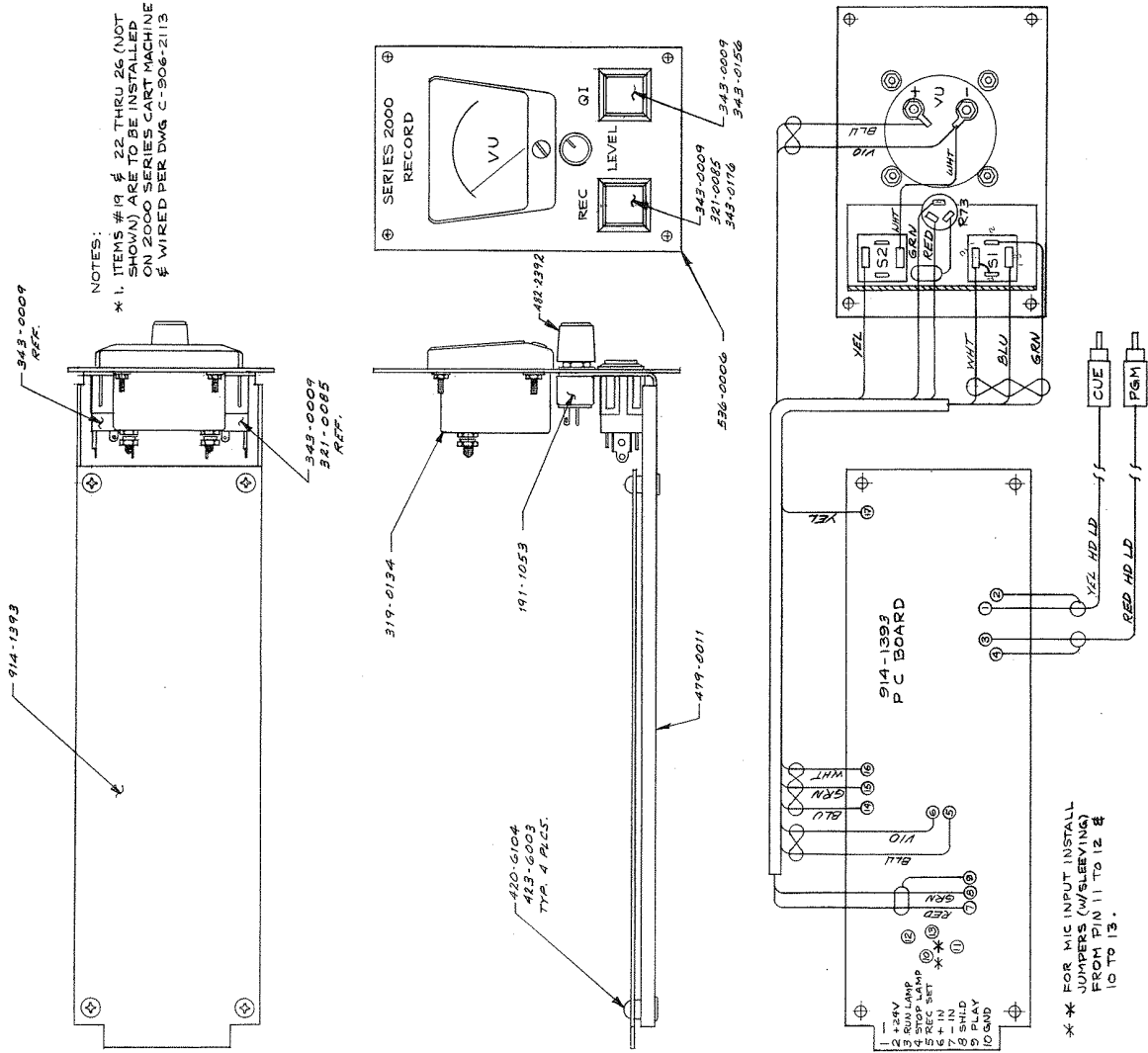


FIGURE 1
 CONFIGURATION WHEN ALTERNATE
 OUTPUT XFMR IS USED



BOTTOM VIEW
 1/2 SCALE

REV A ECN 436 4/7/55
 B ECN 556 7/29/55
 C ECN 889 10/24/56
 D ECN 896 11-15-56
 E PER ECN 4217 MARK22 4-18-65 JLT



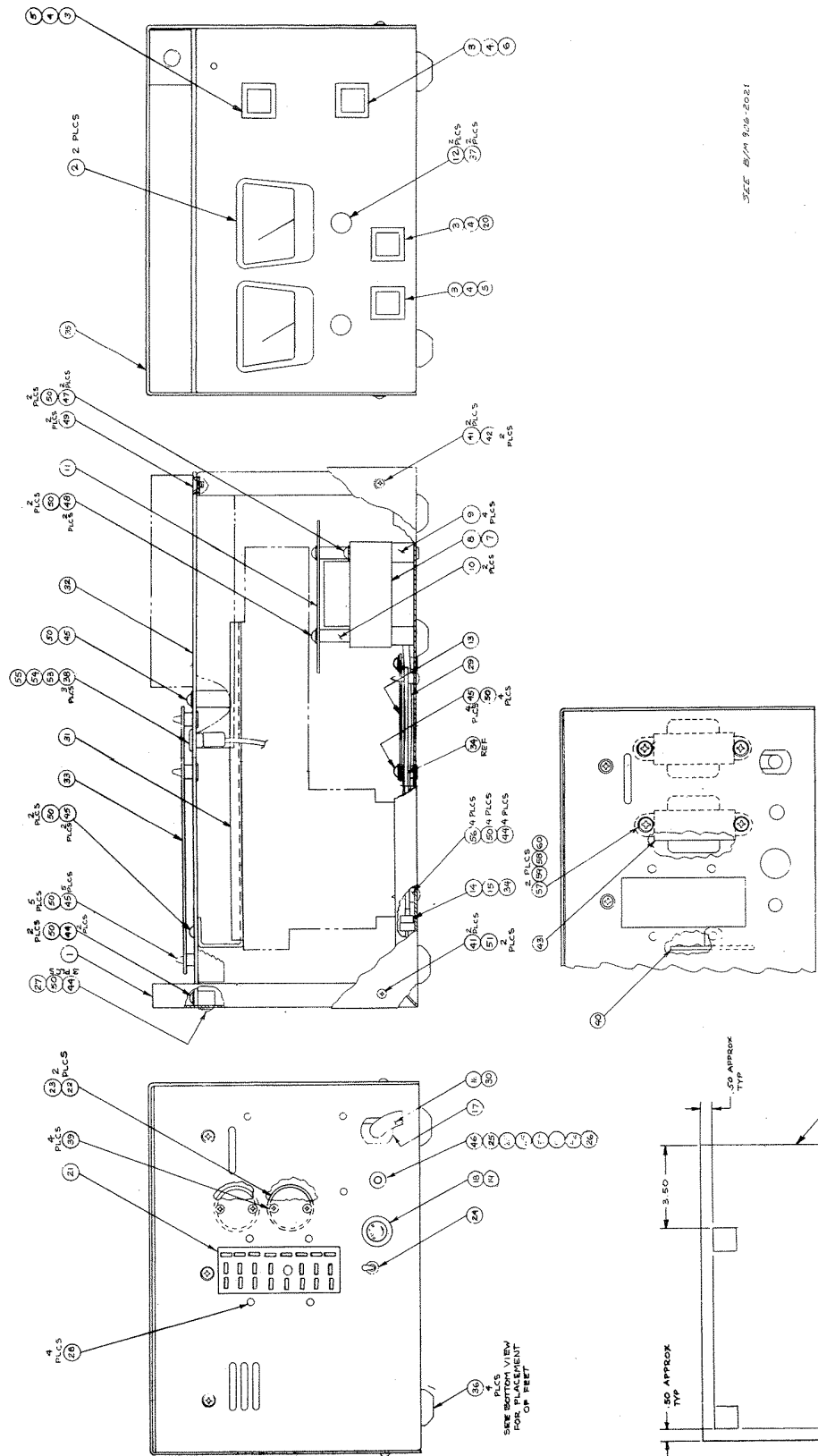
SEE B/M 906-2012

BROADCAST ELECTRONICS, INC.

2000 SERIES
 RECORD MODULE
 FINAL ASSEMBLY
 & WIRING REV F
 C-906-2012

DRAWN: 12/6/74 MJS
 CHECKED:
 SCALE: FULL
 (FORMERLY C-906-2104)

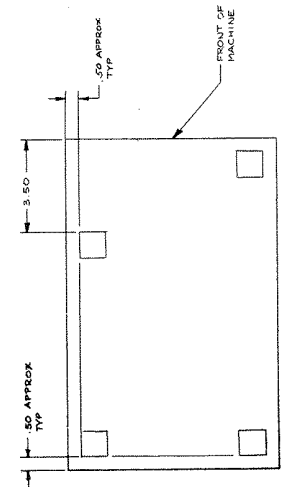
REV A
 REV B
 REV C



SEE 201-22-76 Wm.

BROADCAST ELECTRONICS, INC.
 A WHITTAKER COMPANY
 2000 SERIES
 RECORD PLAY STEREO
 FINAL ASSEMBLY
 REV D
 D-906-2021
 SCALE: 1:1
 DRAWN: J.E. Wm.

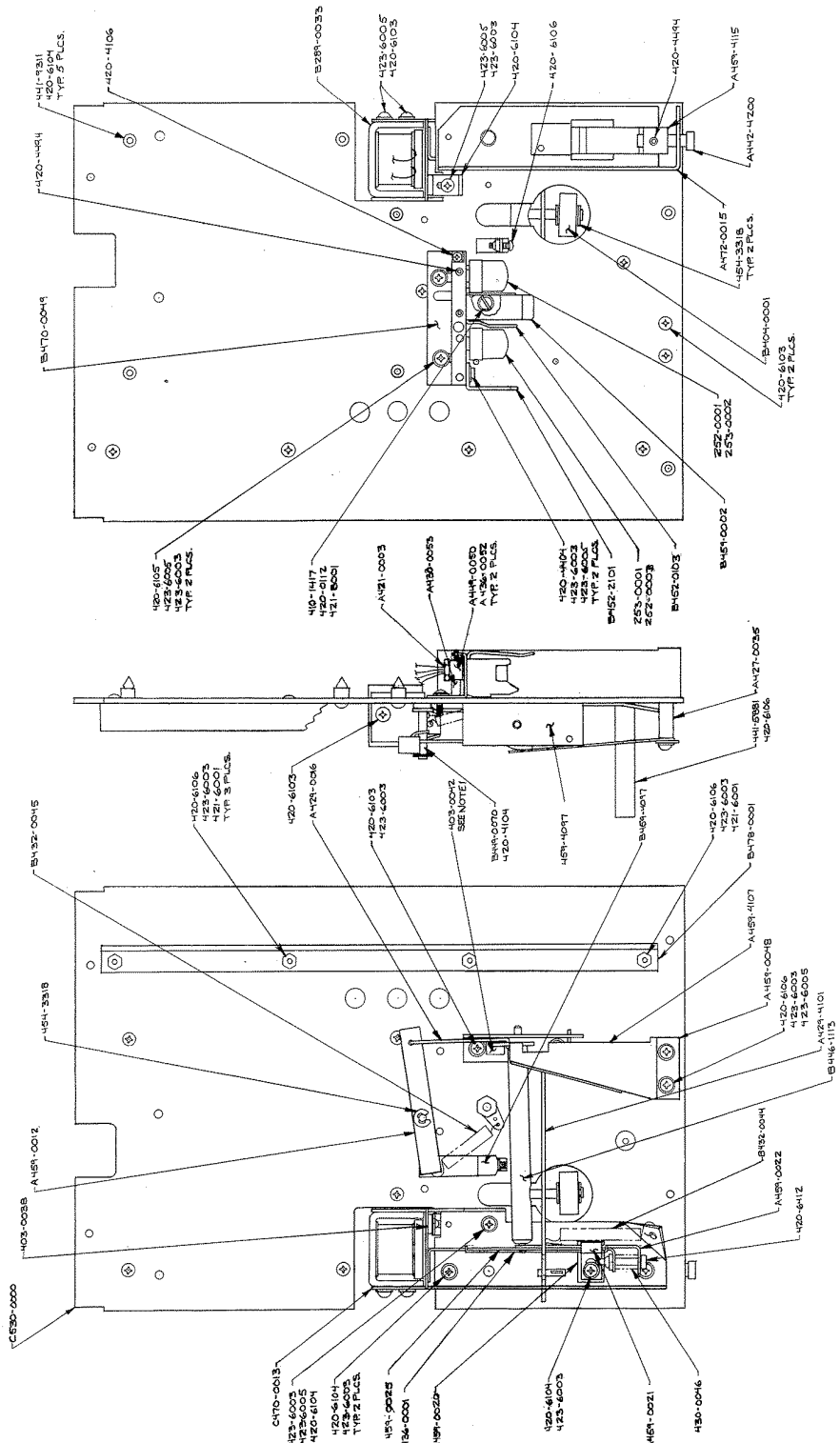
FIGURE 1
 CONFIGURATION WHEN ALTERNATE
 OUTPUT XPHRS ARE USED



BOTTOM VIEW
 1/2 SCALE

REV A ECN # TCO 4/19/76
 B ECN # 919 6-4-76
 C ECN # 919 6-4-76
 D ECN # 919 6-4-76
 E ECN # 926 3-15-77
 F ECN # 926 3-15-77
 G ECN # 978 12-18-78

