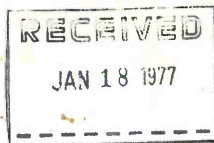


# Broadcast Electronics



**INSTRUCTION  
MANUAL**

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**SERIES 3000  
TAPE CARTRIDGE MACHINES**

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0157-176

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# ADDENDUM

## 3000 SERIES MANUAL

### 4.3 RECORD AMPLIFIER/BIAS BOARD

#### 4.3.1 Configurations

The Record Amplifier/Bias Board, installed only in record models, contains the program track record amplifiers, the record input transformers, the 100 KHz record bias oscillator, and the cue track record control. As shown in the table in Figure 18, separate versions are manufactured for monophonic and stereophonic machines. The assembly and its parts are shown in Figure 9. The schematic diagrams in Figure 8 shows the stereophonic version which incorporates two identical program amplifier circuits.

#### 4.3.2 Bias Oscillator

Transistors Q11 and Q12 form a push-pull oscillator providing a 100 KHz sine wave voltage. The primary of T3 and C39 form a tuned circuit resonant at 100 KHz. Positive feedback is provided by C24 and C25. To ensure smooth cut-off and minimize distortion, negative feedback is supplied to the non-conducting transistor by C26. Bias voltages for the transistors are supplied by R55, R56, R58, R61. Emitter dropping resistors R54 and R57 provide a small amount of negative feedback to maintain purity of the 100 KHz output.

Transistor Q13 controls the oscillator. When the base of Q13 is grounded through CR1 to the record flip flop, Q13 turns on to supply +24 VDC to the oscillator. To minimize starting transients, C23 provides a gradual turn-on. The oscillator runs whenever the unit is in the record mode.

To provide isolation and minimize cross talk, the secondary of T3 is divided into two parts. Bias for the program tracks is taken from transformer terminal 5; bias for the cue track is taken from terminal 7.

#### 4.3.3 Program Track Record and Bias Control Circuitry

The rear panel line and microphone input jacks are connected to separate windings of T1 (T2). The secondary of the transformer is directly coupled to the input of the preamplifier IC-1A (IC-1B). Gain in this stage is switchable 0 dB (LO) for use with line level sources or 35 dB (HI) for microphone input. The gain is determined by R15 (R17) and R14 (R16) as selected by S1. The frequency response of the pre-amplifier is flat. Bias is provided from the voltage divider R18, R19, C3.

The output of IC-1A (IC-1B) is coupled through C4 (C5) to the front panel record level control. The output of the level control is returned to the Record Amplifier/Bias Board and to the VU meter amplifier (on the Record Control and Generator Board Signal is coupled through C11 (C12) to booster amplifier IC-2A (IC-2B) which supplies an additional 32 dB of gain as determined by R24 (R21) and R25 (R26). Bias for IC-2A (IC-2B) is supplied through R22 (R23).

Following amplification, the signal is coupled through C13 (C10) to the record equalizer. The record equalization network is composed of R5 (R4), R30 (R29), R31 (R32), R27 (R28), C15 (C14). The high frequency trimmer R5 (R4) permits adjusting the equalization for the individual head, type of tape used, and the various standards (NAB, IEC, CCIR, etc.).

The equalized signal is coupled through C17 (C16) to the head driver amplifier Q2 (Q3). This stage provides sufficient current to drive the record head. The amplified signal is coupled through C32 (C33), R39 (R42) to the program record control FET Q4 (Q5). This P channel FET is held off by voltage supplied to the gate through R47 and R49. When the unit is in the record mode, the gate grounds to the record flip flop through CR6. The FET conducts to allow the program signal to reach record head. At all other times the signal is shut off.

Following the FET, the program signal is coupled through the bias trap C35 (C38). L1 (L2) which prevents the high level bias from overloading the record amplifiers. The variable inductor permits tuning the bias trap to the exact frequency of the bias oscillator. Following the bias trap, the audio signal is mixed with the bias supplied through R3 (R2) and R64 (R63). The variable bias control permits adjusting the bias level for optimum recording from the particular tape used.

