INSTRUCTION MANUAL

SERIES 3000 TAPE CARTRIDGE MACHINE

May, 1986

IM No. 597-0300

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

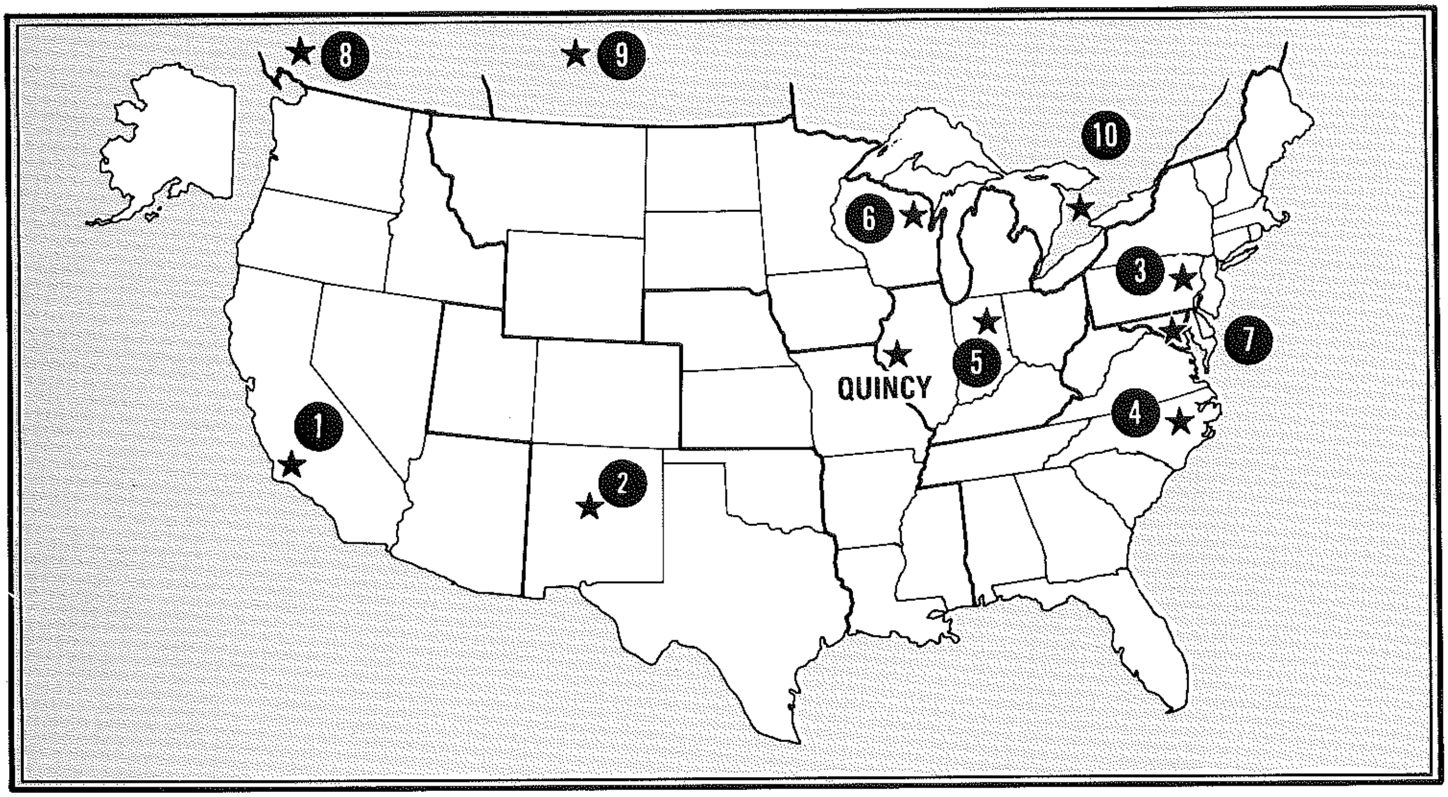
PROPRIETARY NOTICE

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



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3. Radio Systems Design
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Ph: (215) 356-4700

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Four Oaks, NC 27524
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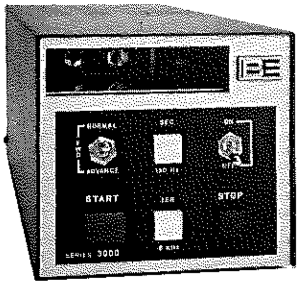
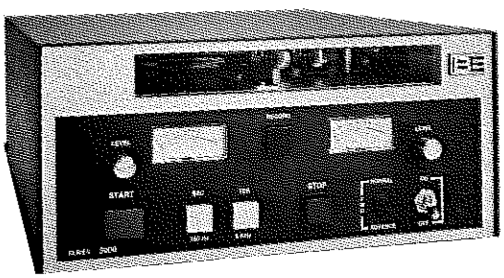
BROADCAST ELECTRONICS INC

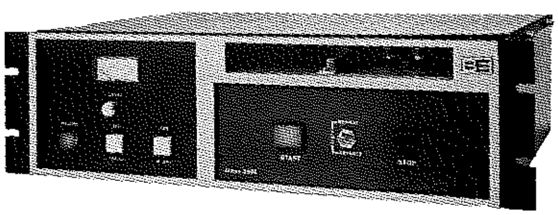
4100 N. 24th ST., P.O. BOX 3606, QUINCY, IL 62305 U.S.A., TELEX: 25-0142, CABLE: BROADCAST, PHONE: (217) 224-9600

TECHNICAL MANUAL

BROADCAST ELECTRONICS
SERIES 3000
TAPE CARTRIDGE MACHINE
597-0300







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SECTION I

GENERAL INFORMATION

1

1-1. INTRODUCTION.

1-2. This section contains a general description of the Series 3000 cartridge machines, equipment identification, options, accessories, and equipment specifications.

1-3. EQUIPMENT DESCRIPTION.

1-4. Broadcast Electronics Series 3000 Cartridge Machines are designed with reliable performance and ease of service in mind. A wide range of monaural and stereophonic models (refer to Table 1-1) and a large selection of options allows flexibility for customizing a system for any broadcasting need.

1-5. Both playback and record/playback models offer quality construction, integrated circuit/solid-state electronic design, and extensive shielding to help protect the tape heads from magnetic fields. The cartridge guidance system provides the precise positioning required for quality playback and recording operation. The tapered right side cartridge guide ensures the cartridge is channeled into the proper position, and the beryllium upper clamp provides a locking action to hold the cartridge in the correct position.

1-6. A half inch thick machined deck provides rigid unit support and a stable reference for the head mounting. The Phase Lok IV head mounting bracket permits independent head adjustments for height, zenith, and azimuth. Other features include an efficient direct-drive hysteresis-synchronous motor and a low-voltage, solid-state solenoid switching circuit which keeps total power consumption low.

1-7. NAB primary cue tone (1kHz) circuitry is included as standard on all models. Secondary (150 Hz) and tertiary (8 kHz) cue tone circuitry is optionally available. An automatic/manual fast forward option, which includes the secondary and tertiary cue tone option, is also available.

1-8. MODEL IDENTIFICATION.

1-9. MODEL 3100. The 3100 is a playback only model available in mono or stereo. The 3100 accepts NAB size A and AA cartridges. The 3100 can be desk or rack mounted, with three 3100 units fitting side-by-side in a single 19 inch (48.26 cm) rack.

1-10. MODEL 3200. The 3200 is available in mono or stereo as playback only and record/playback models. Both NAB size A, AA, B, and BB cartridges can be used. The 3200 can be desk mounted or rack mounted, with two units fitting side-by-side in a standard 19 inch (48.26 cm) rack.

Table 1-1. 3000 SERIES TAPE CARTRIDGE MACHINES

MODEL	STOCK NUMBER	DESCRIPTION		AVAILABLE WITH MIC Input
3100P	900-3100	Playback, Mono, A Size Cartridges		
3100PS	900-3102	Playback, Stereo, A Size Cartridges		
3200P	900-3200	Playback, Mono, A and B Size Cartridges		
3200RP	900-3201	Record/Playback, Mono, A and B Size Cartridges		X
3200PS	900-3202	Playback, Stereo, A and B Size Cartridges		
3200RPS	900-3203	Record/Playback, Stereo, A and B Size Cartridges		X
3200RP/DL	900-3204	Record/Playback, Delay, Mono, A and B Size Cartridges	*	X
3300P	900-3300	Playback, Mono, A, B, and C Size Cartridges		
3300RP	900-3301	Record/Playback, Mono, A, B, and C Size Cartridges		X
3300PS	900-3302	Playback, Stereo, A, B, and C Size Cartridges		
3300RPS	900-3303	Record/Playback, Stereo, A, B, and C Size Cartridges		X
3300RP/DL	900-3304	Record/Playback, Delay, Mono, A, B, and C Size Cartridges	*	X
3400P	900-3400	Playback, Mono, Rack Mount, A, B, and C Size Cartridges		
3400RP	900-3401	Record/Playback, Mono, Rack Mount, A, B, and C Size Cartridges		X
3400PS	900-3402	Playback, Stereo, Rack Mount, A, B, and C Size Cartridges		
3400RPS	900-3403	Record/Playback, Stereo, Rack Mount, A, B, and C Size Cartridges		X
3400RP/DL	900-3404	Record/Playback, Delay, Mono, Rack Mount, A, B, and C Size Cartridges	*	X

ALL OF THE ABOVE STANDARD MODELS CAN BE EQUIPPED WITH THE FOLLOWING OPTIONS: (See Table 1-3 for a Description of the Options.)

-1XX (Suffix) 117 VAC/50 Hz POWER SOURCE
-2XX (Suffix) 220 VAC/60 Hz POWER SOURCE
-3XX (Suffix) 220 VAC/50 Hz POWER SOURCE
-X1X (Suffix) Q's I AND II
-X2X (Suffix) AUTOMATIC FAST FORWARD WITH Q's I AND II
-X7X (Suffix) STANDARD MACHINE WITH 3.75 in/s TAPE SPEED
-X8X (Suffix) 3.75 in/s TAPE SPEED WITH Q's I AND II

* NOTE: Delay Models: 1) Provide 150 Hz cue (QI) circuitry as a standard feature.
2) May be equipped with QII and Fast Forward, 117V 50 Hz Power Source, or 220V 50 Hz Power Source Only.

1-11. MODEL 3300. The 3300 is available in the same configurations as the 3200, with the additional capability of accepting NAB size C and CC cartridges. The 3300 can be desk or rack mounted. A 3300 and a 3100 will fit side-by-side in a standard 19 inch (48.26 cm) rack.

1-12. MODEL 3400. The 3400 is a rack mount cartridge machine available in the same wide range of configurations as the model 3300.

1-13. DELAY MODELS. Model 3200, 3300, and 3400 units are available as a mono delay programmer. The delay unit can be operated either as a delay unit or a normal record or playback unit. Secondary (150 Hz) cue tone circuitry is a standard feature of this model. Additional information, exclusive to the service and operation of this unit, can be found in the 3000 Delay Supplement Manual (597-0300-001).

1-14. SPECIFICATIONS.

1-15. Refer to Table 1-2 for electrical and physical specifications related to the operation of the Series 3000 cartridge machines.

1-16. OPTIONS AND ACCESSORIES.

1-17. Refer to Table 1-3 for a listing and brief description of the options and accessories available for the Series 3000 cartridge machines.

TABLE 1-2. ELECTRICAL AND PHYSICAL SPECIFICATIONS
(Sheet 1 of 3)

PARAMETER	SPECIFICATIONS
TAPE SPEED:	
STANDARD	7.5 in/s (19.05 cm/s) ±0.1%.
OPTIONAL	3.75 in/s (9.53 cm/s).
TAPE START/STOP TIME	0.1 second maximum.
WOW AND FLUTTER	0.15% peak weighted. 0.08% typical.
NOISE: (No Tape Running)	
MONOPHONIC	54 dB below 185 nWb/m at 700 Hz.
STEREOPHONIC	52 dB below 185 nWb/m at 700 Hz.

Table 1-2. ELECTRICAL AND PHYSICAL SPECIFICATIONS
(Sheet 2 of 3)

PARAMETER	SPECIFICATIONS
AMPLIFIER DISTORTION	0.5% THD or less.
SYSTEM DISTORTION	2% or less record to playback at 185 nWb/m at 700 Hz.
EQUALIZATION	NAB, IEC, CCIR as specified.
FREQUENCY RESPONSE	±2 dB from 50 Hz to 15 kHz, exclusive of head contour effect.
CROSSTALK (magnetic head limited):	
CUE CHANNEL TO PROGRAM CHANNEL, MONOPHONIC	1000 Hz: -50 dB or better.
STEREO, BETWEEN PROGRAM CHANNELS	1000 Hz: 50 dB or better.
AUDIO INPUT IMPEDANCE:	
LINE	50 k Ohms (transformer) balanced floating.
MICROPHONE (optional)	150 Ohms (transformer) balanced floating.
AUDIO INPUT LEVEL:	
LINE	-20 to +20 dBm (50 mV to 7.7V).
MICROPHONE (optional)	-70 to -24 dBm (HI gain to LO gain)
AUDIO OUTPUT IMPEDANCE	600 Ohms (transformer) balanced.
AUDIO OUTPUT LEVEL	Maximum adjustable level +10 dBm from 185 nWb/m at 1 kHz.
BIAS OSCILLATOR FREQUENCY	100 kHz.
CUE TONES:	
STANDARD	1kHz Stop tone (all models). 150 Hz Secondary tone (delay models only).

TABLE 1-2. ELECTRICAL AND PHYSICAL SPECIFICATIONS
(Sheet 3 of 3)

PARAMETER	SPECIFICATIONS
OPTIONAL	150 Hz (secondary) and 8 kHz (tertiary). Relay contact closure for external control (150 Hz and 8 kHz). External cue input/output available at remote control connector for other control functions.
AMBIENT OPERATING TEMPERATURE	32° to 132°F (Ø° to 55°C).
TRANSPORT	Direct Drive Capstan.
MOTOR	Hysteresis Synchronous.
POWER REQUIREMENTS:	
STANDARD 60 Hz	105 to 125V ac.
OPTIONAL 60 Hz	210 to 240V ac.
OPTIONAL 50 Hz	105 to 125V or 210 to 240V ac.
POWER CONSUMPTION	45 to 50 Watts Maximum.
MOUNTING:	
MODEL 3100, 3200, and 3300	Table top mounting standard. Rack mounting adapters available.
MODEL 3400	Standard 19 inch (48.3 cm) rack.
DIMENSIONS:	All units are 15.5 inches deep (39.4 cm) and 5.25 inches * high (13.34 cm).
<u>WIDTH</u>	
3100	5.875 inches (14.9 cm).
3200	8.75 inches (22.2 cm).
3300	11.75 inches (29.8 cm).
3400	17 inches (43.2 cm).
	(* Add 0.375 inches/9.5 mm for rubber feet.)
WEIGHT (packed):	
3100	28 pounds (12.7 kg).
3200	33 pounds (15 kg).
3300	37 pounds (16.8 kg).
3400	42 pounds (19 kg).

1

TABLE 1-3. OPTIONS AND ACCESSORIES
(Sheet 1 of 3)

OPTIONS AND ACCESSORIES	STOCK NUMBER	MODEL
<u>FACTORY INSTALLED OPTIONS</u>		
SECONDARY AND TERTIARY CUE TONES (Q's I AND II):		
Employs two auxiliary cue tones as standardized by the NAB for use in tape cartridge systems. The secondary (150 Hz) and tertiary (8 kHz) tones are used to control associated devices in the overall system. This option includes the front panel switch/indicators, 150 Hz and 8 kHz detectors, and oscillators (record models only).	-X1X (Suffix)	
AUTOMATIC/MANUAL FAST FORWARD:		
This option includes the cue tone option. In the automatic mode, the machine detects the end-of-message (150 Hz) cue and automatically advances at three times the normal speed to the next stop tone. Audio is muted during advancement. Manual operation allows use of the front panel switch to advance the tape to the next stop tone.	-X2X (Suffix)	
MICROPHONE INPUT:		
Provides recording flexibility. The 150 Ohm balanced transformer input accepts input signal levels from -70 to -40 dBm.		
Mono Record/Playback Models	906-3003	
Stereo Record/Playback Models	906-3004	
117 Volt ac/50 Hz Power Source	-1XX (Suffix)	
220 Volt ac/60 Hz Power Source	-2XX (Suffix)	
220/240 Volt ac/50 Hz Power Source	-3XX (Suffix)	
3.75 in/s Tape Speed	-X7X (Suffix)	
3.75 in/s Tape Speed with the Cue Tone Option	-X8X (Suffix)	

TABLE 1-3. OPTIONS AND ACCESSORIES
(Sheet 2 of 3)

OPTIONS AND ACCESSORIES	STOCK NUMBER	MODEL
ACCESSORIES		
REMOTE CONTROL PANELS:		RC3000
Provides duplication of essential front panel controls and indicators for use when the equipment is installed at a location other than the operating position.		
Remote panel with START switch/indicators for five Series 3000 units.	906-3016	
Remote panel for a single Series 3000 record/playback unit (START/STOP/RECORD/SEC/TER switch/indicators and FWD switch).	906-3019	
Remote panel for a single Series 3000 play-back only unit (START/STOP/SEC and TER switch/indicators).	906-3020	
Remote panel for a single Series 3000 play-back only unit (START and STOP switch/indicators).	906-3021	
Remote panel with START and STOP switch/indicators and fast forward (FWD) switch for five Series 3000 units.	906-3028	
AUDIO SWITCHER:		
Used with multiple cartridge machines to provide a single balanced output. The switcher selects the last unit started and mutes the other units.		
Three input model accommodates three Series 3000 units. Up to three switchers can be tied together to provide a single output from 9 units. (Manual No. 597-5350)	904-5000	SW5E
Five input model accommodates five Series 3000 units. Up to three switchers can be tied together to provide a single output from up to 15 units.	904-5001	SW5F

TABLE 1-3. OPTIONS AND ACCESSORIES
(Sheet 3 of 3)

OPTIONS AND ACCESSORIES	STOCK NUMBER	MODEL
TELEPHONE ANSWERING EQUIPMENT:		
The PC-1 telephone interface provides cartridge machine/telephone network interfacing. The unit answers incoming telephone calls and enables a cartridge machine for the purpose of transmitting a pre-recorded message.	900-0010	PC-1
EXTENDER, CIRCUIT BOARD	919-1504	
PRESSURE ROLLER TO CAPSTAN ALIGNMENT GAUGE	836-0005	
HEAD AND TAPE ALIGNMENT GAUGE	836-0009	
CUE TONE/LOGGING CALIBRATION TEST TAPE, NAB	808-0011	
REPRODUCE ALIGNMENT TEST TAPE, NAB MONO/STEREO COMPATABLE	808-0004	
RACK MOUNT SHELF FOR EIA 19 INCH RACK	906-3013	
TOP COVER FOR ABOVE SHELF	906-3010	
RACK SHELF FILLER PANEL, 1/3 RACK	906-3014	
RACK SHELF FILLER PANEL, 1/2 RACK	906-3015	

SECTION II
INSTALLATION

2-1. UNPACKING.

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

2

2-3. A set of three hex wrenches, three rear panel connectors, a warranty card, and a test certification card are included with each machine. If the contents are incomplete, or if the unit is damaged, notify both the carrier and Broadcast Electronics, Inc.

2-4. INSTALLATION.

2-5. MOUNTING.

CAUTION — THE TOP AND BOTTOM COVERS OF THE UNIT ARE VENTED TO ALLOW FREE AIR FLOW THROUGH THE MACHINE. DO NOT COVER THESE VENTS.

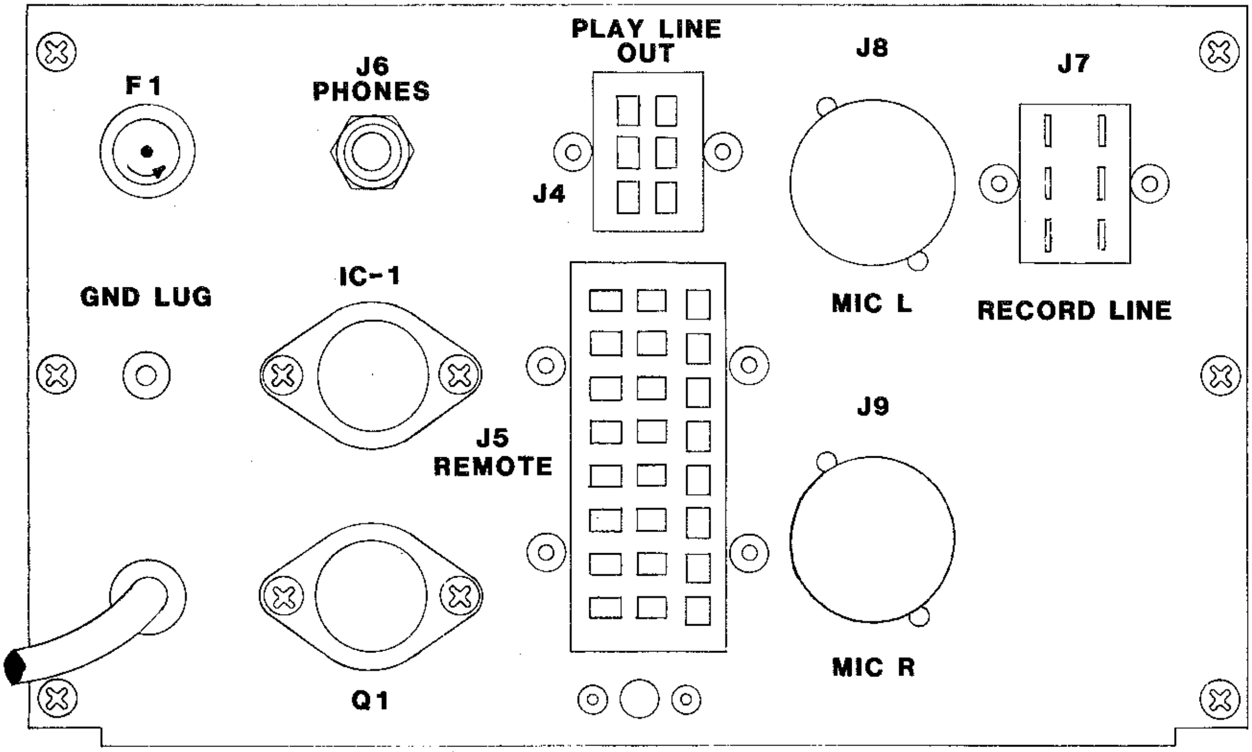
CAUTION

2-6. DESK MOUNTING. The model 3100, 3200, and 3300 cartridge machines are packaged for desk top mounting. The rubber feet absorb shocks and vibrations. It is important to maintain ventilation space above and below the unit.

2-7. RACK MOUNTING. A full range of accessories are available from Broadcast Electronics for rack mounting model 3100, 3200, and 3300 units. The model 3400 is packaged for rack mounting and needs only to be placed into a 19 inch (48.26 cm) rack and secured with the hardware provided with the unit.

2-8. Allowing for a minimum of 1.75 inches (4.45 cm) of ventilation space above and below the cartridge machine, mount the rack adapter shelf in the rack opening from the front. Secure the shelf with No. 10 screws inserted from the front through the trim spacers and the rack shelf into the rack rail.

2-9. Remove the four rubber feet and the top and bottom covers from the cartridge machine. Place the unit onto the shelf from the front. Lock the cartridge machine into place from the rear of the unit. Insert the captive fastener into the opening beneath the REMOTE connector (refer to Figure 2-1), and tighten the captive screw.



597-0300-2

FIGURE 2-1. SERIES 3000 RECORD/PLAYBACK UNIT REAR PANEL

2-10. Filler Panels. Filler panels are available in 1/3 and 1/2 rack widths. Slide the panel into place and secure it in place from below with the flat head screws provided.

2-11. AUDIO OUTPUT CONNECTIONS.

2-12. The Series 3000 cartridge machines are shipped wired for operation at 600 Ohms balanced output. Connect the mono/left channel program line to terminals 3 and 5 of J4 (refer to drawing B906-3104 in Section VII). For stereo operation, connect the right channel program line to terminals 4 and 6 of J4.

2-13. To ground the shields of the output cables at the cartridge machine, connect the external shields to pins 1 and 2 of J4. If the output shields are to be grounded at the console, do not make any connection to pins 1 and 2. A special rear panel ground terminal is provided on the 3000. Connect this terminal to the station ground system with a heavy copper conductor.

2-14. AUDIO INPUT CONNECTIONS.

2-15. Audio is input to the record amplifier through J7 (refer to Figure 2-1). Signals ranging from -20 to +20 dBm (50mV to 7.7V) can be applied to the balanced, 50 k Ohm bridging input. Mono or left channel audio is input through pins 3 (high) and 5 (low) of J7 (refer to drawing B906-3104 in Section VII). For stereo, use pins 4 (high) and 6 (low) for right channel input.

2-16. OPTIONAL MICROPHONE INPUT. Record models are available with an optional microphone input, through a rear panel connector (refer to Figure 2-1). This input is designed for 150 Ohm balanced microphones with an input level of -70 to -24 dBm. A gain switch (two for stereo units) on the record amplifier and bias circuit board is used to switch from line level input (LO) to microphone level input (HI).

2-17. REMOTE CONTROL INTERCONNECTIONS.

2-18. Rear panel connector J5 allows connection of remote stop, start, and record controls along with the associated indicators (refer to drawing B906-3104 in Section VII). If the optional auxiliary cue tones (QI/150 Hz and QII/8 kHz) are installed, normally open relay contacts are accessible through J5. These contacts close during tone playback. In record models, the optional cue tone generators may be remotely controlled.

2-19. Terminals are also provided for supplying an external signal to the recorder cue track and for access to the cue track playback audio. When external cue recording is employed, a switch wired to the external cue record control is also required (refer to paragraph 2-27).

2-20. Five remote control panels in various configurations, are available from Broadcast Electronics (see Table 1-3).

<u>NOTE</u>
<u>NOTE</u>
<u>NOTE</u>

ALL REMOTE SWITCHING MAY BE DONE EITHER BY MECHANICAL SWITCH CONTACTS, OR AN NPN TRANSISTOR SWITCH CAPABLE OF PULLING DOWN 5 mA AT LESS THAN A 0.6V DC DROP. EXTERNAL INDICATORS SHOULD BE 27V DC LAMPS AT 40 mA MAXIMUM.

<u>NOTE</u>
<u>NOTE</u>

ALL WIRING FOR THE FOLLOWING REMOTE CONTROL INTERCONNECTIONS IS DONE THROUGH REMOTE CONNECTOR J5. REFER TO DRAWING B906-3104 AS REQUIRED.

2-21. REMOTE START AND STOP SWITCHES. Connect two wires from a SPST normally open momentary contact push switch between pins 13 and 11 for remote start. Connect a switch between pins 10 and 11 for remote stop. Start/play and stop/ready indicator lamps should be connected between pins 15 and 12 respectively, to pin 11.

2-22. REMOTE FAST FORWARD. Connect two wires from a SPST, normally open, switch between pins 7 and 4.

2-23. AUXILIARY CUE TONE INDICATORS. Connect two lamps from pins 5 and 8 respectively, to pin 11 (+24V). Connect pins 6 and 9 to pin 14 (ground).

2-24. CUE OUT. The cue out signal is available from pins 1 and ground (pin 2) for logging data. Output is 0.5 volt into a 10 k Ohm load resistance.

NOTE THE FOLLOWING REMOTE FUNCTIONS ARE AVAILABLE ON RECORD/PLAYBACK UNITS ONLY.

2-25. RECORD SWITCH AND INDICATOR. Connect two wires from a SPST, N.O., switch between pins 16 and 17. Connect the record indicator between pins 18 to pin 17.

2-26. REMOTE SEC CUE AND TER CUE RECORD PUSH SWITCHES. Connect two wires from a single-pole momentary push switch between pins 19 and 22, to pin 20.

2-27. REMOTE CUE RECORD. The remote cueing feature allows the recording of other than the standard cue tone for data logging or other external functions. To record an external cue tone, connect a SPST, N.O., switch from pin 21 to pin 20. Connect the signal to be recorded to pins 23 and 24. When the switch grounds the cue bias enable line the signal input will be recorded on the cue track. Nominal input level is 0.5V rms into an input impedance of 10 k Ohms.

2-28. AC POWER.

2-29. The standard Series 3000 cartridge machine operates on 60 Hz ac power at either 105 to 125V ac or 210 to 230V ac through internal strapping of the power transformer primary. Units for 50 Hz operation for the same voltage ranges are optionally available. Operating voltage requirements are indicated on the rear panel identification plate of each machine.

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section provides operating procedures and identifies all controls and indicators associated with the operation of Series 3000 cartridge machines.

NOTE INFORMATION EXCLUSIVE TO THE OPERATION OF DELAY UNITS CAN BE FOUND IN THE DELAY SUPPLEMENT (IM No. 597-0300-001). NOTE

3-3. CONTROLS AND INDICATORS.

3-4. Refer to Figures 3-1 and 3-2 for the location of controls and indicators associated with the unit. The function of each control is described in Table 3-1.

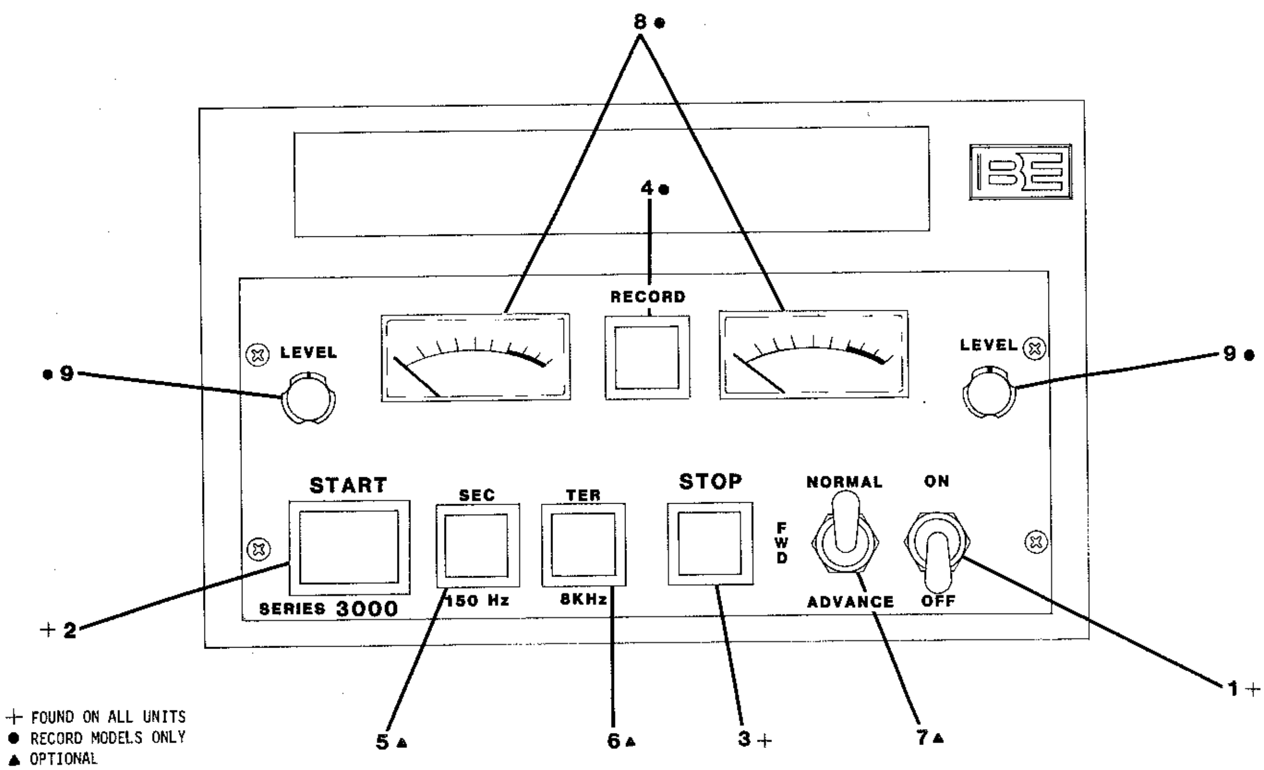


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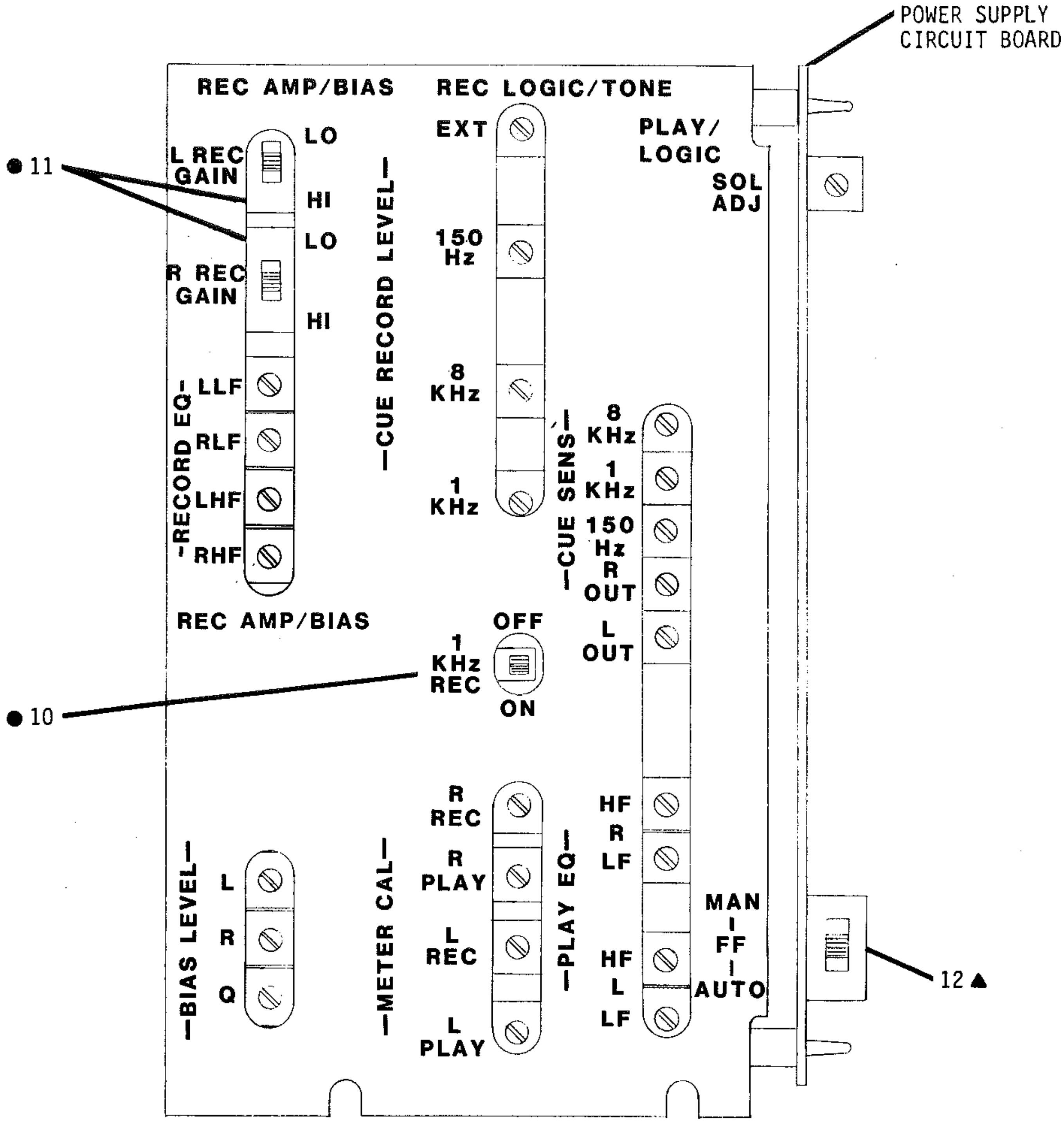
FIGURE 3-1. FRONT PANEL CONTROLS



▲ OPTIONAL
● RECORD UNITS
ONLY

597-0300-4

FIGURE 3-2. CIRCUIT BOARD CONTROLS

TABLE 3-1. CONTROLS AND INDICATORS
(Sheet 1 of 2)

INDEX NO.	NOMENCLATURE	FUNCTION
1	ON/OFF Switch	Controls the application of ac power to the unit. (Located on the rear panel of Model 3400 units.)
2	START Switch/Indicator	Switch: Initiates tape motion for the playback and recording processes. Indicator: Illuminates to indicate the tape is in motion.
3	STOP Switch/Indicator	Switch: Stops tape motion. Returns unit to the ready mode. Indicator: Illuminates to indicate that the unit is in the ready mode; a cartridge fully inserted and power ON.
4	RECORD Switch/Indicator	Switch: Puts unit into record mode. Switches VU meter(s) from playback output to record input. Indicator: Illuminates to indicate the unit is in the record mode.
5	SEC/150 Hz Switch/Indicator	Switch: (Record Models only) Inserts a 150 Hz tone on the cue track of the tape during the record or playback mode of operation. Indicator: Illuminates to indicate the playback of a 150 Hz tone.
6	TER/8 kHz Switch/Indicator	Switch: (Record Models only) Inserts an 8 kHz tone on the cue track of the tape during the record or playback mode of operation.
7	FAST FORWARD: NORMAL/ADVANCE Switch	NORMAL: Tape runs at normal speed (7.5 in/s). ADVANCE: Switches unit into fast forward from playback mode only. Tape advances at three times normal speed (22.5 in/s) until 1kHz stop tone is detected or switch is released. Audio remains on.
8	VU Meter	Provides level indication of the record signal (record mode) and playback audio (playback mode).

3

TABLE 3-1. CONTROLS AND INDICATORS
(Sheet 2 of 2)

INDEX NO.	NOMENCLATURE	FUNCTION
9	LEVEL Control (Potentiometer)	Controls output level of left and right channel record amplifiers.
10	1kHz ON/OFF REC Switch	Controls 1kHz cue tone recording mechanism. OFF: Disables recording mechanism. Does not affect previously recorded tones. ON: Enables recording mechanism. Inserts 1kHz cue on the cue track at the beginning of the recording.
11	HI/LO REC GAIN Switch	Permits recording channel gain to be changed by 35 dB to accommodate both high and low level input sources.
12	FF - MAN/AUTO NOTE: AUDIO IS MUTED DURING AUTOMATIC FAST FORWARD ADVANCE ONLY.	Offers choice between operator control of fast forward mechanism and automatic fast forwarding. MAN: Permits manual control of fast forward mechanism. Audio remains on for editing purposes. Use front panel switch to activate fast forward mechanism. AUTO: Automatically switch the unit into fast forward as a 150 Hz cue tone which has been recorded on the tape ends. Tape advances at 3 times normal speed (22.5 in/s) to the next 1kHz stop tone.

3-5. OPERATION.

3-6. PLAYBACK.

3-7. Turn the machine on by operating the front panel ON/OFF switch to ON. Load a pre-recorded cartridge into the tape deck. The left side cartridge guide should fit snugly against the cartridge. When the cartridge is properly loaded, the STOP switch/indicator will illuminate to indicate the unit is in the ready mode.

3-8. Momentarily depress the START switch/indicator. The START switch/indicator will illuminate, the STOP switch/indicator will go out, and tape motion will begin. The tape will continue to run until the STOP switch/indicator is depressed or a 1kHz stop tone is sensed.

3-9. When the cartridge stops, the START switch/indicator will go out and the STOP switch/indicator will illuminate. When the cartridge is removed from the deck, the STOP switch/indicator will go out.

3-10. If the unit is equipped with the QI or QII option, the appropriate indicator will illuminate whenever a secondary or tertiary cue tone is detected. The indicator will remain illuminated for the duration of the tone.

<u>NOTE</u> THE FAST FORWARD MECHANISM WILL NOT OPERATE WHEN THE UNIT IS IN THE RECORD MODE.

3-11. FAST FORWARD OPTION. If the unit is equipped with the fast forward/cue tone option, this function may be used at any time during playback operation.

3-12. <u>Manual Fast Forward</u>. With the internal fast forward switch set to either AUTO or MAN, operate the front panel FWD switch to ADVANCE. Hold the switch in the ADVANCE position until the tape reaches the desired point. Audio remains on during manual fast forward. A 1kHz tone on the cue track of the tape will stop the fast forward advance and return the unit to the ready mode (STOP switch/indicator illuminated).

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3-13. <u>Automatic Fast Forward</u>. Record a 150 Hz cue tone on the tape where fast forward should begin. Set the internal FF-MAN/AUTO switch to AUTO. As the 150 Hz tone is detected during playback the fast forward circuitry is activated. When the tone ends, the unit switches to fast forward advance with audio muted. Fast forward advance will continue until a stop tone is detected or the STOP switch is depressed. The unit can be returned to normal speed during fast forward without stopping the machine by momentarily operating the front panel FWD switch to ADVANCE.

3-14. RECORDING.

3-15. RECORDER SET-UP. Connect a source of audio to the RECORD LINE or MIC (optional) input of the unit.

<u>NOTE</u> WHEN USING THE MIC INPUT DISCONNECT THE RECORD LINE INPUT.

3-16. Lift the top cover of the unit and set the GAIN switch(es) to the appropriate position. The switch(es) should be set to LO for line input and HI for microphone input. Set the internal 1kHz REC switch to either ON or OFF, as desired. Operate the power switch to ON.

3-17. Select a bulk erased cartridge at least two seconds longer than the material to be recorded. Insert the cartridge into the tape deck. When the cartridge is properly inserted the STOP switch/indicator will illuminate.

3-18. Run the tape in the playback mode for several seconds to align the tape in the guides and to locate the tape splice. Stop the machine just past the splice to avoid recording over the splice.

NOTE THE CARTRIDGE MACHINE MUST BE IN THE READY MODE (STOP SWITCH/INDICATOR ILLUMINATED) IN ORDER TO PLACE THE UNIT IN THE RECORD MODE. NOTE

3-19. SETTING THE RECORD LEVELS. To initiate the recording process depress the RECORD switch/indicator. This will put the unit in the record mode and illuminate the RECORD switch/indicator (the STOP switch/indicator remains illuminated).