SEE B/M 86-2021

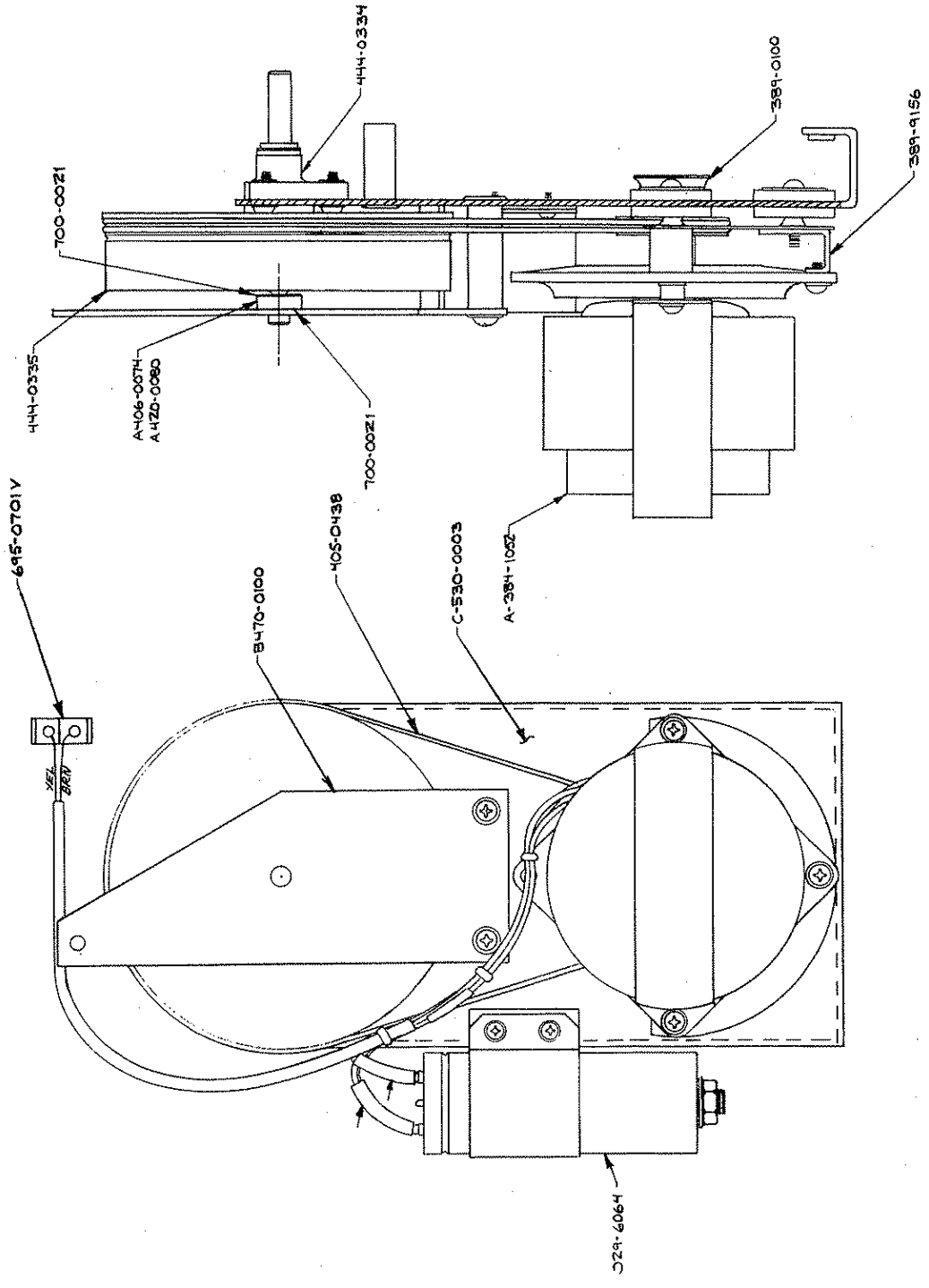


NOTES:
 1. APPLY 403-008 USING EASTMAN 910 (OR EQUIVALENT) IN APPROXIMATE POSITION SHOWN.

BROADCAST ELECTRONICS, INC.
 A FULLWAY COMPANY
 1000/2000 SERIES
 DECK PLATE ASSEMBLY
 REV. D 906-2109
 DRAWN: 1/17/74 MASB
 CHECKED: 1/11/74
 SCALE: 1:1

REV A 04/09/75 ECN 463 W.P.
 B ECN 813 9-4-76
 C ECN 839 9-29-76
 D ECN 1142 2-10-78
 E ECN 4026 -JAH 1-10-83

SEE B/M 906-2021



- NOTES:
1. REMOVE SHAFT FROM FLYWHEEL ASSY (ITEM 2) & REPLACE WITH SHAFT (ITEM 3).

BROADCAST ELECTRONICS, INC.
 1000/2000 SERIES
 MOTOR MOUNTING SUB ASSEMBLY
 REV E
 C-906-2105
 DRAWN: 12/13/74 TMSB SCALE: FULL

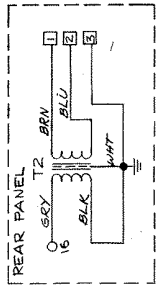
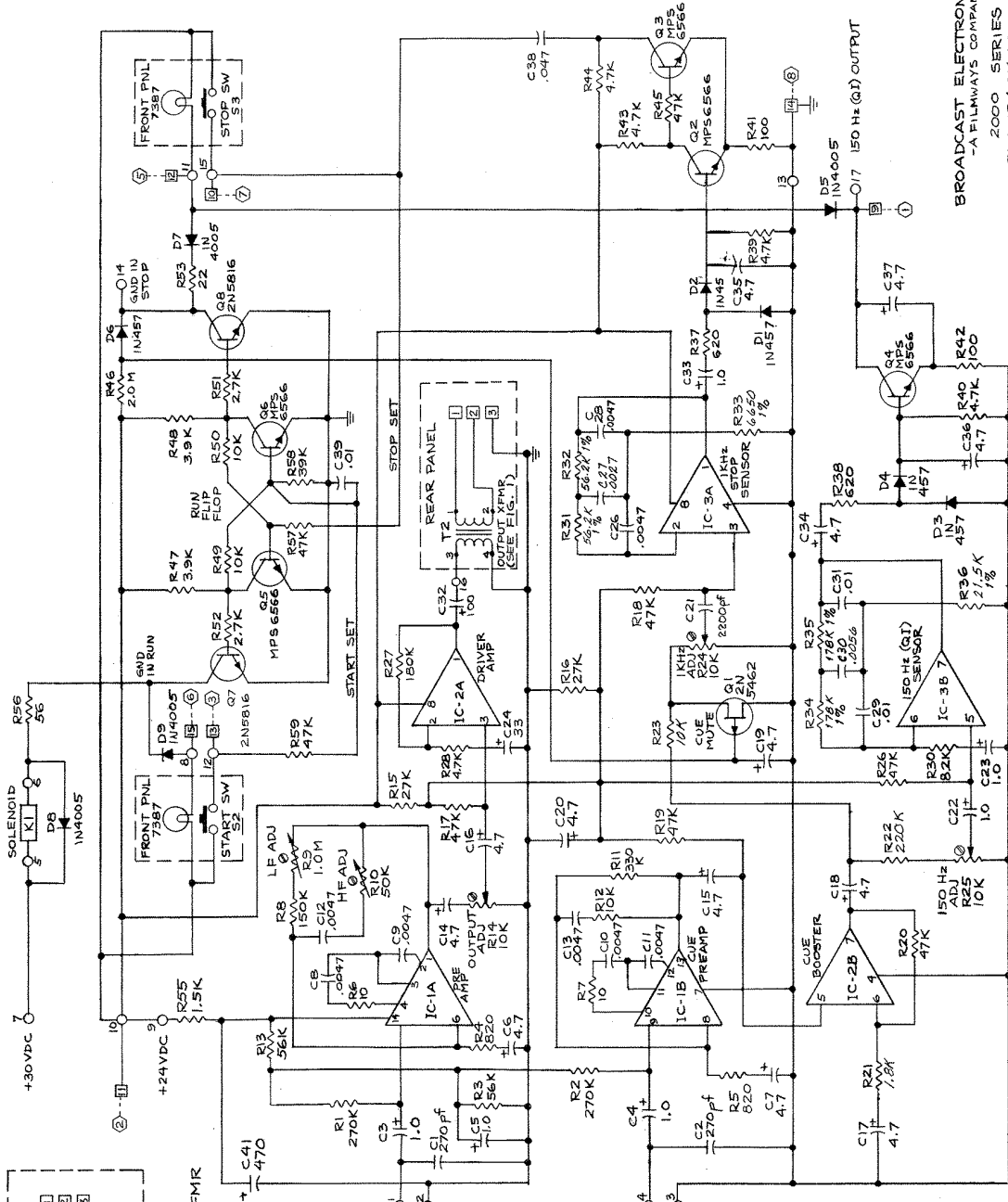


FIGURE 1

(CONFIGURATION WHEN ALTERNATE OUTPUT XFMR IS USED)



NOTES:

1. RESISTORS IN OHMS, 1/4W; CAPACITORS MFD, UNLESS NOTED OTHERWISE.
2. REAR PANEL REMOTE CONTROL SOCKET ON UNITS WITH OCTAL TYPE (INSTEAD OF ⑧).
3. REAR PANEL REMOTE CONTROL SOCKET:

- 1 - + OUTPUT
- 2 - SHLD
- 3 - NC
- 4 - NC
- 5 - NC
- 6 - NC
- 7 - NC
- 8 - NC
- 9 - Q1 LAMP
- 10 - STOP CONTROL
- 11 - +24V CONTROL
- 12 - STOP LAMP
- 13 - START CONTROL

- 14 - GROUND
- 15 - RUN LAMP
- 16 - NC
- 17 - NC
- 18 - NC
- 19 - + INPUT
- 20 - - INPUT
- 21 - SHLD

- 22 - NC
- 23 - NC
- 24 - NC

4. ASSEMBLY DRAWG-2914-1390

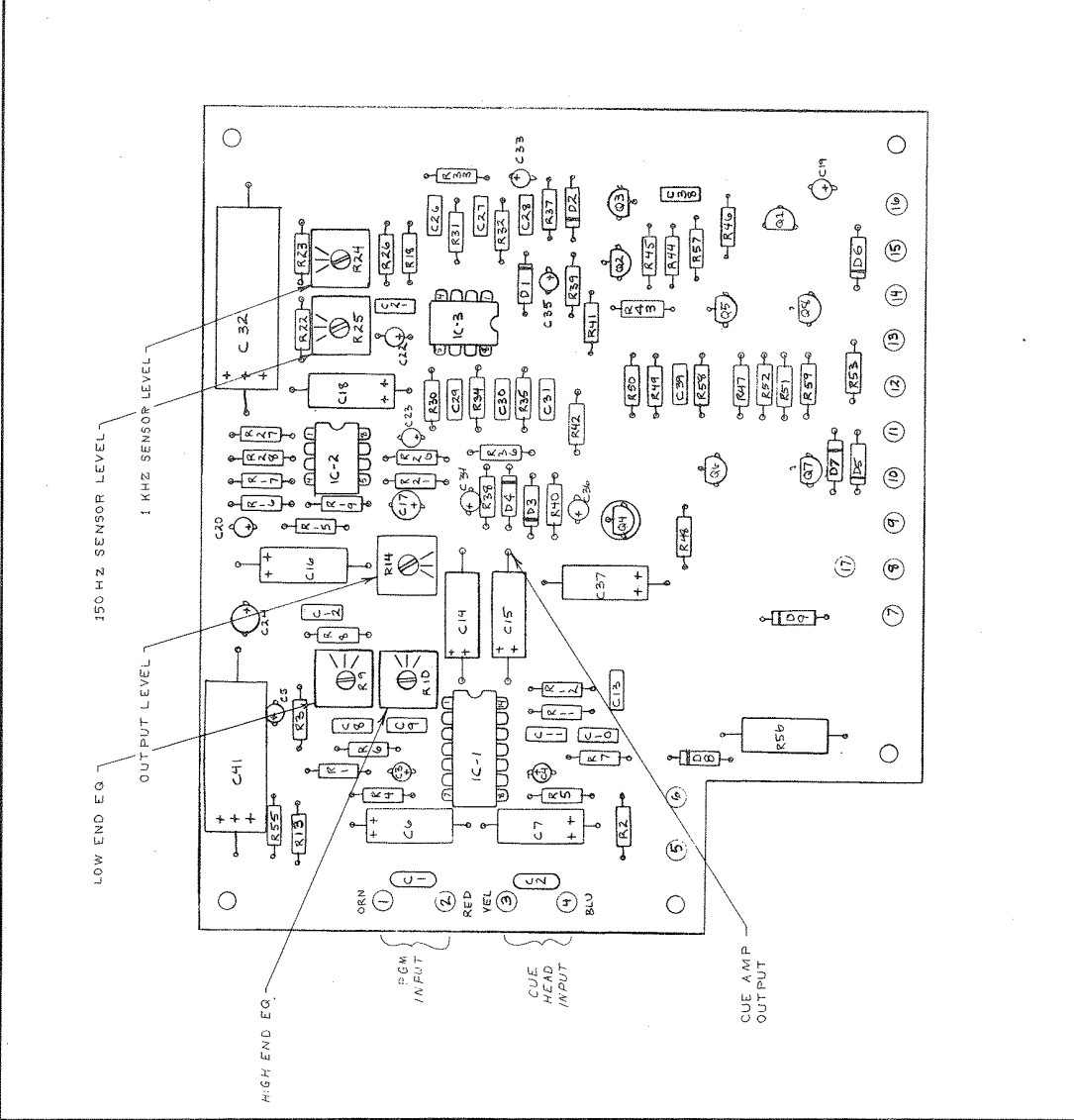
- 1. ECN 3546 6-11-82 DAF
- 2. ECN 3272 3-24-82 MARK
- 3. ECN 1121 2-1-78 CLO
- 4. ECN 884 10-14-76
- 5. ECN 596 4-29-75
- 6. ECN 522 6/24/75
- 7. ECN 480 3/24/75
- 8. ECN 3546 6-11-82 DAF