To prevent bias from appearing on the program track of the record head except in the record mode, the switching circuit Q8, Q6 (Q7) is installed. When Q6 (Q7) is conducting C28 (C29) shunts the bias to ground. The base of Q6 (Q7) is connected through zener diode CR3 (CR4) and R46 (R45) to +24 VDC to permit Q6 (Q7) to conduct. In the record mode the base of Q8 is drawn towards ground through CR5 to the record logic. Transistor Q8 begins conducting to bring down the base of Q6 (Q7) to shut this device off and to restore the bias. When the record logic is not in the record, the base of Q8 is held high through R50 and R51 to keep Q8 turned off. The bias is again shunted as Q6 (Q7) is held in conduction.

Transistor Q1 in conjunction with C7 and C6 provide noise decoupling for +24 VDC supply for the record amplifiers.

#### 4.3.4 Cue Circuitry Bias Control

The audio signal for the cue track is supplied from the Record Control and Tone Generator Board to terminal 19. The audio is coupled through the bias trap (C37, L3, C40) as in the program circuitry. The audio is mixed with the bias from R1, R62 and supplied to the cue track of the record head. As in the program circuitry switching transistors Q9 and Q10 are employed to shunt the bias except when cue tones are actually being recorded. When Q10 is conducting, the bias is shunted. When Q10 is turned off by Q9 drawing the base of Q10 low, the bias is supplied to the head.

Transistor Q9 is turned on by a positive voltage supplied to its base through R52. This voltage is supplied by the cue bias switch control on the Record Control Cue Generator Board when any of the cue generators are running or when the external cue record is activated.

#### 5.5.4 Program Record Adjustments

##### 1. Bias Trap Tuning

Disconnect the AC power and mount the Record/Amplifier Bias printed circuit board on the 919-1703 extender card. Referring to the assembly diagram (Figure 9), connect an oscilloscope to test point L. Reconnect the AC power and place the unit in the record mode. With a non-metallic screwdriver, tune L1 for minimum 100 KHz signal as observed on the oscilloscope. In stereo units, reconnect the oscilloscope to test point R and tune L2. When finished, disconnect the AC power, remove the extender board, remount the Record Amplifier/Bias Board in the unit, and replace the card cage cover.

##### 2. Program Bias Level

#### Note

The bias supplied to the record head is most important in providing optimum frequency response and distortion. Bias requirements vary between brands of tape (and between series of one brand). If more than one type of tape is in use, check the performance of each type at its optimum bias level against its performance at the optimum bias level of other types. Where older and newer types are both in use (such as 3M154 and 3M156), bias just less than the optimum for the newer type usually is an acceptable compromise.

Load a bulk-erased cartridge in the unit. Connect an audio signal generator to the line record input. Set the generator for 1,000 Hz at a level of 0.5V. Adjust the record level control for -10 VU on the front panel meter. Connect an oscilloscope to the output and begin recording. Observe the oscilloscope and adjust the BIAS LEVEL L and R controls for the peak output with no distortion of the 1,000 Hz wave form.

##### 3. VU Meter Calibration

While recording the 1,000 Hz tone, adjust the record level control until the external meter indicates the output level set in 5.5.2. Now adjust the METER CAL R REC and L REC so that the front panel VU meter indicates 0 VU.

##### 4. Record Equalization

Set the signal generator for 15 KHz and reduce the generator output level 10 dB. DO NOT ADJUST THE FRONT PANEL LEVEL CONTROL. While recording the 15 KHz tone, adjust the REC EQ L and R for 10 dB below the output level set in 5.5.2.

## 5.5.5 Cue Record Adjustments

### 1. Bias Trap Tuning

Referring to Step 1 of 5.5.4 connect an oscilloscope to test point Q on the Record Amplifier Board. Referring to Figure 2, activate the external cue record control by connecting remote control terminal 21 to 20. With a non-metallic screwdriver, tune L3 for minimum 100 Hz signal as observed on the oscilloscope.

### 2. Cue Bias Level

Connect an audio signal generator to the external cue input and reconnect the oscilloscope to the cue playback output (refer to Figure 2). Set the generator for 1,000 Hz at a level 10 dB below the reference amplitude determined in Step 1 of 5.5.3. Load a bulk-erased cartridge in the unit, activate the external cue record control, and begin recording the 1,000 Hz tone from the signal generator. Observing the oscilloscope, adjust the BIAS LEVEL Q control for the peak output with no distortion of the 1,000 Hz wave form.