3-20. Start the material to be recorded and set the recorder front panel LEVEL control(s) so that the audio peaks read Ø VU on the meters.

3-21. Stop and recue the program source material.

3-22. MAKING THE RECORDING. With the system in the record mode depress the START switch/indicator. Allow approximately a half second pause, then start the source material. If the internal 1kHz REC switch is in the ON position a stop cue tone will automatically be recorded on the cue track as the START switch/indicator is depressed. As the START switch/indicator is depressed the START switch/indicator will illuminate and the STOP switch/indicator will go out.

NOTE THE QUALITY OF THE RECORDING MAY BE MONITORED IF A PROVISION IS MADE TO FEED THE AUDIO OUTPUT OF THE UNIT TO A SEPARATE MONITOR SYSTEM SUCH AS THE AUDITION CHANNEL OF A CONSOLE. NOTE

3-23. At the end of the recording, the tape will automatically stop if the 1kHz stop tone was recorded at the beginning of the recording. This also means that the cartridge is re-cued and ready to play again.

3-24. The recording may also be manually stopped at any time by depressing the cartridge machine STOP switch/indicator.

3-25. The system is automatically taken out of the record mode (the RECORD switch/indicator will go out) and returned to the ready mode (STOP switch/indicator illuminated) when the deck is stopped.

3-26. CUE OPTION. If the unit is equipped with the secondary and tertiary cue option, these tones may be recorded at any time during playback or recording.

NOTE DO NOT APPLY SECONDARY OR TERTIARY CUE TONES DURING THE FIRST 2.5 SECONDS OF THE MESSAGE.

3-27. To record a secondary or tertiary cue tone during recording or playback, depress the appropriate switch/indicator (SEC or TER) for the length of time a tone is desired. To ensure reliability, tone duration should not be less than one second.

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This section contains the theory of operation for the Broadcast Electronics Series 3000 Cartridge Machine. For purposes of explanation the equipment is divided into functional circuits.

4-3. FUNCTIONAL DESCRIPTION.

4-4. Refer to the schematics in Section VII and Figure 4-1, the Functional Block Diagram, for the following discussions of system components.

4-5. PLAYBACK LOGIC CIRCUIT BOARD.

4-6. GENERAL. The playback logic circuit board contains the playback amplifiers for the program track(s), the output audio muting, the cue track amplifier, the 1 kHz stop cue sensor, and the stop/start logic. When the optional Q-Trips are installed, the QI/150 Hz and QII/8 kHz sensors are incorporated on this circuit board. Additionally, the 3 kHz stop cue sensor is mounted on this circuit board in units equipped for fast forward operation.

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4-7. In all, there are six possible configurations of the playback logic circuit board. The exact configuration used in a particular machine is indicated in Table 5-1. This varies depending on the options the unit is equipped with as well as whether the unit is monophonic or stereophonic. The schematic diagram in Section VII shows the most complex arrangement required for a stereophonic unit with all available options.

4-8. PROGRAM CIRCUITRY. As the left and right program channels are identical, only the left channel will be described.

4-9. The audio from the playback head is applied through coupling capacitor C11 to the input of preamplifier IC-1A. IC-1A provides gain and equalization as determined by R1, R2, R10, R34, and C1. The variable high and low frequency potentiometers allow equalization levels to be adjusted to match NAB, IEC, or CCIR standards. DC voltage is supplied to IC1 through the decoupling network consisting of R26 and C13. Biasing is provided through the use of voltage dividers.

4-10. The output of the preamplifier is coupled through C26 to FET program muting switch Q5. This N-channel device is controlled by logic so that a ground on either CR7 or CR8 will mute the audio signal. The audio is muted whenever the machine is stopped, or when units equipped with the fast forward option operate in the automatic fast forward mode. Twelve volt operating bias for Q5 is developed across a voltage divider from the +24 volt supply. C24 provides supply decoupling to prevent minor power fluctuations from affecting the mute circuitry. Any ac appearing on the gate of Q5 is shunted to ground by C23.

4-11. The output of Q5 is applied to the output level control R5 through C27. The audio signal is also available through pin 14 to the front panel VU meter(s) in record/playback models.

4-12. The signal from R5 is coupled through C30 to output booster IC-3. IC-3 and complementary-symmetry drivers Q3 and Q4 provide 28 dB of gain to drive the output to a maximum +18 dBm. The ratio of R41 and R42 fixes the gain of this stage. Bias for Q3 and Q4 is provided by CR4, CR5, and CR6. Bias for IC-3 is developed across voltage dividers from the +24 volt dc supply.

4-13. The fully amplified signal is coupled through C22 and applied to the primary of the output transformer and the headphone jack. The transformer adds 6 dB of gain to the output signal which then is applied to the output connector.

4-14. CUE TRACK AUDIO AND 1 KHZ STOP SENSOR. The cue track of the playback head is coupled through C15 to the input of preamplifier IC-2A. R21, R22, R23, and C14 provide gain and equalization. Bias for IC-2A is supplied through R15 from voltage dividers R17 and R16.

4-15. The output of the preamplifier is direct coupled to inverting amplifier IC-2B. IC-2B provides 27 dB of gain as determined by R27 and R28. The amplified signal is coupled through C20 to the cue output (on J5, the rear panel REMOTE connector) through pin 19 and to 1kHz sensor level control R8.

4-16. The signal is coupled through C43 to an active band-pass filter comprising IC-4A, R84, R85, R86, C44, C45, and C46. The 1kHz output of the filter is ac coupled to half-wave rectifier consisting of CR21 and CR22. C58 and R97 provide filtering. FET Q10 conducts the signal to ground, muting the sensor. In the stop mode, the gate of Q10 grounds to the stop/start control flip-flop through CR15 and R100, turning Q10 on and muting the sensor. When the ground is removed as the logic changes to the run mode, C55 remains charged (the sensor is muted) for approximately three seconds, preventing a stop tone from halting the just started unit. As C55 discharges Q10 turns off and will pass any 1kHz signals. Q10 can also ground through R95 and CR17 to the fast forward cue shift/mute bus. Removing this ground activates the sensor immediately.

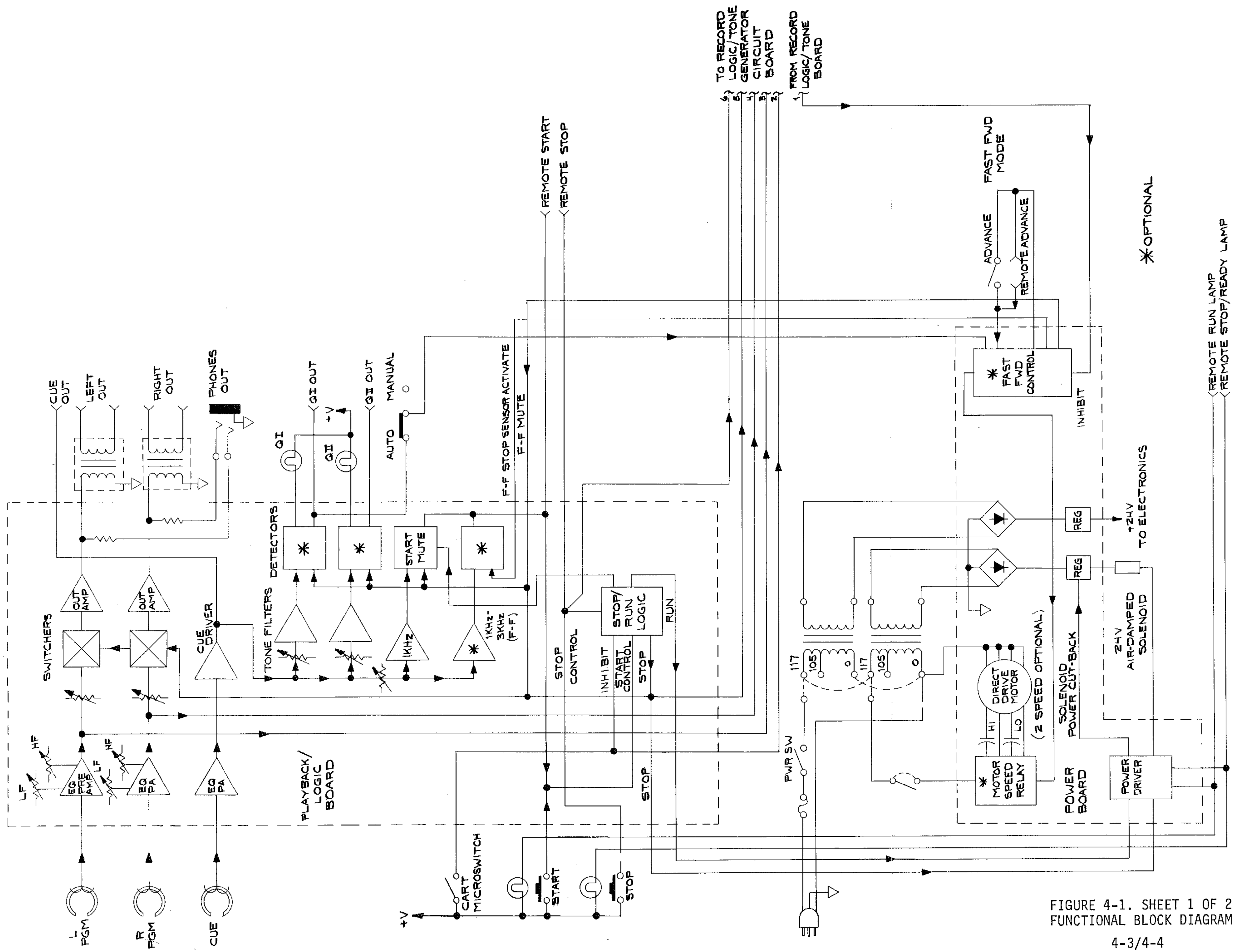

FIGURE 4-1. SHEET 1 OF 2
FUNCTIONAL BLOCK DIAGRAM

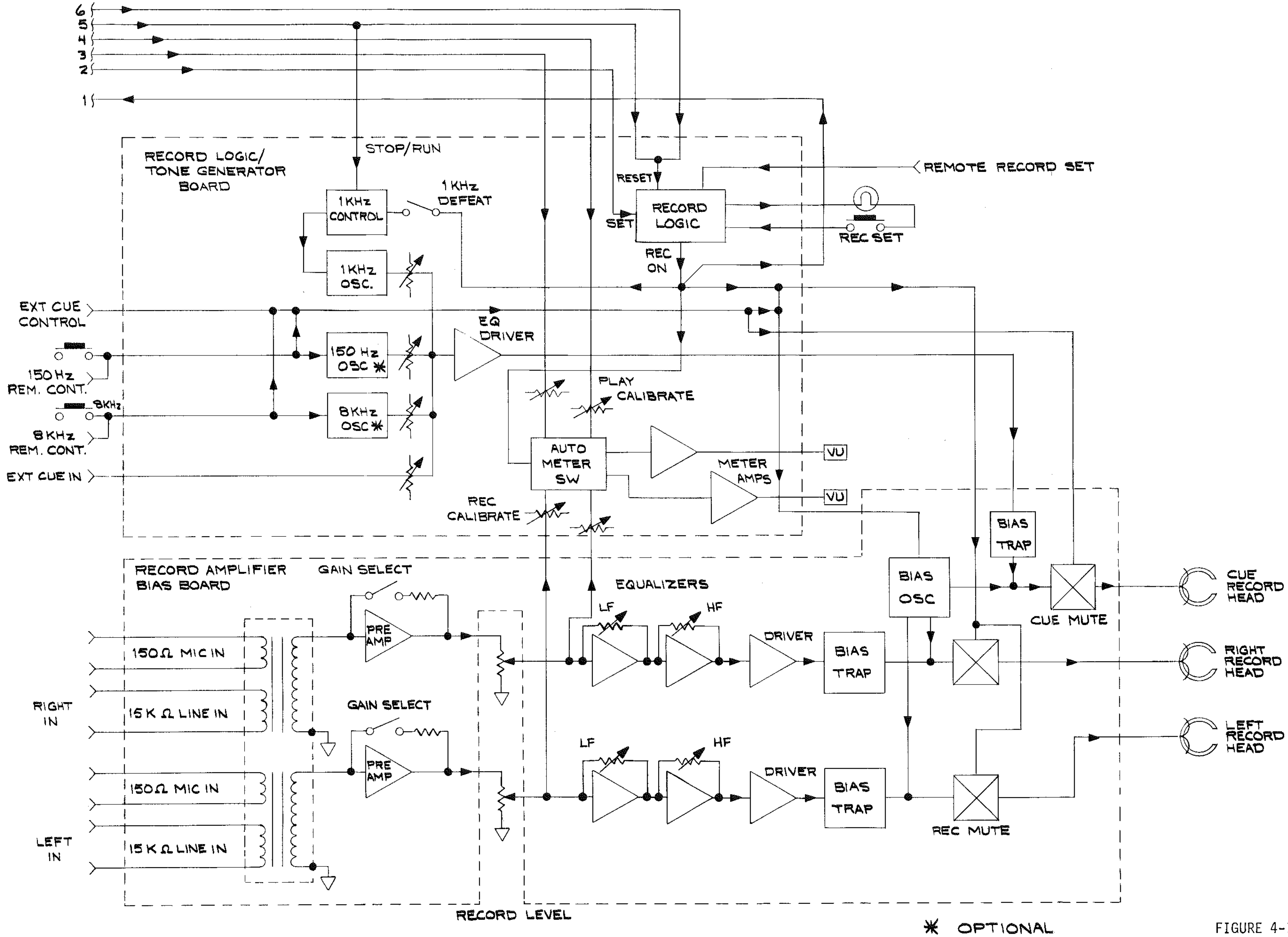

FIGURE 4-1. SHEET 2 OF 2
FUNCTIONAL BLOCK DIAGRAM

4-17. If not grounded by Q10, the dc signal from R75 is applied to comparator IC-6D. A reference voltage is also applied to IC-6D through R72 from R57 and R99. When the dc signal from R75 exceeds the reference voltage, the output of IC-6D goes HIGH delivering a positive pulse through C39 to the stop control.

4-18. 3 KHZ STOP SENSOR (OPTIONAL). In units equipped for operation at both the normal and fast forward (3X normal) speeds, 3 kHz sensor circuitry is also installed. The cue audio from 1kHz level control R8 is applied to FET Q7. Q7 is only active when the fast forward cue shift/mute bus is grounded.

4-19. When a unit is put into the fast forward mode, Q7 gradually turns on as C34 discharges through R55. When the ground is removed, Q7 immediately shuts off disabling the 3 kHz sensor.

4-20. Following Q7, the audio signal is applied across LC network L1, C41 and routed through C42 to IC-4B for amplification. The output is rectified, filtered, and then applied to comparator IC-6B. When a 3 kHz tone is present at the filter, the output of IC-6B goes HIGH, delivering a positive pulse through CR13 and C39 to the stop control.

4-21. 150 HZ AND 8 KHZ SENSORS (OPTIONAL). In units equipped with the optional QI/150 Hz and QII/8 kHz auxiliary cue tones, cue circuitry is installed for each tone. These cue sensors are similar in operation to the 1kHz sensor.

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4-22. Audio from the cue channel is fed through 150 Hz level control R7 to 150 Hz band-pass filter IC-5B. This filter assures only the 150 Hz tone will be processed. The signal is then rectified and applied to comparator IC-6A. When a 150 Hz tone is present, the output of IC-6A goes HIGH, delivering a pulse which drives a relay located on the power supply circuit board.

4-23. Audio from the cue channel is fed through 8 kHz level control R9 to 8 kHz band-pass filter IC-5A. This filter assures only an 8 kHz tone will be processed. The signal from IC-5A is rectified and applied to comparator IC-6C. When an 8 kHz tone is present, the output of IC-6C goes HIGH, delivering a pulse which drives a relay located on the power supply circuit board.

4-24. To prevent chatter of the relays on the power supply circuit board when ac power is applied to the unit, C36 keeps the reference voltage for the comparator higher than normal until the circuit stabilizes. At turn off, C61 and CR24 hold the reference voltage as the power supply shuts down. Muting for these circuits is accomplished by grounding the input to the comparator through the fast forward cue shift/mute bus.

4-25. STOP/START LOGIC. Stopping and starting are controlled by the flip-flop composed of Q8 and Q9. The circuit is a bistable multivibrator. When Q8 is off, the collector draws no current and is at a 18V dc level. This voltage is conducted through R52 to the base of Q9 to hold Q9 in full conduction. Likewise, when Q9 is off, the voltage from the collector of Q9 is routed to the base of Q8 through R53 to hold Q8 in full conduction. The flip-flop will change states when a positive voltage is applied to the base of the non-conducting transistor. This is accomplished through coupling resistors R61 and R62. To prevent false triggering, capacitors C60 and C33 shunt short-duration transient pulses to ground. When power is first applied, R54 ensures that the flip-flop will preset to stop with Q9 conducting. The output voltages from Q8 and Q9 are available on the board pins M and 9 for use in the logic on the power supply and record amplifier bias circuit boards.

4-26. POWER SUPPLY CIRCUIT BOARD.

4-27. GENERAL. The power supply circuit board contains the +24 volt dc supply for the electronics, the +30 volt dc supply and controlling circuitry for the solenoid, and the logic driver circuits. In units equipped with the Q-trips, the QI and QII relays are mounted on this circuit board. In units equipped with the fast forward provision, the motor control circuitry is also incorporated on this circuit board. The power supply circuit board is manufactured in three versions. The schematic diagram in Section VII shows the most complex version with all options.

4-28. VOLTAGE SUPPLIES. AC power is applied to the cartridge machine through fuse F1 and ON/OFF switch S3. The fuse provides overload protection and the switch provides control of the primary ac power. The ac voltage is applied to the primary of transformer T1. Separate secondary windings on the power transformer provide 30 volts dc through J1 to bridge rectifiers CR1 and CR2. The low current for the amplifiers is supplied by CR1.

4-29. Diode CR17 provides reverse voltage protection for the regulator located on the rear panel of the unit. This regulator provides a +24 volt dc supply, which is controlled to within ±24 mV with internal current limiting and thermal overload protection. Voltage for the logic and the solenoid are supplied directly from the output of CR2. C5 provides filtering for this high current source.

4-30 SOLENOID CONTROL. In the stop mode, Q5 is biased off. The resulting potential at the collector allows CR20 to conduct which supplies drive current to IC1 which operates as a constant current source. The output of IC1 forces Q1 off and deenergizes the solenoid. Q7 and Q3 are biased on in stop and C9 will charge to approximately 2.8 volts which is applied to pin 5 of IC1.

4-31. When run is initiated, Q5 is biased on, which prevents current flow through CR20. The absence of drive current to IC1 enables Q1 and energizes the solenoid. The resulting solenoid current develops a voltage across R1. This voltage is applied to pin 4 of IC1 to maintain the potential on pin 4 and pin 5 at the same level. If there is a potential difference between these two pins of IC1, more drive will be applied to Q1 which increases solenoid current, and thereby increases the voltage applied to pin 4. This feedback action provides a high level of drive current to Q1 to assure positive solenoid pull-in as the run mode is initiated.

4-32. Q7 and Q3 will be turned off when run is initiated and C9 will begin to discharge to the lower adjusted voltage established across the voltage divider consisting of R15, R18, and R20. As less drive current is required to compensate for the reduced voltage differential between pins 4 and 5, the feedback loop will reduce solenoid current after pull-in to a minimum holding current.

4-33. FAST FORWARD AND Q-TRIP RELAYS. When a unit is equipped for fast forward operation, relay K1 is installed to control power application to the normal and high-speed motor windings (refer to drawing B959-0009 in Section VII). The ac voltage for the drive motor is supplied from the primary of the power transformer through J1 and J2. Capacitors C1 through C4 provide transient suppression during switching.

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4-34. The high-speed motor winding is connected to the ac voltage only when K1 is energized. A +30 volt dc control voltage for the relay is supplied through Q2. Q2 is enabled when the unit is in the playback mode. In record models pin P is connected to the record logic so that the ground for fast forward is supplied in the playback mode only. To complete the energization of K1, grounding must occur through CR7 and Q5. This ground will be provided when the unit is switched into manual or automatic fast forward operation.

4-35. Manual Fast Forward. When S4, the front panel FWD switch, is operated to the ADVANCE position R6 is connected to CR7 supplying the ground required to energize K1 and place the unit into the fast forward mode of operation. The unit will remain in fast forward until the front panel STOP switch is depressed, a stop tone is detected, or the front panel switch is released.

4-36. When K1 energizes, the cue tone sensors on the playback logic circuit board will be grounded through pin 15 (fast forward cue shift/mute). This ground mutes the 1kHz, 150 Hz, and 8 kHz sensors and enables the 3 kHz sensor. Audio is supplied to the output jack during manual fast forward. Diode CR6 prevents the audio muting circuit from grounding at terminal S.

4-37. Release of S4 or a low on Q5 breaks the grounding path to K1. If S4 is released the unit will continue to operate but at the normal motor speed. If the stop cue tone or STOP switch/indicator halts tape motion by placing a low on Q5, the unit will operate at the normal tape speed when re-started.

4-38. Automatic Fast Forward and QI Relay. When a 150 Hz tone is detected by the cue sensor on the playback logic circuit board, the QI control signal at terminal B goes HIGH enabling Q4. A ground is provided for the QI indicator lamp and relay K2. K2 energizes, closing the normally open contacts which are available through the rear panel REMOTE connector. When the 150 Hz tone ends, the QI control signal returns to a low state and Q4 shuts off. If S1 is in the automatic position as C10 charges, a positive pulse will be applied through CR3 and S1 to the gate of Q1. K1 will then ground through Q1, as will the fast forward cue shift/mute and the automatic fast forward audio mute busses. As this happens, the unit switches to the fast forward mode of operation with audio muted.

4-39. A stop tone detected by the 3 kHz sensor will stop the unit. Q5 shuts off and Q1 can no longer conduct current. With Q1 and Q5 off, K1 returns to the relaxed state and the fast forward cue shift/mute and audio mute busses are deactivated.

4-40. QII Relay. K3, the 8 kHz cue tone relay, operates in the same manner as K2. When the 8 kHz tone is present, the QII control signal at terminal A goes HIGH enabling Q6. The necessary ground is provided for the QII indicator lamp and K3. As K3 energizes, the normally open contacts available through the rear panel REMOTE connector close. When the tone ends, the relay returns to a deenergized condition.

4-41. RECORD AMPLIFIER/BIAS CIRCUIT BOARD.

4-42. PROGRAM CHANNELS. The following text describes the operation of the left and right program channel amplifier circuits. The circuits operate identically, therefore only the left channel circuit will be described. Refer to schematic 910-1050/-1049/-1048 as required.

4-43. Left channel record inputs are applied to input transformer T1 which provides balanced-to-unbalanced impedance conversion. The input impedance is determined by resistors R1, R2, and R3. Audio from the secondaries of T1 is applied to first-stage non-inverting amplifier U1A. The gain of U1A is determined by switch S1. S1 shunts feedback resistor R7 in the LO position and provides an additional gain of 35 dB in the HI position.

4-44. Amplified audio from U1A is applied to second-stage non-inverting amplifier U2A. The gain of U2A is established by feedback resistor R11. The output of U2A is applied through coupling capacitor C6 to front-panel level control R1. The output of R1 is routed to the record amplifier/bias circuit board for application to an equalization network. Also, a sample from R1 is routed to the VU amplifier circuit on the record control and tone generator circuit board.

4-45. The equalization network consists of U3A, U3B, R14, R19, and subsequent associated circuitry. Low frequency equalization control R14 and operational amplifier U3A provide low frequency compensation. High frequency equalization control R19 and operational amplifier U3B provide high frequency compensation.

4-46. The equalized signal is applied to the record head drive transistor (Q1). The output of Q1 is applied to transistor Q2 which operates as a program record control switch. Q2 is controlled by the program control line (pin 16). When the system is operated to the record mode, a ground from the program control line is applied through diode D1 to D2. This ground biases Q2 on which routes program audio through record bias trap L1/C15 to the record head. When the system is operated to the playback mode, a positive voltage from the program control line reverse biases D1 and disables transistor Q2.

4-47. Program Record Head Shunt Circuit. A circuit consisting of D2, Q3, D3, Q4, and associated circuitry shunts the record head inputs to ground when the sytem is in the playback mode. This circuit is required to prevent the application of bias to the record head when recording secondary and tertiary cue tones in the playback mode.

4-48. Transistor Q3 controls the operation of the shunt circuit. When the system is operated to the playback mode, a positive voltage from the program control line reverse biases diode D2 and disables transistor Q3. With Q3 cut-off, voltage is applied through zener diode D3 to transistor Q4. This voltage biases Q4 on which shunts the record head input terminals to ground. When the system is operated to the record mode, a ground biases D2 on and enables Q3. With Q3 enabled, bias for transistor Q4 is shunted to ground.

4-49. Record Bias Circuit. Record bias from the seondary of bias transformer T3 is routed through LDR1 and left channel bias level control R31 to the left channel program amplifier circuit. LDR1 is controlled by the program control line and provides isolation for the application of bias. Bias is applied to the amplifier circuit when a ground from the program control line disables transistor Q14. With Q14 cut-off, bias voltage is applied to LDR1.

4-50. Left channel bias level control R31 permits the adjustment of the recording bias level for minimum distortion, maximum signal-to-noise ratio and maximum frequency response. Left channel bias trap L1/C15 isolates the bias signal from the amplifier circuitry to prevent possible intermodulation distortion of the program audio.

4-51. CUE CHANNEL. Cue record inputs from the record control and tone generator circuit board are applied to cue bias trap L3/C42 which isolates the bias signal from the cue channel driving circuit. Transistors Q12, Q13, and associated circuitry function as a cue record head shunt circuit. The operation of the circuit is controlled by the cue bias switch control line (pin 20). When cue channel recording is required, a positive voltage from the cue bias switch control line is applied to Q12, biasing Q12 on. With Q12 on, transistor Q13 is cut-off which allows cue audio to be routed to the cue record head. When cue channel recording is not required, a ground from the cue bias switch control line disables Q12. With Q12 cut-off, bias is applied to Q13 which shunts the cue record head inputs to ground.

4-52. BIAS OSCILLATOR. The push-pull oscillator consisting of Q9 and Q10 provides a 100 kHz low distortion sine wave for record bias in the left channel, right channel, and cue channel record heads. Positive feedback from the collector of Q9 is applied through C37 to Q10. C38 provides positive feedback from the collector of Q10 to Q9. Operating frequency is determined by the inductance of T3 and the capacitance of C39. Low distortion is achieved by a small amount of negative feedback from emitter resistors R63, R64, and capacitor C36. Capacitor C40 minimizes start-up transients by providing a gradual turn-on of oscillation.

4-53. Control logic on the record control and tone generator circuit board enables the bias oscillator when: 1) the system is operated to the record mode and 2) the system is required to record secondary, tertiary, or external cue tones. When record bias is required, a ground from the bias switch control line is applied to bias switch transistor Q11. This ground enables Q11 which routes a +24V supply to the oscillator. When record bias is not required, a positive voltage is applied to transistor Q11. Q11 is cut-off which removes the supply voltage from the oscillator.

4-54. VOLTAGE REGULATOR. A voltage regulator consisting of Q5, C20, C18, and resistor R35 regulates the +24 volt power supply for proper circuit operation.

4-55. RECORD LOGIC AND TONE GENERATOR CIRCUIT BOARD.

4-56. GENERAL. The record logic and tone generator circuit board is installed in record models only. It incorporates the record logic flip-flop, the VU meter amplifier, and the 1kHz stop cue generator. In units equipped with the optional Q-trips, generators for the 150 Hz and 8 kHz cue tones are also included. This circuit board is supplied in four versions. The exact configuration used in a particular machine is indicated in Table 5-1. The schematic diagram in Section VII shows most complex version of the circuit board.

4-57. RECORD FLIP-FLOP AND RECORD LOGIC. A bistable multivibrator, consisting of transistors Q8 and Q9, activates all record functions and record indications of the system except the QI and QII record modes. This flip-flop is preset in the play state when power is initially applied to the system by R42 which is connected to the base of Q8. R42 holds the base of Q8 at a potential lower than the base of Q9 when power is applied.

4-58. A high logic level pulse entering the circuit through record set terminal 12 switches the flip-flop to the record state by bringing Q8 into conduction. This action may be inhibited, however, by the run interlock logic at terminal 11. If the cartridge is running when the RECORD switch is depressed, terminal 11 is at a low logic level and prevents the flip-flop from entering the record state. If the cartridge is not running, terminal 11 is at a high logic level and is isolated by CR15 which permits the flip-flop to enter the record mode. Additionally, Q9 is cut-off with its collector going positive, and Q13 is brought into conduction with its collector dropping to approximately ground potential. This action places subsequent logic elements in the record mode unless it is cancelled by a high logic level at record cancel terminal 8. Cancel logic is derived from circuitry on the power supply circuit board. However, record status will be cancelled under any of the following conditions:

1) Cartridge not loaded
2) Machine stopped manually
3) Machine stopped by 1kHz cue tone action

4-59. When the RECORD switch/indicator is depressed, a positive pulse is routed to R45. If the unit is in the run mode this pulse will be grounded through CR15. If the unit is in the stop mode the pulse will be routed through CR14 to set the flip-flop to record (Q8 conducting). With Q9 off, Q13 will supply a ground to the record indicator lamp and the program record circuitry on the record amplifier and bias circuit board.

4-60. When the STOP switch/indicator, 1kHz (or 3 kHz) cue sensor, or the deck microswitch (if the cartridge is withdrawn) applies a positive pulse to R69, Q9 will conduct and Q8 will turn off. The base of Q12 will go HIGH to supply a ground to the record interlock. Transistor Q13 will remove the ground from the record indicator lamp and program control.

4-61. 1 KHZ STOP CUE GENERATOR AND CONTROL. The stop cue tone generator comprises IC-2A and IC-2B which oscillate at 1kHz as determined by R11, R58, R59, C14, and C15. The generator oscillates when positive feedback is available through R48 and R49. The output of the generator is routed through R55, C18, level control R6, R46, and C12 to Q5. Emitter follower stage Q5 acts as a current source to drive the record head. The cue output is routed from terminal 7 to the record amplifier and bias circuit board.

4-62. The 1kHz generator automatically records a stop cue tone burst when the unit first starts in the record mode. This control is accomplished by IC-2C and IC-2D which form a monostable multivibrator. A 12 volt dc reference is supplied to IC-2C and IC-2D through R64 and R66 from voltage divider R60, R61. The output of the multivibrator will go HIGH only when the input from R62 goes HIGH.

4-63. A potential of +24 volts dc is available on S1. In the ON position +24 volts dc is applied to R29. If the record logic is not set for the record mode, the voltage will be grounded through CR8 and Q12. Also, if the tape is not running (stop mode), the voltage will be routed to ground through the 1kHz interlock and CR9. If the unit is in the record mode and the tape is running, the voltage from R29 will be applied through CR7 and CR18 to IC-2C. IC-2C will go HIGH and the voltage is routed through C28 and R63 sending IC-2D HIGH. When C28 fully charges, the dc path to IC-2D is blocked and the output of IC-2D goes LOW and remains LOW until IC-2C is unlatched and relatched.

4-64. When multivibrator IC-2C/IC-2D goes HIGH, a voltage is supplied through CR17 and CR23 to the cue bias switching circuit on the record amplifier and bias circuit board. CR20 is reverse-biased through CR16 allowing voltage to be applied to the gate of FET Q10 through R67, enabling Q10. FET Q10 turns on the 1kHz generator by allowing positive feedback through R48 and R49.

4-65. When the multivibrator goes LOW, the voltage applied to Q10 is shunted to ground through CR20 and R68 which turns Q10 off and shuts down the generator. Since the multivibrator has a time constant of approximately three-quarters of a second, a stop tone burst of that length is recorded on the cue track.

4-66. AUXILIARY CUE TONE GENERATORS AND CONTROL. When optional Q-trips are installed, 150 Hz and 8 kHz generators similar in operation to the 1kHz generator are employed. For ease in explanation, the 150 Hz generator and associated circuitry will be explained with 8 kHz generator information appearing in parentheses.

4-67. The 150 Hz cue tone generator comprises IC-3A and IC-3B (IC-3C/IC-3D). The frequency is determined by the network R10 (R12), R50 (R92), R51 (R91), C22 (C24), and C23 (C25). Oscillation occurs when positive feedback is supplied by R73 (R93, R94). The output of the generator is supplied through level control R8 (R7) to cue head driver Q5. To permit recording from an external generator, the rear panel external cue input is connected through level control R9 to Q5.

4-68. The cue tone generators are not automatically controlled by the machine but manually controlled by the front panel switches or through a separate level control connector. When the FET in the feedback circuit, Q11 (Q15), is held off the voltage on its gate is shunted through CR21 (CR22) and R82 (R83) to ground. When a positive voltage is supplied to the cue control through CR29 (CR28), CR21 (CR22) is back biased to allow the FET to turn on. When the control goes LOW, the FET is again biased off.

4-69. When the cue control is HIGH, the voltage is also applied through CR26 (CR27) and CR24 to the cue bias switch to enable the bias switching (on the record amplifier and bias circuit board). To supply bias to record an external signal on the cue track, positive voltage must be supplied from the rear panel REMOTE connector through CR25 to the cue bias switch.

4-70. Transistor Q14 is installed to permit the recording of the 150 Hz, 8 kHz, or external cue tones in the playback mode. A positive voltage on the 150 Hz, 8 kHz, or external cue controls is coupled through R5 and CR23 to the base of Q14. Transistor Q14 supplies a ground to terminal 6 starting the bias oscillator. The cue generators run and the cue track receives bias from the bias oscillator, so a cue tone is recorded. The program track remain undisturbed since program bias and audio are not enabled.

4-71. VU METER AMPLIFIER. As the left and right VU meter amplifier circuits are identical, the left meter circuitry will be described with right meter (stereo models) information appearing in parentheses.

4-72 The VU meter displays the output level of the unit when it is in the playback mode and the signal input level when the unit is in the record mode. The input signal is brought in from the record amplifier and bias circuit board through calibration control R2 (R4) to P-channel FET Q2 (Q4). The output signal is brought in from the playback logic circuit board through calibration control R1 (R3) to N-channel FET Q1 (Q3). These FETs switch the input signal to the meter amplifier.

4-73. In the playback mode, a bias voltage of +12 volts dc is supplied to the FETs from the voltage divider R30 and R31, through R13 (R22), R15 (R23), and R17 (R24). This keeps Q1 (Q3) in conduction and Q2 (Q4) biased off. Only the playback signal reaches the meter amplifier. When the record logic is in the record mode, a ground is applied to the gates of the FETs through CR1 (CR6) to Q13. FET Q1 (Q3) turns off and Q2 (Q4) turns on to connect the record signal and disconnect the playback signal.

4-74. The output of the FET switching is direct coupled through R18 (R26) to the amplifier IC-1A (IC-1B). C1 (C3) and C5 (C9) act as blocking capacitors for the dc bias on the FETs. Bias for IC-1A (IC-1B) is supplied through R17 (R24). After amplification, the signal is rectified to drive the VU meter.

4-75. Transistor Q7 provides power supply decoupling and a controlled turn-on for the VU meter circuit. When ac power is first applied to the unit, the meter circuit is damped to prevent full-scale deflection.

4

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides general maintenance information, mechanical and electrical adjustment procedures, and component replacement procedures for Series 3000 cartridge machines.

5-3. FIRST LEVEL MAINTENANCE.

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

WARNING DISCONNECT POWER PRIOR TO SERVICING.

5-5. Use a soft cloth moistened with a mild household cleaner to clean fingerprints and other marks from the machine chassis and other surfaces. Remove dust from the interior with a soft-bristled brush. Periodically check for loose hardware, improperly seated semi-conductors, and overheated components.

WARNING
WARNING
WARNING

MOST SOLVENTS WHICH WILL REMOVE TAPE RESIDUE 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 OBSERVE 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 cartridge for cleanliness, mechanical defects, and tape wear. The Appendix provides additional information on tape and cartridge maintenance.

5-10. CIRCUIT BOARDS AND CONNECTORS.

5-11. Routing cleaning of circuit boards and connectors is not necessary; however, if visual inspection of the contacts are intermittent machine performance indicates that the contacts may be dirty, the contacts should be cleaned with an aerosol contact cleaner.

5-12. SECOND LEVEL MAINTENANCE.

5-13. Second level maintenance consists of procedures required to restore the unit to proper operation after a fault has occurred.

5-14. MECHANICAL ADJUSTMENTS.

5-15. Specific instructions are provided for the following mechanical adjustments:

A. PRESSURE ROLLER/CAPSTAN SHAFT ALIGNMENT

B. SOLENOID PLUNGER TRAVEL

C. SOLENOID SPEED

D. HEAD ADJUSTMENTS

1. Head Adjustment
2. Zenith
3. Height

5-16. PRESSURE ROLLER/CAPSTAN SHAFT ALIGNMENT. Pressure roller alignment involves positioning the motor/capstan shaft and the pressure roller so that the pressure roller makes even contact with the capstan from top to bottom along the roller surface. This assures even pressure distribution between the pressure roller and the shaft as the tape is fed past the capstan. Improper alignment will direct or skew the tape in either an upward or downward direction, resulting in improper tape flow past the heads.

5-17. Two procedures are provided for this alignment. The first procedure is the recommended procedure and requires the use of a pressure roller alignment gauge (BE P/N 836-0005). The second procedure is an alternate method of alignment to be used when an alignment gauge is not available.

A. Recommended Procedure:

1. Manually raise the pressure roller above deck level by pushing in the solenoid plunger.

2. Remove the E-ring from the top of the pressure roller.

3. Remove and retain the pressure roller, the metal washer, and the nylon washer.

WARNING: DISCONNECT POWER PRIOR TO SERVICING

4. Set the alignment gauge on the pressure roller shaft (refer to Figure 5-3) so that the gauge rests on the deck surface.

5. Loosen the motor mounting screws and adjust the motor until the capstan and the gauge are in contact from top to bottom.

6. Tighten the motor mounting screws and re-check for proper alignment. Repeat the procedure, if necessary, to obtain the proper alignment.

7. Remove the alignment gauge and place the metal washer, the roller, the nylon washer, and the E-ring on the shaft, in that order.

8. Adjust solenoid plunger travel before returning the unit to service.

B. Alternate Procedure:

1. Loosen the two motor mounting screws.

2. Manually raise the pressure roller by pushing in the solenoid plunger.

3. Check for parallelism as the pressure roller comes into contact with the capstan shaft (refer to Figure 5-1).

4. Adjust the motor until the pressure roller is parallel to the capstan shaft and slightly indented by the shaft.

5. Tighten the motor mounting screws and recheck for proper alignment.

6. Adjust solenoid plunger travel before returning the unit to service.

5

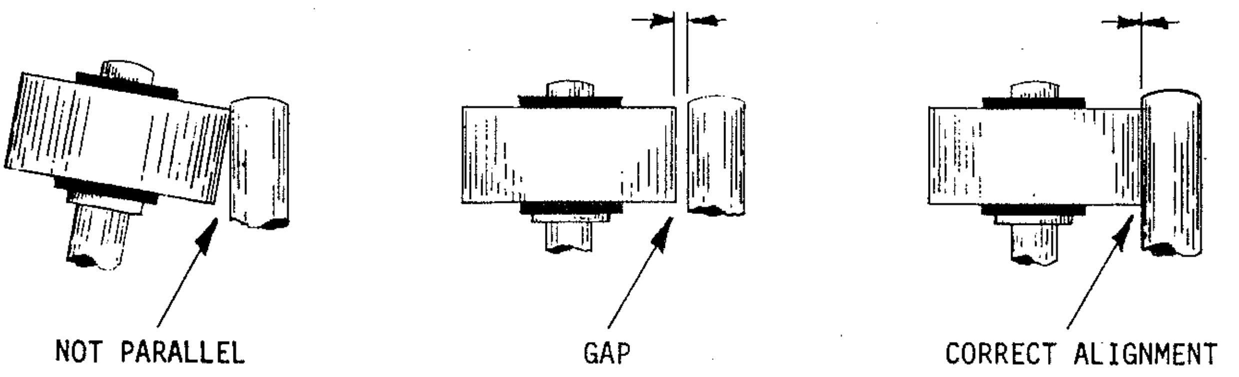

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FIGURE 5-1. PRESSURE ROLLER PARALLELISM

5-18. SOLENOID PLUNGER TRAVEL. Solenoid plunger travel is determined by the plunger adjustment screw which links the plunger to the solenoid chain (refer to Figure 5-2). It is set to bring the pressure roller against the capstan just prior to the plunger reaching the limit of its travel.

NOTE PERFORM PRESSURE ROLLER ALIGNMENT PRIOR TO THE ADJUSTMENT OF THE SOLENOID PLUNGER.

5-19. Turn the machine on. With no cartridge in the machine, hold the ready microswitch open and depress the START switch. The solenoid will pull the pressure roller onto the capstan.

5-20. Loosen the locknut at the end of the plunger. Turn the plunger clockwise in one-half turn increments while alternately depressing the START switch until an audible noise, the plunger hitting bottom, is heard with the solenoid action.

5-21. Turn the plunger counterclockwise for approximately one and one-half turns beyond the point where the noise disappears, and tighten the locknut tightly against the end of the plunger.

5-22. SOLENOID SPEED ADJUSTMENT. The rate at which the solenoid plunger is pulled-in or released is controlled by the solenoid speed adjustment, a spring-loaded screw located on the rear end plate of the solenoid cylinder (refer to Figure 5-2).

5-23. The rate of air passage through the pressure release valve is also determined by the setting of this screw, establishing the level of noise generated by solenoid action. This adjustment is factory set for a moderate balance between solenoid operating rate and noise level, and generally does not need readjustment. If desired, however, it may be reset to suit individual needs.