REV A - ECN NO. 445

BROADCAST ELECTRONICS, INC.
-A PHILMATS COMPANY-
2000 SERIES
PLAYBACK LOGIC PCB
MONO
SCHEMATIC
REV J
C-906-2100

DRAWN: 1/19/74 MRS

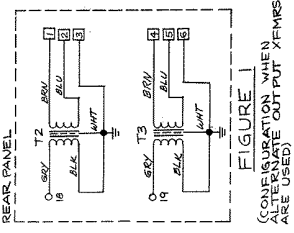
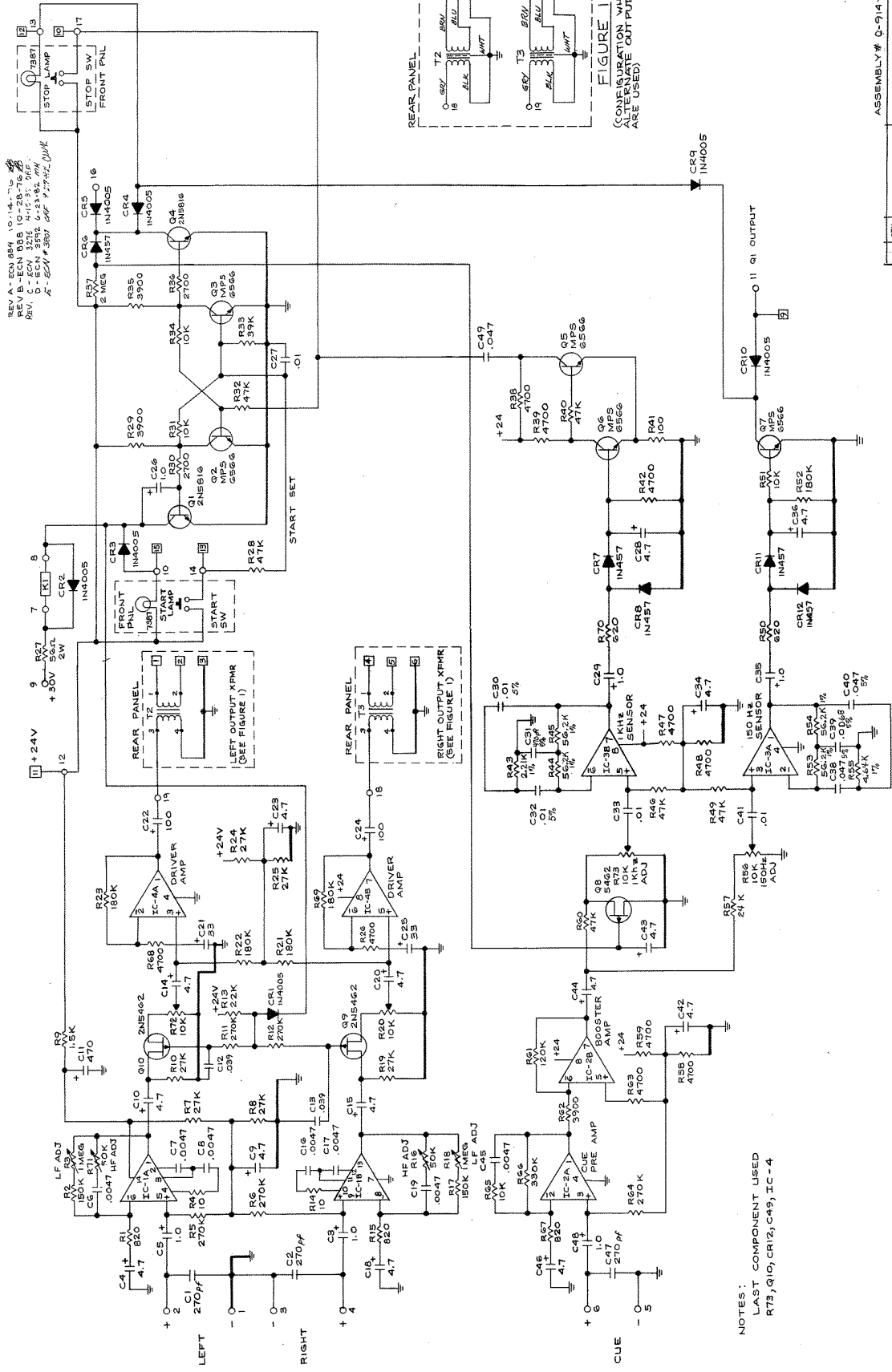
REV	DESCRIPTION	DATE	APPROVED
A	PER ECN NO. 441	12-23-74	
B	PER ECN NO. 441	1-21-75	
C	PER ECN NO. 445	2/12/75	
D	PER ECN NO. 317	6/20/75	
E	PER ECN NO. 395 & 396	7/27/75	
F	PER ECN NO. 759	4-14-76	
G	PER ECN NO. 702	1-26-76-CLO	
H	PER ECN NO. 7721	2-1-78-CLO	
J	REMOVED PART LIST	4-22-81	
K	PER ECN # 3111	12-9-81-NH	
L	PER ECN # 3272	3-24-82-NH	
M	PER ECN # 3546	6-11-82	JAF



SEE B/M NO. 214-1390
SEE SCHEMATIC NO. C-906-2100

TOLERANCE UNLESS OTHERWISE SPECIFIED: RESISTORS ±1% FRACTIONAL ±1% ANGLES ±0.1° TO ±0.5° BEND RADIUS ±0.015" FILLET RADIUS ±0.015"		DRAWN: 12/17/74-JAF	
PROPRIETARY RIGHTS are included in this document. Information contained herein shall be reproduced or transferred to other documents without the written consent of BROADCAST ELECTRONICS, INC.		CHECKED: _____	
PROJECT: _____		DATE: _____	
APPROVED BY: _____		TREATMENT OR FINISH: _____	
TITLE: PLAYBACK LOGIC PC ASSEMBLY		SCALE: E-1	
BROADCAST ELECTRONICS, INC. — A FILMWAYS COMPANY		DWS NO. 914-1390	
2000 SERIES		SHEET 1 OF 1	

REV A - ECN 884 10-14-76
 REV B - ECN 905 12-23-76
 REV C - ECN 906 12-23-76
 REV D - ECN 952 6-23-82
 REV E - ECN 987 4-27-82

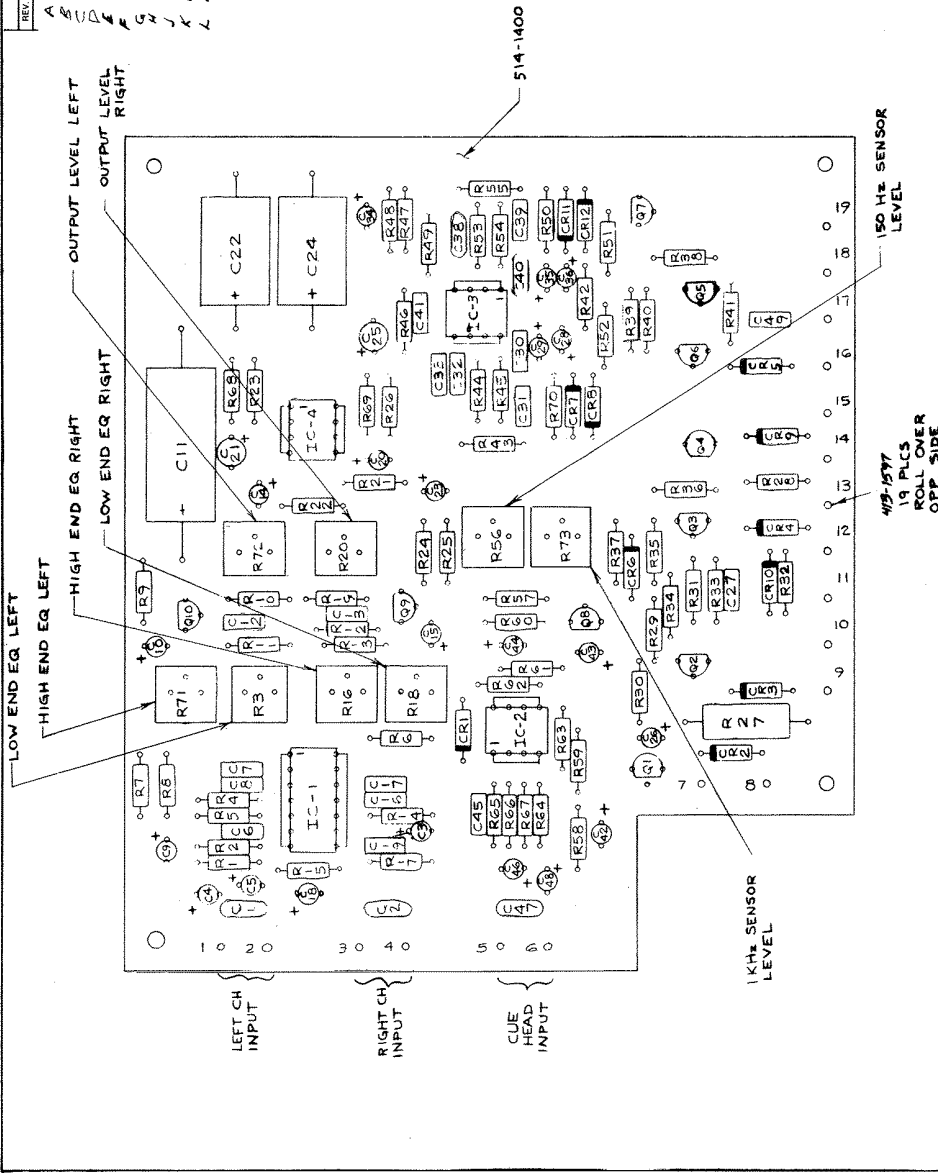


NOTES:
 LAST COMPONENT USED
 R73, Q10, CR12, C49, IC-4

ITEM		PART NUMBER		DESCRIPTION		NOTE																																									
1	PCB	1000	1000	STEREO PLAYBACK/LOGIC PCB																																											
<table border="1"> <thead> <tr> <th colspan="2">LIST OF MATERIAL</th> <th colspan="2">DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td>Q1</td> <td>2N5462</td> <td>Q2</td> <td>2N5462</td> </tr> <tr> <td>Q2</td> <td>2N5462</td> <td>Q3</td> <td>2N5462</td> </tr> <tr> <td>Q3</td> <td>2N5462</td> <td>Q4</td> <td>2N5462</td> </tr> <tr> <td>Q4</td> <td>2N5462</td> <td>Q5</td> <td>2N5462</td> </tr> <tr> <td>Q5</td> <td>2N5462</td> <td>Q6</td> <td>2N5462</td> </tr> <tr> <td>Q6</td> <td>2N5462</td> <td>Q7</td> <td>2N5462</td> </tr> <tr> <td>Q7</td> <td>2N5462</td> <td>Q8</td> <td>2N5462</td> </tr> <tr> <td>Q8</td> <td>2N5462</td> <td>Q9</td> <td>2N5462</td> </tr> <tr> <td>Q9</td> <td>2N5462</td> <td>Q10</td> <td>2N5462</td> </tr> </tbody> </table>								LIST OF MATERIAL		DESCRIPTION		Q1	2N5462	Q2	2N5462	Q2	2N5462	Q3	2N5462	Q3	2N5462	Q4	2N5462	Q4	2N5462	Q5	2N5462	Q5	2N5462	Q6	2N5462	Q6	2N5462	Q7	2N5462	Q7	2N5462	Q8	2N5462	Q8	2N5462	Q9	2N5462	Q9	2N5462	Q10	2N5462
LIST OF MATERIAL		DESCRIPTION																																													
Q1	2N5462	Q2	2N5462																																												
Q2	2N5462	Q3	2N5462																																												
Q3	2N5462	Q4	2N5462																																												
Q4	2N5462	Q5	2N5462																																												
Q5	2N5462	Q6	2N5462																																												
Q6	2N5462	Q7	2N5462																																												
Q7	2N5462	Q8	2N5462																																												
Q8	2N5462	Q9	2N5462																																												
Q9	2N5462	Q10	2N5462																																												
<table border="1"> <thead> <tr> <th colspan="2">FOR THE EXCLUSIVE USE OF PERSONNEL AND COMPONENTS MATERIAL</th> <th colspan="2">TREATMENT OR FINISH</th> <th colspan="2">2000 SERIES</th> <th colspan="2">SHEET 1 OF 1</th> </tr> </thead> <tbody> <tr> <td>DATE</td> <td>10-14-76</td> <td>BY</td> <td>J. J. [unreadable]</td> <td>REV</td> <td>1</td> <td>NO.</td> <td>906-2132</td> </tr> <tr> <td>DESIGNED</td> <td>J. J. [unreadable]</td> <td>CHECKED</td> <td>J. J. [unreadable]</td> <td>DATE</td> <td>10-14-76</td> <td>TITLE</td> <td>SCHEMATIC, STEREO PLAYBACK/LOGIC PCB</td> </tr> <tr> <td>APPROVED</td> <td>J. J. [unreadable]</td> <td>DATE</td> <td>10-14-76</td> <td>BY</td> <td>J. J. [unreadable]</td> <td>NO.</td> <td>906-2132</td> </tr> </tbody> </table>								FOR THE EXCLUSIVE USE OF PERSONNEL AND COMPONENTS MATERIAL		TREATMENT OR FINISH		2000 SERIES		SHEET 1 OF 1		DATE	10-14-76	BY	J. J. [unreadable]	REV	1	NO.	906-2132	DESIGNED	J. J. [unreadable]	CHECKED	J. J. [unreadable]	DATE	10-14-76	TITLE	SCHEMATIC, STEREO PLAYBACK/LOGIC PCB	APPROVED	J. J. [unreadable]	DATE	10-14-76	BY	J. J. [unreadable]	NO.	906-2132								
FOR THE EXCLUSIVE USE OF PERSONNEL AND COMPONENTS MATERIAL		TREATMENT OR FINISH		2000 SERIES		SHEET 1 OF 1																																									
DATE	10-14-76	BY	J. J. [unreadable]	REV	1	NO.	906-2132																																								
DESIGNED	J. J. [unreadable]	CHECKED	J. J. [unreadable]	DATE	10-14-76	TITLE	SCHEMATIC, STEREO PLAYBACK/LOGIC PCB																																								
APPROVED	J. J. [unreadable]	DATE	10-14-76	BY	J. J. [unreadable]	NO.	906-2132																																								

REV	DESCRIPTION	DATE	APPROVED
A	PER E.C.N. # 817	6-17-68	
B	PER E.C.N. # 817	8-17-68 MSD	
C	PER E.C.N. # 817	8-30-68 L8	
D	PER E.C.N. # 817	1-16-78 CLO	
E	PER E.C.N. # 3361	3-23-82 MERK	
F	PER E.C.N. # 3875	4-15-82 XAT	
G	SEE E.C.N. # 3528	6-11-82 CAMK	
H	PER E.C.N. # 3581	6-23-82 CAMK	
J	PER E.C.N. # 3693	7-15-82 CAMK	
K	PER E.C.N. # 3801	8-9-82 CAMK	
L	PER E.C.N. # 3801	9-27-82 CAMK	

CAMK



SEE S/W 914-1400
SEE SCHEMATIC D706-2/32

DRAWN		DATE		CHECKED		DATE		BY		DATE		APPROVED		DATE	
C		9/4/1900		2/1		2/1		2/1		2/1		2/1		2/1	

TREATMENT OF FINISH: _____

MATERIAL: _____

PROPERTY RIGHTS are included in this information disclosed herein. This information is for internal use only and is not to be distributed outside the organization without the express written consent of BROADCAST ELECTRONICS, INC.