### 3. Cue Tone Record Level

Deactivate the external cue record control and the signal generator. Adjust the CUE RECORD LEVEL controls while recording the cue tones, for the reference amplitude determined in Step 1 of 5.5.3. The internal 1 KHz generator is activated each time the unit starts in the record mode. The optional QI 150 Hz and QII 8 KHz generators are activated by depressing the appropriate front panel switch. To set the external cue record level, supply tone to the external cue input and activate the external cue record control.

### 4. Cue Tone Generator Frequency

The frequency of the 1 KHz, optional QI 150 Hz, and optional QII 8 KHz cue generators are adjusted by trimmers R11, R10, and R12 on the Record Control and Tone Generator Board. These controls are set at the factory and should not require subsequent adjustment.

# INSTRUCTION MANUAL

## SERIES 3000

### TAPE CARTRIDGE MACHINES

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# SECTION 1 INTRODUCTION

## 1.1 GENERAL DESCRIPTIONS AND FEATURES

The SERIES 3000 cartridge machine is the first SPOTMASTER® series to incorporate an automatic release deck. Use of a large air damped solenoid and a rugged machined deck surface ensure continuous trouble-free operation.

Total power consumption is low, so the SERIES 3000 is the coolest running unit in the industry. An efficient hysteresis synchronous drive motor and power conserving solenoid circuit keep total consumption to less than 45 watts. There is no excessive heat build-up to damage tape while still offering direct tape drive and optional fast forward.

SPOTMASTER quality construction is standard with the SERIES 3000. All components are chosen for proven dependability. Modern integrated circuits are extensively used in the electronics, and card edge connectors include gold plated contacts, with all audio sections internally shielded.

The SERIES 3000 incorporates the unique PHASE-LOK III head bracket. SPOTMASTER continues to offer the only head mount with independent azimuth adjustment to assure extremely tight control of stereo phasing while permitting easy adjustment.

The SERIES 3000 is available in a full range of mono and stereo models to fit all size cartridges. Units can be desk-top or rack mounted.

Model 3100 is available in mono or stereo playback units which accept A size cartridges. Three 3100 models can be placed in a 19" rack.

Model 3200 is available as playback only or record/playback in either mono or stereo. The 3200 accepts both A and B cartridges so that two units mount in a 19" rack.

Model 3300 is available in the same configurations as the 3200 but accepts A, B, and C cartridges. A 3100 player may be mounted next to the 3300 in the rack configuration.

The list of standard features in the SERIES 3000 underscores the thought which went into its design. Balanced transformer output is provided on all models. Full remote control is provided at a rear panel socket with mating connectors supplied for all interconnections. FET output switching is built-in to permit easy paralleling of machines.

Our options for the SERIES 3000 are impressive, too. Secondary 150 Hz (QI) and tertiary 8 KHz (QII) cue tones are available as a pair in record or playback models. The QI tone installed in units equipped with fast forward provides automatic fast cueing at the end of message. The fast forward option is available in all models. Alternate tape speeds and line voltage/frequency standards are also available. In record models, provision for microphone input is available.

Reliability is the result of the careful design and cool operation of the Series 3000. Yet maintenance requirements were taken into consideration. Readily available, multiple source components are used. Adjustments are accessible. Modular construction is employed throughout, including the motor and power transformer.

Accessories for the Series 3000 include a tape fault/splice detector (BEFSD-200) which can be permanently connected to two SERIES 3000 units. Remote control panels are also available.

## 1.2 SPECIFICATIONS

Record/Playback Equalization:	NAB Standard ( $\infty$ , 50 $\mu$ sec)
Tape Velocity:	7.5 in/s (19.05 cm/s)
Timing Accuracy (7.5 in/s):	0.1%
Frequency Response:	$\pm 1$ dB, 50 Hz to 15 KHz exclusive of head contour effect.
Distortion:	Playback only (50 – 15,000 Hz) using loop injection measurement technique. 0.5% THD, Record/Play (Ref –20 dBm input, 160 nW/M recorded level, +8 dBm output), 2% max.