5-24. Disconnect ac power. Turn the speed adjustment screw about 1/4 turn clockwise to increase solenoid action time. Turn the screw 1/4 turn counterclockwise to reduce time. Noise increases with the speed of the solenoid.

5-25. Apply power to the machine and test operate the solenoid with a cartridge in the machine. Readjust if necessary. After the final adjustment has been determined, check for proper pressure roller adjustment (refer to paragraph 5-17).

NOTE EQUIPMENT THAT FUNCTIONS BOTH AS A PLAYBACK AND RECORD UNIT REQUIRES ALIGNMENT OF THE PLAYBACK HEAD BEFORE THE RECORD HEAD.
NOTE

5-26. HEAD ADJUSTMENTS. Tape guide height, tracking height, and zenith adjustments are normally only required after a tape head has been replaced.

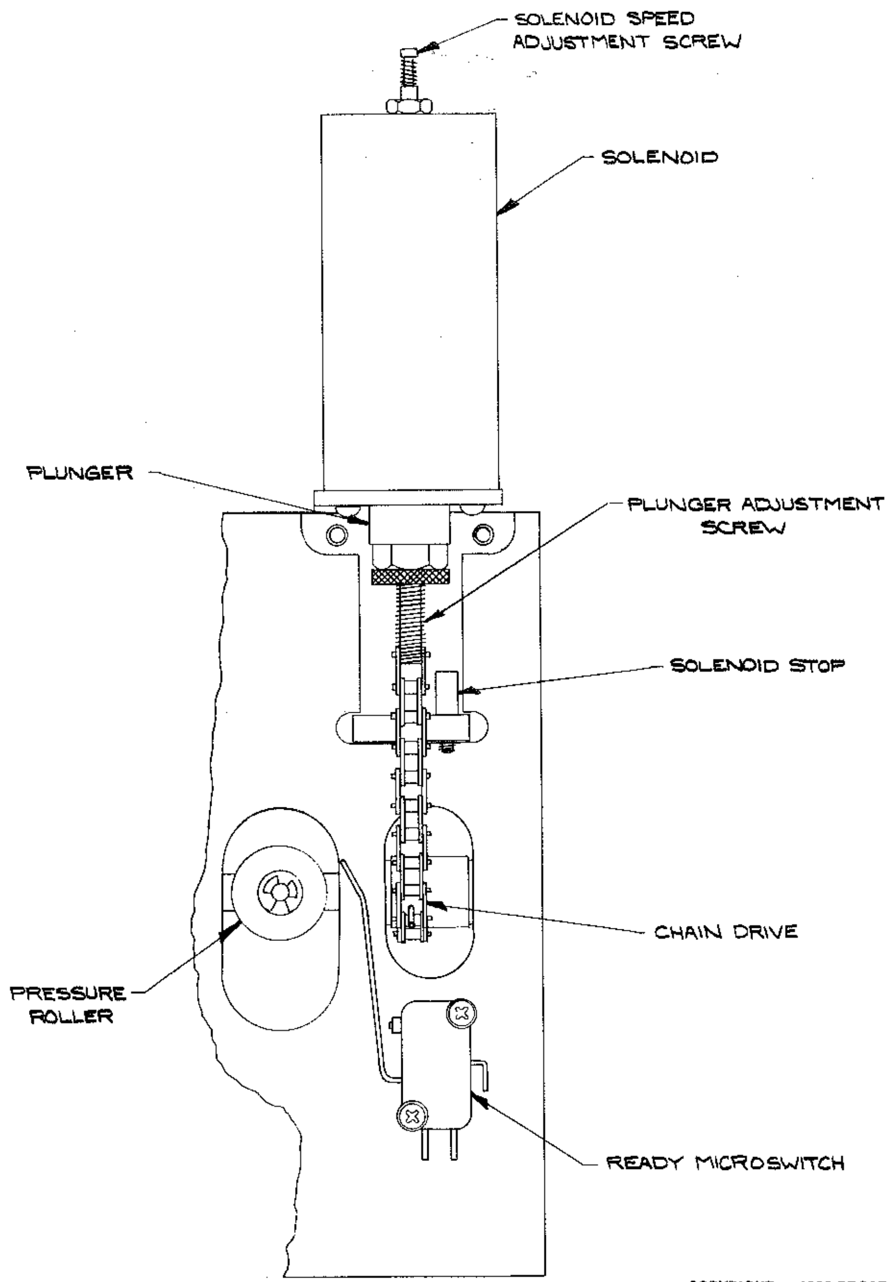

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FIGURE 5-2. SOLENOID ADJUSTMENT

5-27. Required Equipment. The following equipment is required to perform mechanical head adjustments:

A. Head and Tape Guide Adjustment Block (BE P/N 836-0009-1).

B. Hex Wrenches: supplied with machine.

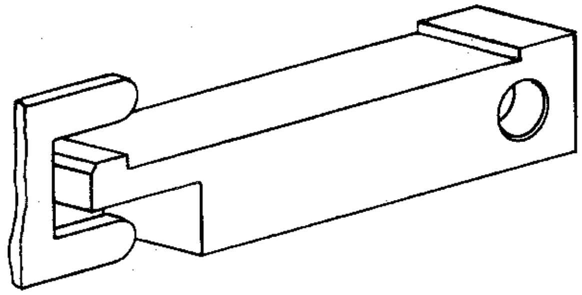
C. Cut-Away Test Cartridge (BE P/N 710-0132).

5-28. Tape Guide Height. Refer to Figure 5-3A and check the tape guide height using the head and tape guide adjustment block. The inside edge of each upper tape guide must just touch the T portion of the block.

A

TAPE GUIDE ADJUSTMENT

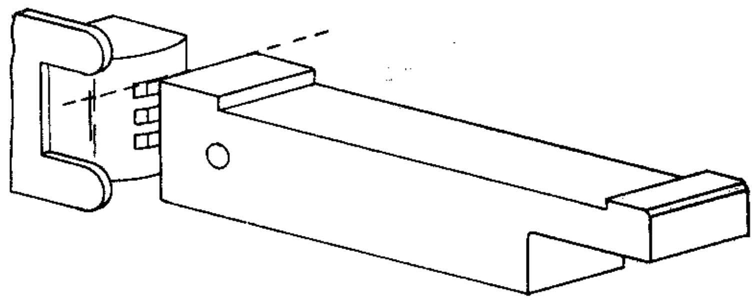
TAPE GUIDE SHOULD TOUCH "T" OF BLOCK.



B

HEAD HEIGHT ADJUSTMENT

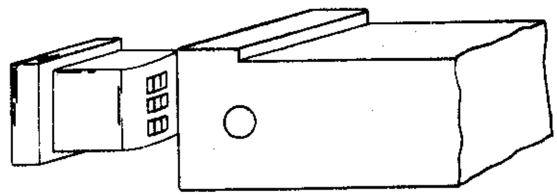
TOP HEAD POLE PIECE SHOULD BE SAME HEIGHT AS BLOCK.



C

ZENITH ADJUSTMENT

HEAD FACE SHOULD BE AT RIGHT ANGLE TO DECK.



D

MOTOR ADJUSTMENT

BLOCK FACE SHOULD BUTT UP AGAINST MOTOR SHAFT MAKING EVEN CONTACT FROM TOP TO BOTTOM.

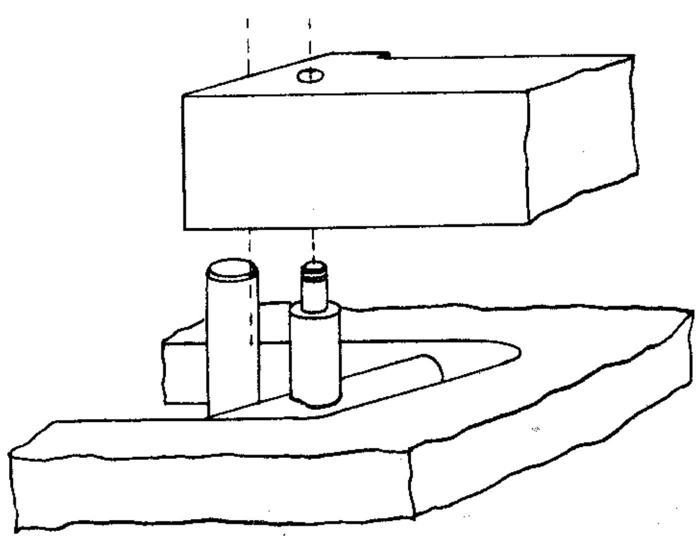


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FIGURE 5-3. HEAD, TAPE GUIDE, AND MOTOR ADJUSTMENT

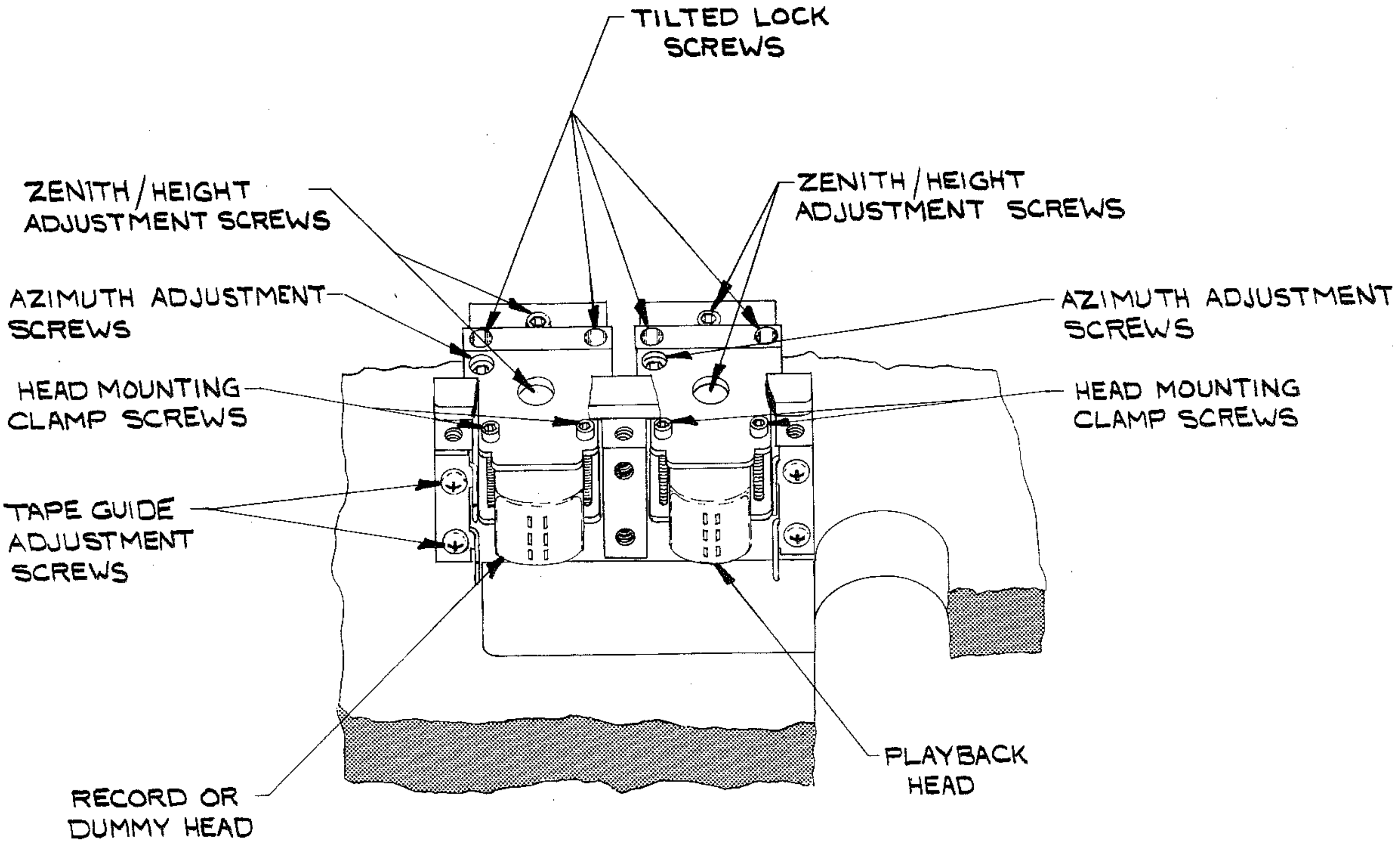

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FIGURE 5-4. HEAD ADJUSTMENT SCREWS

<u>WARNING:</u> DISCONNECT POWER PRIOR TO SERVICING

5-29. If necessary, each tape guide can be moved independently as required for alignment by loosening the two tape guide mounting screws (refer to Figure 5-4).

5-30. Tracking Height. Refer to Figure 5-3B and check the tape head height using the head and tape guide adjustment block. The upper pole piece of the head must be even with the top surface of the gauge.

5-31. Inspect the tracking height visually with a cut-away test cartridge. Operate the tape deck and observe the tape as it passes across the heads. The tape must just cover the top and bottom of the head pole pieces (refer to Figure 5-5).

5-32. If adjustment is required, loosen the two lock screws for the head that is to be adjusted. Refer to Figure 5-4 for the location of these screws. Turn both the front and rear zenith/height adjustment screws as required. Both screws must be turned equal amounts to retain the zenith adjustment.

5-33. Head Zenith. Refer to Figure 5-3C and check the head zenith (perpendicularity of the head) using the head and tape guide adjustment block or machinist's square. The front surface of the head must be perpendicular to the deck surface.

5-34. If adjustment is required, loosen the two lock screws for the head that is to be adjusted and turn the front and/or rear zenith/height adjustment screws as required (refer to Figure 5-4).

5-35. Readjust the head height and zenith until no further improvement can be obtained. Secure the two lock screws for the head that was adjusted.

5-36. Operate the deck and verify the adjustments using a cut-away test cartridge. The tape should just cover the top and bottom head pole pieces (refer to paragraph 5-31).

5-37. For record models, perform adjustments on record head and then perform electrical adjustments (playback first).

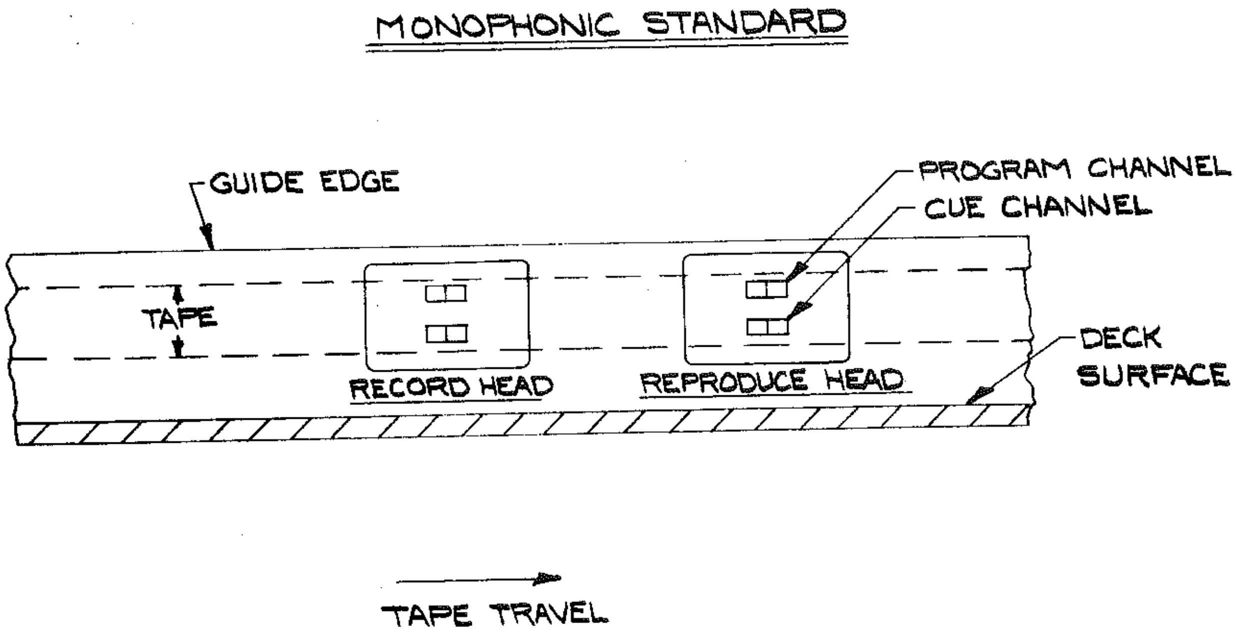
5-38. ELECTRICAL ADJUSTMENTS.

5-39. Electrical adjustments include the following:

A. SOLENOID CURRENT ADJUSTMENT.

B. PLAYBACK ADJUSTMENTS.

1. Playback Head Azimuth
2. Stereo Phase Response
3. Playback Equalization
4. Output Level
5. VU Meter Calibration (record/playback units only)
6. Cue Sensitivity



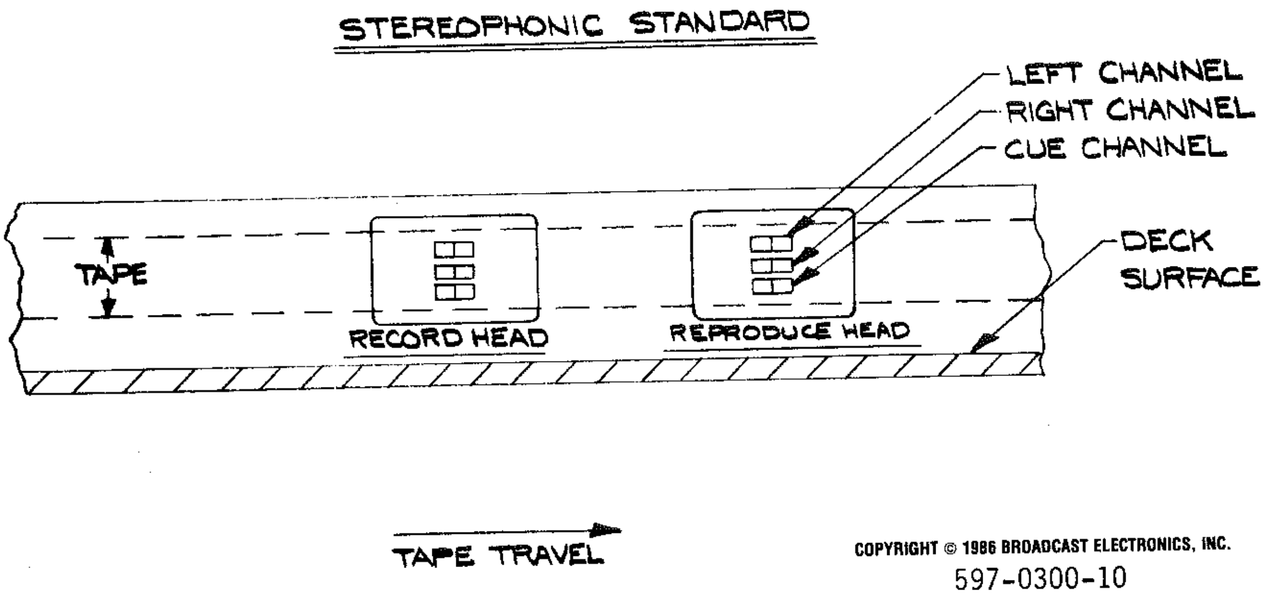


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FIGURE 5-5. TAPE TRACKING HEIGHT

C. RECORD ADJUSTMENTS.

1. Bias Trap Tuning (program and cue)
2. Program Bias Level
3. Record Head Azimuth
4. Stereo Phase Response
5. Record Equalization
6. VU Meter Calibration
7. Cue Bias Level
8. Cue Tone Generator Frequency
9. Cue Tone Record Level

5-40. REQUIRED EQUIPMENT. The following equipment is required for electrical adjustment procedures:

A. Hex Wrenches: supplied with the unit.

B. Oscilloscope: any general purpose model.

C. Reproduce Alignment Test Tape (BE P/N 808-0004).

D. Miniature Flat-tip Screwdriver 1/8 inch (0.125 cm) tip.

RECORD MODELS ONLY

E. Voltmeter.

F. External Audio Signal Generator (audio range 20 Hz to 20 kHz).

G. External VU Meter (or decibel calibrated voltmeter).

H. Frequency Counter.

I. Audio Analyzer.

J. Bulk-Erased Cartridge.

K. NAB Cue Tone/Logging Calibration Test Tape (BE P/N 808-0011).

L. Circuit Board Extender Card (BE P/N 919-1806).

5-41. SOLENOID CURRENT ADJUSTMENT. The solenoid current is adjusted by a control on the power supply circuit board. To adjust the solenoid current, proceed as follows.

WARNING DISCONNECT POWER FROM THE UNIT BEFORE PROCEEDING.

5-42. Disconnect power from the unit.

5-43. Remove the cartridge machine top and bottom panels.

5-44. Connect a voltmeter between J10 pin 4 and chassis ground.

5-45. Apply power to the unit.

WARNING WARNING WARNING MAINTENANCE WITH POWER ENERGIZED IS ALWAYS CONSIDERED HAZARDOUS AND THEREFORE CAUTION SHOULD BE OBSERVED. DO NOT TOUCH ANY COMPONENTS WITHIN THE CHASSIS WHEN POWER IS ENERGIZED.

5-46. Refer to Figure 3-2 and adjust SOL ADJ control R20 until the voltmeter indicates 1.5V dc.

WARNING — DISCONNECT POWER FROM THE UNIT BEFORE PROCEEDING.

5-47. Disconnect power from the unit.

5-48. Remove the test equipment and replace top and bottom panels.

5-49. PLAYBACK ADJUSTMENTS. The following are adjustments to be performed on playback heads and associated circuitry. Unless a head has been replaced, the azimuth adjustment is usually the only head adjustment required.

NOTE

NOTE — DEMAGNETIZE HEADS AND SURROUNDING FERROUS PARTS BEFORE AND AFTER MAKING AZIMUTH AND/OR PHASING ADJUSTMENTS.

5-50. Playback Head Azimuth. Connect an oscilloscope to the program outputs (refer to drawing B906-3104 in Section VII): the left channel audio output to the vertical deflection channel of the oscilloscope and the right channel output to the horizontal deflection channel.

5-51. Turn the unit on and play the reproduce/alignment test tape. Monitor the output on the oscilloscope.

5-52. Adjust the azimuth adjustment screw (refer to Figure 5-4) of the playback head for maximum output at 15 kHz as indicated on the oscilloscope. Remove and reinsert the cartridge to verify the adjustment.

5-53. Stereo Phase Response. For stereo machines, complete the azimuth adjustment as outlined above, and then trim the adjustment to equalize the phase or delay the responses of the left and right channels.

NOTE

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NOTE — CHECK THE RESPONSE DIFFERENCE OF THE OSCILLOSCOPE HORIZONTAL AND VERTICAL CHANNELS BY APPLYING THE SAME SIGNAL TO BOTH CHANNELS. NOTE THE RESULTANT LISSAJOUS FIGURE DISPLAYED ON THE SCOPE. MATCHED PHASE RESPONSE CHARACTERISTICS BETWEEN THE TWO CHANNELS WILL BE INDICATED BY AN APPROXIMATE STRAIGHT LINE ON THE SCOPE FACE, AT AN ANGLE OF 45 DEGREES IF THE HORIZONTAL AND VERTICAL CHANNELS PRODUCE EQUAL DEFLECTION AMPLITUDES.

5-54. With the outputs connected to the scope, play the reproduce/alignment test tape. Since an azimuth adjustment at 15 kHz alone could produce a phase error of 360 degrees, a mid-frequency tone adjustment, in the 400 Hz range, is required to complete the procedure.

5-55. Trim the azimuth adjustment screw for the best phase response (minimum phase angle and longest line) at both the 15 kHz and 400 Hz frequencies. Remove and reinsert the cartridge and perform the phasing test several times, readjusting, if necessary, for minimum phase response.

5-56. Playback Equalization. The playback equalization controls are located in the lower right hand corner of the circuit board card cage (refer to Figure 3-2 if necessary). Both L and R controls must be adjusted on stereo units.

5-57. Connect an external VU meter to the program output channels on J4 (refer to drawing B906-3104 in Section VII). Turn the unit on and reproduce the frequency response series of tones from the test tape.

5-58. Using the non-metallic screwdriver, adjust the PLAY EQ LF control(s) until the level of the 50 Hz tone is within -1 to Ø dB of the -10 dB reference tone level.

5-59. Adjust the PLAY EQ HF control(s) until the 12 kHz tone is the same level as the reference tone.

5-60. Output Level. This adjustment should be made after the equalization adjustment. Two output level controls are available on stereo versions of the 3000: the L OUT and the R OUT. On monaural models, only the L OUT is used. These controls are accessible through the circuit board card cage cover (Figure 3-2).

5-61. Connect an external VU meter to the program output channel(s) on J4. Turn the unit on and play the section of the test tape corresponding to the operating reference level.

5-62. Using a non-metallic adjustment tool adjust R OUT and/or L OUT for the desired output level. Verify the azimuth adjustment. Tighten the adjustment locks and demagnetize the heads and surrounding parts before returning the unit to service.

5-63. VU Meter Calibration. This adjustment is performed on playback/record units only. The controls are accessible through the circuit board card cage cover (refer to Figure 3-2).

5-64. Play the operating level tone from the reproduce/alignment test tape. Using a non-metallic adjustment tool, adjust the L PLAY and R PLAY (stereo units) METER CAL control(s) for Ø VU as indicated by the front panel meter(s).

5-65. Cue Sensitivity. The cue tone sensors (CUE SENS 8 KHZ, 1KHZ, and 150 HZ) are adjusted to operate at a level of 6 dB below the NAB standard level. This allows for variations in tone level due to tape wear.

5-66. Cue sensitivity may be adjusted with the use of a NAB cue/logging test tape (BE P/N 808-0011).

5-67. RECORD ADJUSTMENTS. Perform these adjustments after playback adjustments are complete.

WARNING — DO NOT REMOVE OR REPLACE CIRCUIT BOARDS WITHOUT FIRST DISCONNECTING PRIMARY POWER.

5-68. Program Bias Trap Tuning. Disconnect ac power from the unit, lift the top cover, and remove the circuit board card cage cover. Remove the record amplifier bias circuit board, insert the extender card, and plug the circuit board into the extender card.

5-69. Connect an oscilloscope to test point TP1 (refer to assembly drawing AC910-1050/-1049/-1048 as required), reconnect power, and place the unit in the record mode. With a non-metallic adjustment tool, adjust L1 for a minimum 100 kHz indication on the oscilloscope. In stereo units, reconnect the oscilloscope to test point TP2 and adjust L2 in a similar manner.

5-70. Cue Bias Trap Tuning. Refer to drawing AC910-1050/-1049/-1048 as required. Connect the oscilloscope to test point TP3 on the record amplifier bias circuit board, activate the cue bias switch by shorting pins 20 and 21 of the rear panel REMOTE connector J5, and adjust L3 for a minimum 100 kHz signal as indicated on the oscilloscope. Disconnect ac power and remove the extender card before continuing. Reconnect ac power.

5-71. Program Bias Level. Adjust the audio signal generator for -20 dBm and record a 1kHz tone on a bulk erased cartridge. Use the front panel record LEVEL controls to adjust the audio output while recording for -10 dBm as indicated on an external VU meter. Observe the waveform on the oscilloscope and adjust the left (L) and right (R) BIAS LEVEL controls (refer to Figure 3-2) for peak output with no distortion of the 1kHz waveform on the respective right and left channels.

5-72. Record Head Azimuth. Adjust the audio signal generator for -20 dBm and record a 15 kHz tone on a bulk erased cartridge. While recording the 15 kHz tone, adjust the record head azimuth screw (refer to Figure 5-4) for peak output as measured on an external VU meter.

NOTE
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ADJUST THE OSCILLOSCOPE USED IN THE FOLLOWING STEP 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 (REFER TO FIGURE 5-6).

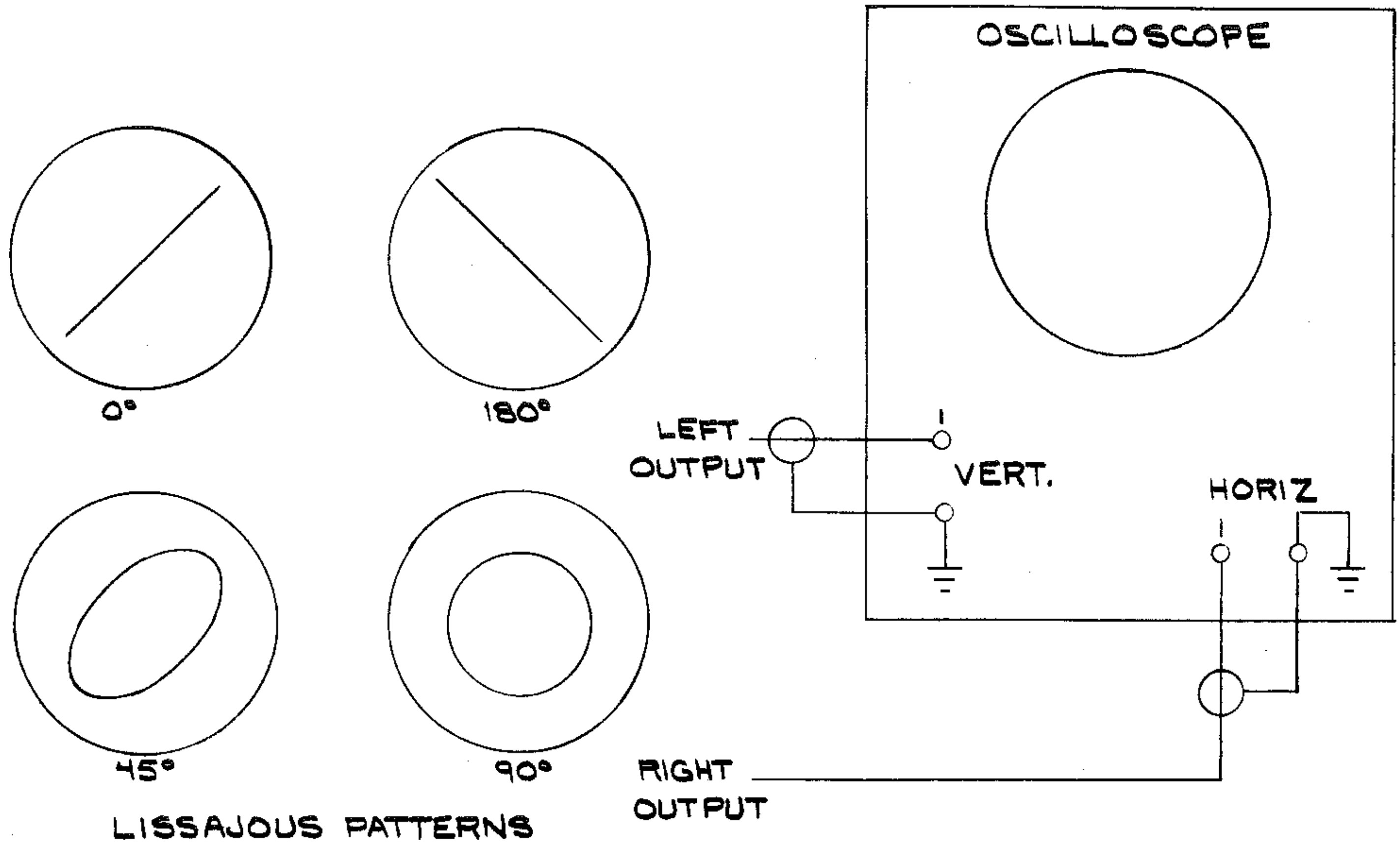

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FIGURE 5-6. LISSAJOUS PATTERNS FOR STEREO PHASE ADJUSTMENTS

5-73. Stereo Phase Response. Connect the left output to the vertical channel of the oscilloscope and the right channel to the horizontal channel as illustrated in Figure 5-6. With the audio analyzer in the unbalanced mode, observe the Lissajous pattern produced on the oscilloscope while recording a 15 kHz tone. Trim the azimuth adjustment screw for a zero degree phase angle. Perform the phasing test several times, readjusting for minimum phase difference if necessary.

5-74. Record Equalization. Adjust the audio generator for a -20 dBm output and begin recording a 1 kHz tone on a bulk erased cartridge. Adjust the front-panel record LEVEL controls until the external VU meter indicates -10 dBm.

5-75. Adjust the audio generator for a -20 dBm output at 50 Hz and begin recording the 50 Hz tone. Refer to Figure 3-2 and adjust LLF RECORD EQ control until the external VU meter indicates -10 dBm. Adjust the audio generator for a -20 dBm output at 12 kHz and begin recording the 12 kHz tone. Refer to Figure 3-2 and adjust the LHF RECORD EQ control until the external VU meter indicates -10 dBm. Repeat the procedure for the right channel. Adjust the right channel equalization with the RLF and RHF RECORD EQ controls (refer to Figure 3-2).

5-76. VU Meter Calibration. Adjust the audio signal generator for -20 dBm and record a 700 Hz tone on a bulk erased cartridge. Adjust the front panel record LEVEL controls for an indication of Ø VU on an external VU meter. Adjust L REC/R REC METER CAL, the VU meter calibration record controls (refer to Figure 3-2), for an indication of Ø VU on the front panel meters.

5-77. Cue Bias Level. Disconnect ac power from the unit. Remove the circuit board card cage cover. Carefully remove the record logic and tone generator circuit board, insert the extender card, and plug the circuit board into the extender card. Reconnect ac power.

5-78. Place a temporary jumper from the cathode of diode CR16 to the cathode of diode CR17 (refer to drawing D914-1533 as required) to activate the 1kHz oscillator. Activate the cue bias switch by connecting pin 20 to pin 21 of rear panel REMOTE connector J5. While monitoring the cue channel output on an oscilloscope, record the 1kHz tone on a bulk erased cartridge and adjust the Q BIAS LEVEL control (refer to Figure 3-2) for peak output with minimum distortion of the 1kHz waveform. Disconnect ac power and remove the jumpers and the extender card when the adjustment is complete.

5-79. Cue Tone Generator Frequency. Disconnect ac power. Remove the circuit board card cage cover and carefully remove the record logic and tone generator circuit board. Insert the extender card and plug the circuit board into the extender card. Reconnect ac power. Refer to assembly drawing D914-1533 for the following adjustments.

A. 1KHZ ADJUSTMENT.

1. Place a temporary jumper from the cathode of diode CR16 to the cathode of CR17 to activate the 1kHz oscillator.

2. Activate the cue bias switch by shorting pins 20 and 21 on J5, the rear panel REMOTE connector.

3. Insert a bulk erased cartridge and put the unit into the play mode.

4. While monitoring the cue channel output on a frequency counter, adjust the 1kHz frequency control, R11, for an indication of 1kHz ±50 Hz.

5. Disconnect the jumper from diodes CR16 and CR17 and deactivate the cue bias switch.

B. 150 HZ ADJUSTMENT.

1. Insert a bulk erased cartridge and put the unit into the play mode.

2. Depress and hold the front panel SEC/150 Hz switch/indicator.

3. While monitoring the cue channel output on a frequency counter, adjust the 150 Hz frequency control, R10, for an indication of 150 Hz ±8 Hz.

C. 8 KHZ ADJUSTMENT.

1. Insert a bulk erased cartridge and put the unit into the play mode.

2. Depress and hold the TER/8 kHz switch/indicator.

3. While monitoring the cue channel output on the frequency counter, adjust the 8 kHz frequency control, R12, for an indication of 8 kHz ±400 Hz.

5-80. Disconnect ac power, remove the extender card, and reconnect ac power after the record logic and tone generator circuit board is back in the unit.

5-81. Cue Tone Record Level. Prior to making the following adjustments, use the NAB cue tone test tape and monitor the cue output channel on the oscilloscope to establish peak-to-peak reference levels for 1kHz, 150 Hz, and 8 kHz cue tone frequencies. Record these levels.

NOTE THE FOLLOWING ADJUSTMENT CONTROLS ARE ACCESSIBLE THROUGH THE CIRCUIT BOARD CARD CAGE COVER (REFER TO FIGURE 3-2).
NOTE

A. 1KHZ ADJUSTMENT.

1. Activate the 1kHz generator by placing the unit in the record mode.

2. While monitoring the cue channel output on the oscilloscope, adjust the 1kHz CUE RECORD LEVEL control to correspond to the peak-to-peak reference level recorded previously (paragraph 5-81).

3. Repeat this step until the correct level is obtained.

B. 150 HZ ADJUSTMENT.

1. Place the unit in the play mode.

2. Depress and hold the SEC/150 Hz switch/indicator.

3. While monitoring the cue channel output on the oscilloscope, adjust the 150 Hz CUE RECORD LEVEL control to correspond to the peak-to-peak reference level recorded previously (paragraph 5-81).

C. 8 KHZ ADJUSTMENT.

1. Place the unit in the record mode.

2. Depress and hold the TER/8 kHz switch/indicator.

3. While monitoring the cue channel output on the oscilloscope, adjust the 8 kHz CUE RECORD LEVEL control to correspond to the peak-to-peak reference level recorded previously (paragraph 5-81).

5-82. Disconnect all test equipment before returning the unit to service.

5-83. MECHANICAL PARTS REPLACEMENT.

5-84. Specific instructions are provided for the following:

A. HEAD REPLACEMENT
B. PRESSURE ROLLER REPLACEMENT
C. MOTOR REPLACEMENT

5

<u>WARNING</u> DISCONNECT POWER PRIOR TO ANY SERVICING.

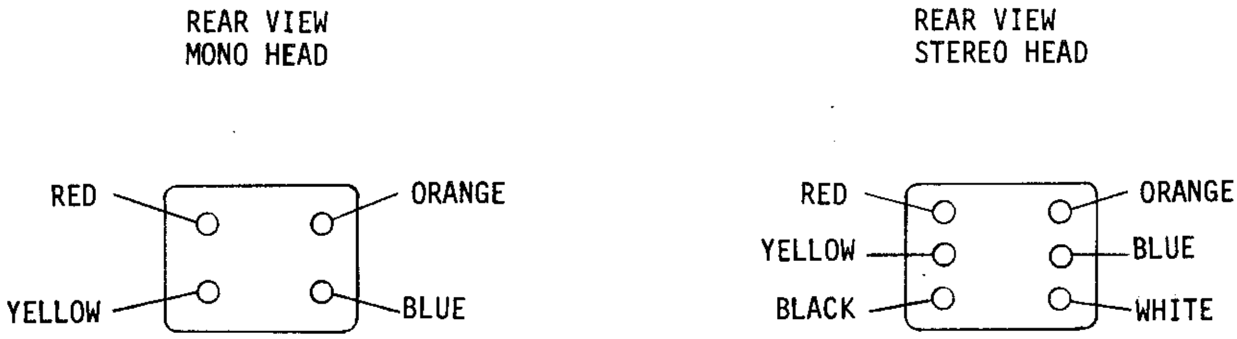
<u>WARNING</u>

<u>WARNING</u> BE CERTAIN THAT THE LARGE ELECTROLYTIC CAPACITORS ON THE POWER SUPPLY BOARD AND THE MOTOR CAPACITORS ON THE CHASSIS ARE FULLY DISCHARGED BEFORE ATTEMPTING MAINTENANCE INSIDE THE UNIT.

5-85. HEAD REPLACEMENT. Disconnect ac power and remove the unit's top cover. Remove the beryllium copper cartridge hold-down clamp from the top of the head bracket and the tape guides surrounding the head.

5-86. Loosen the two head mounting clamp screws (refer to Figure 5-4) and withdraw the head from the clamp. Remove the head cables and check the position and color of the cables against the head wiring diagram (Figure 5-7).

5-87. Reconnect the leads to the replacement head. Seat the new head in the mounting clamp, positioning it so that the head penetration is set by the machined step in the head mounting block.



597-0300-12

FIGURE 5-7. TAPE HEAD WIRING

5-88. Hold the head laterally centered and firmly against the clamp backstop and tighten the screws with moderate pressure. Replace the tape guides.

5-89. Complete the head adjustments as described in paragraph 5-26 and the appropriate azimuth and phasing adjustments as described in paragraph 5-39. Degauss the heads before returning the unit to service.

5-90. PRESSURE ROLLER REPLACEMENT. Disconnect ac power. Manually raise the pressure roller above deck level by pushing in the solenoid plunger. Use a small pair of needlenose pliers to remove the E-ring from the top of the pressure roller.

5-91. Using care not to lose the metal and nylon washers which fit on the shaft, remove these elements and the roller from the shaft.

5-92. If a pressure roller alignment gauge (BE P/N 836-0009-1) is available, perform the pressure roller alignment as described in procedure A of paragraph 5-17. Follow steps 4 - 8, replacing the old roller with the new roller in step 7.

5-93. If a pressure roller alignment gauge is not available, place the metal washer, the new roller, and the nylon washer on the shaft. Then seat the E-ring on the shaft. When the E-ring is properly seated on the shaft, it will snap onto the shaft. Perform the pressure roller alignment as described in procedure B of paragraph 5-17.

5-94. MOTOR REPLACEMENT. Disconnect ac power. Remove the top and bottom covers and place the unit on its left side.

CAUTION CAUTION CAUTION	CARE MUST BE USED IN HANDLING AND STORING MOTORS TO AVOID DAMAGING THE BEARINGS. STORE SPARE MOTORS IN THE ORIGINAL PACKING MATERIAL AND HANDLE THE MOTOR BY THE CASE, NEVER BY THE SHAFT. PROTECT THE MOTOR FROM SHARP BLOWS AND ROUGH HANDLING.

5-95. Unplug the motor connector (P2) from the power supply circuit board (refer to drawing D914-1535-1), grasp the motor in one hand, and remove the motor mounting screws from the top of the deck. Carefully remove the motor. Remove the motor mounting bracket from the old motor and reinstall the bracket on the replacement motor.

5-96. Install the replacement motor being careful not to bump or jar the motor or capstan. Tighten the motor screws alternately and slowly. Plug the motor connector (P2) into the power supply circuit board.