OTHERWISE SPECIFIED: _____

DECIMAL 2 PL ± 0.1 3PL ± 0.05

ANGULAR ± 0.1 15M

SHARP EDGES TO

OR USE OF DISCREETION TO OBTAIN FOR MANUFACTURING PURPOSES UNLESS OTHERWISE SPECIFIED BY BROADCAST ELECTRONICS, INC.

BROADCAST ELECTRONICS INC.
—A FILMWAYS COMPANY—

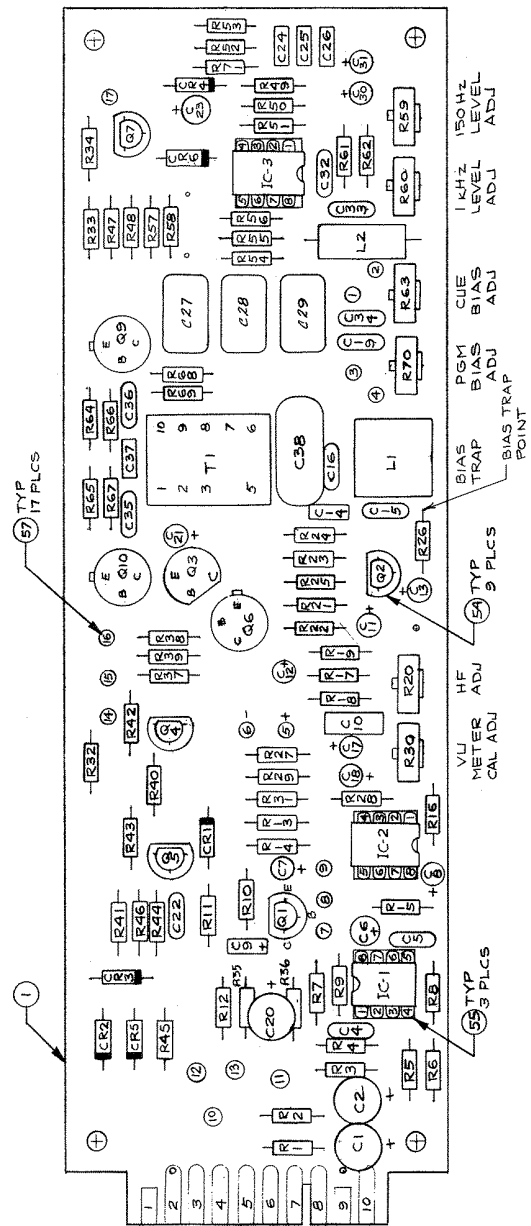
TITLE: **PLAYBACK (STEREO)**

DWG. NO.: **914-1400**

SCALE: **2/1**

SHEET: **1** OF **1**

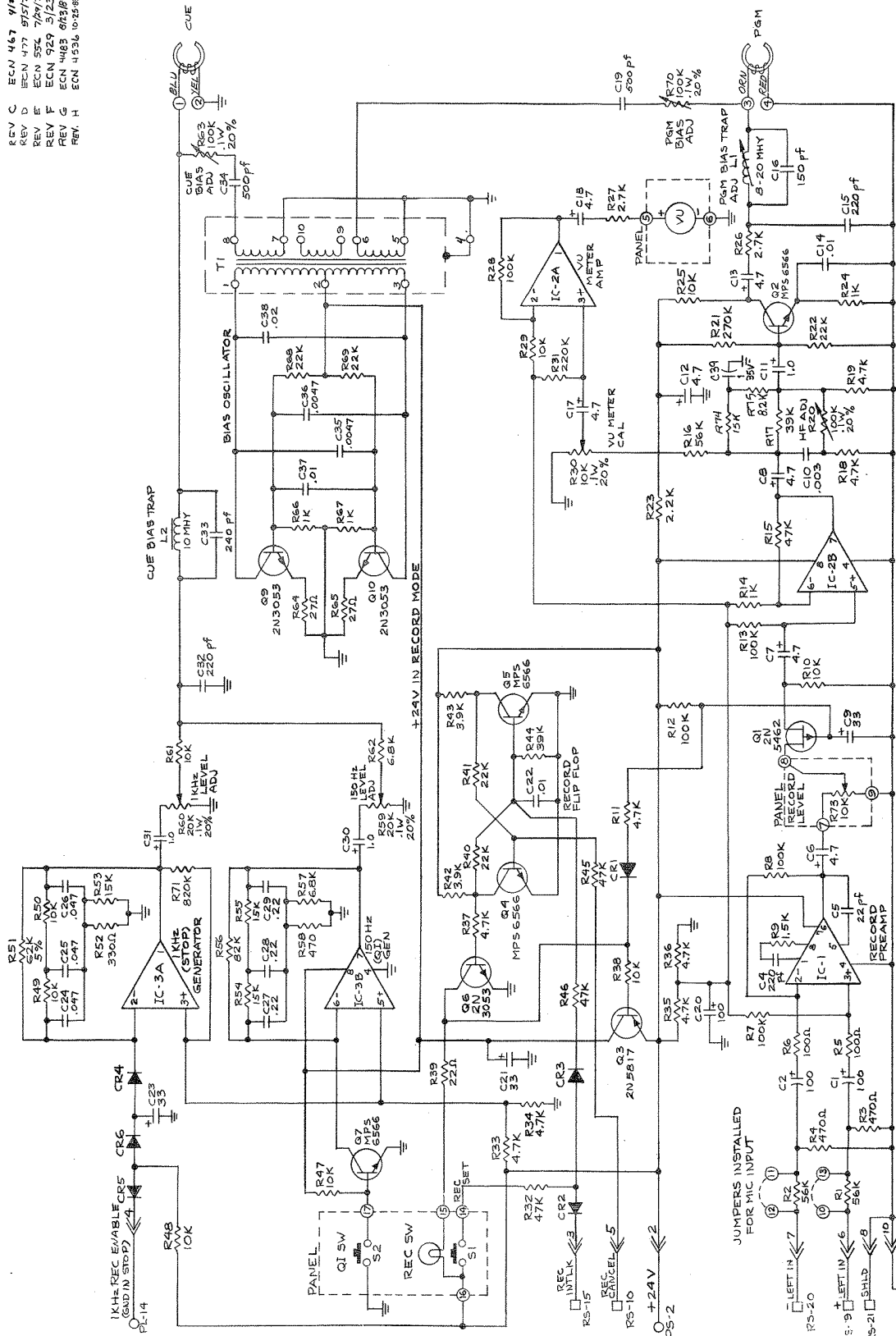
REV.	DESCRIPTION	DATE	APPROVED
A	PER ECM 453	7-26-74	
B	PER ECM 456	1-6-75	
C	PER ECM 462 & 467	4-29-75	
D	PER ECM 477	5-5-75	MB
E	PER ECM 536	7-27-75	MB
F	PER ECM 696	10-27-75	LD
G	PER ECM 663	11-10-75	LD
H	PER ECM 663	5-21-81	MB
J	PER REV 3757	9-16-88	CMR



SEE SCHEMATIC #906-2102
SEE B/M # 914-1393

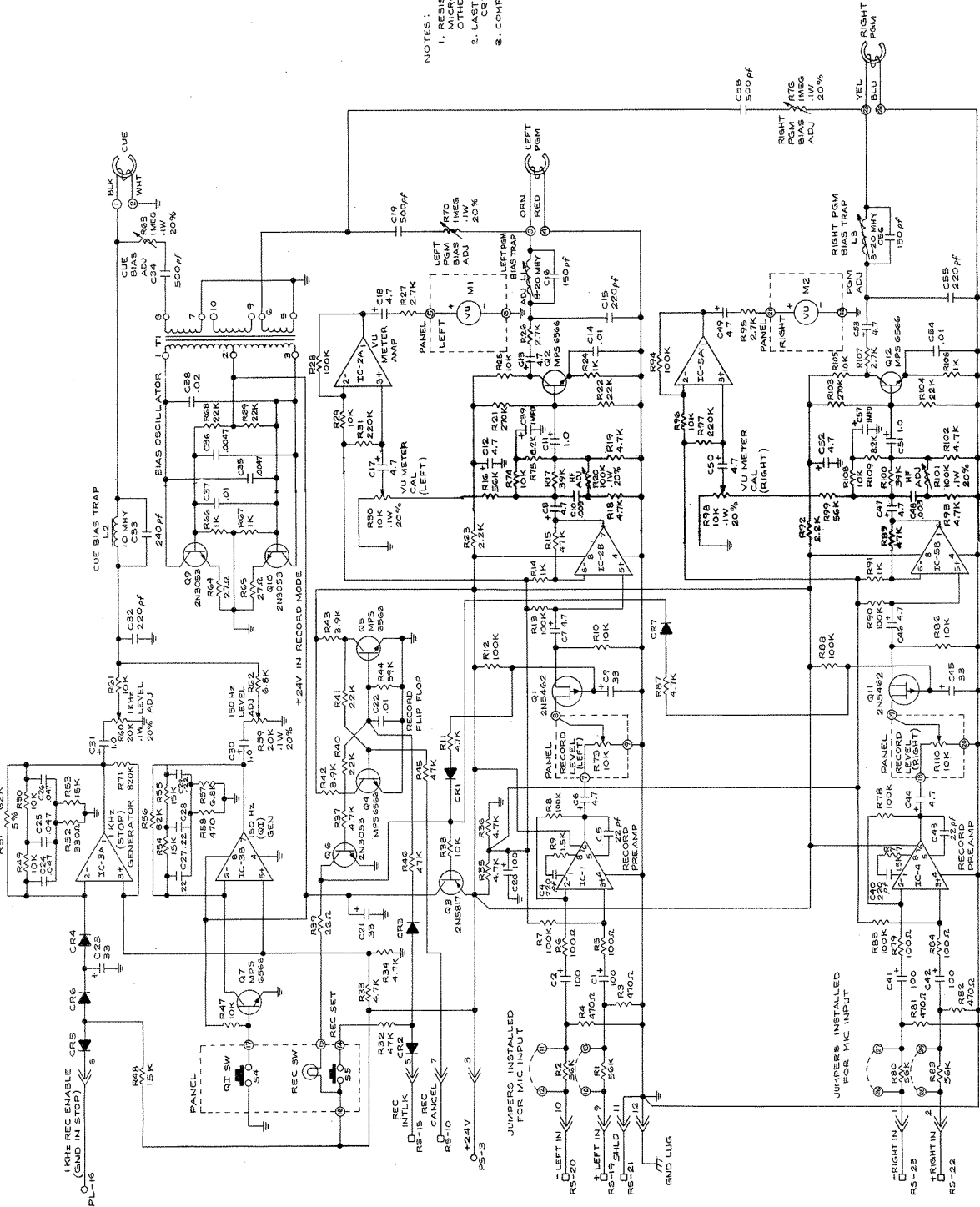
BROADCAST ELECTRONICS INC.		DATE 12/25/74	
TOLERANCE UNLESS OTHERWISE SPECIFIED		BY	DATE
DECIMALS 2 PL = 01 3PL = 005		BY	DATE
FRACTIONAL 1/16 1/8 1/4 1/2 3/4 1		BY	DATE
SHARP EDGES TO POINTS		BY	DATE
PILET HOLE		BY	DATE
MATERIAL		TREATMENT ON FINISH	
PROPRIETARY RIGHTS ARE RESERVED IN THIS INFORMATION. THIS INFORMATION IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITING OF BROADCAST ELECTRONICS, INC.		REV. <input checked="" type="checkbox"/>	SCALE
TITLE PCB ASSEMBLY RECORD MODULE		2000 SERIES	SHEET 1 OF 1
DRAWING NO. 914-1393			