Signal/Noise Ratio	62 dB mono, 60 dB stereo. Below 400 Hz @ 3% THD level, 3M156 tape, 20 Hz to 20 KHz
Wow and Flutter (unweighted):	0.2% RMS max, 0.15% peak weighted
Crosstalk (Magnetic head limited):	
Cue channel to program channel:	150 Hz: -50 dB max. 1000 Hz: -55 dB max. 8000 Hz: -50 dB max.
Input Impedance:	Recorder Input Low Level/high level input amplifier Mic: 150 ohm balanced floating Line: balanced bridging; 15K ohms balanced floating
Input Levels:	
High level inputs:	-24 to +20 dBm (50 mV to 7.7V)
Microphone inputs:	-70 to -44 dBm
Output Impedance (Balanced):	Less than 1/8 load of 150/600 ohms.
Output Level (From 160 nW/M Recording):	+8 dBm
Peak Output Level:	+20 dBm before clipping
Bias Oscillator Frequency:	100 KHz
Fast-Forward Tape Velocity:	22.5 in/s (57 cm/s).
Ambient Operating Temperature (Machine Only):	0° to 55°C (32° to 130° F)
Tape Start/Stop Time:	0.1 s max.
Tape Pull Force:	1.5 lbs. (6.67N) min.

### 1.3 WARRANTY

Broadcast Electronics products are guaranteed to be free from defects in workmanship and material for a period of one year after shipping date when subjected to normal usage or service. All warranties are void, A) If equipment has been altered or repaired by others without Broadcast Electronics' specific prior authorization, or B) If equipment is operated under environmental conditions or circumstances other than those specifically described in Broadcast Electronics literature or instruction manuals.

### 1.4 SERVICE

Technical assistance is available by letter or prepaid telephone or telegram from Broadcast Electronics or the franchised parts and repair depots shown on the outside back cover of this manual. 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 or the nearest repair depot for a Return Authorization.



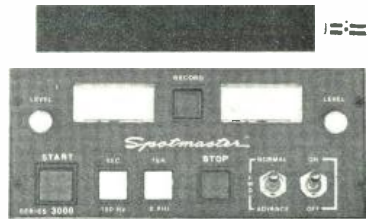
3100P monophonic playback with optional Q Trips and automatic fast forward



3100PS stereophonic playback with no options installed



3200RP monophonic record/playback with no options installed



3200RPS stereophonic record/playback with optional Q Trips and automatic fast forward



3300P monophonic playback with optional Q-Trips installed

Figure 1. Representative Series 3000 Units

## SECTION 2 INSTALLATION

### 2.1 OPTIONAL RACK MOUNTING

SERIES 3000 units are equipped for table-top mounting. An optional shelf is available for mounting units in a standard EIA 19" rack. Three 3100 models, two 3200, or one 3300 and one 3100 models may be mounted side-by-side in 5-1/4 inches of vertical space. Blank filler panels are available in 1/3 and 1/2 rack widths.

To install units in a rack, remove the top and bottom covers, install any filler panels in the front of the adapter shelf and mount the adapter shelf in the rack opening from the front. Secure the shelf with No. 10 screws driven from the front through the trim spacers and the rack shelf into the rack rail. Finally, place the units into the adapter shelf from the front and secure with the captive fasteners installed at the rear of the shelf.

### 2.2 AUDIO INPUT AND OUTPUT

Refer to Figure 2.

The playback audio output and line level record input are available on separate six pin cinch connectors on the rear panel. Mating connectors are supplied. The output is balanced with a low impedance for driving a 600 ohm load. The input is high (15 K ohms) impedance balanced bridging for signals from -22 to +14 dBm (60 mV to 4 V) level. The input or output may be connected for unbalanced operation by connecting the "-" and shield. If a 600 ohm transformer coupled device is connected, a 560 ohm or 620 ohm terminating resistor should be installed to ensure proper frequency response. To ensure proper grounding and to prevent the formation of ground loops, the shield of the audio cable should be connected at one end only. It may be connected in the middle or at both ends if this provides better shielding.

The output level is adjusted at the factory for a nominal 0 dBm. This may be adjusted as explained in Section 5.

### 2.3 OPTIONAL MICROPHONE INPUT

Record models are available with an optional microphone input through a rear panel socket. This input is designed for 150 ohm balanced microphones with an output level of -70 to -44 dBm.

#### Note

When operating with the microphone input, disconnect the line input. Set the gain switch (two in stereo) on the record amplifier/bias module to HI

### 2.4 REMOTE CONTROL CONNECTIONS

Refer to Figure 2.

A rear panel 24 pin cinch connector allows connection of remote stop, start, and record controls along with the associated indicators. When the optional auxiliary cue tones (Q1 150 Hz and Q11 8 kHz) are installed, the normally open relay contacts are accessible. These contacts provide a closure during tone playback. In record models, the optional cue tone generators may be remotely controlled.