5-97. Perform the pressure roller alignment as described in paragraph 5-17. When this adjustment is complete, reconnect ac power, turn the unit on, and check to make sure the motor shaft rotates in a counterclockwise direction. Test operate the unit in the normal and fast forward (if so equipped) modes of operation.

5-98. ELECTRICAL PARTS REPLACEMENT.

5-99. The circuit boards used in Series 3000 cartridge machines 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.

5-100. 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.

5-101. To remove a component from a board such as the type used in the 5300B, cut the leads from the body of the defective component while the device is still soldered to the board.

5-102. 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.

5-103. 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.

5-104. 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.

5-105. 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.

5-106. 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.

Table 5-1. SERIES 3000 CIRCUIT BOARD COMPLEMENT

MODEL	OPTION INSTALLED	POWER SUPPLY CIRCUIT BOARD	PLAYBACK/ LOGIC CIRCUIT BOARD	RECORD AMPLIFIER BIAS CIRCUIT BOARD	RECORD CONTROL AND TONE GENERAOR CIRCUIT BOARD
Mono, Playback Only 3100P, 3200P 3300P, 3400P	None Q-Trips (only) Fast Forward +Q's	914-1505 914-1515 914-1535-1	914-1501 914-1521 914-1531	----- ----- -----	----- ----- -----
Stereo, Playback Only 3100PS, 3200PS 3300PS, 3400PS	None Q-Trips (only) Fast Forward +Q's	914-1505 914-1515 914-1535-1	914-1541 914-1561 914-1571	----- ----- -----	----- ----- -----
Mono, Record/ Playback 3200RP, 3300RP 3400RP	None Q-Trips (only) Fast Forward +Q's	914-1505 914-1515 914-1535-1	914-1501 914-1521 914-1531	910-1049 910-1049 910-1049	914-1503 914-1513 914-1513
Stereo, Record/ Playback 3200RPS, 3300RPS 3400RPS	None Q-Trips Fast Forward +Q's	914-1505 914-1515 914-1535-1	914-1541 914-1561 914-1571	910-1050 910-1050 910-1050	914-1523 914-1533 914-1533
Mono Delay Record/Playback 3200RP/DL 3300RP/DL 3400 RP/DL See Note 2	None Fast Forward	914-1515 914-1535-1	914-1521 914-1531	Refer to Delay Supplement	914-1513
Table No. See Note 1	-----	6 - 11	6 - 12	6 - 13	6 - 14

NOTE 1 - 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. PARTS UNIQUE TO A PARTICULAR VERSION OF A CIRCUIT BOARD ASSEMBLY ARE LISTED UNDER A SPECIAL HEADING WHICH FOLLOWS THE BASIC PARTS IN THE SAME TABLE.

NOTE 2 - ADDITIONAL DELAY UNIT CIRCUIT BOARD ASSEMBLIES ARE INDEXED IN THE DELAY SUPPLEMENT.

SECTION VI

PARTS LIST

6-1. <u>INTRODUCTION</u>.

6-2. This section provides descriptions and part numbers of parts and assemblies required for maintenance of the Broadcast Electronics Series 3000 Cartridge Machines. Each table entry in this section is 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.

<u>NOTE</u> <u>NOTE</u> <u>NOTE</u> <u>NOTE</u>

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. PARTS UNIQUE TO A PARTICULAR MODEL OR VERSION OF THAT CIRCUIT BOARD ASSEMBLY ARE LISTED UNDER A SPECIAL HEADING WHICH FOLLOWS THE LISTING OF BASIC PARTS IN THE SAME TABLE.

<u>NOTE</u>

TABLE 5-1 SHOWS WHICH VERSION OF A CIRCUIT BOARD IS FOUND IN A SPECIFIC MODEL OF THE 3000.

TABLE 6-1. REPLACEABLE PARTS LIST INDEX
(Sheet 1 of 2)

TABLE NO.	DESCRIPTION	PART NO.	PAGE
6-2	FINAL ASSEMBLY WITHOUT Q'S AND FAST FORWARD	906-3100 906-3101 906-3200 906-3201 906-3202 906-3203 906-3204 906-3300 906-3301 906-3302 906-3303 906-3304 906-3400 906-3401 906-3402 906-3403 906-3404	6-3

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Table 6-1. Replaceable Parts List Index
(Sheet 2 of 2)

TABLE NO.	DESCRIPTION	PART NO.	PAGE
6-3	3000 SERIES CARTRIDGE MACHINE CUE TONE OPTION	906-3000	6-6
6-4	3000 SERIES CARTRIDGE MACHINE FAST FORWARD AND CUE TONE OPTION	906-3006	6-7
6-5	3.75 IN/S TAPE SPEED	906-3009	6-8
6-6	DECK PARTS	906-0300	6-9
6-7	60 Hz SINGLE SPEED MOTOR ASSEMBLY	954-0009	6-9
6-8	50 Hz SINGLE SPEED MOTOR ASSEMBLY	954-0008X	6-9
6-9	50 Hz DUAL SPEED MOTOR ASSEMBLY	954-0008	6-10
6-10	60 Hz DUAL SPEED MOTOR ASSEMBLY	954-0003	6-10
6-11	POWER SUPPLY CIRCUIT BOARD ASSEMBLY	914-1505 914-1515 914-1535-1	6-10
6-12	PLAYBACK LOGIC CIRCUIT BOARD ASSEMBLY	914-1501 914-1521 914-1531 914-1541 914-1561 914-1571	6-12
6-13	RECORD AMPLIFIER BIAS CIRCUIT BOARD ASSEMBLY	910-1049 910-1050	6-20
6-14	RECORD CONTROL AND TONE GENERATOR CIRCUIT BOARD ASSEMBLY	914-1503 914-1513 914-1523 914-1533	6-23

Table 6-2. Final Assembly (W/O Q's and FF) - 906-3100/-3101/-3200/-3201//3202/ -3203/-3300/-3301/-3302/-3303/-3400/-3401/-3402/-3403 (Sheet 1 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	REFER TO FINAL ASSEMBLY DRAWINGS IN SECTION VII FOR MECHANICAL PARTS		
	ALL MODELS		
C1	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
DS1,DS2	Lamp, No. 327, Incandescent, Subminiature, 28V, 0.040 Ampere (for STOP and START switches)	321-0327	2
F1	Fuse, AGC, 1 Ampere	330-0100	1
IC1	Integrated Circuit, MC7824, 24 Volt Positive Regulator, 1.5 Ampere Maximum, TO-3 Case	227-7824	1
J1	Connector, 22-Pin Card Edge (for Circuit Boards)	417-2100	1
J4	Connector, 6-Pin (PLAY LINE OUT)	418-0302	1
J5	Connector, 24-Pin (REMOTE)	418-0303	1
J6	Phone Jack (PHONES)	417-0311	1
J10	Connector, 22-Pin Card Edge (for Circuit Boards)	417-2100	1
P4	Plug, 6-Pin (PLAY LINE OUT)	418-0304	1
P5	Plug, 24-Pin (REMOTE)	418-0306	1
Q1	Transistor, 2N3055, Silicon, NPN, 15 Ampere, TO-3 Case	219-3055	1
R3	Resistor, 3.3 Ohm ±5%, 2W, W/W	122-3313	1
S1	Switch, Illuminated, SPST, Normally Open, Momentary Contact, Push, 5-100 mA (START switch/indicator)	343-0150 343-0150	1 1
S2	Switch, Illuminated, SPST, Normally Open, Momentary Contact, Push, 5-100 mA (STOP switch/indicator)	343-0012	1
S3	Switch, Miniature Toggle, SPDT, 5 Ampere @ 120V ac or 2 Ampere @ 250V ac (ON/OFF switch)	347-7101	1
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, 30 mW, +15 dBm, 50 Hz to 15 kHz ±1 dB Dual Primary: 600/150 Ohm Split, dc resistance 70 Ohms with both windings connected in series Dual Secondary: 2000/500 Ohm Split, dc resistance, 280 Ohms with both windings connected in series	370-0025	1
XF1	Fuse Holder, AGC	415-2012	1
XIC1,XQ1	Transistor Socket, TO-3	417-0298	2
----	Switch Cap, Red (for STOP switch)	343-0013	1
----	Switch Cap, Green (for START switch)	343-0152	1
----	Foot, Rubber	403-2194	4
----	Transistor Cover	407-3000	1
----	Head Lead Assembly	906-3119-1	1
----	Head Lead Assembly	906-3119-2	1
----	Head Lead Assembly	906-3119-3	1

Table 6-2. Final Assembly (W/O Q's and FF) - 906-3100/-3101/-3200/-3201/-3202/-3203/-3300/-3301/-3302/-3303/-3400/-3401/-3402/-3403 (Sheet 2 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Cue Tone Option	906-3000	1
----	Fast Forward and Cue Tone Option	906-3006	1
----	Deck Parts	906-0300	1
----	Motor Assembly, 60 Hz (Table 6-7)	954-0009	1
----	Motor Assembly, 50 Hz (Table 6-8)	954-0008	1
----	Power Supply Circuit Board Assembly (Table 6-11)	914-1505	1
	ADDITIONAL PARTS FOR MODELS 3100P, 3200P, 3300P and 3400P		
----	Head, Dummy	407-0001	1
----	Head, Playback, 2-Channel, Model LMP Inductance: 400 mH Impedance at 1kHz: 2.55 k Ohms DC Resistance: 410 Ohms per channel	252-0017	1
----	Mono Playback Logic Circuit Board Assembly (Table 6-12)	914-1501	1
	ADDITIONAL PARTS FOR MODELS 3100PS, 3200PS, 3300PS and 3400PS		
----	Head, Dummy	407-0001	1
----	Head, Playback, 3-Channel, Model LSP Inductance: 350 mH Impedance at 1kHz: 2.2 k Ohms DC Resistance: 600 Ohms per channel	253-0014	1
T3	Transformer, Audio Output, 30 mW, +15 dBm, 50 Hz to 15 kHz ±1 dB Dual Primary: 600/150 Ohm Split, dc resistance, 70 Ohms with both windings connected in series Dual Secondary: 2000/500 Ohm Split, dc resistance, 280 Ohms with both windings connected in series	370-0025	1
----	Stereo Playback Logic Circuit Board Assembly (Table 6-12)	914-1541	1
	ADDITIONAL PARTS FOR MODELS 3200RP, 3300RP and 3400RP		
DS3	Lamp, No. 327, Incandescent, Subminiature, 28V, 0.040 Ampere (for RECORD switch)	321-0327	1
J2,J3	Connector, 22-Pin Card Edge (for Record Circuit Boards)	417-2100	2
J7	Connector, 6-Pin (RECORD LINE IN)	418-0301	1

Table 6-2. Final Assembly (W/O Q's and FF) - 906-3100/-3101/-3200/-3201/-3202/-3203/-3300/-3301/-3302/-3303/-3400/-3401/-3402/-3403 (Sheet 3 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
M1	Meter, VU, 1.5 inch (3.81 cm) dc Microammeter Type, 200 uA movement, 225 Ohm resistance	319-0081	1
P7	Plug, 6-Pin (RECORD LINE IN)	418-0305	1
R1	Potentiometer, 10 k Ohm ±10%, 1/2W (Left Channel Record LEVEL control)	191-1053	1
S5	Switch, Illuminated, SPST, Normally Open, Momentary Contact, Push, 5-100 mA (RECORD switch/indicator)	343-0012	1
----	Head, Playback, 2-Channel, Model LMP Inductance: 400 mH Impedance at 1kHz: 2.55 k Ohms DC Resistance: 410 Ohms per channel	252-0017	1
----	Head, Record, 2-Channel, Model LMR Inductance: 50 mH Impedance at 1kHz: 330 Ohms DC Resistance: 115 Ohms per channel	252-0018	1
----	Switch Cap, Red (RECORD)	343-0013	1
----	Knob (for LEVEL Control)	484-0500	1
----	Mono Playback Logic Circuit Board Assembly (Table 6-12)	914-1501	1
----	Mono Record Amplifier Bias Circuit Board Assembly (Table 6-13)	910-1049	1
----	Mono Record Control and Tone Generator Circuit Board Assembly (Table 6-14)	914-1503	1
	ADDITIONAL PARTS FOR MODELS 3200RPS, 3300RPS and 3400RPS		
DS3	Lamp, No. 327, Incandescent, Subminiature, 28V, 0.040 Ampere (RECORD)	321-0327	1
J2,J3	Connector, 22-Pin Card Edge (for Record Circuit Boards)	417-2100	2
J7	Connector, 6-Pin (RECORD LINE IN)	418-1301	1
M1,M2	Meter, VU, 1.5 inch (3.81 cm), dc Microammeter Type, 200 uA movement, 225 Ohm resistance	319-0081	2
P7	Plug, 6-Pin (RECORD LINE IN)	418-0305	1
R1,R2	Potentiometer, 10 k Ohm ±10%, 1/2W (Left and Right Channel Record LEVEL Control)	191-1053	2
S5	Switch, Illuminated, SPST, Normally Open, Momentary Contact, Push, 5-100 mA (RECORD switch/indicator)	343-0012	1

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Table 6-2. Final Assembly (W/O Q's and FF) - 906-3100/-3101/-3200/-3201/-3202/-3203/-3300/-3301/-3302/-3303/-3400/-3401/-3402/-3403 (Sheet 4 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
T3	Transformer, Audio Output, 30 mW, +15 dBm, 50 Hz to 15 kHz ±1 dB Dual Primary: 600/150 Ohm Split, dc resistance, 70 Ohms both windings seriesed Dual Secondary: 2000/500 Ohm Split, dc resistance, 280 Ohms both windings seriesed	370-0025	1
----	Knob (for LEVEL Controls)	484-0500	2
----	Switch Cap, Red (for RECORD switch)	343-0013	1
----	Stereo Playback Circuit Board Assembly (Table 6-12)	914-1541	1
----	Stereo Record Amplifier Bias Circuit Board Assembly (Table 6-13)	910-1050	1
----	Stereo Record Control and Tone Generator Circuit Board Assembly (Table 6-14)	914-1523	1
----	Head, Playback, 3-Channel, Model LSP Inductance: 350 mH Impedance at 1kHz: 2.2 k Ohms DC Resistance: 600 Ohms per channel	253-0014	1
----	Head, Record, 3-Channel, Model LSR Inductance: 50 mH Impedance at 1kHz: 400 Ohms DC Resistance: 100 Ohms per channel	253-0015	1

Table 6-3. 3000 Series Cartridge Machine Cue Tone Option - 906-3000 (Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	DELETE FROM TABLE 6-2 - ALL MODELS		
----	Power Supply Circuit Board Assembly	914-1501 OR 914-1541	1
	DELETE FROM TABLE 6-2 - RECORD MODELS		
----	Record Control Tone Generator Circuit Board Assembly	914-1503 OR 914-1523	1
	ADD TO TABLE 6-2 - ALL MODELS		
----	Switch Cap, White	343-0014	2
DS6,DS7	Lamp, No. 327, Incandescent, Subminiature, 28V, 0.040 Ampere (SEC & TER indicators)	321-0327	2
----	Power Supply Circuit Board Assembly W/Q's	914-1515	1
----	Mono Playback Circuit Board Assembly W/Q's OR Stereo Playback Circuit Board Assembly W/Q's	906-1521 906-1561	1 1

Table 6-3. 3000 Series Cartridge Machine Cue Tone Option - 906-3000
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	ADD TO TABLE 6-2 - PLAYBACK ONLY MODELS		
----	Indicator Lamp Holder (for SEC & TER indicators	324-0125	2
	ADD TO TABLE 6-2 RECORD/PLAYBACK MODELS		
S6,S7	Switch, Illuminated, SPST, Normally Open, Momentary Contact, Push, 5-100 mA	343-0012	2
----	Mono Record Control and Tone Generator Circuit Board Assembly W/Q's	914-1513	1
	OR		
	Stereo Record Control and Tone Generator Circuit Board Assembly W/Q's	914-1533	1

Table 6-4. 3000 Series Cartridge Machine Fast Forward and Cue Tone Option
906-3006 (Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	DELETE FROM TABLE 6-2 - ALL MODELS		
----	Power Supply Circuit Board Assembly	914-1505	1
----	Mono Playback Circuit Board Assembly	914-1501	1
	OR		
	Stereo Playback Circuit Board Assembly	914-1541	1
----	Motor Assembly	954-0009	1
	DELETE FROM TABLE 6-2 - PLAYBACK/RECORD MODELS		
----	Mono Record Control and Tone Generator Circuit Board Assembly	914-1503	1
	OR		
	Stereo Record Control and Tone Generator Circuit Board Assembly	914-1523	1
	ADD TO TABLE 6-2 - ALL MODELS		
DS6,DS7	Lamp, No. 327, Incandescent, Subminiature, 28V, 0.040 Ampere (SEC & TER indicators)	321-0327	2
S4	Switch, Toggle, SPST, Momentary Contact, 5A @ 120V ac or 2A @ 250V ac (FAST FORWARD Switch)	347-7108	1
----	Dual Speed Motor Assembly - 117V, 60 Hz	954-0003	1
	OR		
	Dual Speed Motor Assembly - 117V, 50 Hz	954-0008	1

Table 6-4. 3000 Series Cartridge Machine Fast Forward and Cue Tone Option 906-3006 (Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Switch Cap, White (SEC & TER switches)	343-0014	2
----	Power Supply Circuit Board Assembly W/Q's and Fast Forward	914-1535-1	1
----	Mono Playback Circuit Board Assembly W/Q's and Fast Forward	914-1531	1
	OR		
	Stereo Playback Circuit Board Assembly W/Q's and Fast Forward	914-1571	1
	ADD TO TABLE 6-2 - PLAYBACK ONLY MODELS		
----	Indicator Lamp Holder	324-0125	2
	ADD TO TABLE 6-2 - RECORD/PLAYBACK MODELS		
S6,S7	Switch, Illuminated, SPST, Normally Open, Momentary Contact, Push, 5-100 mA (SEC & TER switch/indicators)	343-0012	2
----	Mono Record Control and Tone Generator Circuit Board Assembly W/Q's	914-1513	1
	OR		
	Stereo Record Control and Tone Generator Circuit Board Assembly W/Q's	914-1533	1

Table 6-5. 3.75 IN/S Tape Speed - 906-3000

REF. DES.	DESCRIPTION	PART NO.	QTY.
	MODIFICATIONS TO TABLE 6-2 FOR UNITS EQUIPPED FOR 3.75 IN/S TAPE SPEED		
	DELETE		
----	Motor Assembly	954-0009	1
	ADD		
B1 (60 Hz)	Motor, Synchronous, 60 Hz, 450 RPM @ 7 oz-in, 24W @ 117V, 3.75 IPS (9.5 cm/s)	382-1011	1
B1 (50 Hz)	Motor, Synchronous, 50 Hz, 375 RPM @ 10 oz-in/m, 24W @ 117V, 3.75 IPS (9.5 cm/s)	382-1051	1
C1 (60 Hz)	Capacitor, Motor Start, 0.95 uF, 300V ac	029-1075	1
C1 (50 Hz)	Capacitor, Motor Start, 1.4 uF, 300V ac	029-1463	1
P2	Plug, 12-Pin	418-1271	1
----	Pins for P2	417-0053	1

Table 6-6. Deck Parts - 906-0300

REF. DES.	DESCRIPTION	PART NO.	QTY.
	REFER TO DRAWING D906-0000 FOR MECHANICAL PARTS		
K1	Assembly, Solenoid: Air Dampened, 24V, 2 inch (5.08 cm) diameter	289-2565	1
S8	Microswitch, SPDT, 125V ac, 0.5 Ampere	346-6100	1
----	Pressure Roller OD: 0.795 ± 0.003 inches ID: 0.189 +0.0 -0.001 inch Thickness: 0.375 +0.0 -0.015 inch	404-0001	1
----	Guide, Tape	452-0001	2
----	Shaft, Roller	459-0081-1	1
----	Shaft, Pinch Roller	459-0082-1	1
----	Spring	432-0044	1

Table 6-7. 60 Hz Single Speed Motor Assembly
954-0009

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1	Motor, Synchronous, 60 Hz, 600 RPM @ 7 oz-in, 7.5 in/s (19.05 cm/s), 26W @ 117V ±10%	380-1000	1
C1	Capacitor, Motor Start, 0.7 uF, 300V ac	029-1067	1
P2	Plug, 12-Pin	418-1271	1
----	Pins for P2	417-0053	9

Table 6-8. 50 Hz Single Speed Motor Assembly - 954-0008X

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1	Motor, Synchronous, 50 Hz, 500 RPM @ 10 oz-in, 7.5 in/s (19.05 cm/s), 25W @ 117V ac	382-2080	1
C1	Capacitor, Motor Start, 0.95 uF, 300V ac	029-1075	1
P2	Plug, 12-Pin	417-1271	1
----	Pins for P2	417-0053	1

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Table 6-9. 50 Hz Dual Speed Motor Assembly
954-0008

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1	Motor, Synchronous, 50 Hz Speed 1: 500 rpm @ 10 oz-in, 7.5 in/s (19.05 cm/s), 25W @ 117V ac Speed 2: 1500 rpm @ 10 oz-in, 22.5 in/s (57 cm/s), 60W @ 117V ac	382-2080	1
C1	Capacitor, Motor Start, 0.95 uF, 300V ac	029-1075	1
C2	Capacitor, Fast Forward Start, 3 uF, 370V ac	029-1066	1
P2	Plug, 12-Pin	418-1271	1
----	Pins for P2	417-0053	10

Table 6-10. 60 Hz Dual Speed Motor Assembly - 954-0003

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1	Motor, Synchronous, 60 Hz Speed 1: 600 rpm @ 7 oz-in, 7.5 in/s (19.05 cm/s), 17W @ 117V ac ±10% Speed 2: 1800 rpm @ 9 oz-in, 22.5 in/s (57 cm/s), 52W @ 117V ac ±10%	382-2070	1
C1	Capacitor, Motor Start, 0.7 uF, 300V ac	029-1067	1
C2	Capacitor, Fast Forward Start, 3 uF, 370V ac	029-1066	1
P2	Plug, 12-Pin	418-1271	1
----	Pins for P2	417-0053	10

Table 6-11. Power Supply Circuit Board Assembly
914-1505/-1515/-1535-1 (Sheet 1 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C5	Capacitor, Electrolytic, 1000 uF, 50V	014-1094	1
C7	Capacitor, Electrolytic, 2200 uF, 50V	014-2294	1
C8	Capacitor, Electrolytic, 100 uF, 40V	014-1084	1
C9	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C11	Capacitor, Ceramic Disc, 0.01 uF, 25V	000-1044	1
CR1,CR2	Diode, Bridge Rectifier, MDA970-3, Full Wave 200V, 4 Ampere	239-0003	2
CR12 THRU CR15,CR17	Diode, 1N4005, Rectifier, Silicon, 600V @ 1 Ampere	203-4005	5
CR20	Diode, Zener, 1N4739, Silicon, 9.1V ±10%, 1W	200-0009	1
CR21	Diode, 1N4005, Rectifier, Silicon, 600V @ 1 Ampere	203-4005	1

Table 6-11. Power Supply Circuit Board Assembly
914-1505/-1515/-1535-1 (Sheet 2 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
IC1	Integrated Circuit, MC723CL, Adjustable Positive Voltage Regulator, 37V to 2V @ 150 mA, 14-Pin DIP	227-0723	1
J1,J2	Connector, 12-Pin (to Motor and Power Transformer)	417-1276	2
Q3	Transistor, 2N5462, P-Channel, JFET, TO-92 Case	212-5462	1
Q5,Q7	Transistor, 2N5816, Silicon, NPN, TO-92 Case	211-5816	2
R7,R17	Resistor, 3.9 k Ohm ±5%, 1/4W	100-3943	2
R8	Resistor, 1.5 k Ohm ±5%, 1/2W	110-1543	1
R9,R10	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	2
R14	Resistor, 8.2 k Ohm ±5%, 1/4W	100-8243	1
R15	Resistor, 12 k Ohm ±5%, 1/4W	100-1253	1
R16	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R18	Resistor, 2.2 k Ohm ±5%, 1/4W	100-2243	1
R19	Resistor, 220 k Ohm ±5%, 1/4W	100-2263	1
R20	Potentiometer, 5 k Ohm ±10%, 1/2W	178-5044	1
R22,R23	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	2
XIC1	Socket, 14-Pin DIP	417-1400	1
----	Blank Circuit Board	514-1505-2	1
	ADDITIONAL PARTS FOR UNITS W/Q-TRIP OPTION 914-1515		
CR8 THRU CR11	Diode, 1N4005, Rectifier, Silicon, 600V @ 1 Ampere	203-4005	4
K2,K3	Relay, Circuit Board Mount, SPDT, 24V @ 2A	270-0024	2
Q4,Q6	Transistor, 2N5816, Silicon, NPN, TO-92 Case	211-5816	2
R12,R13	Resistor, 220 Ohm ±5%, 1/2W 110-2233	2	
	ADDITIONAL PARTS FOR UNITS W/Q AND FF OPTION 914-1535-1		
C1 THRU C4	Capacitor, Mylar, 0.47 uF, 400V	033-4753	4
C10	Capacitor, Mylar, 0.047 uF, 100V	030-4743	1
C12 THRU C15	Capacitor, Ceramic Disc, 0.1 uF ±20%, 1kV	001-1044	4
C16	Capacitor, Mylar, 0.01 uF, 100V	031-1043	1
CR3 THRU CR11, CR18,CR19	Diode, 1N4005, Rectifier, Silicon, 600V @ 1 Ampere	203-4005	11
K1	Relay, DPDT, 24V dc, 50/60 Hz, 1.2 Ampere	270-0029	1
K2,K3	Relay, SPDT, 24V @ 2 Ampere 270-0024	2	
Q1	Silicon Controlled Rectifier, GE6CA, 100V @ 1.6 Ampere	237-0006	1

Table 6-11. Power Supply Circuit Board Assembly
914-1505/-1515/-1535-1 (Sheet 3 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
Q2	Transistor, GES5817, Silicon, PNP, TO-92 Case	210-5817	1
Q4,Q6	Transistor, GES5816, Silicon, NPN, TO-92 Case	211-5816	2
R1	Resistor, 8.2 k Ohm ±5%, 1/4W	100-8243	1
R2	Resistor, 27 k Ohm ±5%, 1/4W	100-2753	1
R3 THRU R5	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	3
R6	Resistor, 220 Ohm ±5%, 1/2W	110-2233	1
R11	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R12,R13	Resistor, 220 Ohm ±5%, 1/2W	110-2233	2
R21	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
S1	Switch, Slide, SPDT, 300 mA @ 125V ac (FF MAN/AUTO)	345-0120	1
XK1	Relay Socket	270-0031	1
XQ1	Transistor Socket	417-0330	1

Table 6-12. Playback Logic Circuit Board Assembly
914-1501/-1521/-1531/-1541/-1561/-1571 (Sheet 1 of 9)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 THRU C3	Capacitor, Ceramic, 0.0047 uF ±10%, 200V	032-4733	3
C10	Capacitor, Electrolytic, 47 uF, 35V, Tantalum	064-4763	1
C11	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
C12	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C13	Capacitor, Electrolytic, 100 uF, 25V	023-1083	1
C14	Capacitor, Ceramic, 0.0047 uF ±10%, 200V	032-4733	1
C15	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
C16,C19	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	2
C22	Capacitor, Electrolytic, 100 uF, 25V	023-1083	1
C23	Capacitor, Mylar, 0.047 uF, 100V	030-4743	1
C24	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
C26,C27	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	2
C29	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C30	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C33	Capacitor, Mylar, 0.01 uF, 100V	030-1043	1
C36	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C39	Capacitor, Mylar, 0.047 uF, 100V	030-4743	1
C43	Capacitor, Mylar, 0.01 uF, 100V	030-1043	1
C44,C45	Capacitor, Ceramic, 0.01 uF, 100V	003-1013	2
C46	Capacitor, Ceramic, 470 pF ±5%, 200V	003-4713	1
C55	Capacitor, Electrolytic, 2.2 uF, 35V, Tantalum	064-2263	1
C58,C59	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	2
C60	Capacitor, Mylar, 0.01 uF, 100V	030-1043	1
C61	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C62	Capacitor, Electrolytic, 100 uF, 25V	023-1084	1

Table 6-12. Playback Circuit Board Assembly
914-1501/-1521/-1531/-1541/-1561/-1571 (Sheet 2 of 9)

REF. DES.	DESCRIPTION	PART NO.	QTY.
CR4 THRU CR8,CR14, CR15,CR17, CR21,CR22, CR24	Diode, 1N4148, Silicon, 75V @ 0.3 Ampere	203-4148	11
IC1	Integrated Circuit, RC4739, Low Noise, Linear Operational Amplifier, 14-Pin DIP	221-2310	1
IC2 THRU IC4	Integrated Circuit, RC4558, Dual Operational Amplifier, 8-Pin DIP	221-4558	3
IC6	Integrated Circuit, LM3900, Quad Operational Amplifier, 14-Pin DIP	221-3900	1
Q3	Transistor, GES5817, Silicon, PNP, TO-92 Case	210-5817	1
Q4	Transistor, GES5816, Silicon, NPN, TO-92 Case	211-5816	1
Q5	Transistor, 2N5457, N-Channel, JFET, TO-92 Case	212-5457	1
Q8,Q9	Transistor, MPS6566, Silicon, NPN, TO-92 Case	211-6566	2
Q10	Transistor, 2N5462, P-Channel, JFET, TO-92 Case	212-5462	1
R1	Potentiometer, 1 Meg Ohm ±10%, 1/2W	178-1074	1
R2	Potentiometer, 50 k Ohm ±10%, 1/2W	178-5054	1
R5	Potentiometer, 10 k Ohm ±10%, 1/2W	178-1054	1
R8	Potentiometer, 2 k Ohm ±10%, 1/2W	178-2044	1
R10	Resistor, 150 k Ohm ±5%, 1/4W	100-1563	1
R12,R14	Resistor, 10 Ohm ±5%, 1/4W	100-1023	2
R15	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
R16,R17	Resistor, 4.7 K Ohm ±5%, 1/4W	100-4743	2
R18	Resistor, 10 Ohm ±5%, 1/4W	100-1023	1
R19	Resistor, 270 K Ohm ±5%, 1/4W	100-2763	1
R20	Resistor, 27 k Ohm ±5%, 1/4W	100-2753	1
R21	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R22	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	1
R23	Resistor, 820 Ohm ±5%, 1/4W	100-8233	1
R24	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
R25	Resistor, 27 k Ohm ±5%, 1/4W	100-2753	1
R26	Resistor, 1.5 k Ohm ±5%, 1/4W	100-1543	1
R27	Resistor, 7.5 k Ohm ±5%, 1/4W	100-7543	1
R28	Resistor, 120 k Ohm ±5%, 1/4W	100-1263	1
R34	Resistor, 820 Ohm ±5%, 1/4W	100-8233	1
R35	Resistor, 2.7 k Ohm ±5%, 1/4W	100-2743	1
R36,R37, R39	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	3
R40	Resistor, 120 k Ohm ±5%, 1/4W	100-1263	1
R41	Resistor, 4.7 k Ohm ±5%, 1/4W	100-4743	1
R42	Resistor, 120 k Ohm ±5%, 1/4W	100-1263	1
R43,R44	Resistor, 27 Ohm ±5%, 1/4W	100-2723	2
R45	Resistor, 7.5 k Ohm ±5%, 1/4W	100-7543	1
R50,R51	Resistor, 1.8 k Ohm ±5%, 1/2W	110-1843	2
R52,R53	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	2
R54	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	1
R57	Resistor, 150 k Ohm ±5%, 1/4W	100-1563	1

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Table 6-12. Playback Circuit Board Assembly
914-1501/-1521/-1531/-1541/-1561/-1571 (Sheet 3 of 9)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R60	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R61,R62	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	2
R72,R75	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	2
R76	Resistor, 10 Meg Ohm ±5%, 1/4W	100-1083	1
R77	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R83	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
R84,R85	Resistor, 56.2 k Ohm ±1%, 1/4W	103-5651	2
R86	Resistor, 2210 Ohm ±1%, 1/4W	103-2241	1
R94,R95	Resistor, 560 k Ohm ±5%, 1/4W	100-5663	2
R97	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
R98	Resistor, 2.7 k Ohm ±5%, 1/4W	100-2743	1
R99	Resistor, 68 k Ohm ±5%. 1/4W	100-6853	1
R100	Resistor, 15 k Ohm ±5%, 1/4W	100-1553	1
R101	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
XIC1	Socket, 14-Pin DIP	417-1400	1
XIC2,XIC3, XIC4	Socket, 8-Pin DIP	417-0800	3
XIC6	Socket, 14-Pin DIP	417-1400	1
----	Blank Circuit Board	514-1501	1
	ADDITIONAL PARTS FOR ASSEMBLY 914-1501		
C20	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C7,C9	Capacitor, Mica, 150 pF, 500V	040-1522	2
	ADDITIONAL PARTS FOR ASSEMBLY 914-1521		
C7,C9	Capacitor, Mica, 150 pF, 500V	040-1522	2
C20	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C35,C37	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	2
C47	Capacitor, Mylar, 0.01 uF, 100V	030-1043	1
C48	Capacitor, Ceramic, 0.047 uF ±5%, 50V	003-4733	1
C49	Capacitor, Mylar, 0.01 uF, 100V	030-1043	1
C50	Capacitor, Mica, 1000 pF ±5%, 500V dc	041-1032	1
C51	Capacitor, Ceramic, 0.0068 uF ±5%. 100V	003-6823	1
C52	Capacitor, Ceramic, 0.047 uF ±5%, 50V	003-4733	1
C53	Capacitor, Mica, 1000 pF ±5%, 500V dc	041-1032	1
C54	Capacitor, Ceramic, 500 pF ±5%, 500V	041-5023	1
C56	Capacitor, Ceramic, 0.0047 uF ±10%, 200V	032-4733	1
C57	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
CR9,CR10, CR16,CR18, CR19,CR20	Diode, 1N4148, Silicon, 75V @ 0.3 Ampere	203-4148	6
IC5	Integrated Circuit, RC4558, Dual Operational Amplifier, 8-Pin DIP	221-4558	1

Table 6-12. Playback Circuit Board Assembly
914-1501/-1521/-1531/-1541/-1561/-1571 (Sheet 4 of 9)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R7,R9	Potentiometer, 2 k Ohm ±10%, 1/2W	178-2044	2
R58	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
R63	Resistor, 4640 Ohm ±1%, 1/4W	103-4641	1
R64	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	1
R69	Resistor, 3.9 k Ohm ±5%, 1/4W	100-3943	1
R70	Resistor, 10 Meg Ohm ±10%, 1/4W	100-1083	1
R71,R73	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	2
R74	Resistor, 390 k Ohm ±5%, 1/4W	100-3963	1
R78	Resistor, 3.9 k Ohm ±5%, 1/4W	100-3943	1
R79	Resistor, 10 Meg Ohm ±10%, 1/4W	100-1083	1
R87	Resistor, 5.1 k Ohm ±5%, 1/4W	100-5143	1
R88,R89	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	2
R90,R91	Resistor, 56.2 k Ohm ±1%, 1/4W	103-5651	2
R92,R93	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	2
R96	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
XIC5	Socket, 8-Pin DIP	417-0800	1
	ADDITIONAL PARTS FOR ASSEMBLY 914-1531		
C7,C9	Capacitor, Mica, 150 pF, 500V	040-1522	2
C20	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C34	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C35,C37, C38,C40	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	4
C41	Capacitor, Mylar, 0.027 uF, 100V	030-2743	1
C42,C47	Capacitor, Mylar, 0.01 uF, 100V	030-1043	2
C48	Capacitor, Ceramic, 0.047 uF ±5%, 50V	003-4733	1
C49	Capacitor, Mylar, 0.01 uF, 100V	030-1043	1
C50	Capacitor, Mica, 1000 pF ±5%, 500V dc	041-1032	1
C51	Capacitor, Ceramic, 0.0068 uF, 100V	003-6823	1
C52	Capacitor, Ceramic, 0.047 uF ±5%, 50V	003-4733	1
C53	Capacitor, Mica, 1000 pF ±5%, 500V dc	041-1032	1
C54	Capacitor, Ceramic, 500 pF, 500V	041-5023	1
C56	Capacitor, Ceramic, 0.0047 uF ±10%, 200V	032-4733	1
C57	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
CR9 THRU CR13,CR16, CR18 THRU CR20,CR23	Diode, 1N4148, Silicon, 75V @ 0.3 Ampere	203-4148	10
IC5	Integrated Circuit, RC4558, Dual Operational Amplifier, 8-Pin DIP	221-4558	1
L1	Choke, 100 mH, 125 mA	364-1662	1
Q7	Transistor, 2N5462, P-Channel, JFET, TO-92 Case	212-5462	1
R7,R9	Potentiometer, 2 k Ohm ±10%, 1/2W	178-2044	2
R55	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	1
R56	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R58,R59	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	2

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Table 6-12. Playback Circuit Board Assembly
914-1501/-1521/-1531/-1541/-1561/-1571 (Sheet 5 of 9)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R63	Resistor, 4640 Ohm ±1%, 1/4W	103-4641	1
R64 THRU R66	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	3
R67	Resistor, 10 Meg Ohm ±5%, 1/4W	100-1083	1
R68	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R69	Resistor, 3.9 k Ohm ±5%, 1/4W	100-3943	1
R70	Resistor, 10 Meg Ohm ±5%, 1/4W	100-1083	1
R71,R73	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	2
R74	Resistor, 390 k Ohm ±5%, 1/4W	100-3963	1
R78	Resistor, 3.9 k Ohm ±5%, 1/4W	100-3943	1
R79	Resistor, 10 Meg Ohm ±5%, 1/4W	100-1083	1
R80	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
R81	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R82	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	1
R87	Resistor, 5.1 k Ohm ±5%, 1/4W	100-5143	1
R88,R89	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	2
R90,R91	Resistor, 56.2 k Ohm ±1%, 1/4W	103-5651	2
R92,R93	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	2
R96	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
XIC5	Socket, 8-Pin DIP	417-0800	1
	ADDITIONAL PARTS FOR ASSEMBLY 914-1541		
C4 THRU C6	Capacitor, Ceramic, 0.0047 uF ±10%, 200V	032-4733	3
C7 THRU C9	Capacitor, Mica, 100 pF, 500V	040-1022	3
C17	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
C18,C20	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	2
C21	Capacitor, Electrolytic, 100 uF, 25V	023-1083	1
C25,C28, C31	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	3
C32	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
CR1 THRU CR3	Diode, 1N4148, Silicon, 75V @ 0.3 Ampere	203-4148	3
Q1	Transistor, GES5816, Silicon, NPN, TO-92 Case	211-5816	1
Q2	Transistor, GES5817, Silicon, PNP, TO-92 Case	210-5817	1
Q6	Transistor, 2N5457, N-Channel, JFET, TO-92 Case	212-5457	1
R3	Potentiometer, 1 Meg Ohm ±10%, 1/2W	178-1074	1
R4	Potentiometer, 50 k Ohm ±10%, 1/2W	178-5054	1
R6	Potentiometer, 10 k Ohm ±10%, 1/2W	178-1054	1
R11	Resistor, 150 k Ohm ±5%, 1/4W	100-1563	1
R13	Resistor, 10 Ohm ±5%, 1/4W	100-1023	1
R24	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
R29	Resistor, 7.5 Ohm ±5%, 1/4W	100-7543	1
R30,R31	Resistor, 27 Ohm ±5%, 1/4W	100-2723	2
R32	Resistor, 10 Ohm ±5%, 1/4W	100-1023	1
R33	Resistor, 820 Ohm ±5%, 1/4W	100-8233	1
R39	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	1

Table 6-12. Playback Circuit Board Assembly
914-1501/-1521/-1531/-1541/-1561/-1571 (Sheet 6 of 9)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R46	Resistor, 4.7 k Ohm ±5%, 1/4W	100-4743	1
R47	Resistor, 120 k Ohm ±5%, 1/4W	100-1263	1
R48	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	1
R49	Resistor, 120 k Ohm ±5%, 1/4W	100-1263	1
	ADDITIONAL PARTS FOR ASSEMBLY 914-1561		
C4 THRU C6	Capacitor, Ceramic, 0.0047 uF ±10%, 200V	032-4733	3
C7 THRU C9	Capacitor, Mica, 100 pF, 500V	040-1022	3
C17	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
C18	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	1
C20	Capacitor, Electrolytic, 33 uF, 35V, Tantalum	024-3335	1
C21	Capacitor, Electrolytic, 100 uF, 25V	023-1083	1
C25,C28, C31	Capacitor, Electrolytic, 4.7 uF, 35V, Tantalum	064-4763	3
C32	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C35,C37	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	2
C47	Capacitor, Mylar, 0.01 uF, 100V	030-1043	1
C48	Capacitor, Ceramic, 0.047 uF ±5%, 50V	003-4733	1
C49	Capacitor, Mylar, 0.01 uF, 100V	030-1043	1
C50	Capacitor, Mica, 1000 pF ±5%, 500V dc	041-1032	1
C51	Capacitor, Ceramic, 0.0068 uF, 100V	003-6823	1
C52	Capacitor, Ceramic, 0.047 uF ±5%, 50V	003-4733	1
C53	Capacitor, Mica, 1000 pF ±5%, 500V dc	041-1032	1
C54	Capacitor, Ceramic, 500 pF, 500V	041-5023	1
C56	Capacitor, Ceramic, 0.0047 uF ±10%, 200V	032-4733	1
C57	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
CR1 THRU CR3,CR9, CR10,CR16, CR18 THRU CR20	Diode, 1N4148, Silicon, 75V @ 0.3 Ampere	203-4148	9
IC5	Integrated Circuit, RC4558, Dual Operational Amplifier, 8-Pin DIP	221-4558	1
Q1	Transistor, GES5816, Silicon, NPN, TO-92 Case	211-5816	1
Q2	Transistor, GES5817, Silicon, PNP, TO-92 Case	210-5817	1
Q6	Transistor, 2N5457, N-Channel, JFET, TO-92 Case	212-5457	1
R3	Potentiometer, 1 Meg Ohm ±10%, 1/2W	178-1074	1
R4	Potentiometer, 50 k Ohm ±10%, 1/2W	178-5054	1
R6	Potentiometer, 10 k Ohm ±10%, 1/2W	178-1054	1
R7,R9	Potentiometer, 2 k Ohm ±10%, 1/2W	178-2044	2
R11	Resistor, 150 k Ohm ±5%, 1/4W	100-1563	1
R13	Resistor, 10 Ohm ±5%, 1/4W	100-1023	1
R29	Resistor, 7.5 k Ohm ±5%, 1/4W	100-7543	1
R30,R31	Resistor, 27 Ohm ±5%, 1/4W	100-2723	2
R32	Resistor, 10 Ohm ±5%, 1/4W	100-1023	1