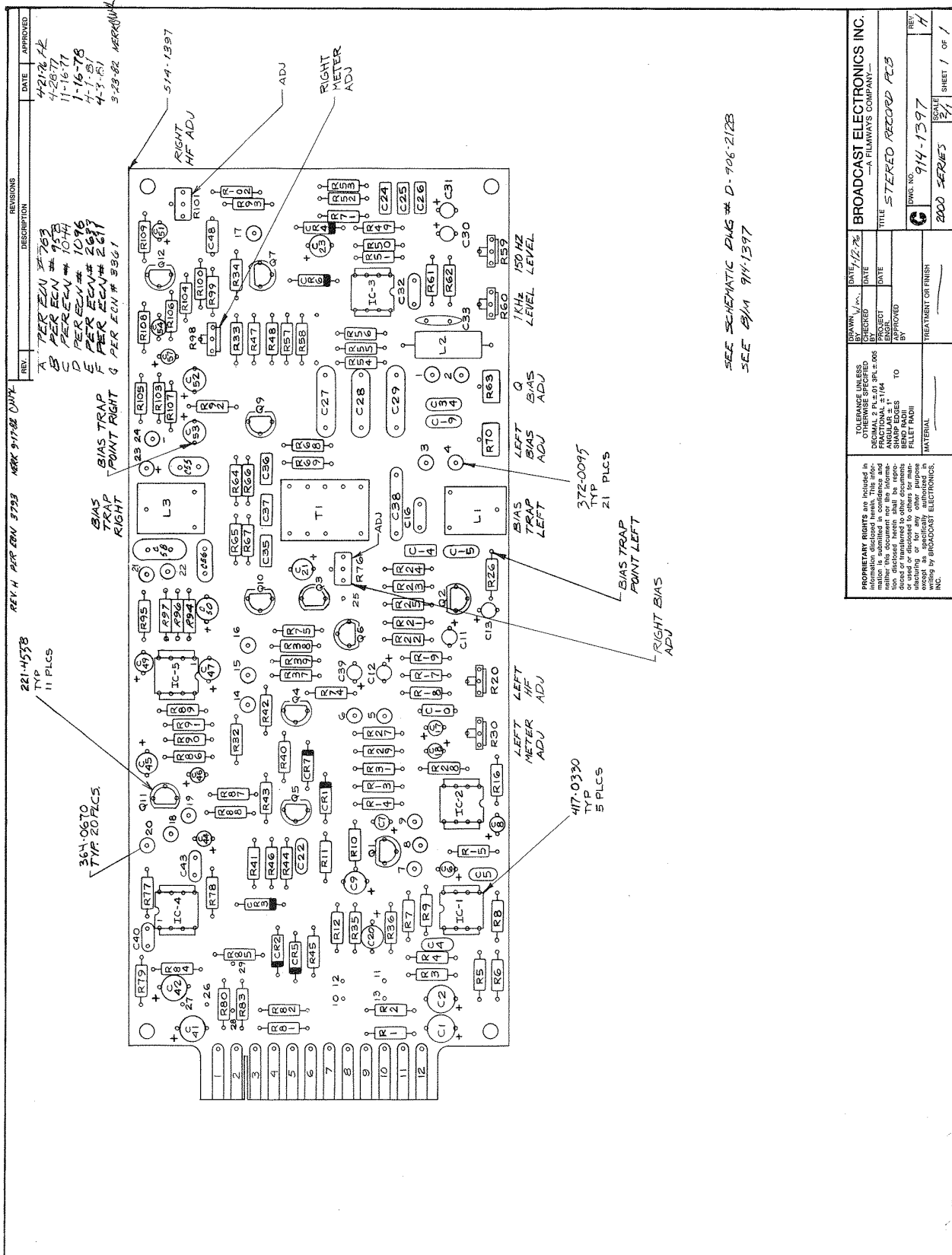
REV C ECN 467 9/24/70
 REV D ECN 477 9/27/70
 REV E ECN 552 7/27/70
 REV F ECN 929 5/23/77
 REV G ECN 483 8/23/88 OK JLD
 REV H ECN 4536 10/25/88 OK JLD



BROADCAST ELECTRONICS, INC.
 - A FILMWAYS COMPANY -
 2000 SERIES
 RECORD MODULE SCHEMATIC
 REV H
 C-906 - 2102
 DRAWN: 11/17/74 TMSB
 CHECKED:

NOTES:
 1. RESISTORS IN OHMS, 1/4W, 10%; CAPACITORS IN MICROFARADS; DIODES IN 457; UNLESS NOTED OTHERWISE.





REV. H PER ECU 3753 MARK 9-7-82 DW/VE

REV.	DESCRIPTION	DATE	APPROVED
A	TER ECU # 783	4-21-76	AK
B	PER ECU # 753	4-28-77	
C	PER ECU # 1044	11-16-77	
D	PER ECU # 1096	1-16-78	
E	PER ECU # 2637	4-1-81	
F	PER ECU # 2671	4-1-81	
G	PER ECU # 3807	3-28-82	MEK/ANK

221-4538
TYP
11 PLCS

364-0670
TYP
20 PLCS

417-0330
TYP
5 PLCS

372-0097
TYP
21 PLCS

SEE SCHEMATIC DIAG # D-906-2/2B
SEE B/M 914-1397

DESIGNED BY	DATE	DATE	DATE
BY	12-76		
PROJECT			
APPROVED			
TITLE	STEERED RECORD PCB		
DWG. NO.	914-1397		
SERIES	2000		
SHEET	1 OF 1		

BROADCAST ELECTRONICS INC.
—A FILMWAYS COMPANY—

PERMANENT RIGHTS are retained in this information disclosed herein. This information is submitted in confidence and shall not be disclosed to any third party without the express written consent of Broadcast Electronics Inc. or used or disclosed to others for manufacturing or for any other purpose without the express written consent of Broadcast Electronics Inc.

TOLEANCE UNLESS OTHERWISE SPECIFIED IS FRACTIONAL ±1/64

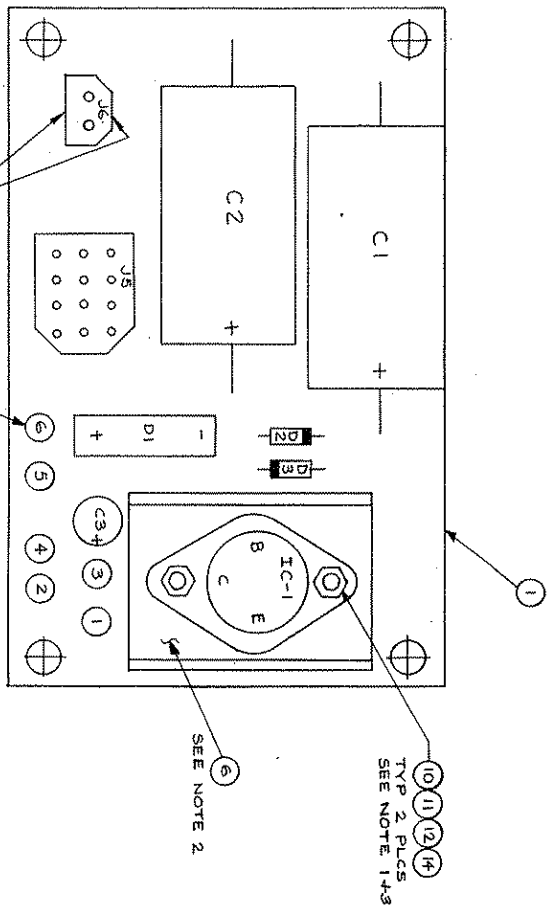
BEND RADIUS TO SHARP EDGES

FILET RADIUS

MATERIAL

TREATMENT OR FINISH

REV B ECN # 444 REVISED 5-10-75
 REDRAWN
 C ECN # 1177 3-27-78 CLO
 D ECN # 1211 6-5-78 CLO
 E ECN # 1809 7-17-77 GH
 F ECN 2090 4-3-70 DLE
 G ECN 2556 3-3-81 LA

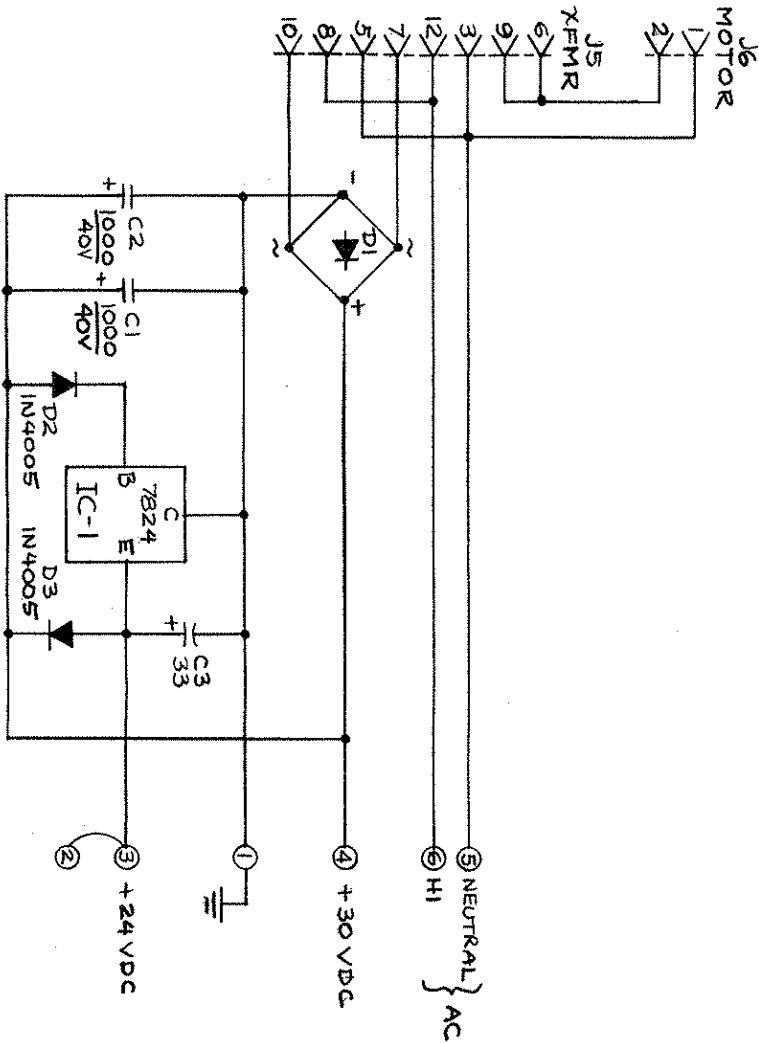


- NOTES:
1. REGULATOR TO BE MOUNTED WITH SCREWS FROM BOTTOM OF BOARD.
 2. HEAT SINK TO BE PROPERLY ORIENTED WITH REGULATOR PINS.
 3. FLAT WASHERS ARE APPLIED TO THE SOLDER SIDE OF THE BOARD UNDER THE SCREW HEAD.

SEE B/M 914-1391
 SEE SCHEMATIC B-906-2114

BROADCAST ELECTRONICS INC
 - A FILMWAYS COMPANY -
 1000/2000 SERIES
 POWER SUPPLY PC ASSY
 C-914-1391
 DRAWN: 01/29/75 WLD. SCALE: 2/1

REV		REVISIONS	DATE	APPROVED
		DESCRIPTION		

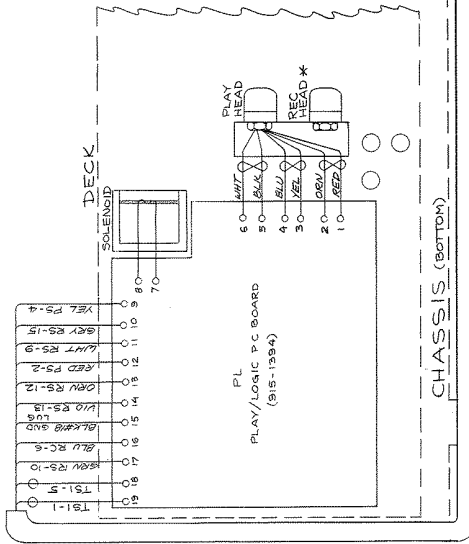
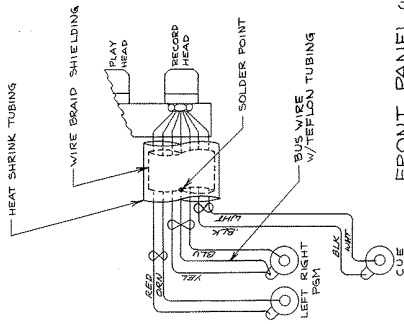


ITEM	QTY	RDD	PART NUMBER	DESCRIPTION	NOTE
LIST OF MATERIAL					
DRAWN BY <i>MSB</i> DATE <i>5/22/65</i>					
CHECKED BY <i>[Signature]</i> DATE <i>5-23-65</i>					
BY <i>[Signature]</i> APPROVED					
TREATMENT OR FINISH					
MATERIAL					
TITLE POWER SUPPLY PCB					
DWG NO. 906-2114					
SCALE 1000/2000 SERIES					
SHEET 1 OF 1					

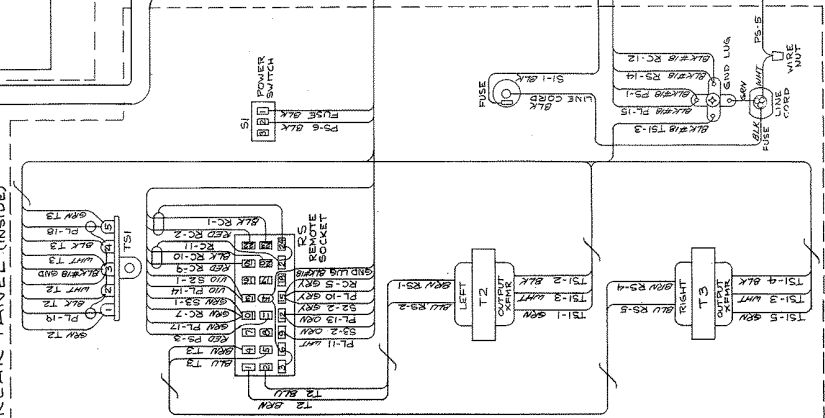
FOR THE EXCLUSIVE USE OF
BROADCAST ELECTRONICS, INC.
PERSONNEL AND CUSTOMERS
ALL RIGHTS RESERVED