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, the EXT CUE record control is also required.

### 2.5 GROUND TERMINAL

The rear panel ground terminal should be connected to the central or station ground with a solid or braided grounding strap.

## 2.6 AC POWER

The fuse is attached to the line cord for shipment. Install the fuse in the rear panel holder.

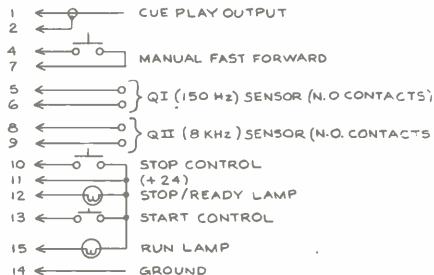
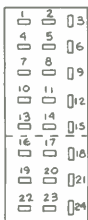
All SERIES 3000 units are equipped with NEMA three-wire grounded AC line cord. Models are available for operation from single phase power sources rated at 117 VAC/60 Hz, 220 VAC/50 Hz, etc., as indicated on the rear panel serial plate.

PLAY LINE OUT  
(J4)  
CINCH NO. P-306-CCT  
6 PIN MALE  
BEI NO. 418-0302



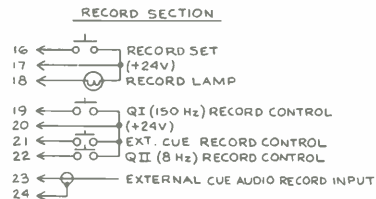
1. SHIELD }  
3. + } LEFT OR MONO 600Ω OUTPUT  
5. - }  
2. SHIELD }  
4. + } RIGHT 600Ω OUTPUT  
6. - }

REMOTE  
CONNECTOR  
(J5)  
CINCH NO. P-324-CCT  
24 PIN MALE  
BEI NO. 418-C306



NOTES:

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



1. SHIELD }  
3. + } LEFT OR MONO LINE IN (RECORD)  
5. - }  
2. SHIELD }  
4. + } RIGHT LINE IN (RECORD)  
6. - }

RECORD LINE IN  
(J7)  
CINCH NO. S-306-CCT  
6 PIN FEMALE  
BEI NO. 418-C305



REAR VIEW, MATING CONNECTORS

BROADCAST ELECTRONICS INC  
- A FILMWAYS COMPANY -  
3000/4000 SERIES

REAR PANEL CONNECTOR WIRING  
B- 906 - 3104

DRAWN : 03/13/75 W.L.J.

Figure 2. Rear Panel Connector Wiring Diagram

## SECTION 3 OPERATION

### 3.1 PLAYBACK

Turn on the AC power with the front panel switch. The motor shaft should begin to rotate. Insert a prerecorded cartridge in the deck opening to the extreme right hand side. The STOP switch lamp should illuminate to indicate the unit is in the ready mode. The 3100 models accept NAB A size cartridges. The 3200 models accept both NAB A and B size. The 3300 models accept all three size cartridges: A, B, and C.

#### Note

The 3200 and 3300 models are equipped with a movable cartridge guide to restrain the left hand side of the cartridge. This is positioned at the factory for A size cartridges. If B or C size cartridges are used, the guide should be moved to the appropriate location.

Put tape in motion by momentarily depressing the START switch. The STOP lamp should extinguish and the START lamp illuminate. The VU meter on record models will indicate the playback audio level. Tape will continue to run until a stop tone is sensed. A cartridge may be stopped manually by depressing the STOP switch. When the unit stops, the START lamp will extinguish and the STOP lamp illuminate. When the cartridge is removed, the STOP lamp will extinguish.

### 3.2 OPTIONAL FAST FORWARD

SERIES 3000 machines may be equipped for manual or automatic fast forward cueing.

When equipped with the optional Q Trips and fast forward provisions, the unit will automatically go into fast forward from playback when the QI 150 Hz tone is sensed. In automatic fast forward, the unit's audio output will be muted.

The manual mode is initiated by placing the front panel switch in the ADVANCE position while the unit is in playback. In manual fast forward the audio output is NOT muted. The unit will return to normal speed when the switch is released.

#### Note

The automatic fast forward can be disabled by placing the MAN-AUTO switch on the power supply board in the MAN (manual) position.

### 3.3 RECORDING

The models 3200 RP, 3200 RPS, 3300 RP, and 3300 RPS can function in the playback only mode as described in paragraph 3.1 or in the record mode as described here.