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Table 6-12. Playback Circuit Board Assembly
914-1501/-1521/-1531/-1541/-1561/-1571 (Sheet 7 of 9)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R33	Resistor, 820 Ohm ±5%, 1/4W	100-8233	1
R38	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	1
R46	Resistor, 4.7 k Ohm ±5%, 1/4W	100-4743	1
R47	Resistor, 120 k Ohm ±5%, 1/4W	100-1263	1
R48	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	1
R49	Resistor, 120 k Ohm ±5%, 1/4W	100-1263	1
R58	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
R63	Resistor, 4640 Ohm ±1%, 1/4W	103-4641	1
R64	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	1
R69	Resistor, 3.9 k Ohm ±5%, 1/4W	100-3943	1
R70	Resistor, 10 Meg Ohm ±5%, 1/4W	100-1083	1
R71,R73	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	2
R74	Resistor, 390 k Ohm ±5%, 1/4W	100-3963	1
R78	Resistor, 3.9 k Ohm ±5%, 1/4W	100-3943	1
R79	Resistor, 10 Meg Ohm ±5%, 1/4W	100-1083	1
R87	Resistor, 5.1 k Ohm ±5%, 1/4W	100-5143	1
R88,R89	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	2
R90,R91	Resistor, 56.2 k Ohm ±1%, 1/4W	103-5651	2
R92,R93	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	2
R96	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
XIC5	Socket, 8-Pin DIP	417-0800	1
	ALTERNATE PARTS FOR ASSEMBLY 914-1571		
C10,C12, C16,C19, C26,C27, C30,C36	Capacitor, Electrolytic, 4.7 uF, 35V	024-4753	8
	ADDITIONAL PARTS FOR ASSEMBLY 914-1571		
C4 THRU C6	Capacitor, Ceramic, 0.0047 uF ±10%, 200V	032-4733	3
C7 THRU C9	Capacitor, Mica, 100 pF, 500V	040-1022	3
C17	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
C18	Capacitor, Electrolytic, 4.7 uF, 35V	024-4753	1
C20	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C21	Capacitor, Electrolytic, 100 uF, 25V	023-1083	1
C25,C28	Capacitor, Electrolytic, 4.7 uF, 35V	024-4753	2
C31	Capacitor, Electrolytic, 4.7 uF, 35V	024-4753	1
C32	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C34	Capacitor, Electrolytic, 4.7 uF, 35V	024-4753	1
C35,C37, C38,C40	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	4

Table 6-12. Playback Circuit Board Assembly
914-1501/-1521/-1531/-1541/-1561/-1571 (Sheet 8 of 9)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C41	Capacitor, Mylar, 0.027 uF, 100V	030-2743	1
C42,C47	Capacitor, Mylar, 0.01 uF, 100V	030-1043	2
C48	Capacitor, Ceramic, 0.047 uF ±5%, 50V	003-4733	1
C49	Capacitor, Mylar, 0.01 uF, 100V	030-1043	1
C50	Capacitor, Mica, 1000 pF ±5%, 500V dc	041-1032	1
C51	Capacitor, Ceramic, 0.0068 uF, 100V	003-6823	1
C52	Capacitor, Ceramic, 0.047 uF ±5%, 50V	003-4733	1
C53	Capacitor, Mica, 1000 pF ±5%, 500V dc	041-1032	1
C54	Capacitor, Ceramic, 500 pF, 500V	041-5023	1
C56	Capacitor, Ceramic, 0.0047 uF ±10%, 200V	032-4733	1
C57	Capacitor, Electrolytic, 1 uF, 35V, Tantalum	064-1063	1
CR1 THRU CR3,CR9 THRU CR13, CR16,CR18 THRU CR20, CR23	Diode, 1N4148, Silicon, 75V @ 0.3 Ampere	203-4148	13
IC5	Integrated Circuit, RC4558, Dual Operational Amplifier, 8-Pin DIP	221-4558	1
L1	Choke, 100 mH, 125 mA	364-1662	1
Q1	Transistor, GES5816, Silicon, NPN, TO-92 Case	211-5816	1
Q2	Transistor, GES5817, Silicon, PNP, TO-92 Case	210-5817	1
Q6	Transistor, 2N5457, N-Channel, JFET, TO-92 Case	212-5457	1
Q7	Transistor, 2N5462, P-Channel, JFET, TO-92 Case	212-5462	1
R3	Potentiometer, 1 Meg Ohm ±10%, 1/2W	178-1074	1
R4	Potentiometer, 50 k Ohm ±10%, 1/2W	178-5054	1
R6	Potentiometer, 10 k Ohm ±10%, 1/2W	178-1054	1
R7,R9	Potentiometer, 2 k Ohm ±10%, 1/2W	178-2044	2
R11	Resistor, 150 k Ohm ±5%, 1/4W	100-1563	1
R13	Resistor, 10 Ohm ±5%, 1/4W	100-1023	1
R29	Resistor, 7.5 k Ohm ±5%, 1/4W	100-7543	1
R30,R31	Resistor, 27 Ohm ±5%, 1/4W	100-2723	2
R32	Resistor, 10 Ohm ±5%, 1/4W	100-1023	1
R33	Resistor, 820 Ohm ±5%, 1/4W	100-8233	1
R38	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	1
R46	Resistor, 27 k Ohm ±5%, 1/4W	100-2753	1
R47	Resistor, 120 k Ohm ±5%, 1/4W	100-1263	1
R48	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	1
R49	Resistor, 120 k Ohm ±5%, 1/4W	100-1263	1
R50,R51	Resistor, 1.8 k Ohm ±5%, 1/2W	110-1843	2
R55	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	1
R56	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R58,R59	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	2
R63	Resistor, 4640 Ohm ±1%, 1/4W	103-4641	1
R64 THRU R66	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	3
R67	Resistor, 10 Meg Ohm ±5%, 1/4W	100-1083	1

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Table 6-12. Playback Circuit Board Assembly
914-1501/-1521/-1531/-1541/-1561/-1571 (Sheet 9 of 9)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R68	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R69	Resistor, 3.9 k Ohm ±5%, 1/4W	100-3943	1
R70	Resistor, 10 Meg Ohm ±5%, 1/4W	100-1083	1
R71,R73	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	2
R74	Resistor, 390 k Ohm ±5%, 1/4W	100-3963	1
R78	Resistor, 3.9 k Ohm ±5%, 1/4W	100-3943	1
R79	Resistor, 10 Meg Ohm ±5%, 1/4W	100-1083	1
R80	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
R81	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R82	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	1
R87	Resistor, 5.1 k Ohm ±5%, 1/4W	100-5143	1
R88,R89	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	2
R90,R91	Resistor, 56.2 k Ohm ±1%, 1/4W	103-5651	2
R92,R93	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	2
R96	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
XIC5	Socket, 8-Pin DIP	417-0800	1

Table 6-13. Monophonic and Stereophonic Record Amplifier/Bias Circuit Board Assemblies - 910-1049/-1050 (Sheet 1 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1,C2	Capacitor, Electrolytic, 100 uF, 25V	023-1083	2
C3	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	1
C4	Capacitor, Electrolytic, 47 uF, 16V	013-4750	1
C5,C6	Capacitor, Electrolytic, 10 uF, 16V	023-1074	2
C7	Capacitor, Mylar, 0.1 uF ±10%, 100V	030-1053	1
C8	Capacitor, Ceramic, 10 pF ±10%, 1kV, Non-Polarized	001-1014	1
C9	Capacitor, Mica, 150 pF ±5%, 500V	040-1522	1
C10	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C11	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	1
C12	Capacitor, Ceramic, 0.01 uF ±10%, 200V	030-1043	1
C13	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C14	Capacitor, Mica, 220 pF ±5%, 500V	040-2223	1
C15	Capacitor, Mica, 150 pF ±5%, 500V	040-1522	1
C16	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	1
C17	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C18	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	1
C19	Capacitor, Mylar, 0.1 uF, 100V	030-1053	1
C20	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C27	Capacitor, Ceramic, 10 pF ±10%, 1kV, Non-Polarized	001-1014	1
C36 THRU C38	Capacitor, Ceramic, 0.0047 uF ±10%, 200V	032-4733	3

Table 6-13. Monophonic and Stereophonic Record Amplifier/Bias Circuit Board Assemblies - 910-1049/-1050 (Sheet 2 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C39	Capacitor, Mylar, 0.02 uF, 100V	030-2043	1
C40	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C41	Capacitor, Mica, 220 pF ±5%, 500V	040-2223	1
C42	Capacitor, Mica, 150 pF ±5%, 500V	040-1522	1
C43	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C44	Capacitor, Mylar, 0.1 uF ±10%, 100V	030-1053	1
C45	Capacitor, Mica, 22 pF ±5%, 500V	040-2213	1
D1,D2	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes, Fast Switching	203-4148	2
D3	Diode, Zener, 1N4739A, 9.1V ±5%, 1W	200-0009	1
D5	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes, Fast Switching	203-4148	1
D6	Diode, Zener, 1N4739A, 9.1V ±5%, 1W	200-0009	1
F4 THRU J6, J10 THRU J12	Pins, Disconnect, Male, Printed Circuit Board Mount	418-0161	6
L1,L3	Adjustable Shielded Coil, 8-20 mH	363-9061	2
LDR1	Optical Isolator, LDR/LED Type, VTL5C2 On Resistance: 500 Ohms Off Resistance: 1 Meg Ohm Cell Voltage: 200V Maximum Cell Current: 10 to 40 mA	323-7345	1
Q1	Transistor, MPS6566, Silicon, NPN, Small Signal, TO-92 Case	211-6566	1
Q2	Transistor, 2N5462, JFET, P-Channel, 40V, TO-92 Case	212-5462	1
Q3	Transistor, PN3644, Silicon, PNP, TO-92 Case	210-3644	1
Q4,Q5	Transistor, GES5816, Silicon, NPN, Small Signal, TO-18 Case	211-5816	2
Q9,Q10	Transistor, 2N3053, Silicon, NPN, TO-5 Case	211-3053	2
Q11	Transistor, GES5817, Silicon, PNP, TO-92 Case	210-5817	1
Q12,Q13	Transistor, GES5816, Silicon, NPN, Small Signal, TO-18 Case	211-5816	2
Q14	Transistor, 2N3904, Silicon, NPN, TO-92 Case	211-3904	1
R1,R2	Resistor, 18 k Ohm ±5%, 1/4W	100-1853	2
R3	Resistor, 62 k Ohm ±5%, 1/4W	100-6253	1
R4	Resistor, 8.2 k Ohm ±5%, 1/4W	100-8243	1
R5	Resistor, 470 Ohm ±5%, 1/4W	100-4733	1
R6	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R7	Resistor, 27 k Ohm ±5%, 1/4W	100-2753	1
R8	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R9	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R10	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R11	Resistor, 2.2 k Ohm ±5%, 1/4W	100-2243	1
R12	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R13	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R14	Potentiometer, 250 k Ohm ±10%, 1/2W	180-0001	1
R15,R16	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	2

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Table 6-13. Monophonic and Stereophonic Record Amplifier/Bias Circuit Board Assemblies - 910-1049/-1050 (Sheet 3 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R17	Resistor, 240 k Ohm ±5%, 1/4W	100-2463	1
R18	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R19	Potentiometer, 100 k Ohm ±10%, 1/2W	178-1064	1
R20	Resistor, 240 k Ohm ±5%, 1/4W	100-2463	1
R21	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
R22	Resistor, 22 k Ohm ±5%, 1/4W	100-2253	1
R23	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R24	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R25	Resistor, 2.7 k Ohm ±5%, 1/4W	100-2743	1
R26	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R27	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	1
R28	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R29	Resistor, 27 k Ohm ±5%, 1/4W	100-2753	1
R30	Resistor, 5.6 k Ohm ±5%, 1/4W	100-5643	1
R31	Potentiometer, 250 k Ohm ±10%, 1/2W	180-0001	1
R32	Resistor, 27 k Ohm ±5%, 1/4W	100-2753	1
R33	Resistor, 8.2 k Ohm ±5%, 1/4W	100-8243	1
R34	Resistor, 22 k Ohm ±5%, 1/4W	100-2253	1
R35	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R63,R64	Resistor, 12 Ohm ±5%, 1/4W	100-1223	2
R65,R66	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	2
R67,R68	Resistor, 22 k Ohm ±5%, 1/4W	100-2253	2
R69	Potentiometer, 250 k Ohm ±10%, 1/2W	180-0001	1
R70	Resistor, 5.6 k Ohm ±5%, 1/4W	100-5643	1
R71,R72	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	2
R73	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	1
R74	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	1
R75	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R77	Resistor, 4.7 k Ohm ±5%, 1/4W	100-4743	1
R78,R79	Resistor, 470 Ohm ±5%, 1/2W	110-4733	2
S1	Switch, Slide, MSS1200R, SPDT, 300 mA @ 125V ac (Gain Switch)	345-0120	1
T1	Transformer, Audio Input, 0.5 kB, 30 Hz to 20 kHz Dual Primary: 150 Ohm and 15 k Ohm Secondary: 60 k Ohm	370-0020	1
T3	Transformer, Bias Oscillator, BE Manufactured, 100 kHz ±5%, dc Supply, 24V dc ±0.1%	372-0095	1
TP1,TP3	Pin, Amplifier Disconnect	418-0161	2
U1 THRU U3	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	3
XU1 THRU XU3	Socket, 8-Pin DIP	417-0800	3
----	Transistor Mounting Pads (for Q9, Q10)	409-0005	2
----	Blank Circuit Board	510-1050	1

Table 6-13. Monophonic and Stereophonic Record Amplifier/Bias Circuit Board Assemblies - 910-1049/-1050 (Sheet 4 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	ADDITIONAL PARTS FOR STEREOPHONIC CIRCUIT BOARD ONLY - 910-1050		
C21	Capacitor, Electrolytic, 100 uF, 25V	023-1083	1
C22	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	1
C23	Capacitor, Electrolytic, 47 uF, 16V	013-4750	1
C24,C25	Capacitor, Electrolytic, 10 uF, 16V	023-1074	2
C26	Capacitor, Mylar, 0.1 uF, 100V	030-1053	1
C28	Capacitor, Mica, 150 pF ±5%, 500V	040-1522	1
C29	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C30	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	1
C31	Capacitor, Ceramic, 0.01 uF ±10%, 200V	030-1043	1
C32	Capacitor, Mica, 220 pF ±5%, 500V	040-2223	1
C33	Capacitor, Mica, 150 pF ±5%, 500V	040-1522	1
C34	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C35	Capacitor, Mylar, 0.1 uF, 100V	030-1053	1
C46	Capacitor, Mica, 22 pF, 500V	040-2213	1
D4	Diode, Zener, 1N4739A, 9.1V ±5%, 1W	200-0009	1
J7 THRU J9	Pin, Disconnect, Male, Printed Circuit Board Mount	418-0161	3
L2	Adjustable Shielded Coil, 8-20 uH	363-9061	1
Q6	Transistor, MPS6566, Silicon, NPN, Small Signal, TO-92 Case	211-6566	1
Q7	Transistor, 2N5462, JFET, P-Channel, 40V, TO-92 Case	212-5462	1
Q8	Transistor, GES5816, Silicon, NPN, Small Signal, TO-18 Case	211-5816	1
R36,R37	Resistor, 18 k Ohm ±5%, 1/4W	100-1853	2
R38	Resistor, 62 k Ohm ±5%, 1/4W	100-6253	1
R39	Resistor, 8.2 k Ohm ±5%, 1/4W	100-8243	1
R40	Resistor, 470 Ohm ±5%, 1/4W	100-4733	1
R41	Resistor, 27 k Ohm ±5%, 1/4W	100-2753	1
R42	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R43	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R44	Resistor, 2.2 k Ohm ±5%, 1/4W	100-2243	1
R45	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R46	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R47	Potentiometer, 250 k Ohm ±10%, 1/2W	180-0001	1
R48,R49	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	2
R50	Resistor, 240 k Ohm ±5%, 1/4W	100-2463	1
R51	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R52	Potentiometer, 100 k Ohm ±10%, 1/2W	178-1064	1
R53	Resistor, 240 k Ohm ±5%, 1/4W	100-2463	1
R54	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
R55	Resistor, 22 k Ohm ±5%, 1/4W	100-2253	1
R56	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R57	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R58	Resistor, 2.7 k Ohm ±5%, 1/4W	100-2743	1

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Table 6-13. Monophonic and Stereophonic Record Amplifier/Bias Circuit Board Assemblies - 910-1049/-1050 (Sheet 5 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	ADDITIONAL PARTS FOR STEREOPHONIC CIRCUIT BOARD ONLY - 910-1050 (Cont'd)		
R59	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R60	Resistor, 5.6 k Ohm ±5%, 1/4W	100-5643	1
R61	Potentiometer, 250 k Ohm ±10%, 1/2W	180-0001	1
R62	Resistor, 22 k Ohm ±5%, 1/4W	100-2253	1
R76	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
S2	Switch, Slide, MSS1200R, SPST, 300 mA @ 125V ac (Gain Switch)	345-0120	1
T2	Transformer, Audio Input, 0.5 dB, 30 Hz to 20 kHz Dual Primary: 150 Ohm and 15 k Ohm Secondary: 60 k Ohm	370-0020	1
TP2	Pin, Amplifier Disconnect	418-0161	1
U4	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	1
XU4	Socket, 8-Pin DIP	417-0800	1

Table 6-14. Record Control and Tone Generator Circuit Board Assembly 914-1503/-1513/-1523/-1533 (Sheet 1 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1,C5, C6	Capacitor, Electrolytic, 4.7 uF ±10%, 35V, Tantalum	064-4763	3
C7	Capacitor, Electrolytic, 1 uF ±10%, 35V, Tantalum	064-1063	1
C10	Capacitor, Electrolytic, 4.7 uF ±10%, 35V, Tantalum	064-4763	1
C11	Capacitor, Electrolytic, 33 uF, 35V	024-3335	1
C12	Capacitor, Electrolytic, 1 uF ±10%, 35V, Tantalum	064-1063	1
C13	Capacitor, Ceramic, 2200 pF ±10%, 200V	030-2033	1
C14,C15	Capacitor, Mylar, 0.039 uF, 100V	030-3942	2
C16,C17	Capacitor, Mylar, 0.01 uF, 100V	030-1043	2
C18	Capacitor, Electrolytic, 1 uF ±10%, 35V, Tantalum	064-1063	1
C27	Capacitor, Mylar, 0.1 uF ±10%, 100V	030-1053	1
C28	Capacitor, Electrolytic, 1 uF ±10%, 35V, Tantalum	064-1063	1
C29	Capacitor, Electrolytic, 4.7 uF ±10%, 35V, Tantalum	064-4763	1

Table 6-14. Record Control and Tone Generator Circuit Board Assembly 914-1503/-1513/-1523/-1533 (Sheet 2 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C30	Capacitor, Electrolytic, 1 uF ±10%, 35V, Tantalum	064-1063	1
CR1	Diode, 1N4148, Silicon, 75V @ 0.3 Ampere	203-4148	1
CR2 THRU CR5	Diode, 1N98, Germanium, 80V @ 0.2 Ampere	202-0098	4
CR7 THRU CR9,CR14 THRU CR20, CR23 THRU CR25	Diode, 1N4148, Silicon, 75V @ 0.3 Ampere	203-4148	13
IC1	Integrated Circuit, RC4558, Dual Operational Amplifier, 8-Pin DIP	221-4558	1
IC2	Integrated Circuit, LM3900, Quad Operational Amplifier, 14-Pin DIP	221-3900	1
Q1	Transistor, 2N5457, N-Channel, JFET, TO-92 Case	212-5457	1
Q2	Transistor, 2N5462, P-Channel, JFET, TO-92 Case	212-5462	1
Q5	Transistor, MPS6566, Silicon, NPN, TO-92 Case	211-6566	1
Q7	Transistor, GES5816, Silicon, NPN, TO-92 Case	211-5816	1
Q8,Q9	Transistor, MPS6566, Silicon, NPN, TO-92 Case	211-6566	2
Q10	Transistor, 2N5457, N-Channel, JFET, TO-92 Case	212-5457	1
Q12,Q13	Transistor, GES5816, Silicon, NPN, TO-92 Case	211-5816	2
Q14	Transistor, MPS6566, Silicon, NPN, TO-92 Case	211-6566	1
R1,R2	Potentiometer, 50 k Ohm ±10%, 1/2W	178-5054	2
R5	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R9	Potentiometer, 50 k Ohm ±10%, 1/2W	178-5054	1
R11	Potentiometer, 2 k Ohm ±10%, 1/2W	177-2044	1
R13 THRU R17	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	5
R18	Resistor, 2.7 k Ohm ±5%, 1/4W	100-2743	1
R19	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	1
R20	Resistor, 2.7 k Ohm ±5%, 1/4W	100-2743	1
R29	Resistor, 4.7 k Ohm ±5%, 1/4W	100-4743	1
R30,R31	Resistor, 2.7 k Ohm ±5%, 1/4W	100-2743	2
R32	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R34,R36	Resistor, 15 k Ohm ±5%, 1/4W	100-1553	2
R37	Resistor, 4.7 k Ohm ±5%, 1/4W	100-4743	1
R38,R39	Resistor, 3.9 k Ohm ±5%, 1/4W	100-3943	2
R40,R41	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	2
R42	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	1
R43	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	1
R44	Resistor, 2.7 k Ohm ±5%, 1/4W	100-2743	1
R45	Resistor, 4.7 k Ohm ±5%, 1/4W	100-4743	1
R46	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R48	Resistor, 180 k Ohm ±5%, 1/4W	100-1863	1
R49	Resistor, 68 k Ohm ±5%, 1/4W	100-6853	1
R52	Resistor, 75 k Ohm ±5%, 1/4W	100-7553	1
R53	Resistor, 56 k Ohm ±5%, 1/4W	100-5653	1
R54	Resistor, 120 k Ohm ±5%, 1/4W	100-1263	1
R55	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1

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Table 6-14. Record Control and Tone Generator Circuit Board Assembly 914-1503/-1513/-1523/-1533 (Sheet 3 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R56,R57	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	2
R58,R59	Resistor, 620 Ohm ±5%, 1/4W	100-6233	2
R60,R61	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	2
R62	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	1
R63	Resistor, 200 k Ohm ±5%, 1/4W	100-2063	1
R64 THRU R66	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	3
R68	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R69	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	1
R70	Resistor, 2.7 k Ohm ±5%, 1/4W	100-2743	1
R72	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
S1	Switch, SPDT, Slide, 300 mA @ 125V ac (ON/OFF - 1kHz Record)	345-0120	1
XIC1	Socket, 8-Pin DIP	417-0800	1
XIC2	Socket, 14-Pin DIP	417-1400	1
----	Blank Circuit Board	514-1503	1
	ADDITIONAL PARTS FOR ASSEMBLY 914-1503		
R6	Potentiometer, 50 k Ohm ±10%, 1/2W	178-5054	1
R67	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	1
	ADDITIONAL PARTS FOR ASSEMBLY 914-1513		
C19,C20	Capacitor, Electrolytic, 1 uF ±10%, 35V, Tantalum	064-1063	2
C21	Capacitor, Mylar, 0.01 uF, 100V	030-1043	1
C22,C23	Capacitor, Mylar, 0.15 uF, 100V	030-1553	2
C24,C25	Capacitor, Mylar, 0.0033 uF, 100V	030-3333	2
C26	Capacitor, Mica, 500 pF, 500V	041-5023	1
CR21,CR22, CR26 THRU CR29	Diode, 1N4148, Silicon, 75 Volts @ 0.3 Ampere	203-4148	6
IC3	Integrated Circuit, LM3900, Quad Operational Amplifier, 14-Pin DIP	221-3900	1
Q11,Q15	Transistor, 2N5457, N-Channel, JFET, TO-92 Case	212-5457	2
R6	Potentiometer, 5 k Ohm ±20%, 3/4W	178-5044	1
R7	Potentiometer, 2 k Ohm ±10%, 1/2W	178-2044	1
R8	Potentiometer, 5 k Ohm ±20%, 3/4W	178-5044	1
R10,R12	Potentiometer, 5 k Ohm ±10%, 1/2W	177-5044	2
R47	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R50	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R51	Resistor, 4.7 k Ohm ±5%, 1/4W	100-4743	1
R71	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R73	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	1

Table 6-14. Record Control and Tone Generator Circuit Board Assembly
914-1503/-1513/-1523/-1533 (Sheet 4 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	ADDITIONAL PARTS FOR ASSEMBLY 914-1513 (Cont'd)		
R74	Resistor, 560 k Ohm ±5%, 1/4W	100-5663	1
R75	Resistor, 82 k Ohm ±5%, 1/4W	100-8253	1
R76	Resistor, 56 k Ohm ±5%, 1/4W	100-5653	1
R77	Resistor, 120 k Ohms ±5%, 1/4W	100-1263	1
R78	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	1
R79	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	1
R80,R81	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	2
R82,R83	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	2
R84	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
R85	Resistor, 75 k Ohm ±5%, 1/4W	100-7553	1
R86	Resistor, 56 k Ohm ±5%, 1/4W	100-5653	1
R87	Resistor, 120 k Ohm ±5%, 1/4W	100-1263	1
R88	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R89,R90	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	2
R91,R92	Resistor, 1.5 k Ohm ±5%, 1/4W	100-1543	2
R93	Resistor, 220 k Ohm ±5%, 1/4W	100-2263	1
R94	Resistor, 68 k Ohm ±5%, 1/4W	100-6853	1
XIC3	Socket, 14-Pin DIP	417-1400	1
	ADDITIONAL PARTS FOR ASSEMBLY 914-1523		
C3	Capacitor, Electrolytic, 4.7 uF ±10%, 35V, Tantalum	064-4763	1
C8	Capacitor, Electrolytic, 1 uF ±10%, 35V, Tantalum	064-1063	1
C9	Capacitor, Electrolytic, 4.7 uF ±10%, 35V, Tantalum	064-4763	1
C31	Capacitor, Electrolytic, 1 uF ±10%, 35V, Tantalum	064-1063	1
CR6	Diode, 1N4148, Silicon, 75V @ 0.3 Ampere	203-4148	1
CR10 THRU CR13	Diode, 1N98, Germanium, 80V @ 0.2 Ampere	202-0098	4
Q3	Transistor, 2N5457, N-Channel, JFET, TO-92 Case	212-5457	1
Q4	Transistor, 2N5462, P-Channel, JFET, TO-92 Case	212-5462	1
R3,R4	Potentiometer, 50 k Ohm ±10%, 1/2W	178-5054	2
R6	Potentiometer, 50 k Ohm ±10%, 1/2W	178-5054	1
R21 THRU R25	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	5
R26,R27	Resistor, 2.7 k Ohm ±5%, 1/4W	100-2743	2
R28	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	1

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Table 6-14. Record Control and Tone Generator Circuit Board Assembly
914-1503/-1513/-1523/-1533 (Sheet 5 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	ALTERNATE PARTS FOR ASSEMBLY 914-1533		
C1,C5, C6,C10, C29	Capacitor, Electrolytic, 4.7 uF, 35V	024-4753	5
	ADDITIONAL PARTS FOR ASSEMBLY 914-1533		
C3	Capacitor, Electrolytic, 4.7 uF, 35V	024-4753	1
C8	Capacitor, Electrolytic, 1 uF ±10%, 35V, Tantalum	064-1063	1
C9	Capacitor, Electrolytic, 4.7 uF, 35V	024-4753	1
C19,C20	Capacitor, Electrolytic, 1 uF ±10%, 35V, Tantalum	064-1063	2
C21	Capacitor, Mylar, 0.01 uF, 100V	030-1043	1
C22,C23	Capacitor, Mylar, 0.15 uF, 100V	030-1553	2
C24,C25	Capacitor, Mylar, 0.0033 uF, 100V	030-3333	2
C26	Capacitor, Mica, 500 pF, 500V	041-5023	1
C31	Capacitor, Electrolytic, 1 uF ±10%, 35V, Tantalum	064-1063	1
CR6	Diode, 1N4148, Silicon, 75V @ 0.3 Ampere	203-4148	1
CR10 THRU CR13	Diode, 1N98, Germanium, 80V @ 0.2 Ampere	202-0098	4
CR21,CR22, CR26 THRU CR29	Diode, 1N4148, Silicon, 75V @ 0.3 Ampere	203-4148	6
IC3	Integrated Circuit, LM3900, Quad Operational Amplifier, 14-Pin DIP	221-3900	1
Q3	Transistor, 2N5457, N-Channel, JFET, TO-92 Case	212-5457	1
Q4	Transistor, 2N5462, P-Channel, JFET, TO-92 Case	212-5462	1
Q11,Q15	Transistor, 2N5457, N-Channel, JFET, TO-92 Case	212-5457	2
R3,R4	Potentiometer, 50 k Ohm ±10%, 1/2W	178-5054	2
R6	Potentiometer, 5 k Ohm ±20%, 3/4W	178-5044	1
R7	Potentiometer, 2 k Ohm ±10%, 1/2W	178-2044	1
R8	Potentiometer, 5 k Ohm ±20%, 3/4W	178-5044	1
R10,R12	Potentiometer, 5 k Ohm ±10%, 1/2W	177-5044	2
R21 THRU R25	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	5
R26,R27	Resistor, 2.7 k Ohm ±5%, 1/4W	100-2743	2
R28	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	1
R38,R39	Resistor, 3.9 k Ohm ±5%, 1/4W	100-3943	2
R47	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R50	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R51	Resistor, 4.7 k Ohm ±5%, 1/4W	100-4743	1
R71	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R73	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	1

Table 6-14. Record Control and Tone Generator Circuit Board Assembly
914-1503/-1513/-1523/-1533 (Sheet 6 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	ADDITIONAL PARTS FOR ASSEMBLY 914-1533 (Cont'd)		
R74	Resistor, 560 k Ohm ±5%, 1/4W	100-5663	1
R75	Resistor, 82 k Ohm ±5%, 1/4W	100-8253	1
R76	Resistor, 56 k Ohm ±5%, 1/4W	100-5653	1
R77	Resistor, 120 k Ohm ±5%, 1/4W	100-1263	1
R78	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	1
R79	Resistor, 330 k Ohm ±5%, 1/4W	100-3363	1
R80,R81	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	2
R82,R83	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	2
R84	Resistor, 270 k Ohm ±5%, 1/4W	100-2763	1
R85	Resistor, 75 k Ohm ±5%, 1/4W	100-7553	1
R86	Resistor, 56 k Ohm ±5%, 1/4W	100-5653	1
R87	Resistor, 120 k Ohm ±5%, 1/4W	100-1263	1
R88	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R89,R90	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	2
R91,R92	Resistor, 1.5 k Ohm ±5%, 1/4W	100-1543	2
R93	Resistor, 220 k Ohm ±5%, 1/4W	100-2263	1
R94	Resistor, 68 k Ohm ±5%, 1/4W	100-6853	1
XIC3	Socket, 14-Pin DIP	417-1400	1

6

SECTION VII
DRAWINGS

7-1. INTRODUCTION.

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

NOTE

NOTE

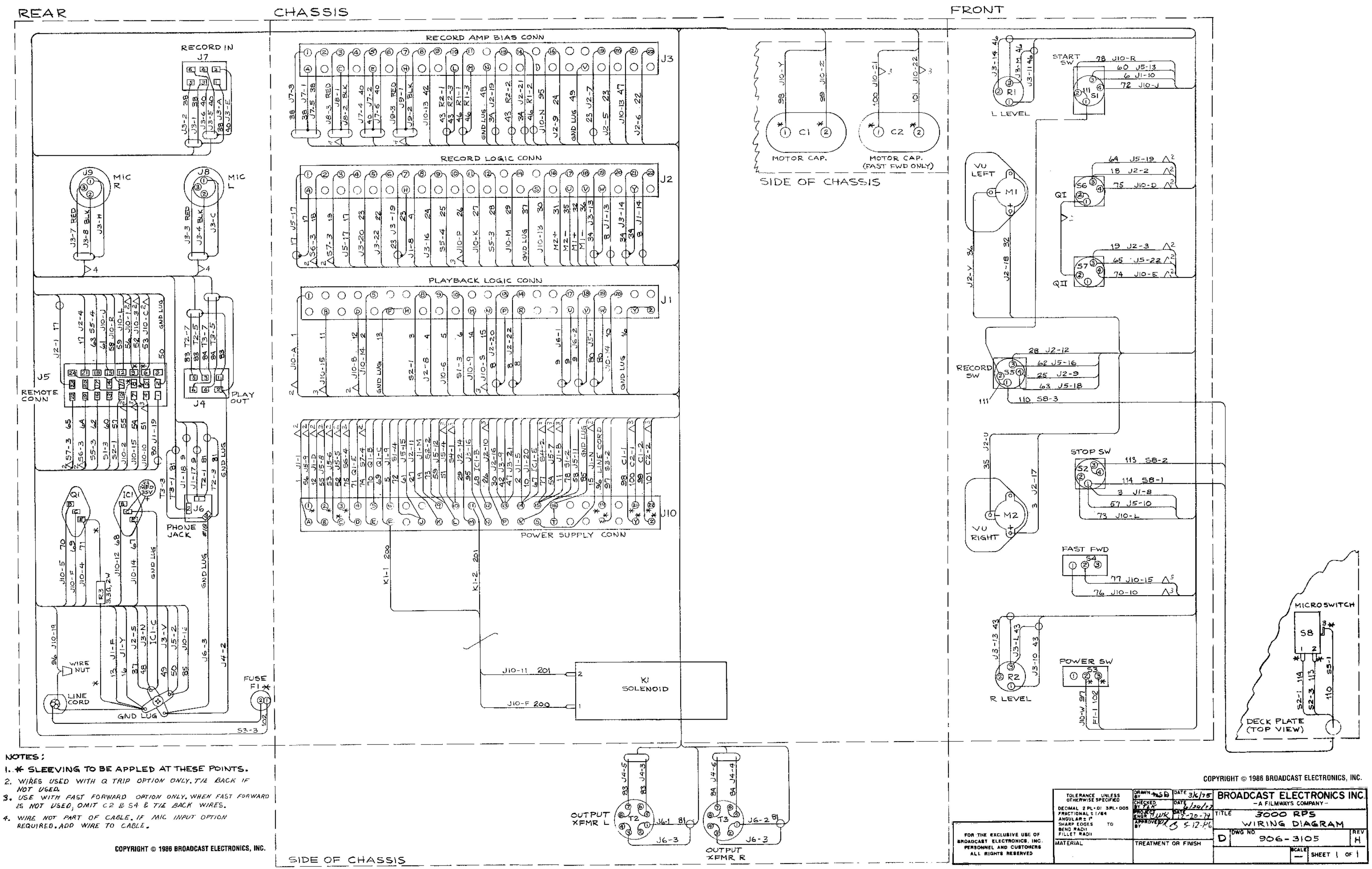
NOTE

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.

NOTE

REFER TO THE PARTS LIST TO VERIFY COMPONENTS USED IN A SPECIFIC ASSEMBLY.

7



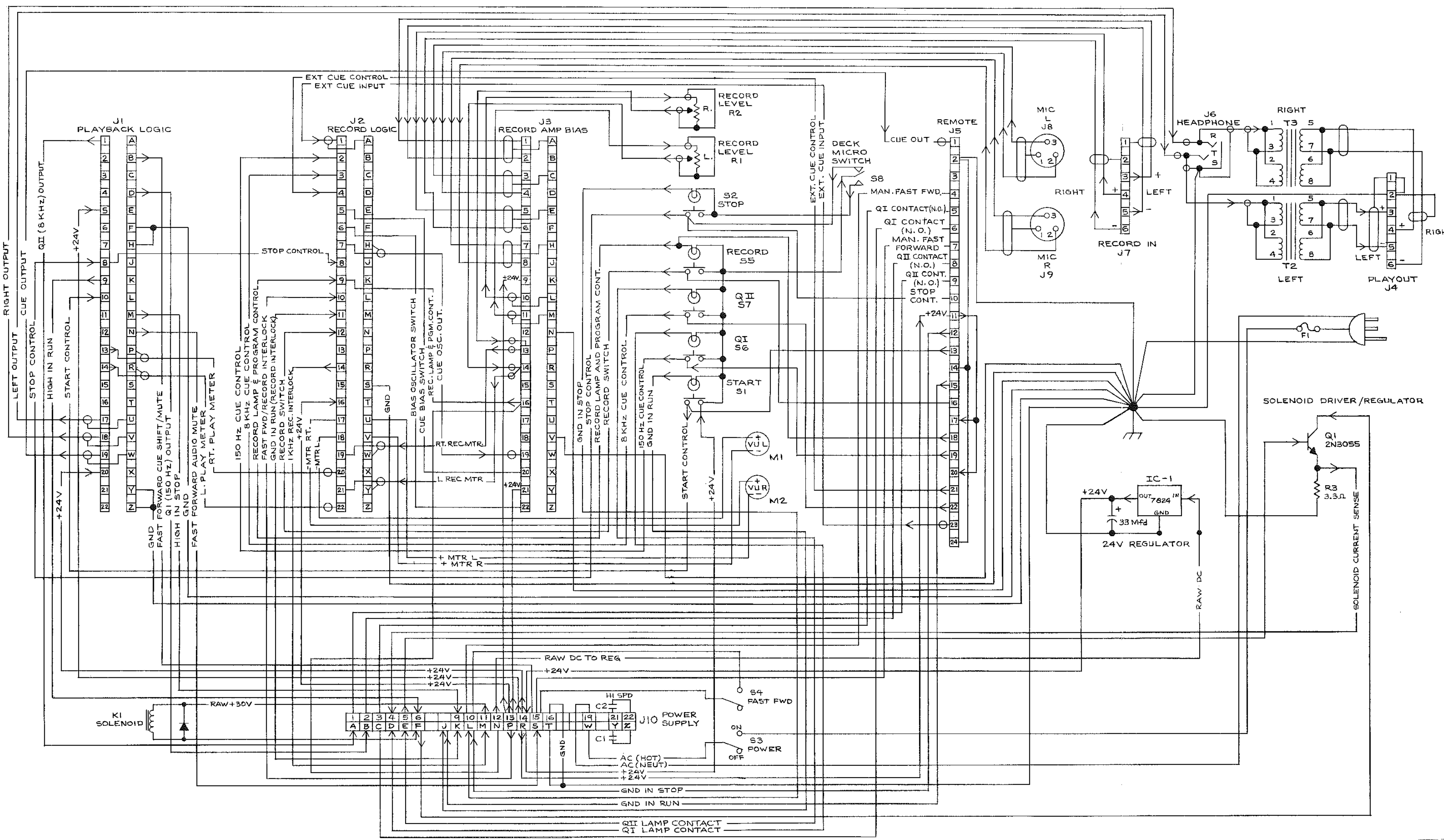
NOTES:

1. * SLEEVING TO BE APPLED AT THESE POINTS.
2. WIRES USED WITH Q TRIP OPTION ONLY. T/E BACK IF NOT USED.
3. USE WITH FAST FORWARD OPTION ONLY. WHEN FAST FORWARD IS NOT USED, OMIT C2 & S4 & T/E BACK WIRES.
4. WIRE NOT PART OF CABLE. IF MIC INPUT OPTION REQUIRED. ADD WIRE TO CABLE.

TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL 2 PL ±.01 3PL ±.005
FRACTIONAL ± 1/64
ANGULAR ± 1°
SHARP EDGES TO
BEND RADII
FILLET RADII
MATERIAL
TREATMENT OR FINISH

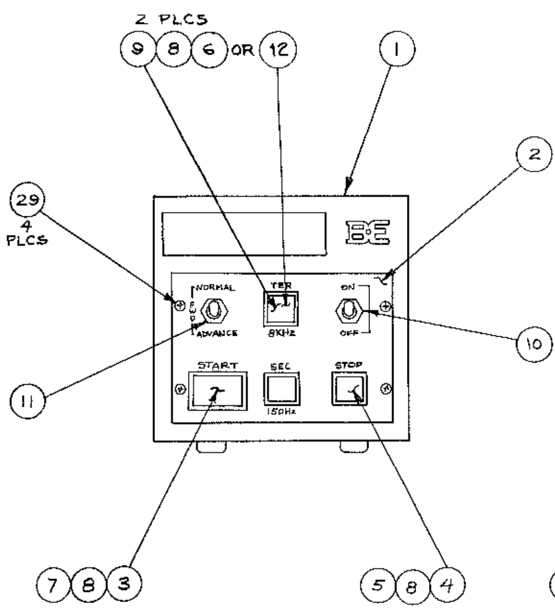
DRAWN BY WSD DATE 3/6/75
CHECKED BY
PROJECT ENGR
APPROVED BY

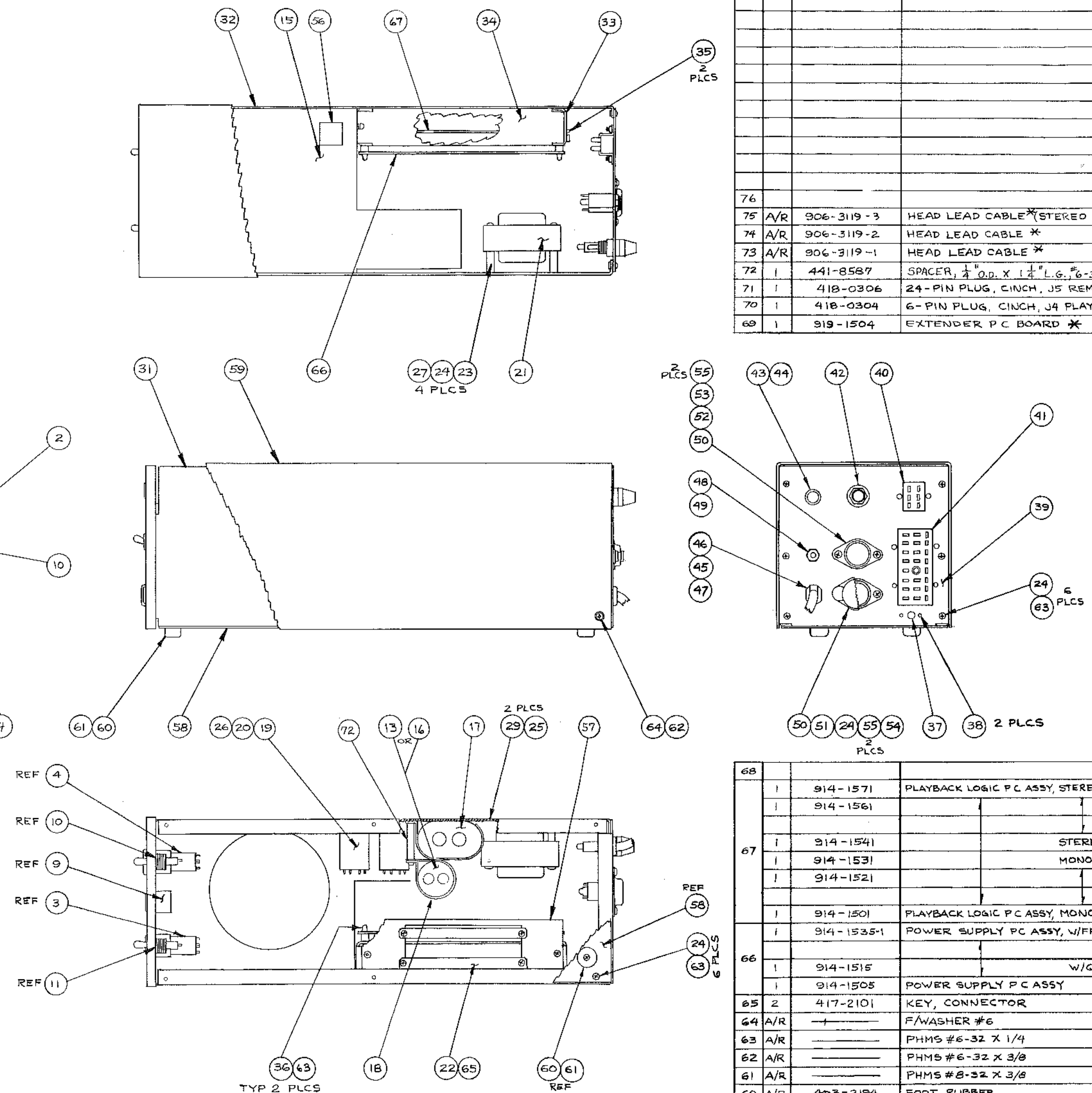
BROADCAST ELECTRONICS INC.
- A FILMWAYS COMPANY -
TITLE 3000 RPS WIRING DIAGRAM
D DWG NO. 906-3105 REV H
SCALE — SHEET 1 OF 1



NOTES:
1. ARROWS SHOW SIGNAL AND CURRENT FLOW.
2. S8 SHOWN WITH DECK UNLOADED.

TOLERANCE UNLESS OTHERWISE SPECIFIED DECIMAL 2 PL ±.01 3 PL ±.005 FRACTIONAL ± 1/64 ANGULAR ± 1° SHARP EDGES TO BEND RADII FILLET RADII	DRAWN BY Wm. DATE 10/5/76 CHECKED BY MLS DATE 10-5-76 PROJECT ENGR MLS DATE 10-5-76 APPROVED BY	BROADCAST ELECTRONICS INC. - A FILMWAYS COMPANY - TITLE 3000 SERIES SYSTEM SCHEMATIC
		D DWG NO. 906-3141 REV C
MATERIAL	TREATMENT OR FINISH	3000 SERIES SCALE — SHEET 1 OF 1





NOTES:

1. ✱ ITEMS NOT SHOWN ON DRAWING.

ITEM	QTY	PART NUMBER	DESCRIPTION
76			
75	A/R	906-3119-3	HEAD LEAD CABLE ✱ (STEREO UNITS ONLY)
74	A/R	906-3119-2	HEAD LEAD CABLE ✱
73	A/R	906-3119-1	HEAD LEAD CABLE ✱
72	1	441-8587	SPACER, $\frac{1}{4}$" O.D. X $1\frac{1}{4}$" L.G., #6-32 TAP
71	1	418-0306	24-PIN PLUG, CINCH, J5 REMOTE ✱
70	1	418-0304	6-PIN PLUG, CINCH, J4 PLAY OUT ✱
69	1	919-1504	EXTENDER P C BOARD ✱
68			
67	1	914-1571	PLAYBACK LOGIC P C ASSY, STEREO, W/FF & Q
	1	914-1561	W/Q's
	1	914-1541	STEREO
	1	914-1531	MONO, W/FF & Q
	1	914-1521	W/Q's
	1	914-1501	PLAYBACK LOGIC P C ASSY, MONO
66	1	914-1535-1	POWER SUPPLY PC ASSY, W/FF & QTRIPS
	1	914-1515	W/Q TRIPS
	1	914-1505	POWER SUPPLY P C ASSY
65	2	417-2101	KEY, CONNECTOR
64	A/R	—	F/WASHER #6
63	A/R	—	PHMS #6-32 X 1/4
62	A/R	—	PHMS #6-32 X 3/8
61	A/R	—	PHMS #8-32 X 3/8
60	A/R	403-2194	FOOT, RUBBER

ITEM	QTY RQD	PART NUMBER	DESCRIPTION	NOTE
59	1	471-0082	COVER	
58	1	471-0079	BOTTOM PLATE	
57	1	471-0180	MOUNTING PLATE, CONNECTORS	
56	1	402-0006	CABLE TIE MOUNT	
55	A/R	—	SELF-TAPPING SCREW, #6 X 1/2	
54	1	407-3000	TRANSISTOR COVER	
53	1	024-3335	CAPACITOR, 33 MFD, 35 V	
52	1	227-7824	24 VOLT REGULATOR, IC-1	
51	1	219-3055	POWER TRANSISTOR, Q1	
50	2	417-0298	TRANSISTOR SOCKET	
49	1	—	KNURLED NUT, #6-32	
48	4	410-1416	SPADE LUG, #6	
47	1	419-0071	WIRE NUT	
46	1	401-0005	STRAIN RELIEF	
45	1	681-1723	LINE CORD	
44	1	330-0100	FUSE, 1 AMP	
43	1	415-2012	FUSE HOLDER	
42	1	417-0311	PHONE JACK	
41	1	418-0303	24-PIN CONNECTOR-CINCH, J5	
40	1	418-0302	6-PIN CONNECTOR-CINCH, J4	
39	1	471-0076	REAR PANEL	
38	2	421-1102	POP RIVET	
37	1	421-0019	FASTENER, RACK	
36	2	441-9311	SUPPORT	
35	2	409-0020	GUIDE, P C CARD	
34	1	471-0085	COVER, P C CARD	
33	1	471-0073	WRAPAROUND, P C CARD CAGE	
32	1	471-0071	SIDE PLATE, LEFT	
31	1	471-0070	SIDE PLATE, RIGHT	
30	2		STANDOFF, 1/4 X 1-1/4 X 6-32 TAP (FF UNITS ONLY)	
29	A/R	—	FHMS, #4-40 X 3/8	
28	A/R	—	FHMS, #6-32 X 3/16	
27	A/R	—	PHMS, #6-32 X 1-3/8	
26	A/R	—	FHMS, #2-56 X 3/16	
25	A/R	—	HEX NUT #6-32 (NOT USED IN FF UNITS) ✱	
24	A/R	—	L/WASHER #6	
23	4	441-8158	STANDOFF, 1/4 X 5/8 X 6-32 TAP	
22	2	417-2100	22-PIN CARD EDGE CONNECTOR	
21	1	376-7656	POWER TRANSFORMER	
20	A/R	370-0017	TRANSFORMER SHIELD	
19	A/R	370-0025	OUTPUT TRANSFORMER	
18	A/R	453-0007	CAPACITOR MTG CLAMP	
17	1	029-1066	FFWD CAPACITOR, 3 MFD 370V	
16	1	029-1067	MOTOR CAPACITOR, 0.7 MFD 300V	
15	1	—	DECK ASSY	
	1			
13	1	029-1075	MOTOR CAPACITOR, .95 MFD (60Hz UNITS)	
12	2	343-0008	HOLE PLUG, Q's	
11	1	450-1700	HOLE PLUG, FF	
	1	347-7108	SWITCH, MIN TOGGLE, SPST-(FF ONLY)	
10	1	347-7101	SWITCH, MIN TOGGLE, SPST - S3 ON/OFF	
9	2	324-0125	INDICATOR LAMP HOLDER (Q TRIPS ONLY)	
8	A/R	321-0327	LAMP	
7	1	343-0152	SWITCH CAP, GREEN	
6	A/R	343-0014	SWITCH CAP, WHITE (Q TRIPS ONLY)	
5	1	343-0013	SWITCH CAP, RED	
4	1	343-0012	SWITCH, ILLUM PB - S2 STOP	
3	1	343-0150	SWITCH, ILLUM PB - S1 START	
2	1	503-0012	FRONT PANEL (Q-TRIP)	
1		460-0005	FRONT PANEL MOUNT	
			FINAL ASSEMBLY, MODEL 3100	

LIST OF MATERIAL

TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL 2 PL ±.01 3 PL ±.005
FRACTIONAL ± 1/64
ANGULAR ± 1°
SHARP EDGES TO
BEND RADII
FILLET RADII

DRAWN BY MSB DATE 4/28/75
CHECKED BY DATE
PROJECT ENGR DATE
APPROVED BY

MATERIAL —
TREATMENT OR FINISH —

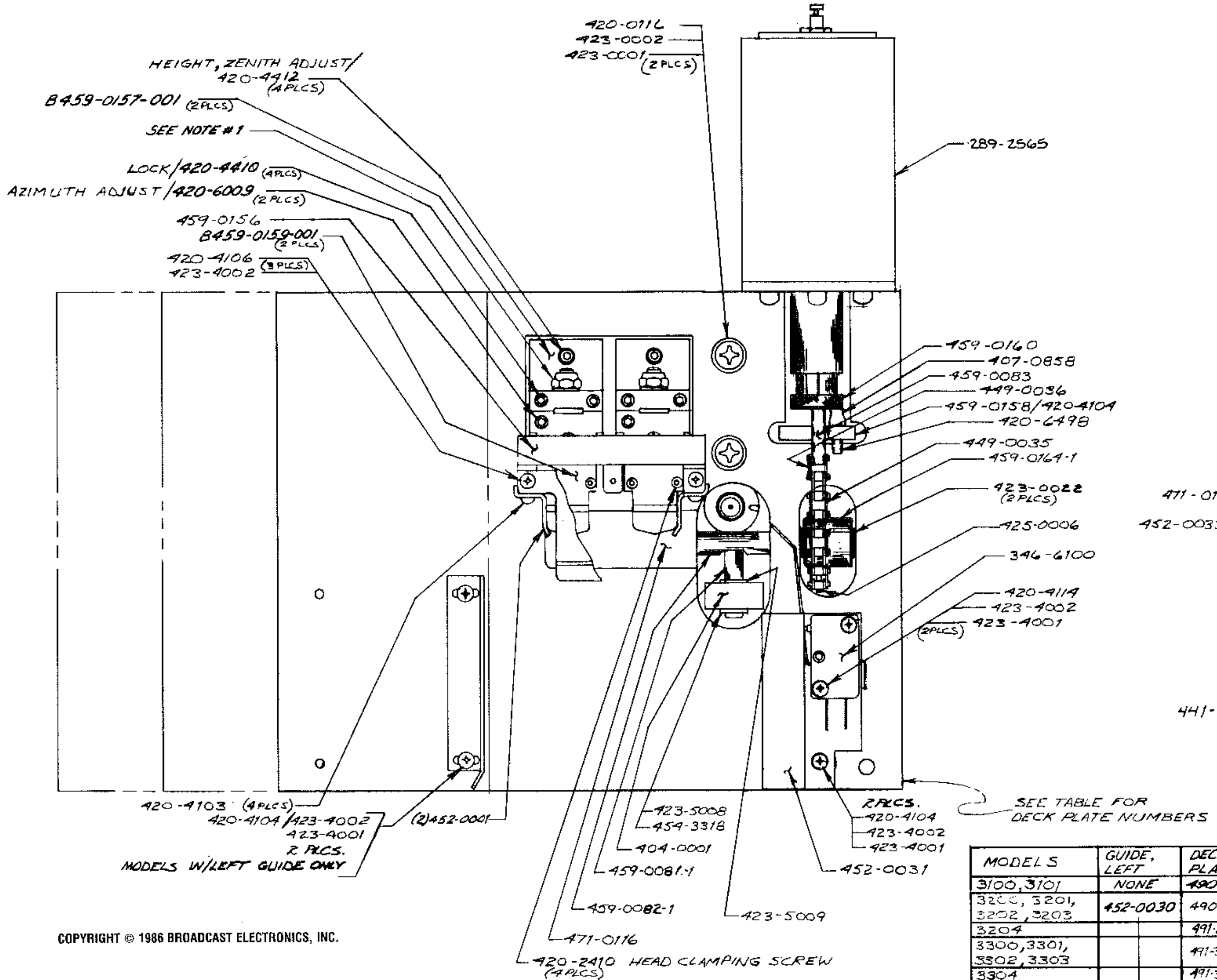
BROADCAST ELECTRONICS INC.

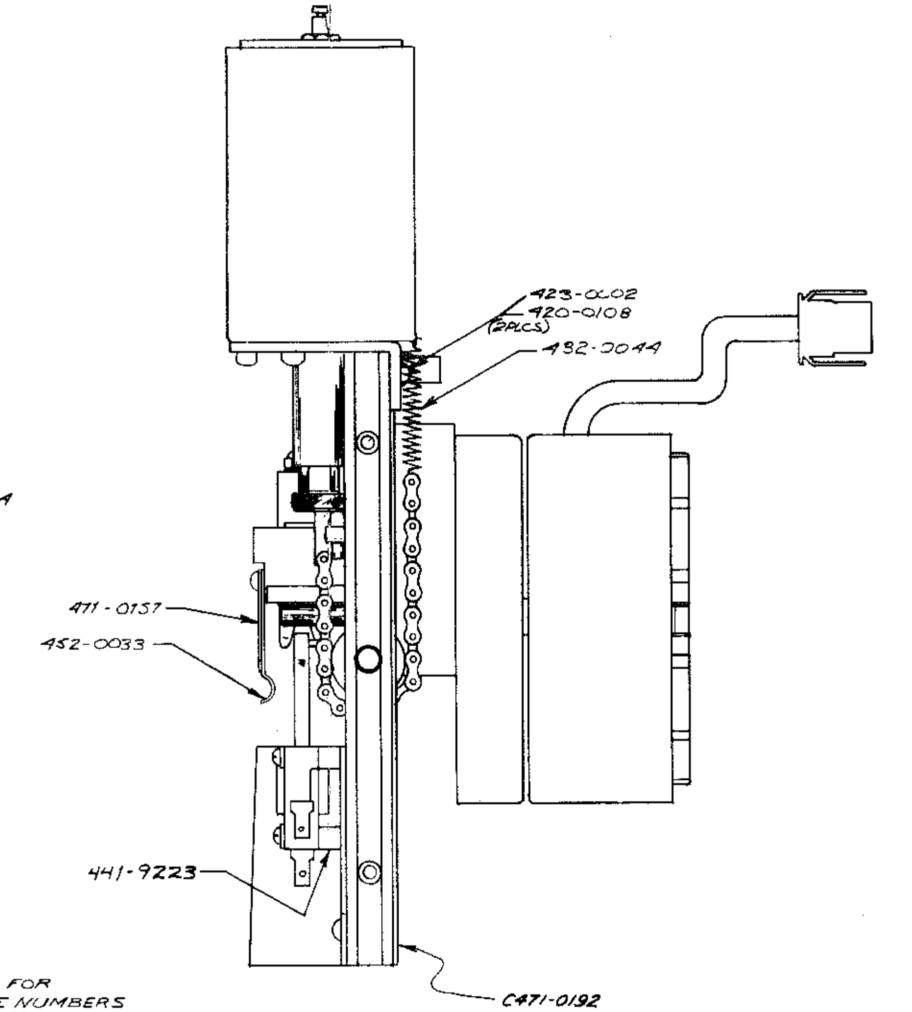
TITLE MODEL 3100 FINAL ASSEMBLY

D DWG NO. 906-3124 REV

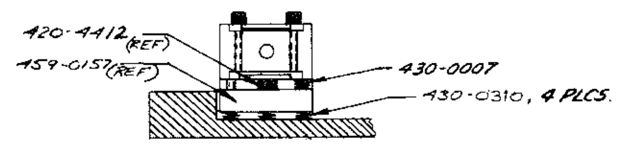
3000 SERIES SCALE 1/2 SHEET 1 OF 1

REV. J PER ECN 5044 ME 8-4-84 RA
REV. I ECN #4164 10-5-83 JLT
REV. H ECN4333 6-28-83 JAH JLT
REV. G ECN 1703 4-26-79 BE
REV. F ECN1650 3/15/79 BE
E - ECN 890
D - ECN 896 11-12-76
C - ECN 747 4/13/76
B - ECN 661 12/8/75
REV A - ECN 634, 11/10/75





MODELS	GUIDE, LEFT	DECK PLATE
3100, 3101	NONE	490-0004
3200, 3201, 3202, 3203	452-0030	490-0005
3204		491-2002-1
3300, 3301, 3302, 3303		491-3002
3304		491-3002-1
3400, 3401, 3402, 3403		491-4002
3404	452-0030	491-4002-1

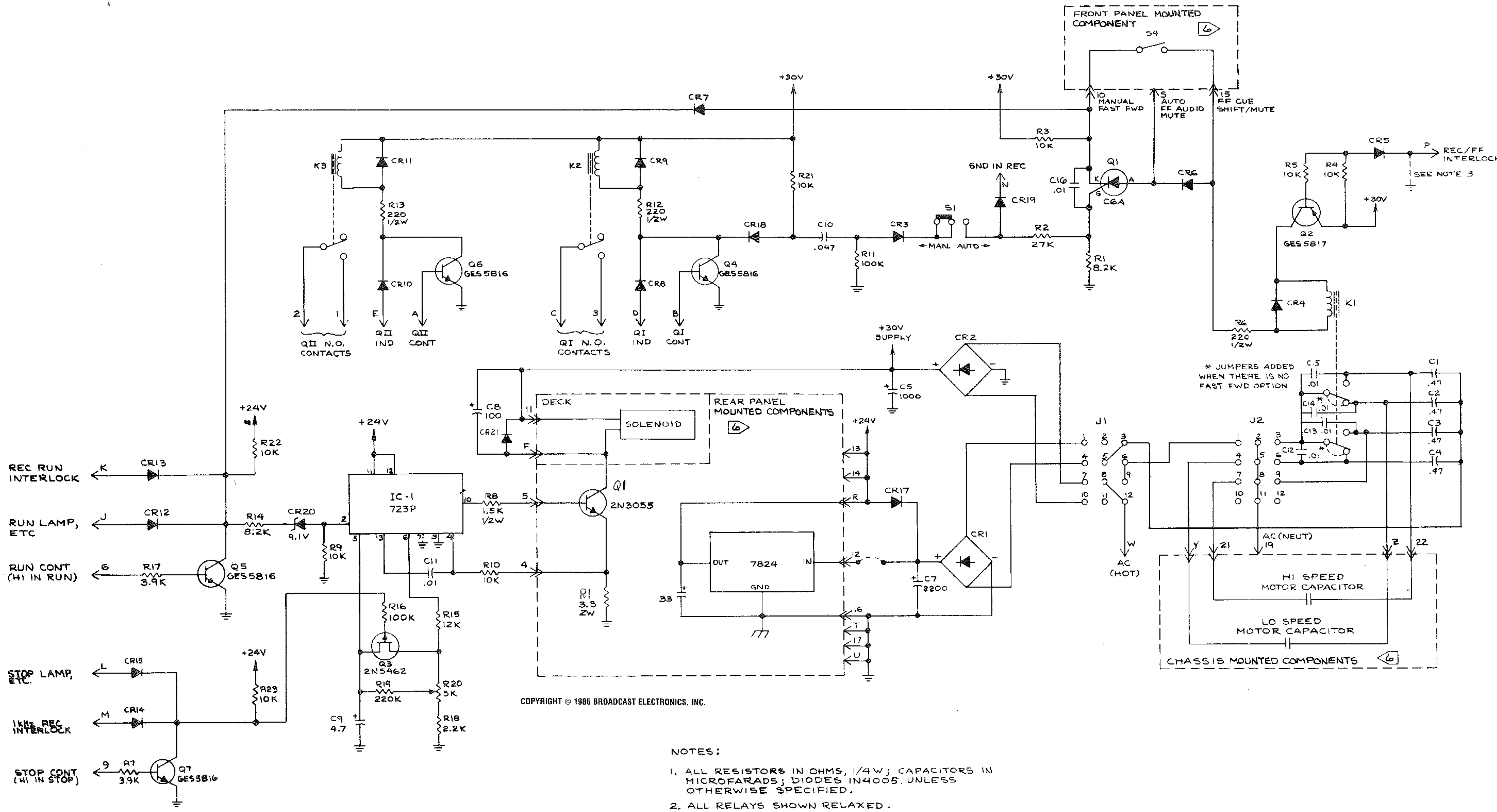


DETAIL B
FRONT VIEW
HEAD CLAMP ASS'Y LESS
HEAD (2 PLCS)

NOTES:

1. A420-0193-001 MOUNTS IN B459-0159-001 USING 700-0015. (LOCTITE 242) THEN 423-1022 WITH 700-0109 (LUBRIPLATE) ON BOTH SIDES AND ON BEARING SURFACE OF A420-0193-001. THEN B459-0157-001. THEN 423-0006 WITH 700-0109 (LUBRIPLATE) ON BOTH SIDES. THEN 421-0005. 2 PLCS.

TOLERANCE UNLESS OTHERWISE SPECIFIED DECIMAL 2 PL = .01 3PL = .005 FRACTIONAL ± 1/64 ANGULAR ± 1° SHARP EDGES TO BEND RADII FILLET RADII	DRAWN BY	DATE	BROADCAST ELECTRONICS INC.
	CHECKED BY RA	DATE 9-1-83	TITLE ASSEMBLY DECK
	PROJECT ENGR. RA	DATE 9-1-83	D DWG. NO. TYPE A 906-0000 REV T
MATERIAL	APPROVED BY / TREATMENT OR FINISH		SERIES SCALE 1/1 SHEET 1 OF 1



NOTES:

1. ALL RESISTORS IN OHMS, 1/4W; CAPACITORS IN MICROFARADS; DIODES 1N4005 UNLESS OTHERWISE SPECIFIED.
2. ALL RELAYS SHOWN RELAXED.
3. IN PLAYBACK-ONLY MACHINES PIN P MUST BE JUMPERED TO GROUND (PIN 16) TO ALLOW FAST FORWARD OPERATION.
4. ←N PIN ON PC BOARD CONN (J10).
   PC BOARD GROUND
   CHASSIS GROUND
5. SEE PCB ASSY DWG #D914-1505-1515, -1525 & -1535.
6. SEE ASSY DIAGRAM AD906-3124 FOR LOCATION OF CHASSIS MOUNTED COMPONENTS

FOR THE EXCLUSIVE USE OF BROADCAST ELECTRONICS, INC. PERSONNEL AND CUSTOMERS ALL RIGHTS RESERVED	TOLERANCE UNLESS OTHERWISE SPECIFIED DECIMAL 2 PL ±.01 3PL ±.005 FRACTIONAL ± 1/64 ANGULAR ± 1° SHARP EDGES TO BEND RADII FILLET RADII	DRAWN BY MIKE MT DATE 9-16-80; CHECKED BY; PROJECT ENGR; APPROVED BY	BROADCAST ELECTRONICS INC. - A FILMWAYS COMPANY -
	MATERIAL	TREATMENT OR FINISH	TITLE SCHEMATIC POWER SUPPLY PCB
			D DWG NO 906-3142-1 REV D
			3000 SERIES SCALE — SHEET 1 OF 1

LIST OF MATERIALS

ITEM	QTY	PART NUMBER	DESCRIPTION
116	A/R	906-3118-1	HEAD LEAD CABLE * (MODEL 3200)
117	A/R	906-3118-2	* (MODEL 3200)
118	A/R	906-3118-3	* (MODEL 3200) (STEREO ONLY)
119	A/R	906-3119-1	* (MODEL 3300)
120	A/R	906-3119-2	* (MODEL 3300)
121	A/R	906-3119-3	HEAD LEAD CABLE * (MODEL 3300) (STEREO ONLY)
122			
123			
124			
125		343-0008	HOLE PLUG, Q's
126			
127			
128			
129			
130			
131			

LIST OF MATERIALS

ITEM	QTY	PART NUMBER	DESCRIPTION
57	1	681-1723	LINE CORD
58	1	401-0005	STRAIN RELIEF
59	1	419-0071	WIRE NUT
60	4	410-1416	#6 SPADE LUG
61	1	———	#6 KNURLED NUT
62	2	417-0298	TRANSISTOR SOCKET
63	1	219-3055	POWER TRANSISTOR, Q1
64	1	227-7824	24V REGULATOR, IC-1
65	1	024-3335	CAPACITOR, 33 MFD, 35V
66	1	407-3000	TRANSISTOR COVER
67	A/R	417-0303A	MIC INPUT JACK, J8 (LEFT), J9 (RIGHT)
	A/R	451-1200	HOLE PLUG
68	A/R	———	SELF TAPPING SCREW #6 x 1/2"
69	1	402-0006	CABLE TIE MOUNT
70			
71	1	471-0080	BOTTOM PLATE, MODEL 3200
	1	471-0081	BOTTOM PLATE, MODEL 3300
72	1	471-0083	COVER, MODEL 3200
	1	471-0084	COVER, MODEL 3300
73	4	403-2194	FOOT, RUBBER
74	A/R	———	PHMS #8-32 x 3/8
75			
76	A/R	———	PHMS #6-32 x 3/8
77	1	914-1505	POWER SUPPLY P C BD
78	1	914-1515	W/Q TRIPS
80	1	914-1535-1	POWER SUPPLY P C BD, W/FF & Q TRIPS
81	1	914-1501	PLAYBACK LOGIC P C BD, MONO
83	1	914-1521	W/Q TRIPS
84	1	914-1531	MONO, W/FF & Q
85	1	914-1541	STEREO
87	1	914-1561	W/Q TRIPS
88	1	914-1571	PLAYBACK LOGIC P C BD, STEREO, W/FF & Q
89	1	914-1502	RECORD AMP/BIAS P C BD, MONO
90	1	914-1512	RECORD AMP/BIAS P C BD, STEREO
91	1	914-1503	REC CONT & TONE GEN P C BD, MONO
92	1	914-1513	MONO, W/Q
93	1	914-1523	STEREO, WO/Q
94	1	914-1533	REC CONT & TONE GEN P C BD, STEREO, W/Q
95	1	919-1504	EXTENDER P C BD *
96			
97			
98	1	418-0304	6-PIN PLUG, CINCH (M), J4 PLAY OUT *
99	1	418-0306	24-PIN PLUG, CINCH (M), J5 REMOTE *
100	1	418-0305	6-PIN PLUG, CINCH (F), J7 REC IN *
101			
102			
103			
104			
105			
106	2	441-9311	SUPPORT
107	2	421-1102	POP RIVET
108	1	421-0019	FASTENER, RACK
109			
110	A/R		F/WASHER #6
111			
112	A/R		PHMS #6-32 x 3/8
113	A/R		PHMS #6-32 x 1/4
114	A/R		FHMS #6-32 x 3/16
115	A/R		PHMS #6-32 x 1-3/8

LIST OF MATERIALS

ITEM	QTY	PART NUMBER	DESCRIPTION
X	X	———	FINAL ASSEMBLY, MODELS 3200, 3300
1	1	460-0006	FRONT PANEL MOUNT, MODEL 3200
	1	460-0007	FRONT PANEL MOUNT, MODEL 3300
4	1	503-0004	FRONT PANEL 3200 RP
6	1	503-0006	FRONT PANEL 3200 RPS
9	1	503-0009	FRONT PANEL 3300 RP
11	1	503-0011	FRONT PANEL 3300 RPS
12	1	503-0013	FRONT PANEL 3200 P/PS
13	1	503-0014	FRONT PANEL 3300 P/PS
14	1	343-0150	SWITCH, ILLUMINATED P B, S1 START
15	A/R	343-0012	SWITCH, ILLUMINATED P B, S2 STOP, S6 QI, S7 QII
16	A/R	343-0013	CAP, RED
17	1	343-0152	CAP, GRN
18	2	343-0014	CAP, WHT
19	1	347-7101	MIN, TOGGLE, SPST, S3 ON/OFF
20	1	347-7108	SWITCH, MIN, TOGGLE, SPST, S4 FF
	1	450-1700	HOLE PLUG
21	A/R	191-1053	POTENTIOMETER, 10K
22	A/R	484-0500	KNOB
23	A/R	319-0081	VU METER
24	A/R	459-0018	VU METER CLAMP
25	A/R	321-0327	LAMP
26	A/R	———	FHMS #4-40 x 3/8,
27	2	324-0125	INDICATOR LAMP HOLDER, S6 & S7 (PLAY ONLY UNITS)
28	1	———	DECK ASSEMBLY, MODEL 3200
	1	———	DECK ASSEMBLY, MODEL 3300
29	A/R	453-0007	MOTOR CAPACITOR, CLAMP
30	1	029-1067	.7 MFD
31	1	029-1066	3 MFD
32	1	029-1075	MOTOR CAPACITOR, .95 MFD (50Hz)
33	A/R	370-0025	OUTPUT TRANSFORMER
34	A/R	370-0017	TRANSFORMER SHIELD
35	1	376-7656	POWER TRANSFORMER
36	A/R	417-2100	22-PIN CARD EDGE CONNECTOR
37	4	441-8158	STANDOFF, 1/4 x 5/8 LG x 6-32 TAP
39	A/R	———	HEX NUT #6-32
40	A/R	———	FHMS #2-56 x 5/16
41	1	471-0070	SIDE PLATE, RIGHT
42	1	471-0071	SIDE PLATE, LEFT
43	1	471-0072	WRAPAROUND, P C CARD CAGE
44	1	471-0074	MOUNTING PLATE, CONN
45	1	471-0086	COVER, P C CARD
46	A/R	409-0020	GUIDE, P C CARD
47	A/R	———	PHMS #6-32 x 1/4
48	A/R	———	L/WASHER #6
49	A/R	417-2101	KEY, CONNECTOR
50	1	471-0077	REAR PANEL, MODEL 3200
	1	471-0078	REAR PANEL, MODEL 3300
51	1	418-0302	6-PIN CONNECTOR, CINCH (F), J4
52	1	418-0303	24-PIN CONNECTOR, CINCH (F), J5
53	1	418-0301	6-PIN CONNECTOR, CINCH (M), J7
	1	451-1200	HOLE PLUG
54	1	415-2012	FUSE HOLDER
55	1	330-0100	FUSE, 1 AMP
56	1	417-0311	PHONE JACK, J6

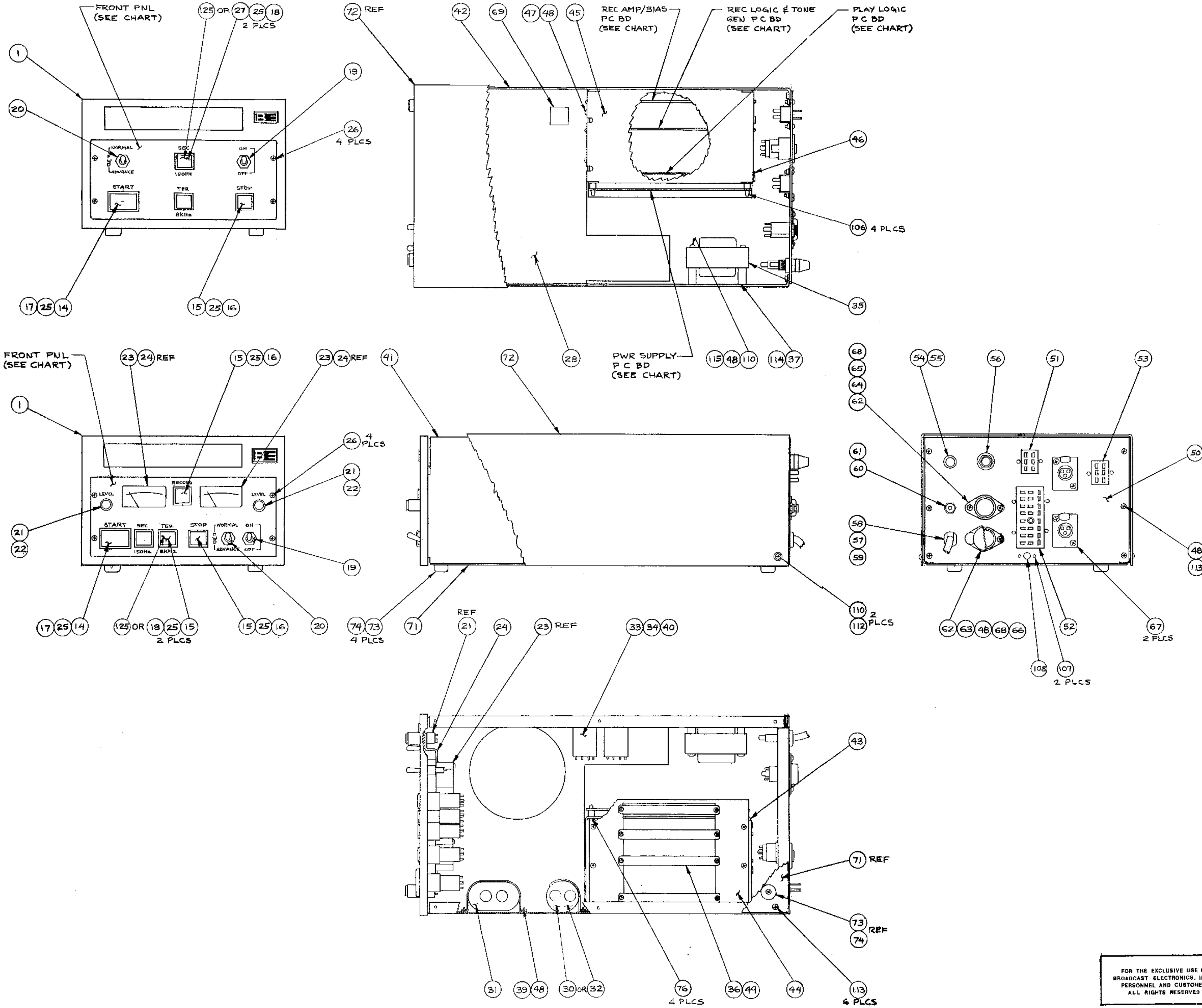
NOTES:

1. * ITEMS NOT SHOWN ON DRAWING.

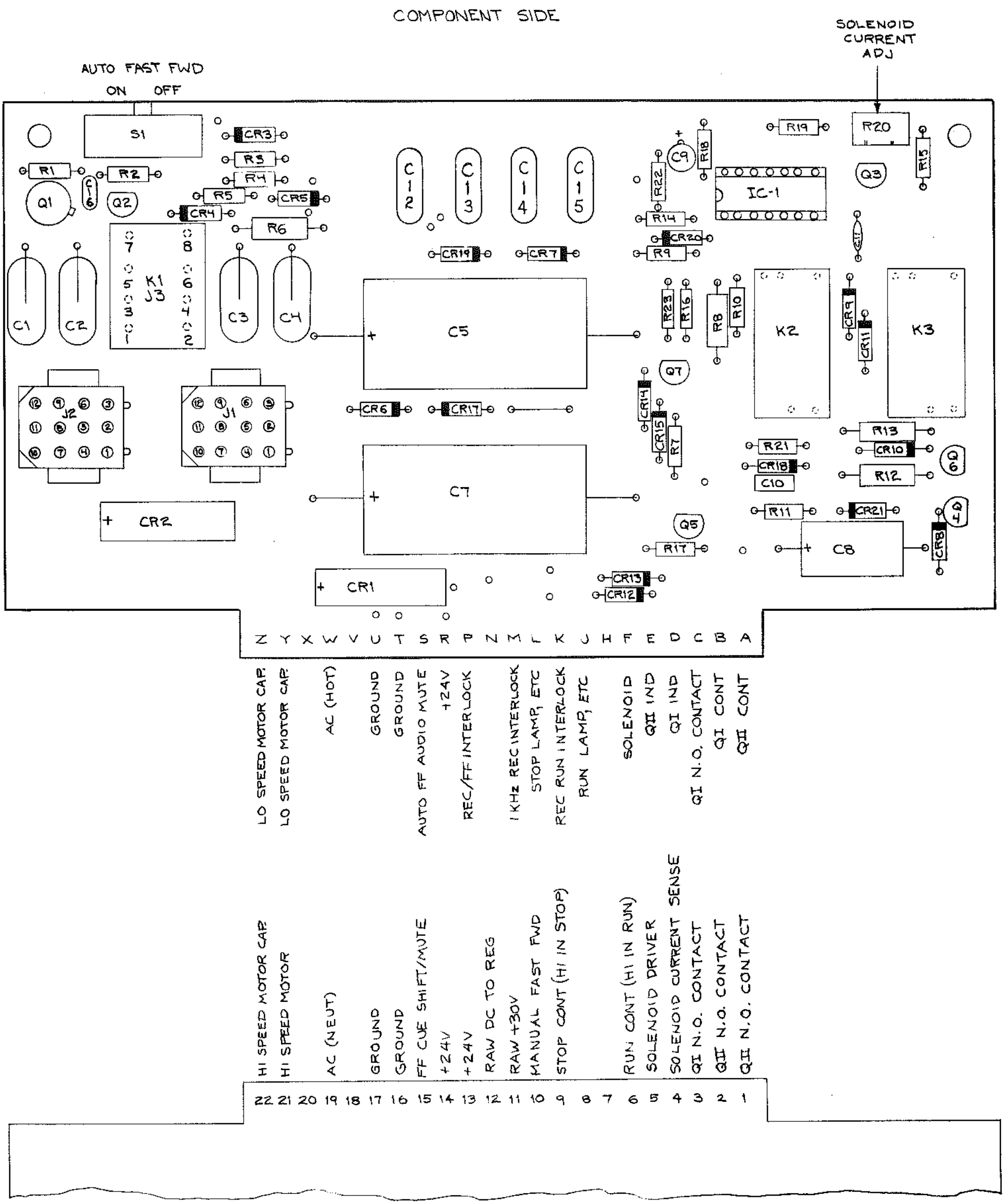
			ITEM NUMBERS: FRONT PANEL	POWER SUPPLY P C BD	PLAYBACK LOGIC P C BD	RECORD AMP/BIAS P C BD	REC CONT & TONE GEN P C BD	7.5 IPS MOTOR CAPACITOR	7.5 IPS MOTOR CAPACITOR (220V/50 Hz)
MODEL 3200P 906-3200	STANDARD		12	77	81	—	—	30	30
	Q-TRIPS	906-3000	12	78	83	—	—	30	30
	F FWD & Q TRIPS	906-3006	12	80	84	—	—	31 & 32	30 & 31
MODEL 3200RP 906-3201	STANDARD		4	77	81	89	91	30	30
	Q-TRIPS	906-3001	4	78	83	89	92	30	30
	F FWD & Q TRIPS	906-3007	4	80	84	89	92	31 & 32	30 & 31
MODEL 3200PS 906-3202	STANDARD		12	77	85	—	—	30	30
	Q TRIPS	906-3000	12	78	87	—	—	30	30
	F FWD & Q TRIPS	906-3006	12	80	88	—	—	31 & 32	30 & 31
MODEL 3200RPS 906-3203	STANDARD		6	77	85	90	93	30	30
	Q TRIPS	906-3001	6	78	87	90	94	30	30
	F FWD & Q TRIPS	906-3007	6	80	88	90	94	31 & 32	30 & 31
MODEL 3300P 906-3300	STANDARD		13	77	81	—	—	30	30
	Q TRIPS	906-3000	13	78	83	—	—	30	30
	F FWD & Q TRIPS	906-3006	13	80	84	—	—	31 & 32	30 & 31
MODEL 3300RP 906-3301	STANDARD		9	77	81	89	91	30	30
	Q TRIPS	906-3001	9	78	83	89	92	30	30
	F FWD & Q TRIPS	906-3007	9	80	84	89	92	31 & 32	30 & 31
MODEL 3300PS 906-3302	STANDARD		13	77	85	—	—	30	30
	Q TRIPS	906-3000	13	78	87	—	—	30	30
	F FWD & Q TRIPS	906-3006	13	80	88	—	—	31 & 32	30 & 31
MODEL 3300RPS 906-3303	STANDARD		11	77	85	90	93	30	30
	Q TRIPS	906-3001	11	78	87	90	94	30	30
	F FWD & Q TRIPS	906-3007	11	80	88	90	94	31 & 32	30 & 31

TOLERANCE UNLESS OTHERWISE SPECIFIED DECIMAL 2 PL±.01 3PL±.005 FRACTIONAL ± 1/64 ANGULAR ± 1° SHARP EDGES TO BEND RADII FILLET RADII	DRAWN BY MSD	DATE 4/18/75	BROADCAST ELECTRONICS INC.
	CHECKED BY	DATE	
	PROJECT ENGR	DATE	TITLE 3200 & 3300 FINAL ASSEMBLY
	APPROVED BY		
MATERIAL —	TREATMENT OR FINISH —		D DWG NO. 906-3123 REV H
			3000 SERIES SCALE SHEET 2 OF 2

REV A - ECN 634 11/10/75
B - ECN 661 12/8/75
C - ECN 747 4/13/76
D - ECN 896 11-12-76
E - ECN 890 6/29/77 TZK
F - ECN 1650 3/15/79 BE
G - ECN 1703 4-26-79 BE
H - ECN 4333 6-28-83 JAH

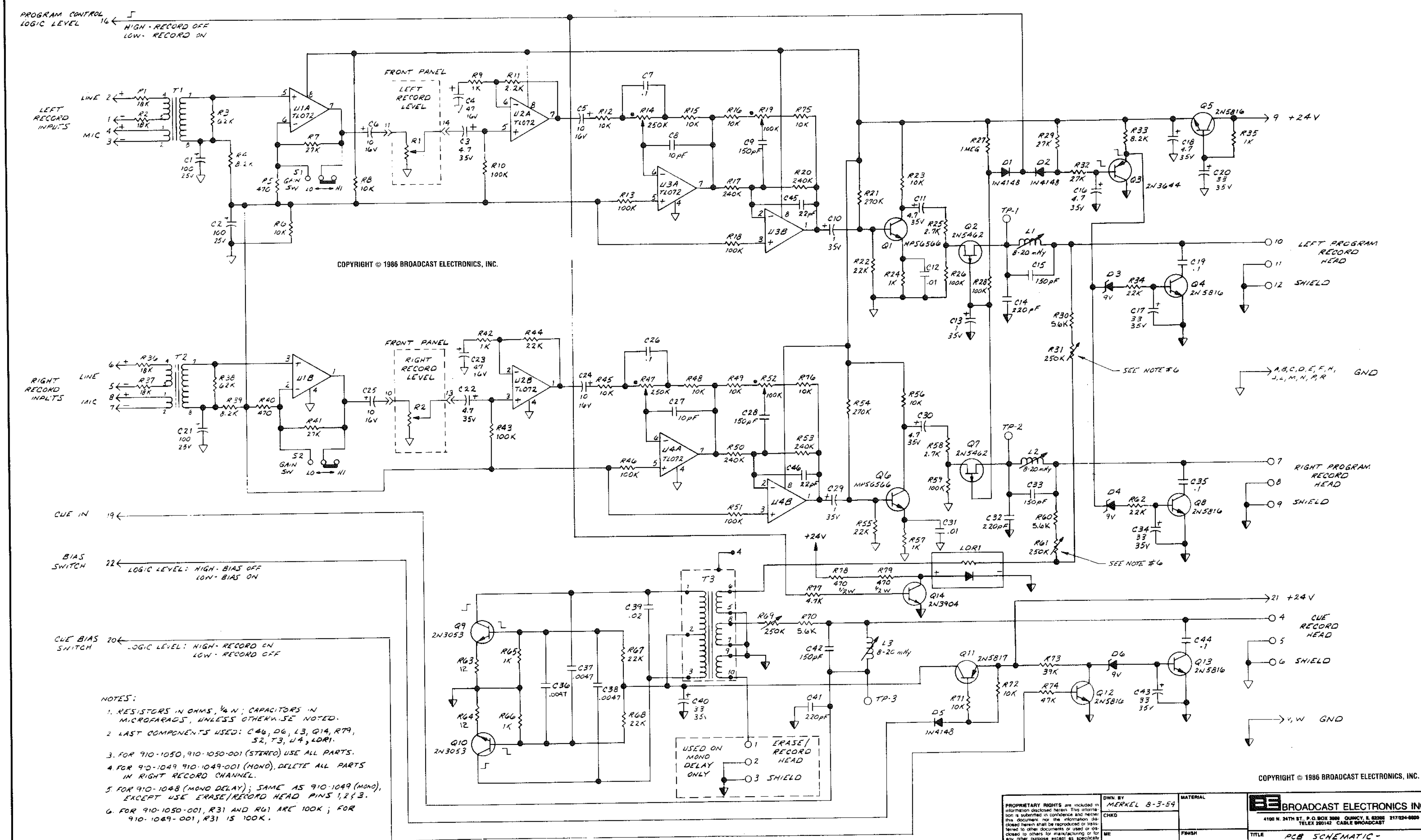


TOLERANCE UNLESS OTHERWISE SPECIFIED DECIMAL 2 PL ±.01 3 PL ±.005 FRACTIONAL ± 1/64 ANGULAR ± 1° SHARP EDGES TO BEND RADII FILLET RADII	DRAWN BY TSD DATE 4/21/75 CHECKED BY DATE PROJECT ENGR DATE APPROVED BY	BROADCAST ELECTRONICS INC. -A FILMWAYS COMPANY-	
MATERIAL —	TREATMENT OR FINISH —	TITLE 3200 & 3300 FINAL ASSEMBLY	
		D DWG NO. 906-3123	REV H
		3000 SERIES SCALE 1/2	SHEET 1 OF 2



CIRCUIT SIDE

D914-1535-1 3000 CARTRIDGE MACHINE POWER SUPPLY ASSEMBLY DRAWING (REV. F)



NOTES:

1. RESISTORS IN OHMS, 1/4 W; CAPACITORS IN MICROFARADS, UNLESS OTHERWISE NOTED.
2. LAST COMPONENTS USED: C46, D6, L3, Q14, R79, S2, T3, U4, LDR1.
3. FOR 910-1050, 910-1050-001 (STEREO) USE ALL PARTS.
4. FOR 910-1049, 910-1049-001 (MONO), DELETE ALL PARTS IN RIGHT RECORD CHANNEL.
5. FOR 910-1048 (MONO DELAY); SAME AS 910-1049 (MONO), EXCEPT USE ERASE/RECORD HEAD PINS 1,2 & 3.
6. FOR 910-1050-001, R31 AND R61 ARE 100K; FOR 910-1049-001, R31 IS 100K.

TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xxx ± .005 .xx ± .015 ANGLES ± 1°

DWN. BY	MERKEL 8-3-84	MATERIAL	
CHKD			
ME		FINISH	
PROJ. ENGR.			
MFG.		NEXT ASSY.	

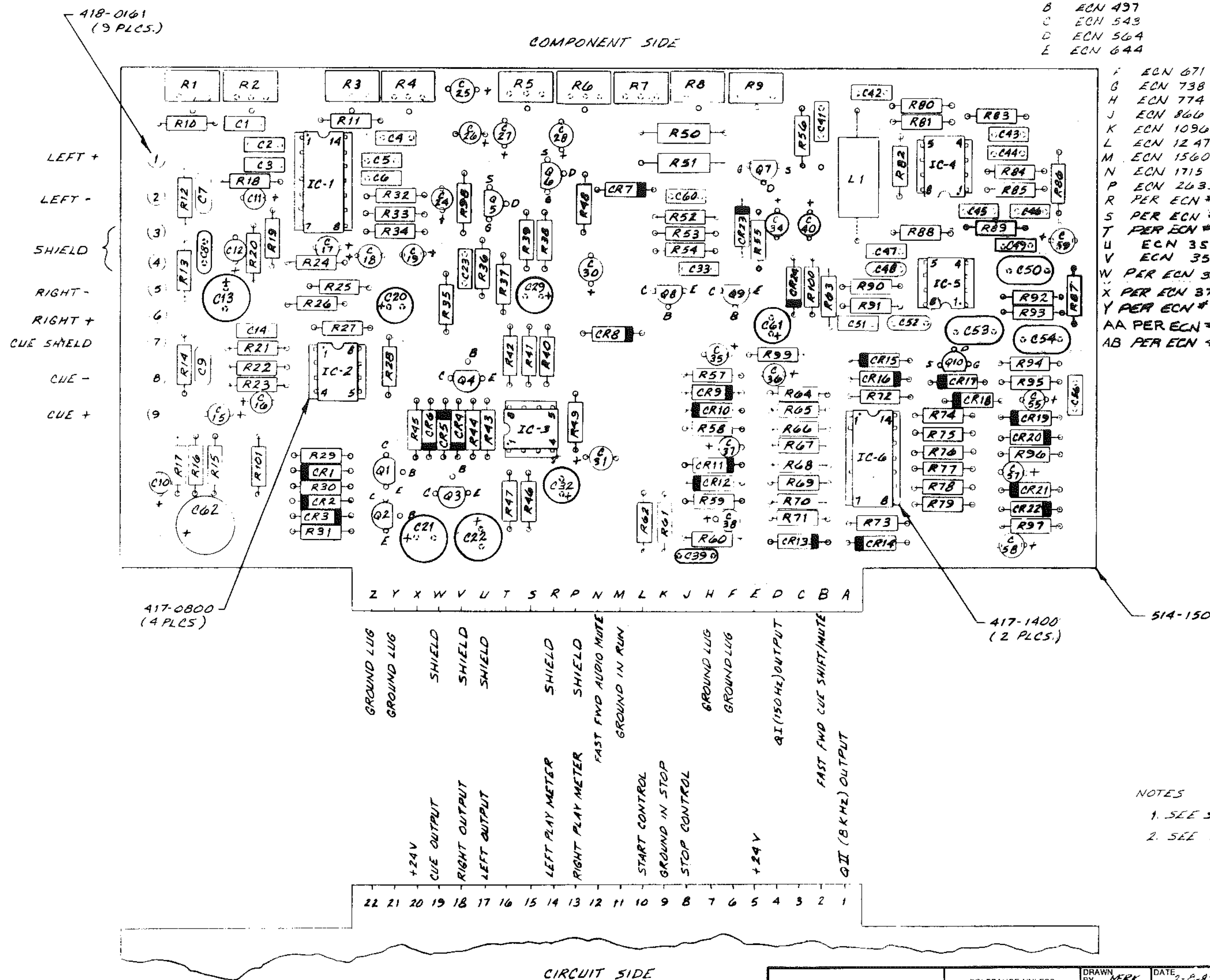
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST

TITLE: PCB SCHEMATIC - RECORD AMP BIAS

TYPE: 5 SIZE: D DWG. NO. 910-1050; 910-1050-001; 910-1049; 910-1049-001; 910-1048 REV: F

MODEL: 3000 SERIES SCALE: NONE SHEET 1 OF 1

REV.	DESCRIPTION		DATE	APPROVED
A	GENERAL UPDATE TO REV-A FOIL		4/22/75	H.B
B	ECN 497		5/26/75	H.B.
C	ECN 543		[illegible]	H.B.
D	ECN 564		8/12/75	H.B
E	ECN 644		11/20/75	H.B
F	ECN 671		12/10/75	H.B
G	ECN 738		3/30/76	H.B.
H	ECN 774		4/27/76	H.B.
J	ECN 866		9/8/76	H.B
K	ECN 1096		1/16/78	CLO
L	ECN 1247		7/13/78	MH
M	ECN 1560		1/5/79	MH
N	ECN 1715		5/17/79	GH
P	ECN 2633		4/1/81	CRF
R	PER ECN #3111		12/5/81	JAH
S	PER ECN #3361		3-23-82	MERK
T	PER ECN # 3394		4-15-82	ORF
U	ECN 3538		6/11/82	RRT
V	ECN 3547	ORF	6-17-82	CWK
W	PER ECN 3651	MERK	7-15-82	CWK
X	PER ECN 3772	MERK	9-8-82	CWK
Y	PER ECN #4420	ORF	8-4-83	JLT
AA	PER ECN #4540	JAH	10-10-83	MH
AB	PER ECN 4668	LEF	11-21-83	JLT



NOTES
1. SEE SCHEMATIC #D906-3111
2. SEE B/M # 914-1571

TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL 2 PL=.01 3PL=.005
FRACTIONAL ±1/64
ANGULAR ± 1°
SHARP EDGES TO
BEND RADII
FILLET RADII

MATERIAL

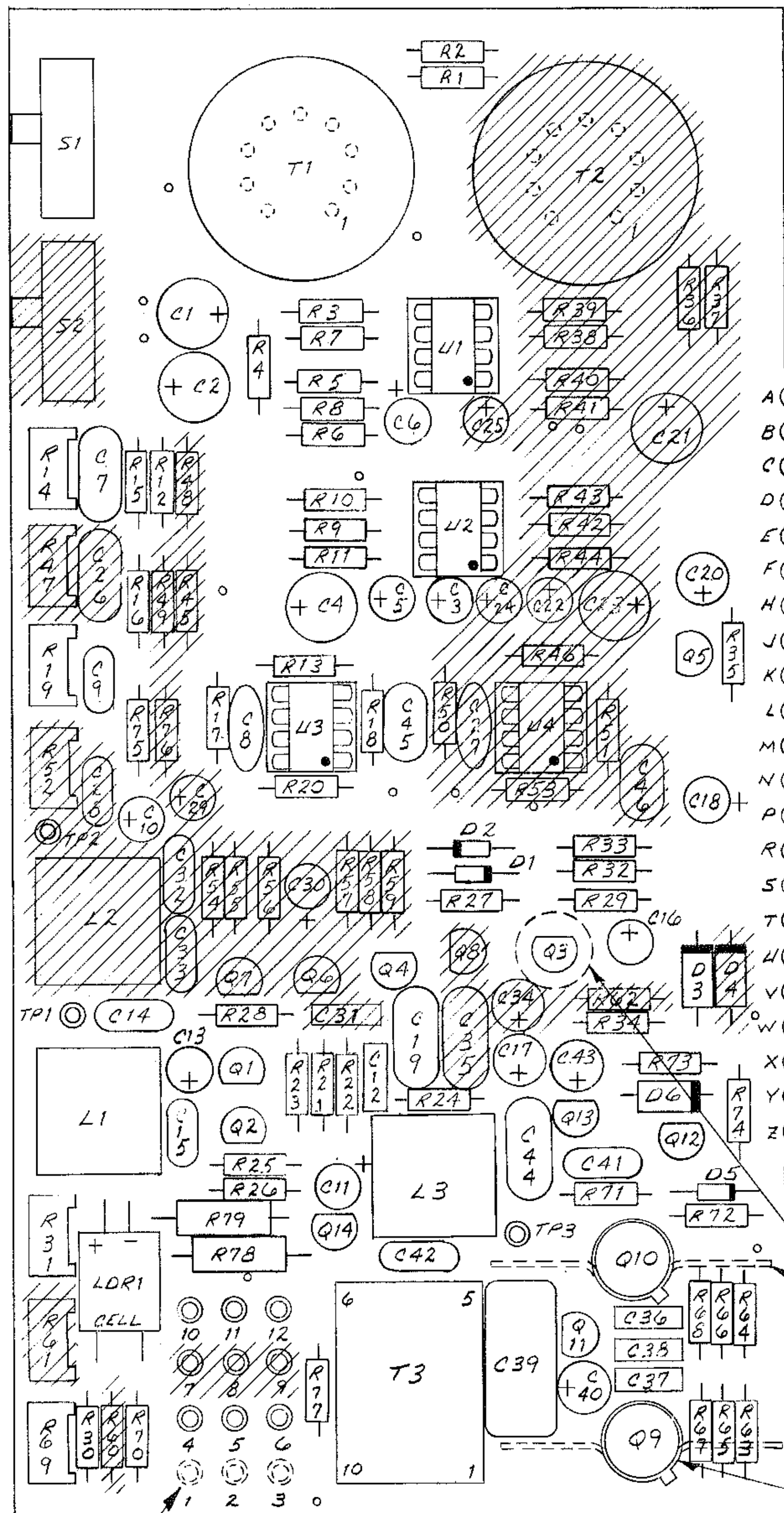
DRAWN BY MERK	DATE 2-8-82		
CHECKED BY	DATE		
PROJECT ENGR.	DATE		
APPROVED BY			
TREATMENT OR FINISH			

BROADCAST ELECTRONICS INC.
A FILMWAYS COMPANY

TITLE PLAYBACK BD ASSY. STEREO W/Q TRIPS & FAST FWD

C DWG. NO 914-1571 REV. AB

3000 SERIES SCALE 2/1 SHEET 1 OF 1

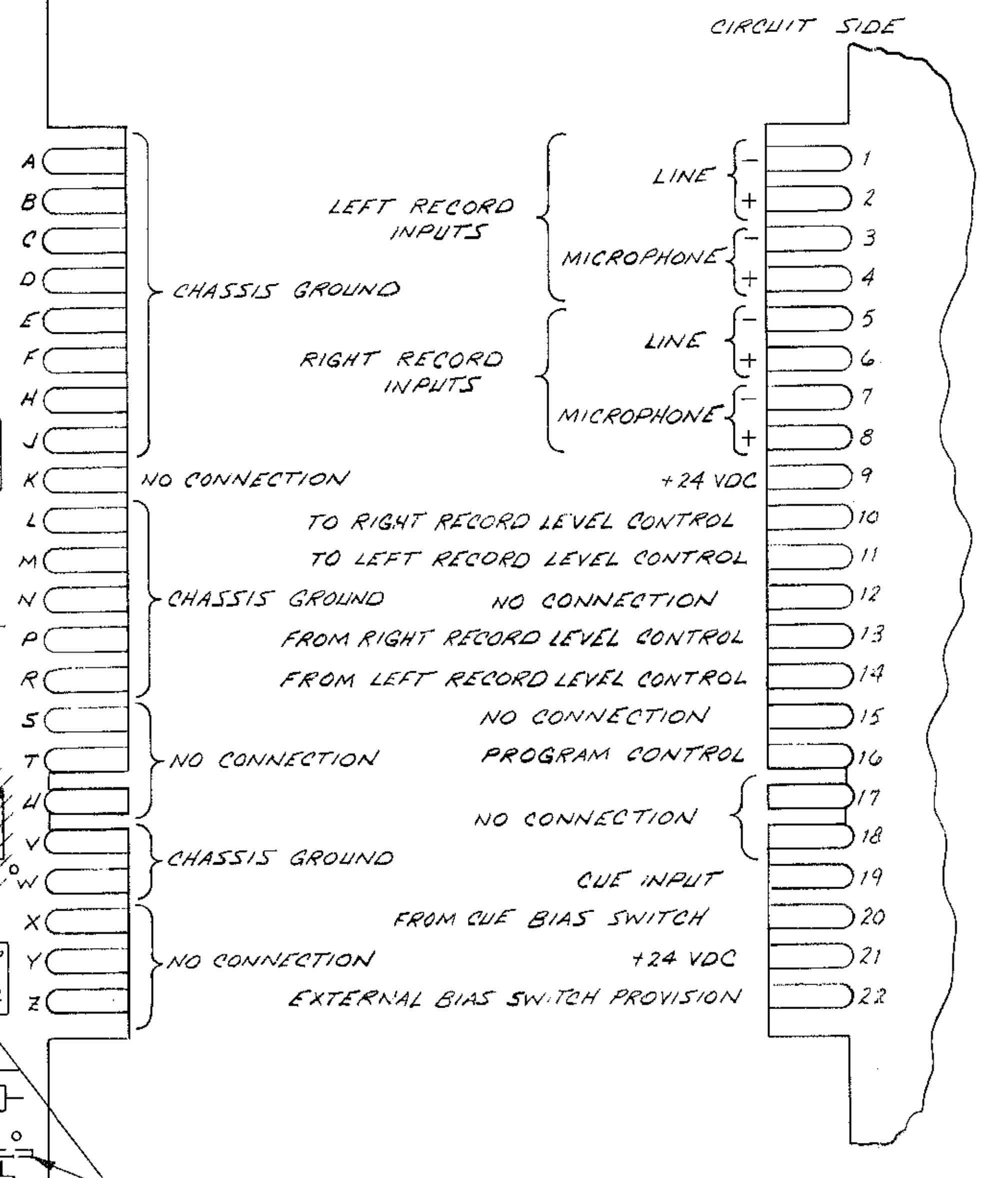


510-1050 (PCB BLANK)

ON MONO DELAY VERSION ONLY, USE TRANSISTOR MOUNTING PAD (#409-0005) FOR Q3; AND HEATSINKS (#455-2963) FOR Q9 AND Q10.

409-0005 (2 PLCS.)

PINS 1, 2 & 3 USED ONLY ON MONO DELAY VERSION (#910-1048) (SEE NOTE # 3.)

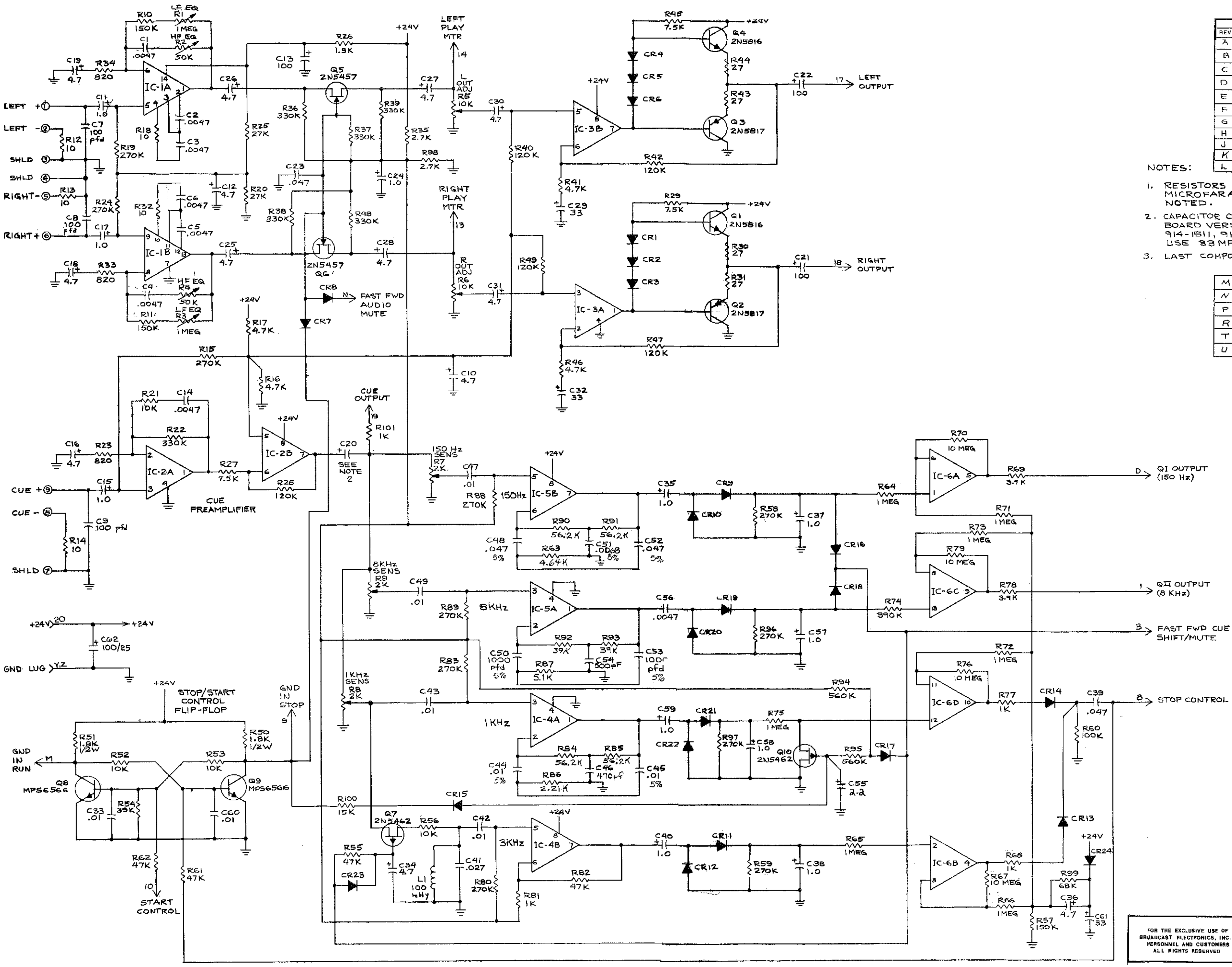


NOTES:

1. FOR 910-1050, 910-1050-001 (STEREO), USE ALL PARTS.
2. ////// - INDICATES COMPONENTS NOT USED ON 910-1049, 910-1049-001, (MONO).
3. FOR 910-1048 (MONO DELAY), USE PINS 1, 2 & 3 ; DO NOT USE COMPONENTS INDICATED IN NOTE #2.
4. SEE B/M # 910-1050 (STEREO)
   # 910-1050-001 (STEREO)
   # 910-1049 (MONO)
   # 910-1049-001 (MONO)
   # 910-1048 (MONO DELAY)
5. SEE SCHEMATIC # SD 910-1050; 910-1050-001; 910-1049; 910-1049-001; 910-1048.

TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY MERKEL 7-31-84	MATERIAL	BROADCAST ELECTRONICS INC. 4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL 62305 217/224-9600 TELEX 250142 CABLE BROADCAST
CHKD		
ME	FINISH	TITLE PCB ASSEMBLY - RECORD AMP BIAS
PROJ. ENGR.		TYPE A · SIZE C · DWG. NO. 910-1050; 910-1050-001; 910-1049; 910-1049-001; 910-1048 · REV G
MFG.	NEXT ASSY.	MODEL 3000 SERIES · SCALE 2/1 · SHEET 1 OF 1



REV	DESCRIPTION	DATE	APPROVED
A	ADDED R100, C61 & CR11	4/2/75	
B	PER ECN #497	5-19-75	
C	PER ECN #543	7/16/75	
D	PER ECN #671	12-16-75	
E	PER ECN #684	1-7-76	
F	PER ECN #738	3/30/76	
G	PER ECN #866	9-8-76	
H	PER ECN #1247	7-13-78	MH
J	PER ECN #1560	1-5-79	MH
K	PER ECN #1715	5-16-79	GH
L	PER ECN # 3388 ORF	4-15-82	

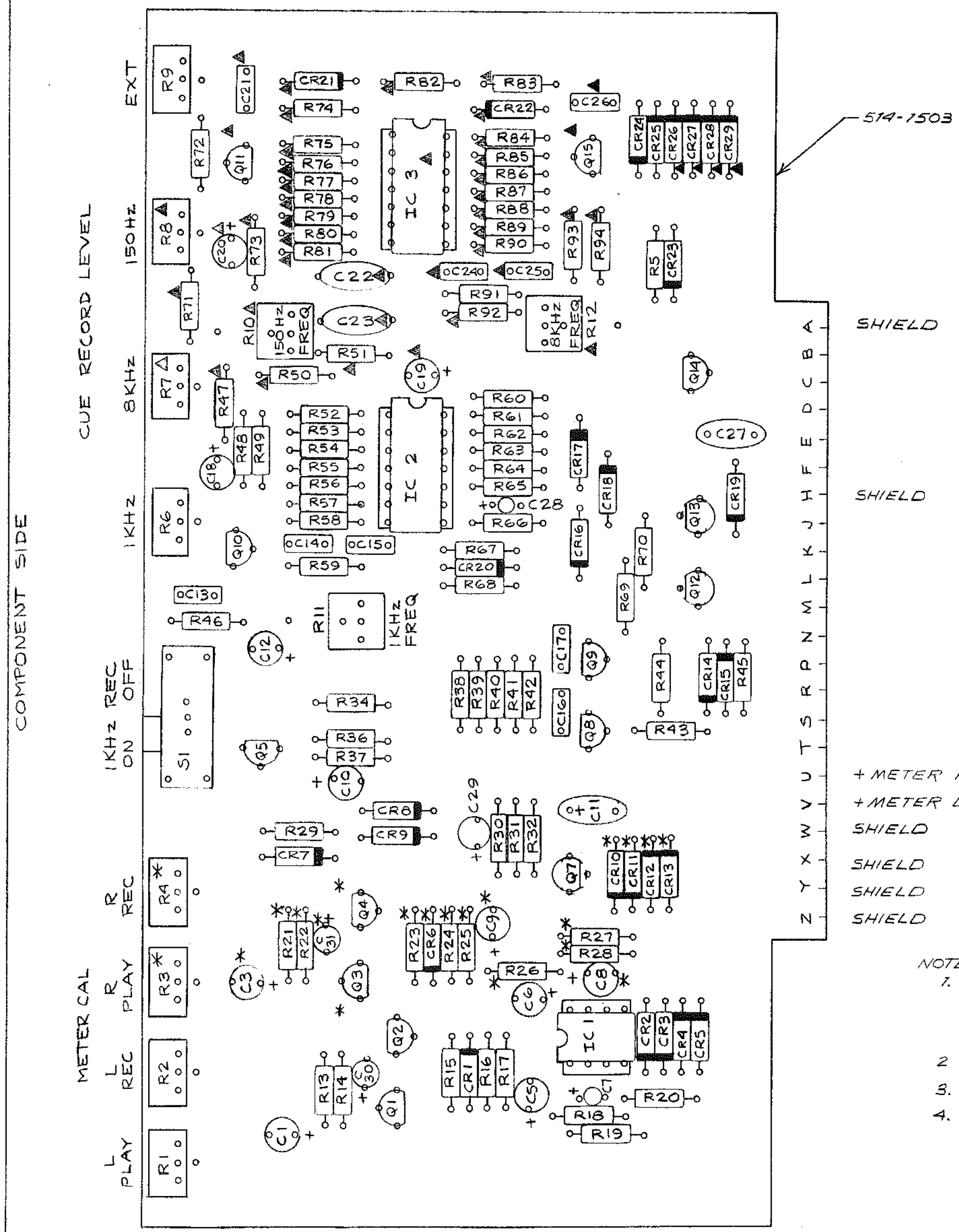
NOTES:

1. RESISTORS IN OHMS, 1/4 WATT; CAPACITORS IN MICROFARADS; DIODES 1N457, UNLESS OTHERWISE NOTED.
2. CAPACITOR C20 VALUE VARIES DEPENDING UPON BOARD VERSION. 4.7MFD IS USED WITH 914-1501, 914-1511, 914-1541, & 914-1551. ALL OTHER VERSIONS USE 33MFD.
3. LAST COMPONENTS USED: R101, C62, CR11, Q10, IC-6 & L1.

M	PER ECN #3547 ORF	6-17-82	CWK
N	PER ECN #3690 M.M.	8-4-82	CWK
P	PER ECN # 4325 JAH	6-21-82	JLT
R	PER ECN # 4420 ORF	8-4-83	JLT
T	PER ECN # 4540 JAH	10-10-83	MH
U	PER ECN 4668 LEF	11-21-83	JLT

SEE P C ASSY DWGS # D-914-1501, -1511, -1521, -1531, -1541, -1551, -1561, & -1571

DRAWN BY MSB	DATE 4/1/75	BROADCAST ELECTRONICS INC. — A FILMWAYS COMPANY —	
CHECKED BY	DATE	TITLE SCHEMATIC PLAYBACK LOGIC PCB	
PROJECT ENGR MIA	DATE 4/17/75	D	DWG NO. 906-3111
APPROVED BY		3000 SERIES	SCALE — SHEET 1 OF 1
TREATMENT OR FINISH —			



Pin	Component side	Circuit side	Pin
A	SHIELD	EXTERNAL CUE IN	1
B		150 Hz CUE CONTROL	2
C		8 KHz CUE CONTROL	3
D		EXTERNAL CUE CONTROL	4
E		CUE BIAS SWITCH	5
F		BIAS OSCILLATOR SWITCH	6
H	SHIELD	CUE OUT	7
J		STOP SWITCH	8
K		RECORD LAMP & PROGRAM CONTROL	9
L		FAST FORWARD/RECORD INTERLOCK	10
M		GND IN RUN	11
N		RECORD SWITCH	12
P		BLANK	13
R		1 KHz RECORD INTERLOCK	14
S		GND	15
T		+24 V	16
U	+METER RIGHT	-METER RIGHT OUT	17
V	+METER LEFT	-METER LEFT OUT	18
W	SHIELD	RIGHT RECORD METER IN	19
X	SHIELD	RIGHT PLAYBACK METER IN	20
Y	SHIELD	LEFT RECORD METER IN	21
Z	SHIELD	LEFT PLAYBACK METER IN	22

NOTES:
1. PART NUMBER & B/M 914-1503 – MONOPHONIC
   " " " " 914-1513 – MONOPHONIC W/Q TRIPS
   " " " " 914-1523 – STEREOPHONIC
   " " " " 914-1533 – STEREOPHONIC W/Q TRIPS
2. * ITEMS NOT USED WITH MONO VERSIONS 914-1503 & 914-1513.
3. ▲ ITEMS NOT USED WITH STANDARD VERSIONS 914-1503 & 914-1523.
4. SEE SCHEMATIC D906-3112.

TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL 2 PL ±.01 3PL ±.005
FRACTIONAL ±1/64
ANGULAR ± 1°
SHARP EDGES TO
BEND RADII
FILLET RADII

MATERIAL

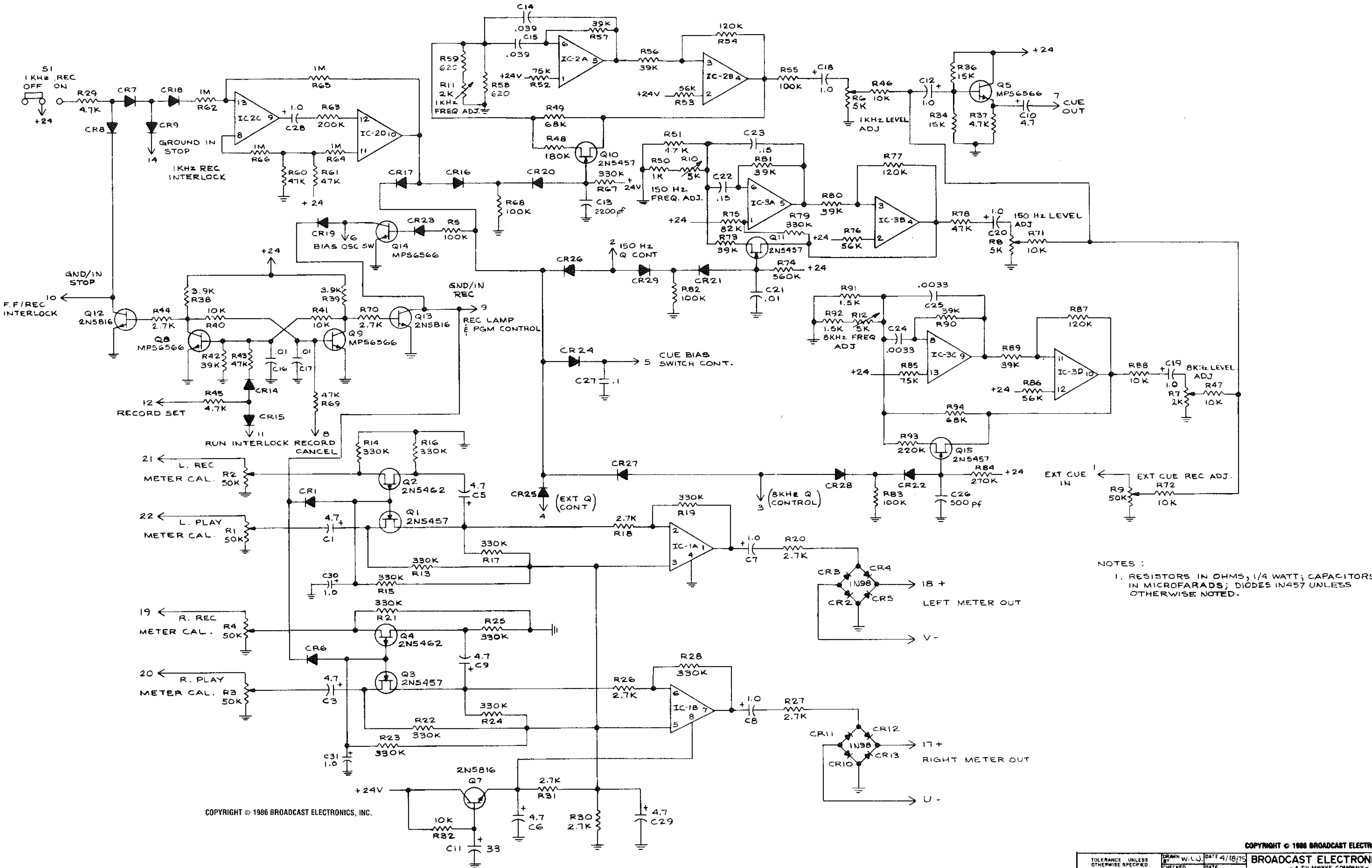
DRAWN BY N.L.J. DATE 2/24/75
CHECKED BY DATE
PROJECT ENGR. DATE
APPROVED BY
TREATMENT OR FINISH

BROADCAST ELECTRONICS INC.
—A FILMWAYS COMPANY—

TITLE RECORD CONTROL & TONE GENERATOR

C DWG. NO. 914-1503, 1513, 1523, & 1533 REV K

3/5000 SERIES SCALE 2/1 SHEET 1 OF 1

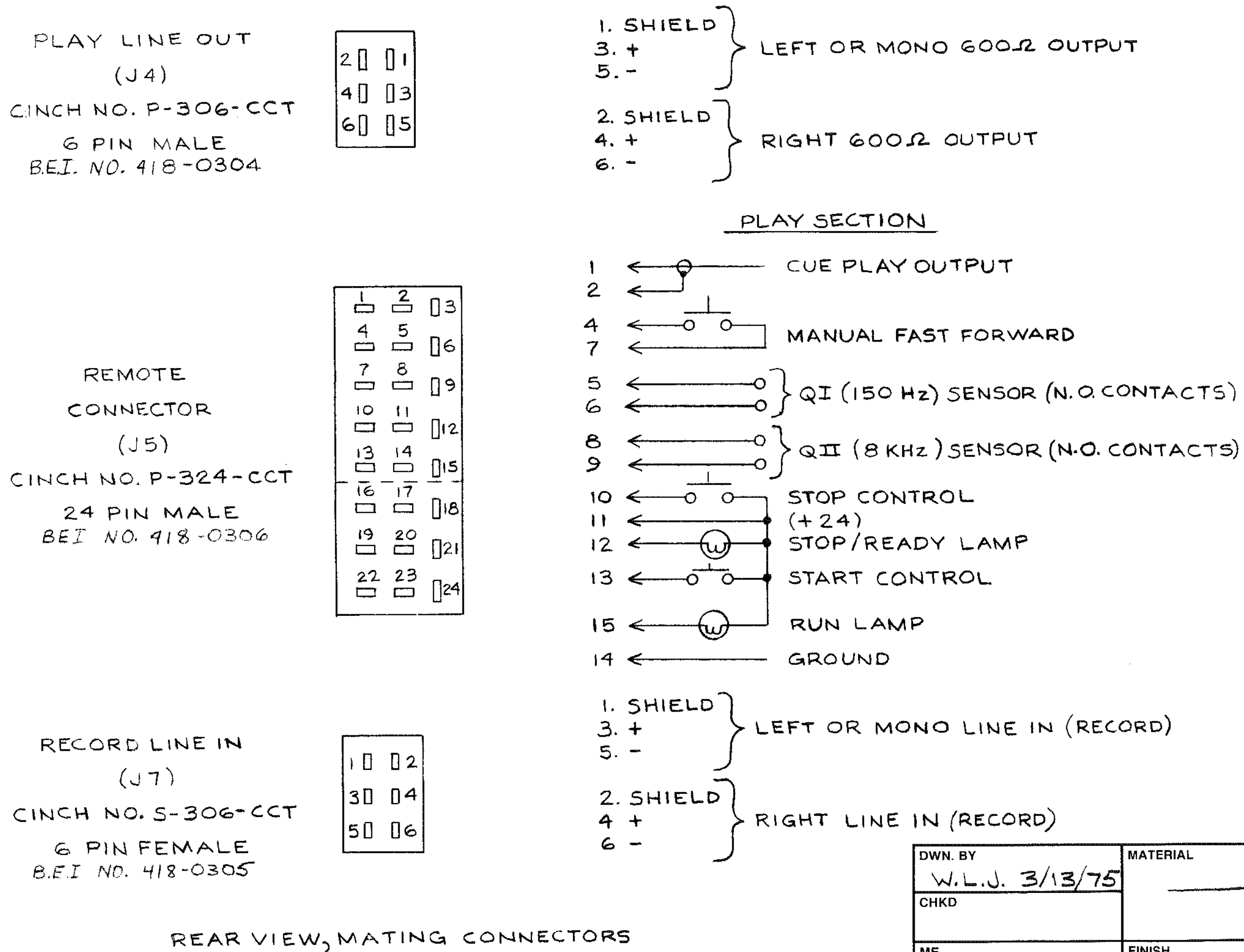


NOTES :

1. RESISTORS IN OHMS, 1/4 WATT; CAPACITORS IN MICROFARADS; DIODES 1N457 UNLESS OTHERWISE NOTED.

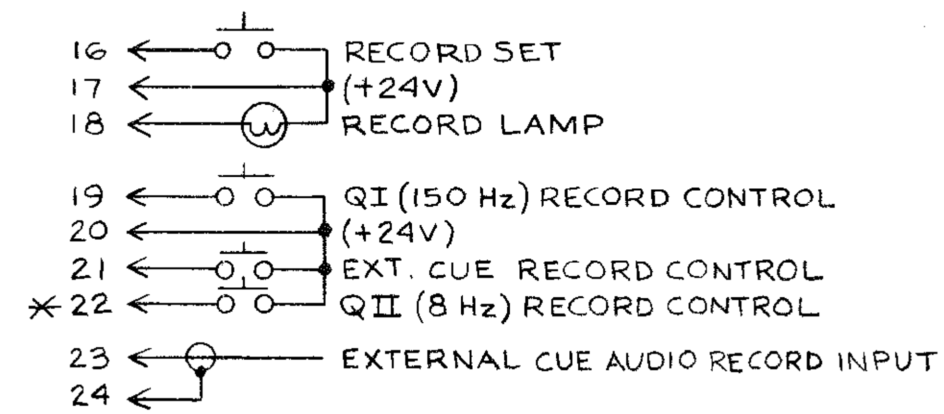
TOLERANCE UNLESS OTHERWISE SPECIFIED DECIMAL 2 PL ±.01 3 PL ±.005 FRACTIONAL ± 1/64 ANGULAR ± 1° SHARP EDGES TO BEND RADII FILLET RADII	DRAWN BY W.L.J. DATE 4/18/75 CHECKED BY DATE PROJECT ENGR DATE APPROVED BY	BROADCAST ELECTRONICS INC. - A FILMWAYS COMPANY - TITLE (SCHEMATIC) RECORD LOGIC TONE GENERATOR
MATERIAL —	TREATMENT OR FINISH —	D DWG NO 906-3112 REV F 3000 SERIES SCALE SHEET 1 OF 1

REV A - ECN 890



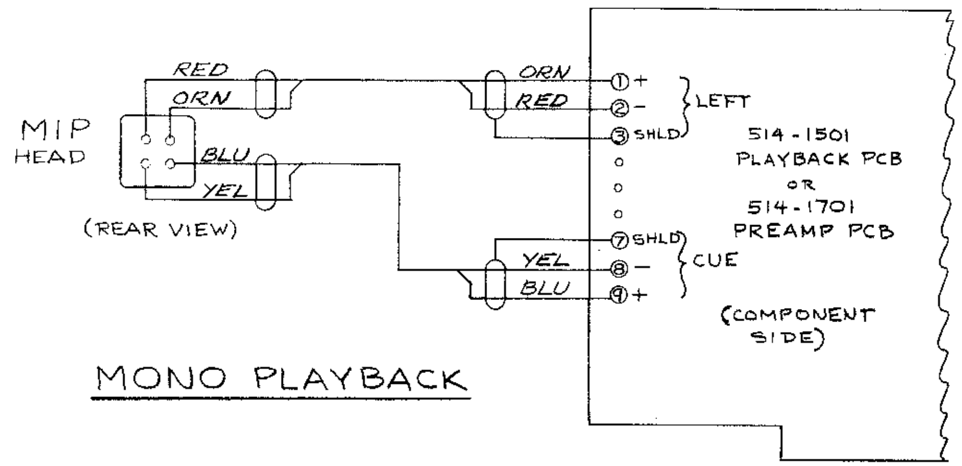
NOTES:
1. ANY 24V PIN (11 PLAY; 11, 17 & 20 RECORD/PLAY) MAY BE USED AS COMMON FOR ALL CONTROLS & LAMPS IF DESIRED.
2. ALL LAMPS 28V, .05A OR LESS.
3. QI & QII CONTACTS RATED 5.0A RESISTIVE, 120V RMS OR 28VDC. AVOID EXCESSIVE CURRENT INTERRUPTION TO AVOID NOISE.
4. CUE OUTPUT LOAD 1.5KΩ MINIMUM. CUE INPUT IMPEDANCE APPROX. 50KΩ UNBALANCED.