REV A - ECM 894 15-05-74
 B - ECM 894 11-18-76
 C - PER ECM 4211 MARKER #18-83 TLT

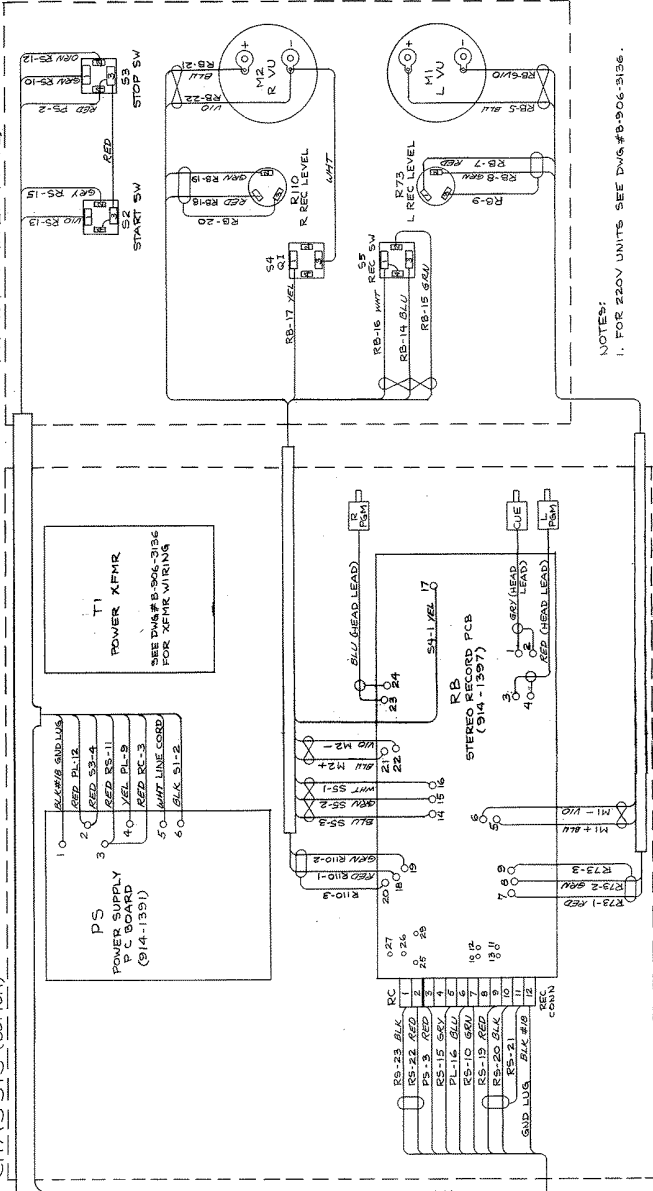
* WIRING FOR RECORD HEAD



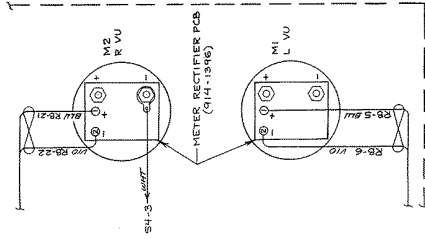
REAR PANEL (INSIDE)



FRONT PANEL (INSIDE)



ALTERNATE WIRING
 TO BE USED WHEN VU METERS
 WITH INTERNAL RECTIFIERS.



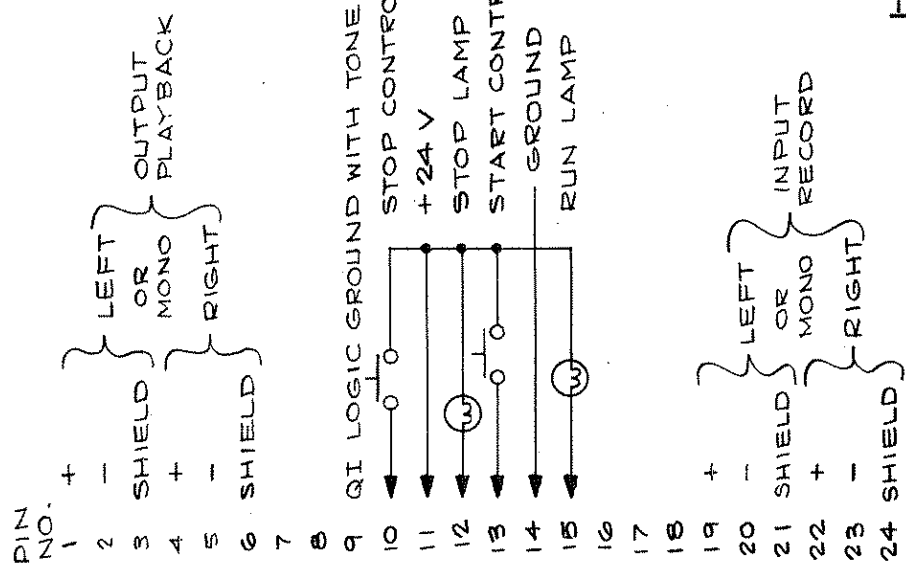
BROADCAST ELECTRONICS, INC.

2000 RPS
 WIRING DIAGRAM
 D. 906-2130

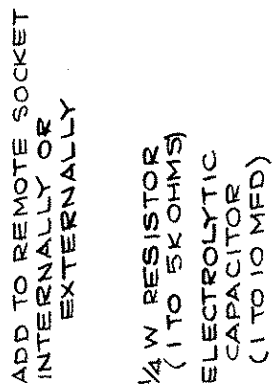
REV 4

NOTES:
 1. FOR 220V UNITS SEE DWS#B-906-3136.

REV	DESCRIPTION	DATE	APPROVED

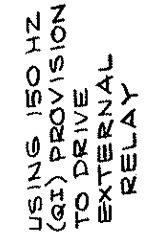


CINCH NO.
P-324-CCT
24 PIN MALE
BEI NO.
418-0306



(SEE NOTE 2)

START CONTROL SECOND UNIT



ITEM	QTY	ROD	PART NUMBER	DESCRIPTION	NOTE

LIST OF MATERIAL	
DRAWN BY	DATE
CHECKED BY	DATE
PROJECT ENGR	DATE
APPROVED BY	DATE
TREATMENT OR FINISH	
MATERIAL	

BROADCAST ELECTRONICS INC. - A FILMWAYS COMPANY -	
TITLE REAR PANEL CONNECTOR WIRING	
DWG NO.	REV
B	906-2115
SCALE	SHEET 1 OF 1

FOR THE EXCLUSIVE USE OF BROADCAST ELECTRONICS, INC. PERSONNEL AND CUSTOMERS ALL RIGHTS RESERVED

NOTES :

- UNBALANCED INPUT OR OUTPUT CONNECT (-) TO SHIELD.
- PROVIDING SEQUENCING OF SEVERAL SERIES 2000 MACHINES USING BUILT IN 150 HZ (Q1) PROVISION.
- ALL LAMPS 28V, .05A OR LESS.

SECTION VIII

APPENDIX

8-1. INTRODUCTION.

8-2. This appendix lists data applicable to the operation and use of the Broadcast Electronics Series 2000 Audio Cartridge Machine. The following information is contained in this section:

A. The NAB Tape Cartridge and Its Maintenance.

BROADCAST ELECTRONICS, INC.

The NAB Tape Cartridge and Its Maintenance

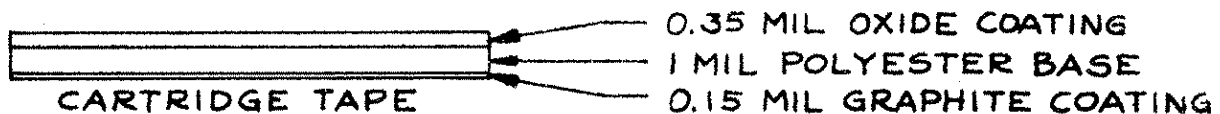
TABLE OF CONTENTS	PAGE NO.
The NAB Tape Cartridge	1
Cartridge Maintenance Tips	7
Cartridge Recording Procedure	10
Cartridges in Stereophonic Systems	11

THE NAB TAPE CARTRIDGE

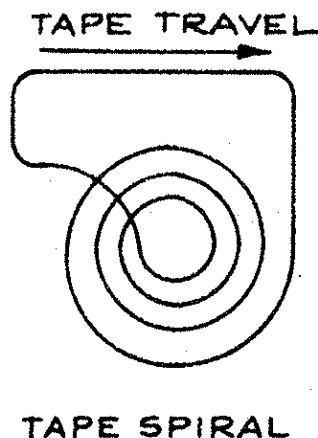
The National Association of Broadcasters (NAB) defines a cartridge as "a plastic or metal enclosure containing an endless loop of lubricated tape, wound on a rotatable hub in such a fashion as to allow continuous motion." Cartridges from the various manufacturers differ slightly in details, but all cartridges usable in NAB standardized systems fit the preceding definition.

THE TAPE

Cartridge tape consists of a synthetic base material approximately 1 mil (0.001 inch) thick. One side of the base is coated with ferric oxide particles for magnetic recording. The other surface is coated with a graphite layer. The total thickness of the tape is approximately 1.5 mils (0.0015 inch). The tape is 0.248 (+0/-0.002) inches wide.



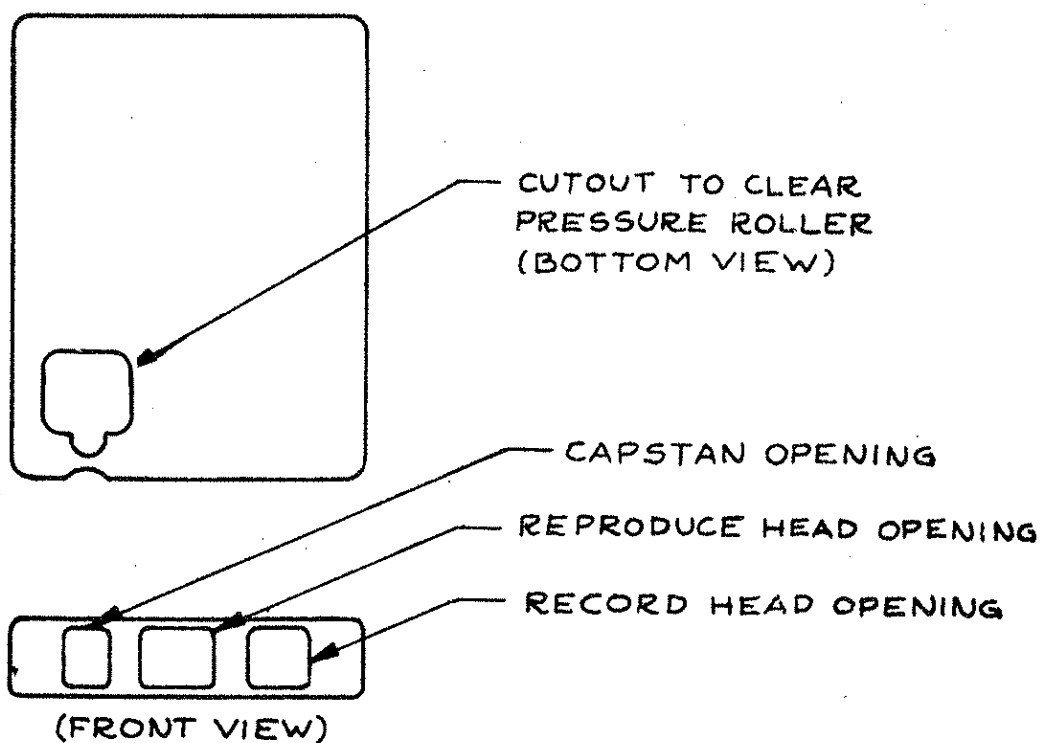
The endless loop is formed by wrapping the tape with the oxide side out into a spiral. The two ends are spliced together so that as the tape is pulled from the center, it passes across the tape heads and winds back onto the outside of the tape spiral.



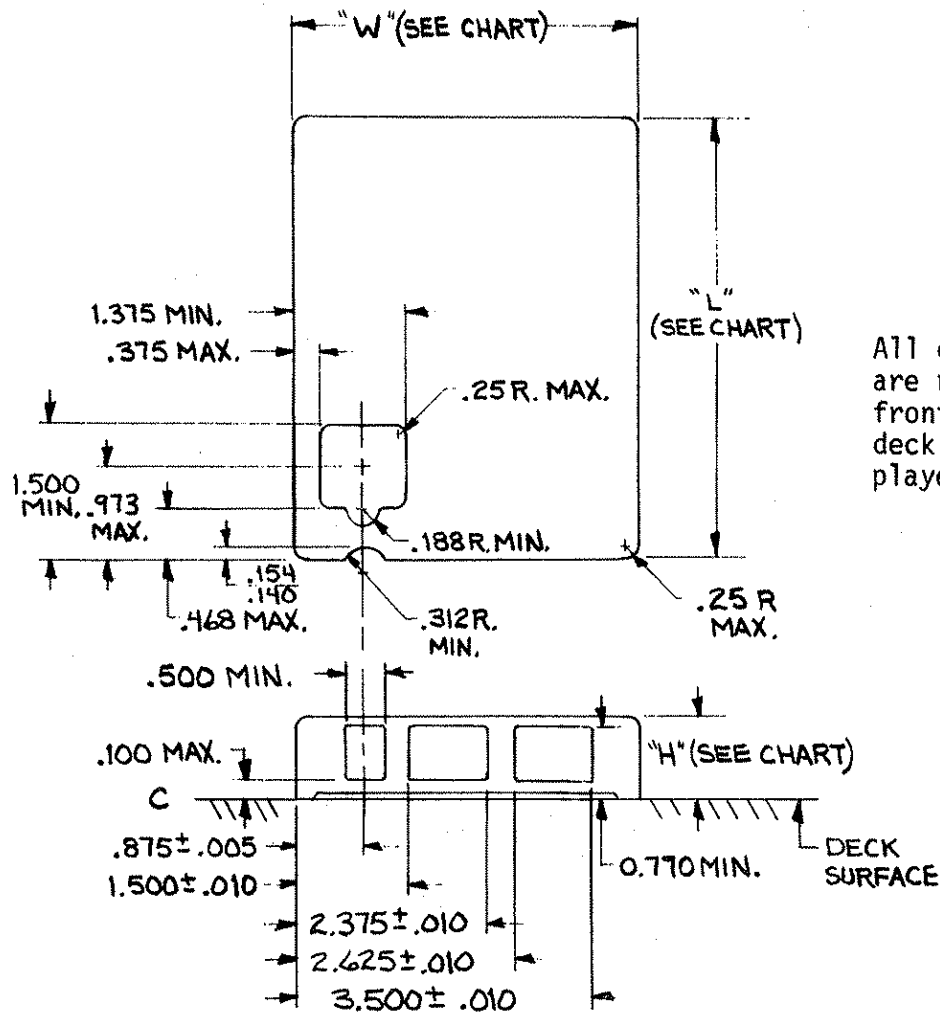
THE SHELL

The shell holds the tape and other parts. There are three standard sizes of shells: A (Broadcast Electronics 300 series), B (600 series), and C (1200 series). Assuming 1.5 mil tape, the type A cartridge can be loaded with up to 395 feet of tape, the B with up to 650 feet, and the C with up to 1250 feet.