Load a bulk erased cartridge in the deck. Select a cartridge at least two seconds longer than the program material to be recorded. If more than one "cut" will be recorded on a cartridge, allow at least two seconds between cuts.

Run the cartridge in the playback mode for several seconds. While running the cartridge to align the tape in the guides, check the location of the splice. Avoid recording over the splice, since audio will "drop-out" or "bump" on most splices.

#### Note

The splice may be automatically located by use of the accessory BEFSD-200 tape Fault/Splice Detector.

Place the unit in record by depressing the RECORD switch. The lamp in this switch should illuminate. The unit will only go into record in the stop mode when a cartridge is in the unit.

Preset the record level by playing the material to be recorded. *Do Not Start the Cartridge.*

Adjust the front panel level control so that the VU meter indicates a maximum 0 VU (100) on peaks. (In the record mode, the meter indicates input to the recorder.)

When the level is set, re-cue the material to be recorded. Start the SERIES 3000 recorder by depressing the START switch. Then start the material to be recorded. For best operation, there should be a 1/4 to 1/2 second lag between the start of the cartridge and the beginning of the program material.

While recording, the quality can be checked if provision is made to feed the audio output to a separate monitor system such as an audition channel of a console. The program material can be "A — B" ed by monitoring alternately the input and the output (which is the reproduction of the audio just recorded). With monitor systems of equal quality and equal volume, no difference should be detected in the signal before recording and after.

When the recording is complete, and the cartridge has run its full course, the unit will stop. You may stop it manually by depressing the STOP switch.

#### Note

When the unit recues or the STOP switch is depressed, the unit will return to the playback mode.

### 3.4 OPTIONAL AUXILIARY CUE TONES (Q-TRIPS)

In addition to the standard 1,000 Hz stop (primary) cue tone, all models of the SERIES 3000 are available with additional frequency tones. These optional auxiliary cue tones are used to control other devices associated with the cartridge machine.

The 150 Hz (QI) secondary tone is defined by the NAB cartridge standards as the "end of message" cue and is generally used to activate another device at the end of a recorded segment. This could be, for example, a sequence cue to an automation system. Similarly, it could be used to automatically start another cartridge machine. In SERIES 3000 units so equipped, this tone is used to initiate automatic fast forward cueing after a cartridge has played.

The 8,000 Hz (QII) tertiary tone is defined as an auxiliary tone to be used as needed. Generally, it is used to activate another device during reproduction of a recorded segment. For example, this tone can initiate slide changes during a recorded commentary. Or it might provide a warning signal that a cartridge is nearing the end (a popular use in radio stations using music on cartridges in place of records).

In playback, auxiliary tones close normally open relay contacts available on the rear panel remote control connector. At the same time, the indicator lamp on the front panel is illuminated to visually indicate tone presence. The relay contacts remain closed and the indicator remains illuminated for the duration of the tone as recorded on the cartridge. When so equipped, the fast forward cueing begins at the end of the 150 Hz tone.

When so equipped, record models can both playback and record the auxiliary cue tones. The tones are recorded by pressing the appropriate front panel switch (SEC 150 Hz or TER 8 KHz). As long as the switch is depressed, the tone will be recorded on the cartridge. To insure positive operation in playback, NAB standards call for a minimum burst of 100 (at 150 Hz) or 2 (at 8 kHz) milliseconds duration. The exact positioning of the tone and its duration depends upon the requirements in the individual installation. When recording the 150 Hz (QI) tone to provide automatic fast forward, the tone must not end before the program material ends.

#### Note

The auxiliary cue tones may be recorded whenever tape is in motion in either playback or record.

## SECTION 4

# ELECTRONIC THEORY OF OPERATION

### 4.1 PLAYBACK/LOGIC BOARD CIRCUIT DESCRIPTION

#### 4.1.1 Configuration

The Playback/Logic board contains the playback amplifiers for the program tracks, 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 Q1 150 Hz and Q11 8 KHz sensors are incorporated on this board. Additionally, the 3 KHz stop cue sensor required for units equipped with the fast forward option is mounted on this board.

In all, there are eight possible configurations of the Playback/Logic board as shown in the assembly diagram in Figure 5. The exact configuration used in a particular machine is indicated in Table 1. This varies depending upon whether a unit is monophonic or stereophonic; equipped with Q Trips; or equipped for single speed, manual or automatic fast forward. The schematic diagram in Figure 4 shows the most complex arrangement required for a stereophonic machine with all options.