RECORD SECTION

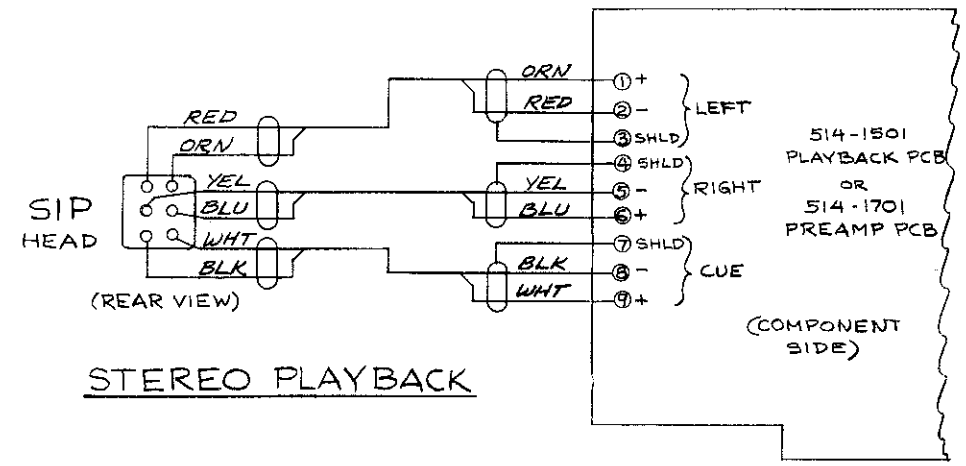


* IN DELAY UNITS THIS PIN BECOMES DELAY SET.

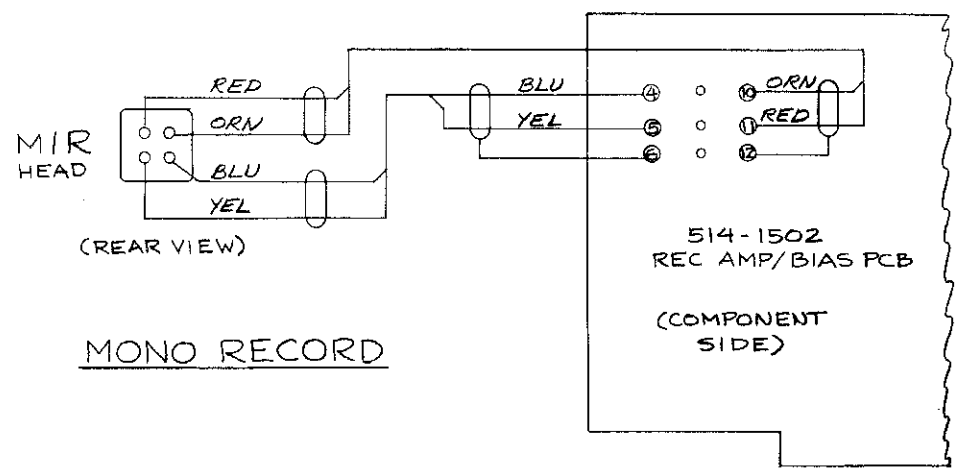
DWN. BY W.L.J. 3/13/75	MATERIAL —	BROADCAST ELECTRONICS INC. 4100 N. 24TH ST. QUINCY, IL 62305 217/224-9600 TELEX 250142 CABLE BCST ELECT QUI
CHKD		TITLE REAR PANEL CONNECTOR WIRING
ME	FINISH —	TYPE W · SIZE B · DWG. NO. 906-3104 · REV A
PROJ. ENGR.		
MFG.	NEXT ASSY. —	MODEL 3000/4000 · SCALE — · SHEET 1 OF 1



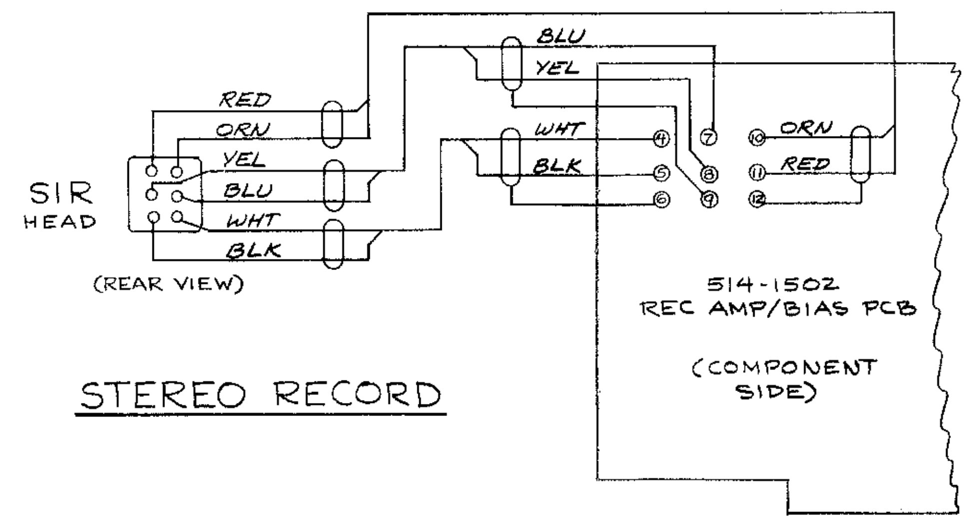
MONO PLAYBACK



STEREO PLAYBACK



MONO RECORD



STEREO RECORD

ITEM	QTY RQD	PART NUMBER	DESCRIPTION	NOTE

LIST OF MATERIAL

TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL 2 PL=.01 3PL=.005
FRACTIONAL ± 1/64
ANGULAR ± 1°
SHARP EDGES TO
BEND RADII
FILLET RADII

DRAWN BY MSB	DATE 9/7/76	
CHECKED BY	DATE	
PROJECT ENGR	DATE	
APPROVED BY		

MATERIAL

TREATMENT OR FINISH

BROADCAST ELECTRONICS INC.
- A FILMWAYS COMPANY -

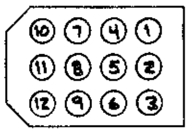
TITLE HEAD LEAD TO PCB WIRING

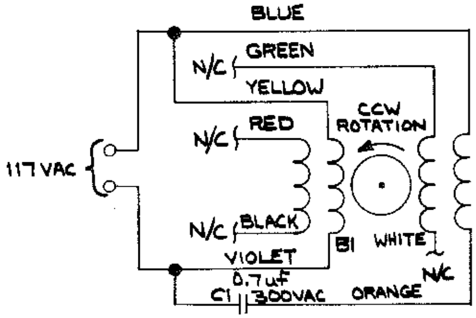
C DWG NO. 906-3140 REV

3000 & 4000 SERIES SCALE 1/1 SHEET 1 OF 1

REV.	DESCRIPTION		DATE	APPROVED
A	PER ECN 4457	JAH	8-8-83	JL

MATING SIDE OF MOTOR PLUG
SOCKET PART NO. 418-1271
PINS PART No. 417-0053

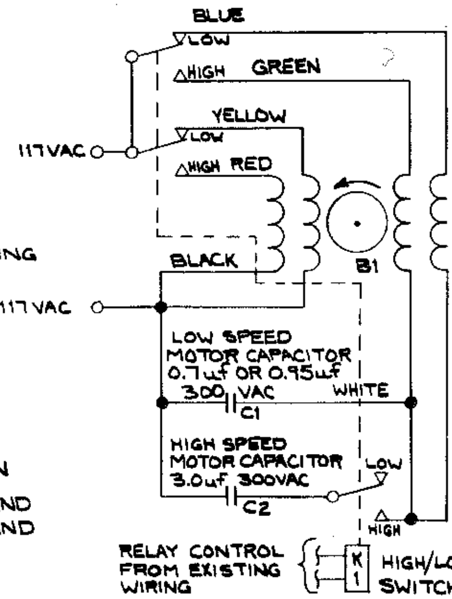




MOTOR START CAPACITOR

WIRING CONNECTIONS FOR SINGLE SPEED EQUIPMENT. CCW ROTATION VIEWING SHAFT END.

NOTES:
1. N/C = NO CONNECTION
2. GREEN, WHITE, RED AND BLACK WIRES CUT AND INSULATED



WIRING CONNECTIONS FOR EQUIPMENT WITH MANUAL AND/OR AUTOMATIC FAST FORWARD. CCW ROTATION VIEWING SHAFT END.

NOTE:
1. * JUMPER NORMALLY INSTALLED BETWEEN PINS 1 & 3. WHEN DECK MICROSWITCH IS USED TO TURN OFF MOTOR WHEN CART IS REMOVED, BREAK JUMPER & WIRE SWITCH BETWEEN PINS 1 & 3.

PIN	SINGLE SPEED	TWO SPEED
1	*	*
2	VIOLET	VIOLET
3	*	*
4	BLUE	BLUE
5	ORANGE	ORANGE
6	YELLOW	YELLOW
7	(OPEN)	GREEN
8		BLACK
9		RED
10		(OPEN)
11		WHITE
12	(OPEN)	(OPEN)

TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL 2 PL±.01 3PL±.005
FRACTIONAL ±1/64
ANGULAR ± 1°
SHARP EDGES TO
BEND RADII
FILLET RADII

MATERIAL ——

DRAWN BY JAH | DATE 2-14-83
CHECKED BY [initials] | DATE 2/14/83
PROJECT ENGR. | DATE
APPROVED BY

TREATMENT OR FINISH ——

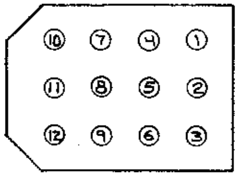
BROADCAST ELECTRONICS INC.

TITLE MOTOR WIRING DIAGRAM

B | DWG. NO. 959-0009 | REV. A

3000 CART. MACH. | SCALE — | SHEET 1 OF 1

MATING SIDE OF TRANSFORMER PLUG
SOCKET PART NO. 418-1271
PINS PART NO. 417-0053

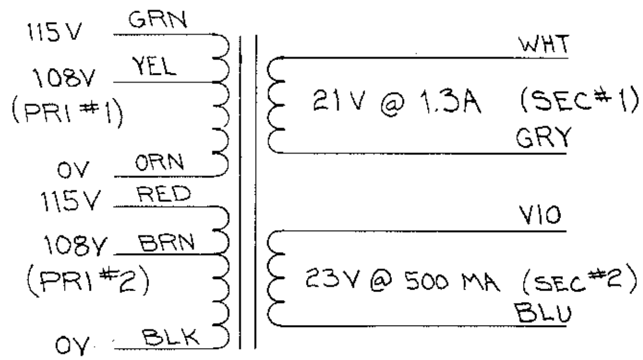


POWER TRANSFORMER (376-7656 & 376-7660 WIRING

PIN	120V	110V	240V	220V
1	VIO	VIO	VIO	VIO
2	BRN	RED	BRN	RED
3	BLK	BLK	BLK	BLK
4	BLU	BLU	BLU	BLU
5	ORN	ORN	(OPEN)	(OPEN)
6	RED	BRN	RED	BRN
7	WHT	WHT	WHT	WHT
8	}JUMPER	}JUMPER	(OPEN)	(OPEN)
9			ORN	ORN
10	GRY	GRY	GRY	GRY
11	YEL	GRN	YEL	GRN
12	GRN	YEL	GRN	YEL

REVISIONS

REV	DESCRIPTION		DATE	APPROVED
A	110V WAS 105V; 220V WAS 210V		6/27/75	
B	ECN 739 (DWG # WAS 906-3100)		3/30/76	
C	ECN 3024	JAH	10/21/81	
D	ECN 3898	JAH	10/28/82	JLT
E	ECN 4089	JAH	2/14/83	JLT
F	ECN 4889	RES	1-31-84	mH



ITEM	QTY RQD	PART NUMBER	DESCRIPTION	NOTE
REF.	1	376-7656	FM 600 SERIES AGC LIMITER AMP (120/240V)	
REF.	1	376-7656	3000 SERIES CART. MACH. PWR XMFR	
REF.	1	376-7660	5000 SERIES CART. MACH. PWR XMFR	

LIST OF MATERIAL

TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL 2 PL ±.01 3PL ±.005
FRACTIONAL ± 1/64
ANGULAR ± 1°
SHARP EDGES TO
BEND RADII
FILLET RADII

MATERIAL —

DRAWN BY MSD DATE 2/24/75
CHECKED BY DATE
PROJECT ENGR DATE
APPROVED BY

TREATMENT OR FINISH —

BROADCAST ELECTRONICS INC.
[redacted]

TITLE POWER XFMR WIRING

B DWG NO. 906-3136 REV F

SCALE — SHEET 1 OF 1

SECTION VIII
APPENDIX

8-1. INTRODUCTION.

8-2. This appendix lists data applicable to the operation and use of the Broadcast Electronics Series 3000 Cartridge Machine. The following information is contained in this section:

A. The NAB Tape Cartridge and Its Maintenance.

8

BROADCAST ELECTRONICS, INC.

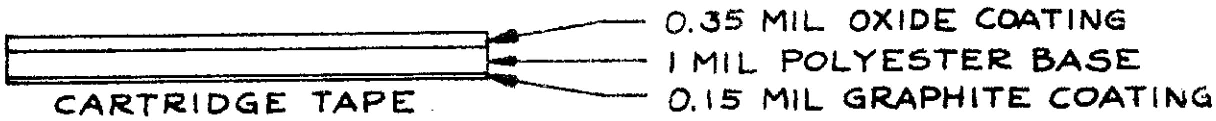
The NAB Tape Cartridge and Its Maintenance

THE NAB TAPE CARTRIDGE

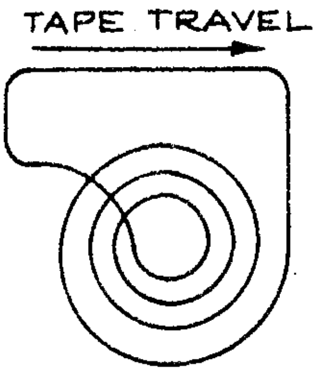
The National Association of Broadcasters (NAB) defines a cartridge as "a plastic or metal enclosure containing an endless loop of lubricated tape, wound on a rotatable hub in such a fashion as to allow continuous motion." Cartridges from the various manufacturers differ slightly in details, but all cartridges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

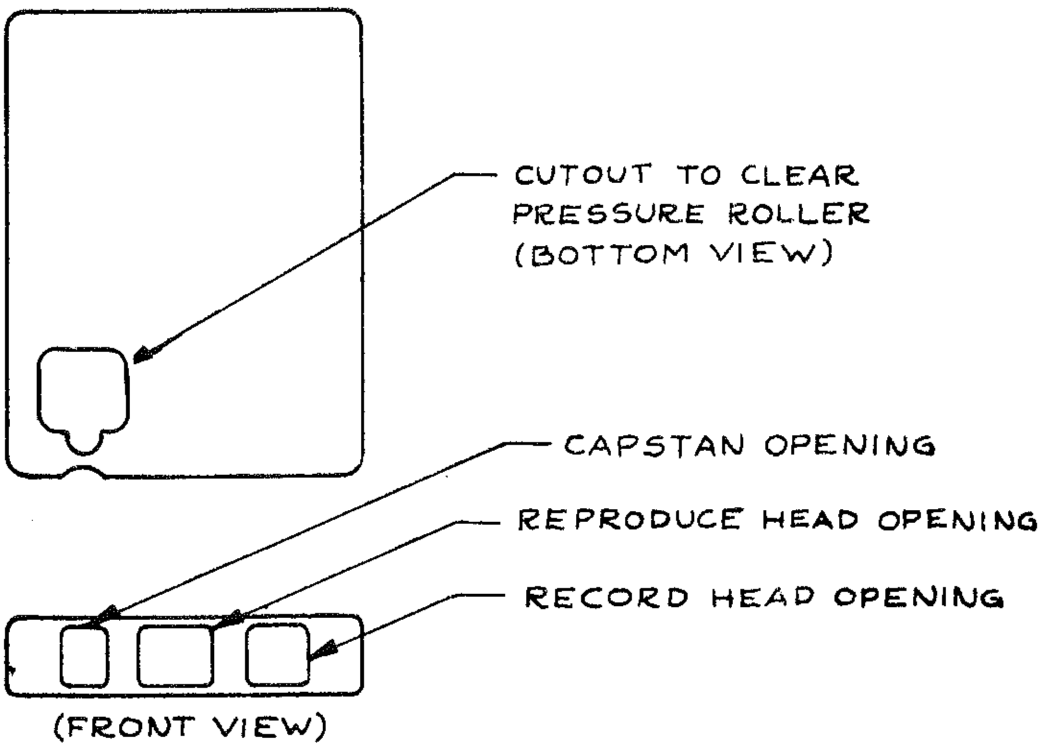


TAPE SPIRAL

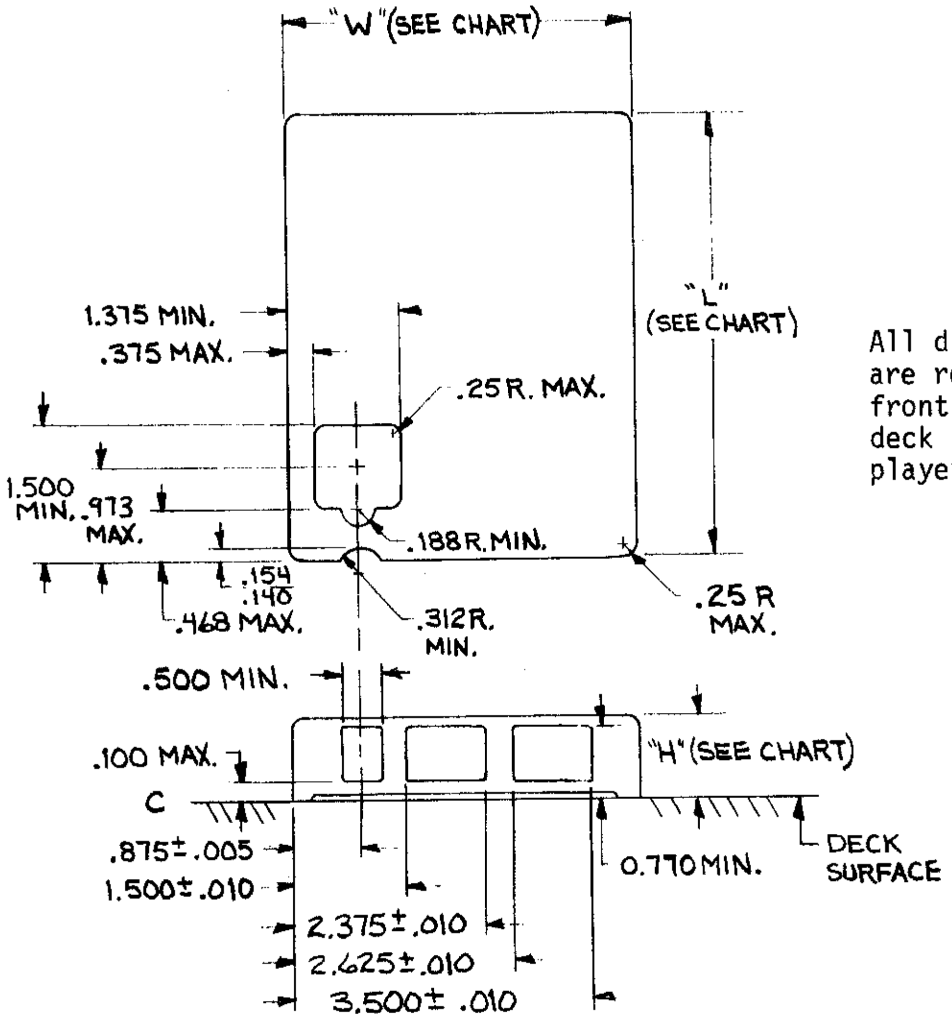
THE SHELL

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.



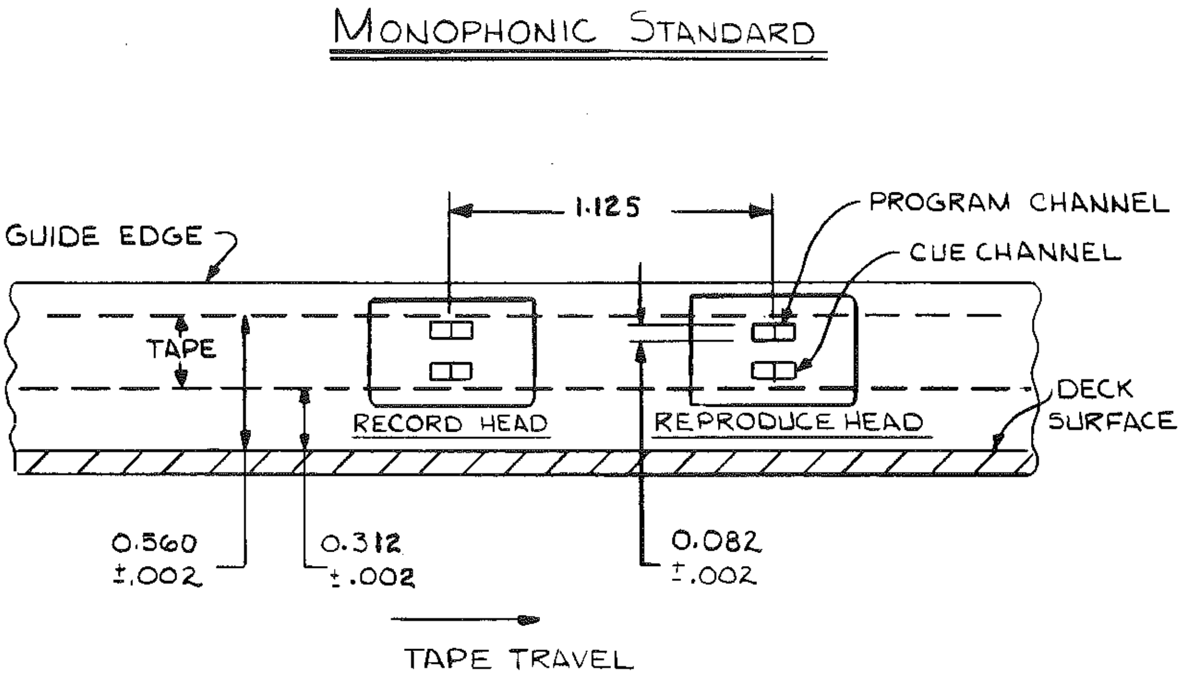
NAB tape cartridge dimension standards are presented in Figure 1 and NAB tape head dimension standards are presented in Figure 2.



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



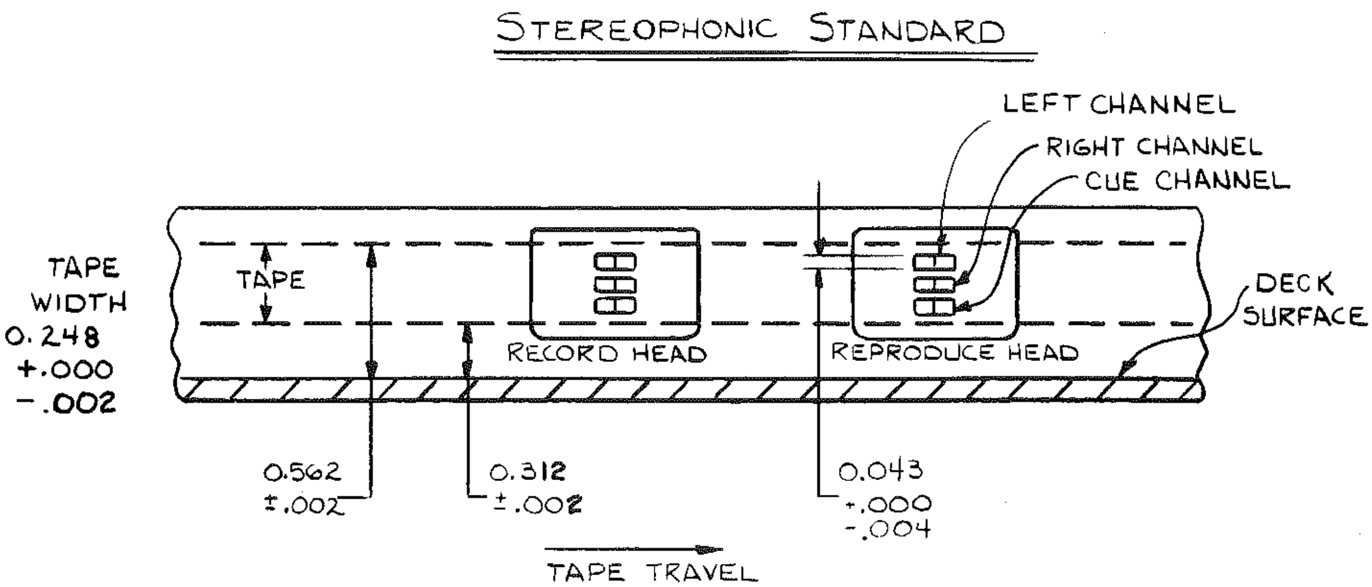
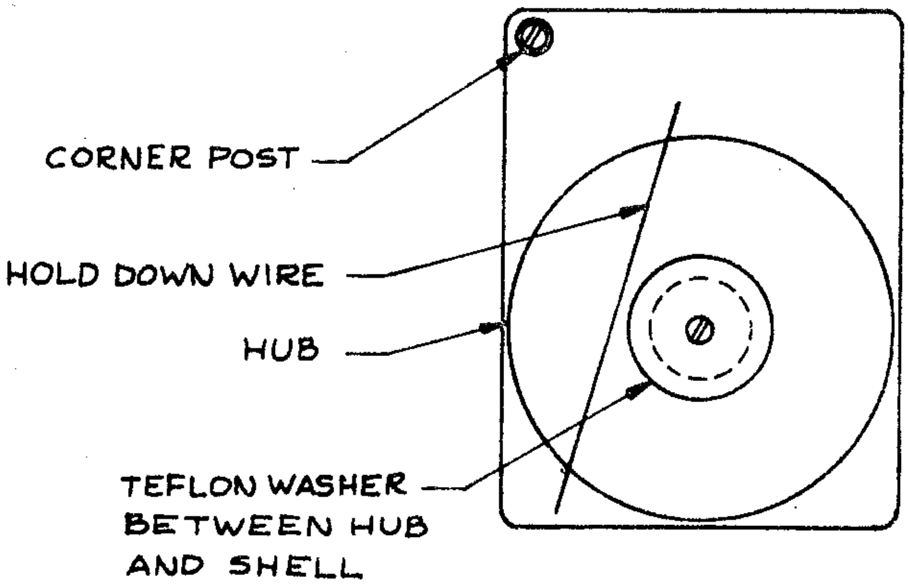


Figure 2. NAB TAPE HEAD DIMENSION STANDARDS

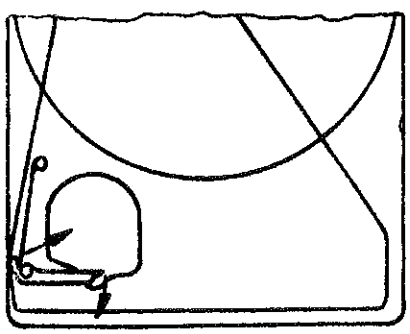
TAPE HUB, TEFLON WASHER, AND CENTER POST

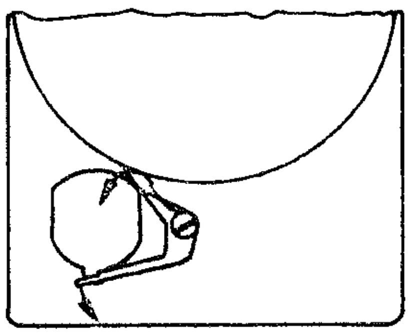
The tape hub stores the tape which is not passing by the cartridge openings. The hub is free to rotate around the center post. To allow free rotation, a teflon washer is used between the hub and the shell. Some means must be provided to keep the tape flat on the hub. A separate cover may fit over the 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.

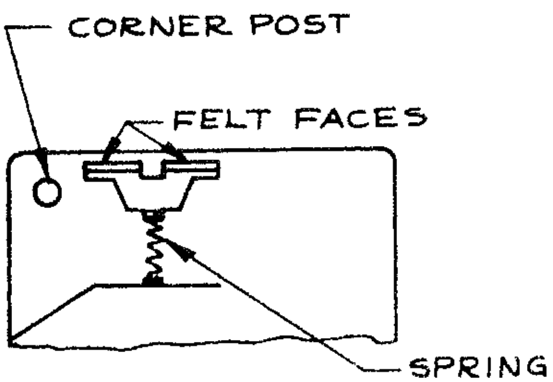


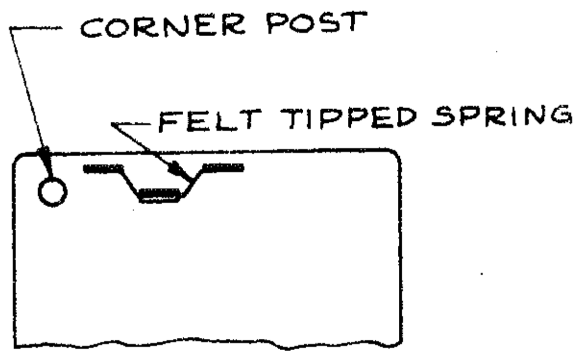


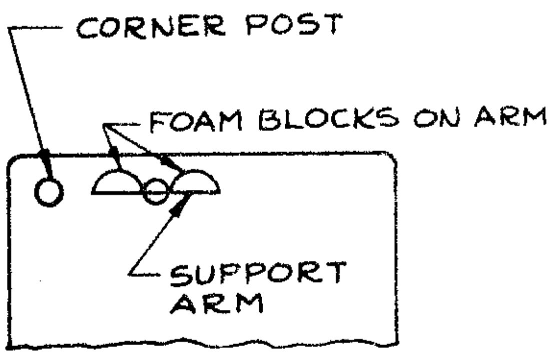
PRESSURE PADS

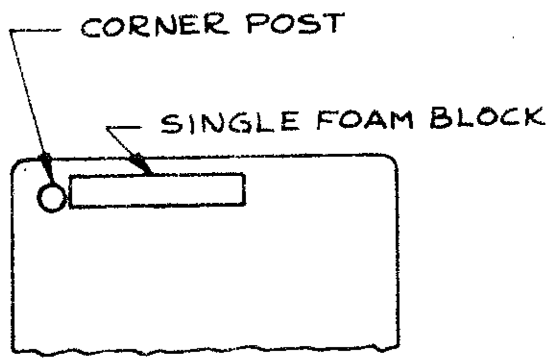
The pressure pads ensure the tape remains in contact with the heads. A foam plastic is the most commonly used material for the pressure pads. The compression of the foam provides pressure to wrap the tape slightly around the heads. Felt is less frequently used. To provide pressure on the tape, the felt 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.

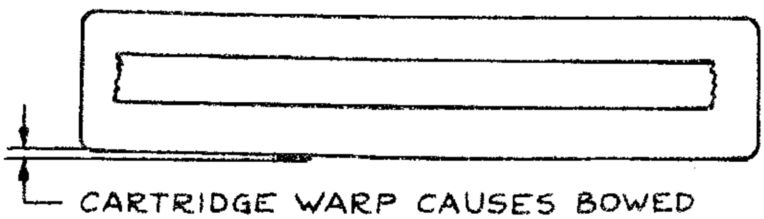
Proper tape tension is most critical. If the tension is too great, the tape will wear rapidly as it is squeezed against the hub, the pressure pads, the corner post, and the tape on the hub. If the tension is too light, the tape will not be pulled back into the hub.

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

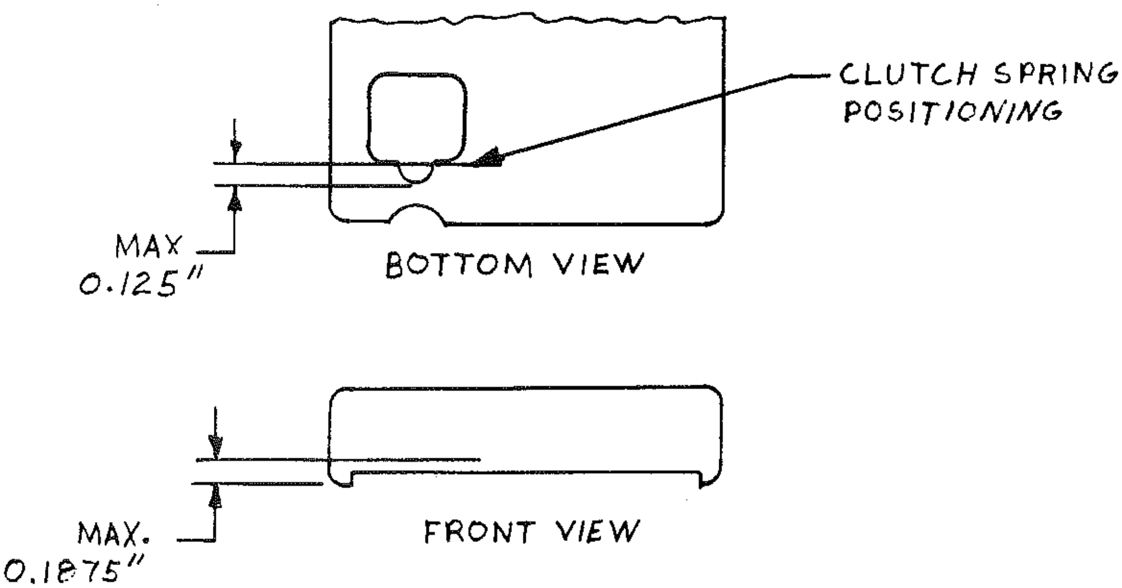
A deformed shell can adversely affect frequency response by distorting the tape path. In particular, a warped cartridge may cause the tape to traverse the head openings in an arc or bowed path rather than a straight line. Sometimes an ill-fitting top can spread the sides of the cartridge enough to cause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


CARTRIDGE WARP CAUSES BOWED PATH ACROSS HEADS - TAPE HIGHER ACROSS REPRODUCE HEAD THAN RECORD HEAD

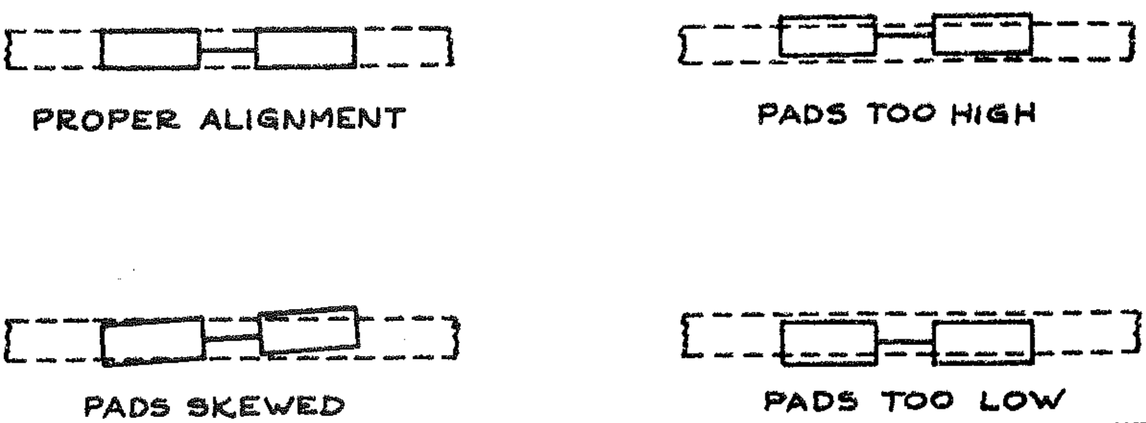
CLUTCH SPRING OR HUB BRAKE

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.



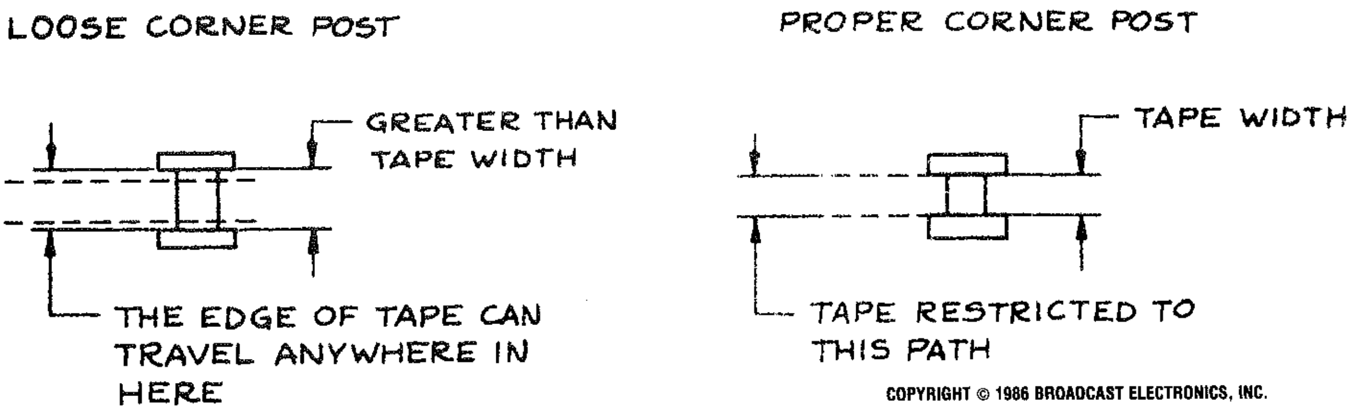
PRESSURE PADS

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.



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.



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^{0} 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 STEREOPHONIC 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.

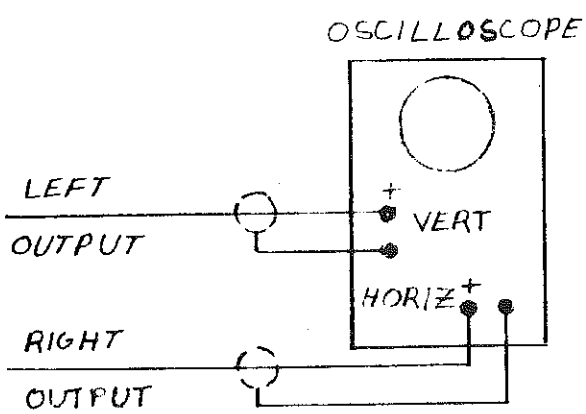
The most important characteristic of a cartridge for stereophonic use is the ability to consistently maintain the identical tape path each time the cartridge is inserted in the player. This allows reliable recording and subsequent accurate reproduction.

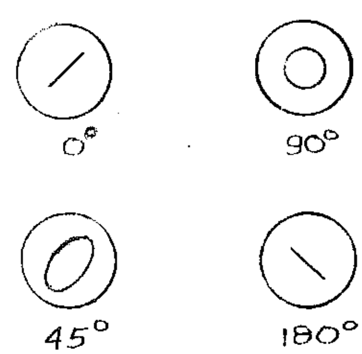
Cartridges used in a stereophonic system should initially be selected for phase repeatability using the phasing test outlined below. This test should be repeated on a regular basis throughout the life of the cartridge. A cartridge which fails this test should be discarded.

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 of 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.

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