There are three openings across the front of the cartridge that allow the heads and capstan to penetrate the shell and contact the tape. In addition, there is an opening in the bottom for the pressure roller to rotate through the cartridge behind the tape. Unlike some cartridges used in consumer entertainment systems, the pressure roller (pinch roller or capstan idler) is part of the cartridge player and not the cartridge.



NAB tape cartridge dimension standards are presented in Figure 1 and NAB tape head dimension standards are presented in Figure 2.

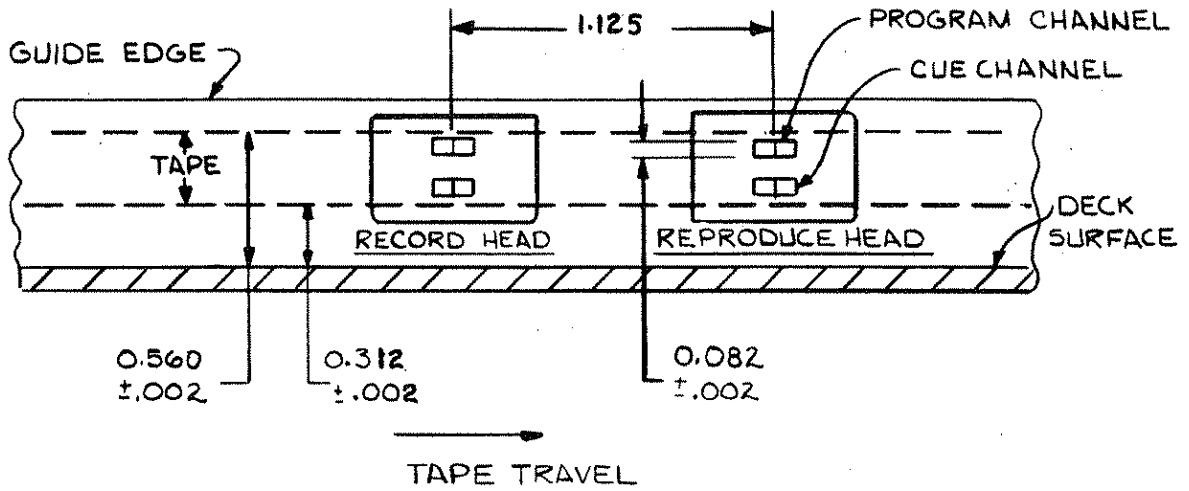


All dimensions are in inches and are referenced from the side and front of the cartridge and the deck surface of the cartridge tape player.

CARTRIDGE NAB TYPE	WIDTH ±0.015625	LENGTH MAXIMUM	HEIGHT MAXIMUM
A,AA	4"	5.25"	0.9375" FOR A 0.895" FOR AA
B,BB	6"	7"	0.9375" FOR B 0.895" FOR BB
C,CC	7.625"	8.5"	0.9375" FOR C 0.895" FOR CC

FIGURE 1. NAB CARTRIDGE DIMENSION STANDARDS

MONOPHONIC STANDARD



STEREOPHONIC STANDARD

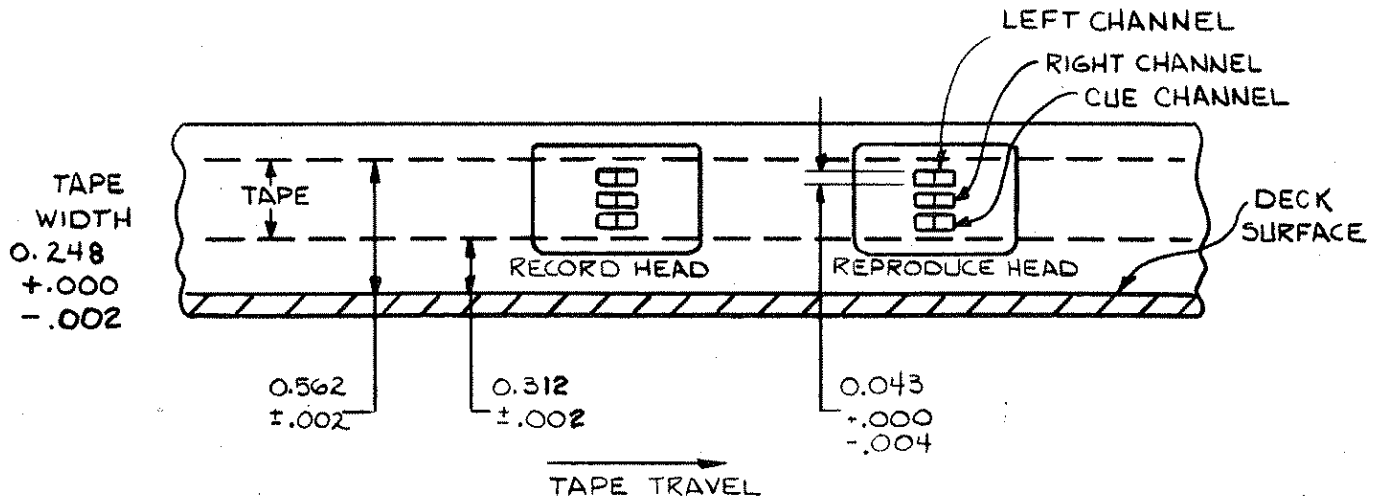
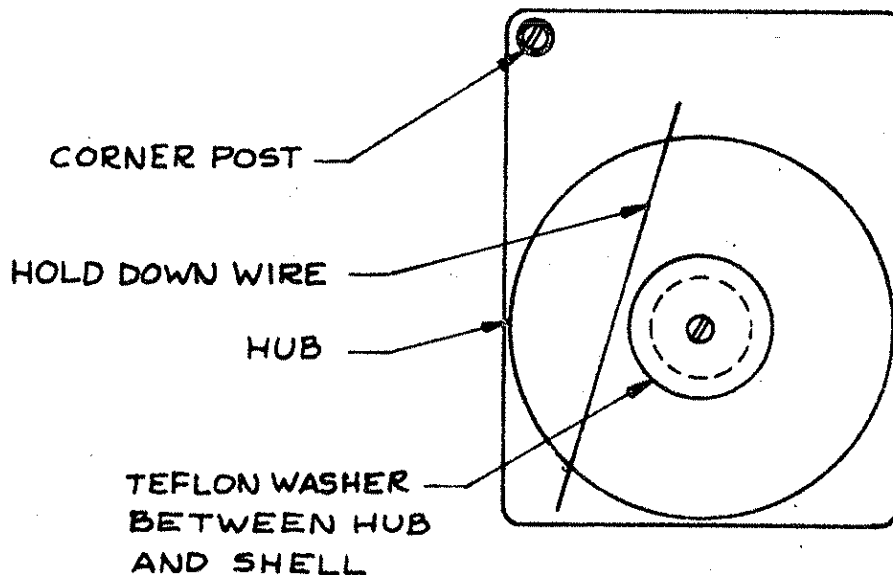


Figure 2. NAB TAPE HEAD DIMENSION STANDARDS

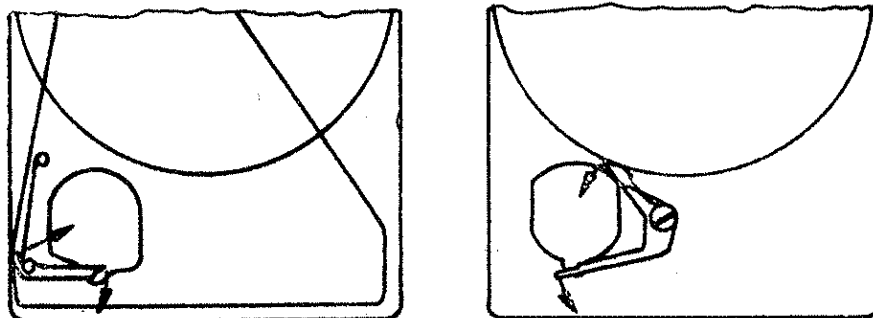
TAPE HUB, TEFLON WASHER, AND CENTER POST

The tape hub stores the tape which is not passing by the cartridge openings. The hub is free to rotate around the center post. To allow free rotation, a teflon washer is used between the hub and the shell. Some means must be provided to keep the tape flat on the hub. A separate cover may fit over the hub, the top may be molded so that the clearance between the hub and the shell is just greater than the tape width, or a hold-down wire may be placed so that it passes above one side of the hub.



CLUTCH SPRING OR HUB BRAKE (SPRING ACTION DEVICE)

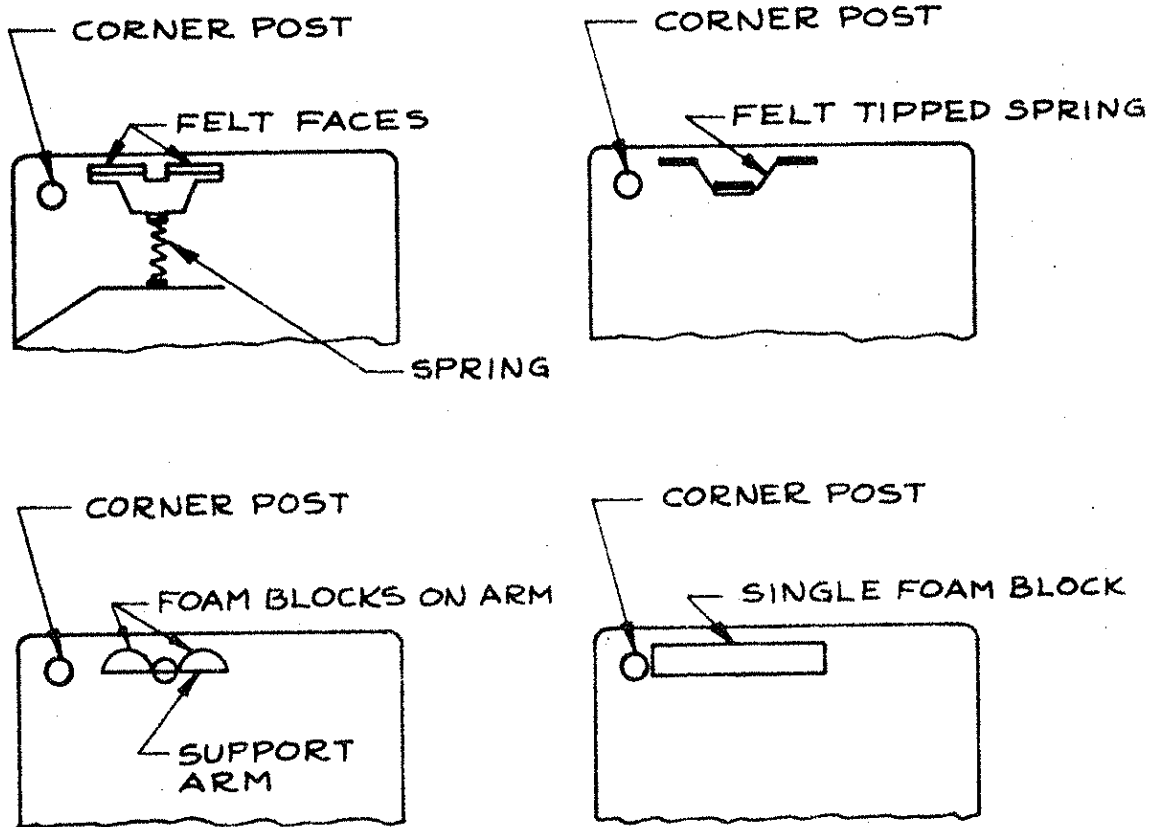
The clutch spring or hub brake keeps the tape from moving when the cartridge is not in place in a machine. This is done either by applying a brake to the hub or by pressing the tape against the shell. The clutch or brake is released by the shaft of the pressure roller when the roller is in the vertical position.



PRESSURE PADS

The pressure pads ensure the tape remains in contact with the heads. A foam plastic is the most commonly used material for the pressure pads: The compression of the foam provides pressure to wrap the tape slightly around the heads. Felt is less frequently used. To provide pressure on the tape, the felt is mounted on a phosphor bronze arm or a spring-loaded plastic block.

The foam may be a single block mounted behind the two openings for the record and reproduce heads and held in place by ridges cast into the shell. Alternately, the foam may be in two separate pieces fastened to a metal or plastic arm. A third type mounts the foam on a spring-loaded plastic block. To ensure smooth tape travel, teflon is usually applied to the face of the foam.



TAPE GUIDANCE

Primary control of the tape as it moves across the heads is maintained by external guides in the head bracket. Guidance is provided within the cartridge to keep the tape traveling the same path. This is generally accomplished with tabs and grooves molded into the shell. Of primary importance is the corner post which must straighten the tape before it passes across the front openings of the shell. This post may be molded into the shell or a separate piece glued into a dimple in the shell.

CARTRIDGE MAINTENANCE TIPS

The cartridge is the second half of the tape cartridge system. The cartridge needs regular care just like the cartridge recorder or reproducer. The service department of Broadcast Electronics has developed over the years a rule of thumb for trouble-shooting: Check the cartridge before adjusting the machine.

TAPE

For maximum performance, the tape must be in good condition. The tape in cartridges wears rapidly, particularly in short length cartridges (70 seconds or less) and cartridges that are used frequently. The tape should be inspected regularly and frequently for obvious signs of wear.

Cartridges should be rewound or replaced when the oxide side of the tape is shiny. Likewise the tape should be discarded if it is wrinkled, or contaminated with fingerprints, grease, or dirt. Less obvious are drop-outs or areas where the iron oxide particles have come loose from the base of the tape. Drop-outs may not be visible, but will show up as a loss of audio signal.

If possible only one type of tape should be used in a single installation. Different brands, and even different types of the same brand of tape require different bias recording levels for optimum response.

When rewinding cartridges use only a graphite lubricated tape. Silicone lubricated tapes cannot stand up to the rugged service in a cartridge.

Every cartridge tape must have one splice, but multiple splices can cause problems. If the top tape ends overlap at the splice or do not meet squarely, the audio may dropout. In addition, a poor splice will catch on the cartridge or the hub. After a splice has been in use for some time, the tape tension may pull the two ends of the tape apart, slightly opening the splice.

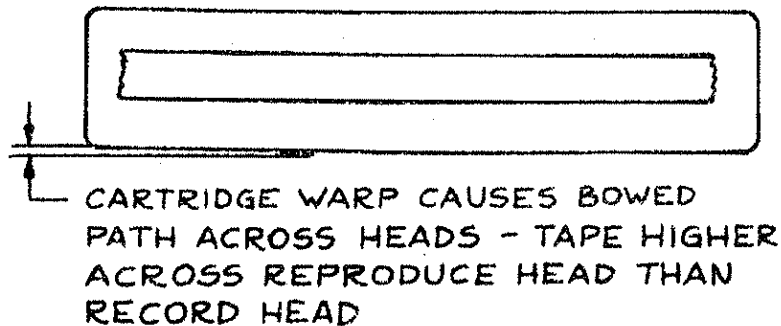
Proper tape tension is most critical. If the tension is too great, the tape will wear rapidly as it is squeezed against the hub, the pressure pads, the corner post, and the tape on the hub. If the tension is too light, the tape will not be pulled back into the hub.

The NAB specifies that tape tension at the capstan should not exceed 3 ounces. Cartridges over 70 seconds in length tend to have too little tension, while those less than 70 seconds tend to have too much. When running, a properly wound cartridge moves tape freely with no reluctance to wind onto the hub. To increase the tension in a cartridge, open up the splice and gently pull on the tape as it wraps onto the hub. To decrease the tension, open up the splice and gently pull out several loops from the center of the hub. Trim off the excess and resplice the tape.

THE SHELL

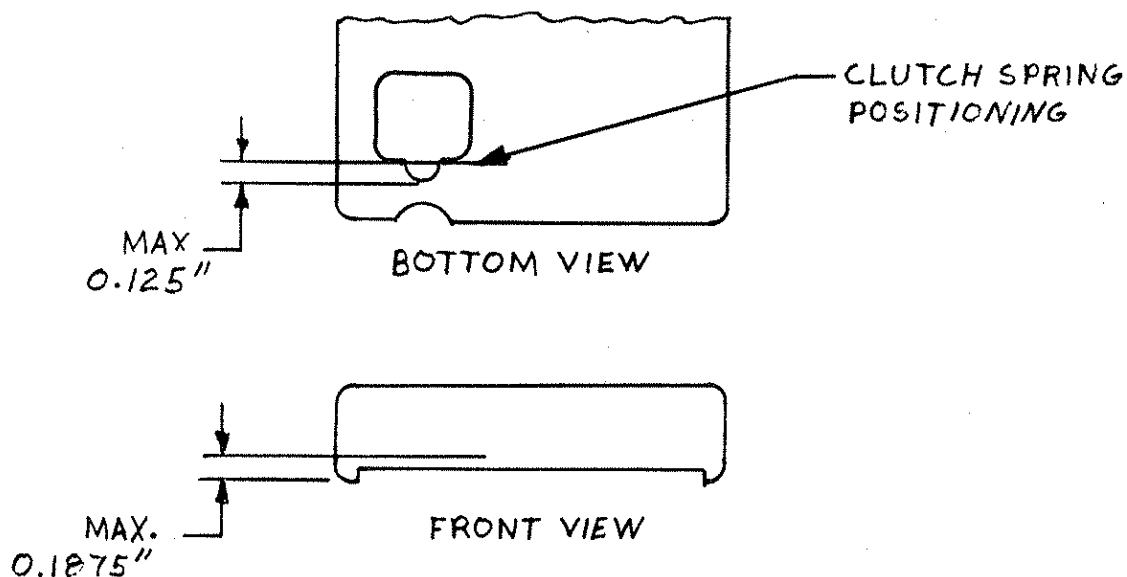
A deformed shell can adversely affect frequency response by distorting the tape path. In particular, a warped cartridge may cause the tape to traverse the head openings in an arc or bowed path rather than a straight line. Sometimes an ill-fitting top can spread the sides of the cartridge enough to cause this same bowing. Check suspect cartridges on a flat surface.

Periodically the cartridge center post should be cleaned. Gummy deposits on the post increase tape tension by not allowing the tape hub to turn freely. Equally important to free movement of the hub is the washer. This washer should always be in place underneath the tape hub, between the hub and the shell. This washer is easily misplaced when the cartridge is opened and the hub removed.



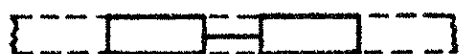
CLUTCH SPRING OR HUB BRAKE

The clutch spring or hub brake should completely release when the pressure roller is in the vertical position. This allows the hub, and the tape, to move freely. An improperly adjusted clutch spring or defective hub brake may prevent the roller from engaging or disengaging. The clutch should be parallel to the bottom of the shell and no more than 0.1875 inch above the surface of the tape deck. The clutch must not protrude more than 0.125 inch into the opening for the pressure roller. Less than 8 ounces should be required to release the clutch.



PRESSURE PADS

The pressure pads must wrap the tape around the face of the heads. The pressure applied must be uniform across the tape as it is in contact with the head. Periodically check the pads to see that they are lined up squarely with the tape. If one portion of the tape is not in contact with the pads, that portion of the tape will make poor contact with the head. This may show up as poor frequency response from an individual cartridge.



PROPER ALIGNMENT



PADS TOO HIGH



PADS SKEWED

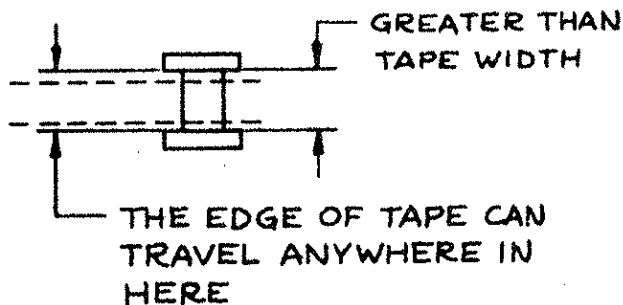


PADS TOO LOW

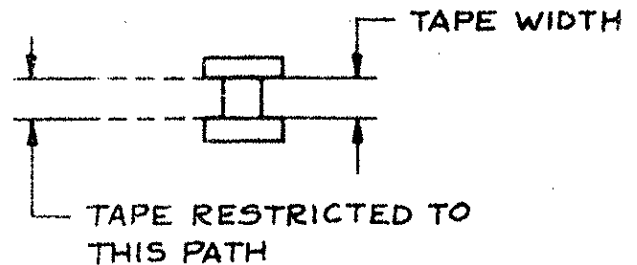
THE TAPE PATH

The most frequent cause of distortion of the tape path in the cartridge is a loose corner post. The post should always be glued down so that there is 0.250 inch between the shoulder of the post and the shell. If the post is high, the tape will not run straight across the heads. A loose post frequently causes muffled-sounding audio when the cartridge unit starts.

LOOSE CORNER POST



PROPER CORNER POST



The hold-down wire used in many cartridges is important in maintaining proper tape travel. This wire keeps the tape flat on the hub as tape is pulled from the center and returned to the outside. The wire must not exert any pressure on the stored tape or the tape may wrinkle and jam. If a cartridge is dropped this hold-down wire may unseat.

CARTRIDGE STORAGE

The cartridges should be stored away from direct sunlight, or heat from electronic equipment, radiators, etc. Ideal conditions are a temperature of 70° and a relative humidity of 50%. The cartridges storage area should be as free from dust as possible.

CARTRIDGE RECORDING PROCEDURE

The following procedure is particularly important when recording cartridges. When the cartridge is first inserted into the machine, put the tape in motion in playback for several seconds. This allows the tape to seat properly in the tape guides and across the heads.

Stop the tape. Do not remove the cartridge after the initial run-in. Ensure the tape splice is positioned in an unrecorded portion of the tape between the end and the beginning of the program material.

The tape may now be recorded with satisfactory results.

CARTRIDGES IN STEREOGRAPHIC SYSTEMS

MAINTENANCE

Rigorous maintenance is a must for cartridges used in a stereophonic system, since any distortion of the tape path can cause phase differences between the program material on the two tracks. When the program material is mixed, phase differences cause degradation of the frequency response.

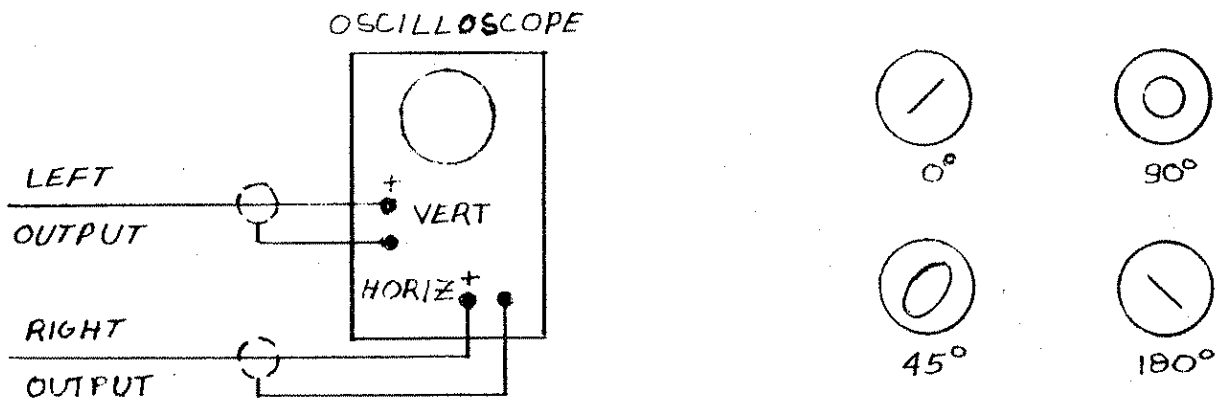
The most important characteristic of a cartridge for stereophonic use is the ability to consistently maintain the identical tape path each time the cartridge is inserted in the player. This allows reliable recording and subsequent accurate reproduction.

Cartridges used in a stereophonic system should initially be selected for phase repeatability using the phasing test outlined below. This test should be repeated on a regular basis throughout the life of the cartridge. A cartridge which fails this test should be discarded.

To provide better guidance within the cartridge, several manufacturers have introduced cartridges with an adjustable corner post. The post is threaded into the shell so that the precise post height may be maintained. These and other cartridges designed to improve performance should be considered for use in a stereophonic system.

STEREO PHASING TEST

Connect the output of a record/playback unit to an oscilloscope as shown. Connect an audio signal generator to both inputs of the recorder. While recording observe the phase of the reproduce signals. Remove and re-insert the cartridge several times. Cartridges which exhibit poor phase repeatability or stability should be discarded. Do not test only for the higher frequencies, but check selected frequencies across the audio band.



PRODUCT WARRANTY

LIMITED ONE YEAR

While this warranty gives you specific legal rights, which terminate one (1) year (6 months on turntable motors) from the date of shipment, you may also have other rights which vary from state to state.

Broadcast Electronics, Inc. ("BE"), 4100 North 24th Street, P. O. Box 3606, Quincy, Illinois 62305, hereby warrants cartridge machines, consoles, transmitters and other new Equipment manufactured by BE against any defects in material or workmanship at the time of delivery thereof, that develop under normal use within a period of one (1) year (6 months for turntable motors) from the date of shipment. Other manufacturers' Equipment, if any, shall carry only such manufacturers' standard warranty. This warranty extends to the original user and any subsequent purchaser during the warranty period. BE's sole responsibility with respect to any Equipment or parts not conforming to this warranty is to replace such equipment or parts upon the return thereof F.O.B. BE's factory or authorized repair depot within the period aforesaid.

In the event of replacement pursuant to the foregoing warranty, only the unexpired portion of the warranty from the time of the original purchase will remain in effect for any such replacement. However, the warranty period will be extended for the length of time that the original user is without the services of the Equipment due to its being serviced pursuant to this warranty. The terms of the foregoing warranty shall be null and void if the Equipment has been altered or repaired without specific written authorization of BE, or if Equipment is operated under environmental conditions or circumstances other than those specifically described in BE's product literature or instruction manual which accompany the Equipment purchased. BE shall not be liable for any expense of any nature whatsoever incurred by the original user without prior written consent of BE.

BE shall not be liable to the original user for any and all incidental or consequential damages for breach of either expressed or implied warranties. However, some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. All express and implied warranties shall terminate at the conclusion of the period set forth herein.

Except as set forth herein, and except as to title, there are no warranties, or any affirmations of fact or promises by BE, with reference to the Equipment, or to merchantability, fitness for a particular application, signal coverage, infringement, or otherwise, which extend beyond the description of the Equipment in BE's product literature or instruction manual which accompany the Equipment. Any card which is enclosed with the Equipment will be used by BE for survey purposes only.

BROADCAST ELECTRONICS, INC.
4100 North 24th Street, P. O. Box 3606, Quincy, Illinois 62305