#### 4.1.2 Program Circuitry

The program tracks of the playback head are coupled through C11 (C17) to the input of the preamplifier IC-1A (IC-1B). This dual integrated circuit amplifier provides gain and equalization as determined by the network R1 (R3), R2 (R4), R10 (R11), R34 (R33), C1 (C4). The variable high and low frequency trimmers permit adjusting the equalization to match individual heads to NAB or other standards (IEC, CCIIR, etc.). Internal DC voltage is supplied to both halves of IC-1 through pin 14 from the decoupling network R26, C13. Bias DC is provided from the voltage divider R20, R25, C12 through R19, R24.

The output of the preamplifier is coupled through C26 (C25) to the FET program muting switch Q5 (Q6). This N channel device is controlled by the logic so that a ground on either CR7 or CR8 shuts off the audio signal. This is provided whenever the machine is in the stop mode or when units equipped for automatic fast forward are so operating. Bias (12 VDC) for the FET is provided from the voltage divider R35, R98, C24 through R36, R37, (R38), R39, (R48). Filtering is provided by C23 which shunts to ground any AC appearing on the gate.

The output of the FET is coupled through C27 (C28) to the output level control R15 (R16) mounted on the playback board. The audio signal is also available through board pin 14 (13) for the VU meter installed in record/playback models.

Signal from the level control is coupled through C30 (C31) to the output booster IC-3. This dual amplifier and the complementary symmetry drivers Q4, Q3 (Q1, Q2) provide 28 dB gain to drive the output to a maximum +18 dBm. This gain is determined by R42 (R47), R41 (R46). DC bias for Q3, Q4 (Q1, Q2) is provided by CR4, CR5, CR6 (CR1, CR2, CR3). Bias for IC-3 is supplied from the divider R16, R17, C10 through, R40, R49; and internal voltage directly from the +24 VDC.

The fully amplified signal is coupled through C22 (C21) to the primary of the output transformer and the headphone jack. (The transformer adds 6 dB of gain to the output signal which then appears at the output connector.)

#### 4.1.3 Cue Track Audio and 1 KHz Stop Sensor

The cue track of the playback head is coupled through C15 to the input of IC2A which acts as a preamplifier with gain and equalization comparable to the program preamplifiers as provided by R21, R22, R23 and C14. Bias for IC-2A is supplied through R15 from voltage divider R17, R16.

The output of the preamplifier is direct coupled to the booster IC-2B. Inverting amplifier 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 the rear panel remote control connector) through pin 19 and to the 1 KHz sensor level control (R8).



The signal is coupled through C43 to a fixed tuned twin-T filter composed of IC-4A, R84, R85, R86, C44, C45, and C46. The 1 KHz output of the filter is AC coupled to half wave rectifier CR21, CR22. Capacitor C58 and resistor R97 provide filtering. The FET Q10 is connected to ground the signal to disable the sensor. In the stop mode, the gate of Q10 grounds to the stop/start logic through CR15 and R100 to turn Q10 on. When the ground is removed as the logic changes to the run mode, C55 keeps Q10 in conduction (and the sensor muted) for approximately three seconds. Similarly, the gate of Q10 can ground through R95 and CR17 to the fast forward cue shift/mute bus. Removing this ground activates the sensor almost immediately.

The DC signal from R75 is connected to comparator IC-6D. When this voltage exceeds the reference from R57, R99, connected through R72, the output of IC-6D goes to +VDC to deliver a pulse through C39 to the stop control.

#### 4.1.4 Optional 3 KHz Stop Sensor

In units equipped for operation at both the normal and fast forward (3X normal) speeds, a 3 KHz stop sensor is also installed. Signal is taken from the 1 KHz level control (R8) to FET Q7. In this case the sensor is active only when the FET is conducting. This is accomplished by grounding the fast forward cue shift/mute bus.

The mute is gradually removed as C34 discharges through R55. Even if the tape is not up to full 3X normal speed, a stop tone can be sensed, since the normal 1 KHz sensor is slowly turning off as the 3 KHz sensor is turned on. When the ground is removed, Q7 immediately shuts off to disable the 3 KHz sensor.

Following Q7 the audio signal is fed to LC filter L1, C41, and to IC-4B for amplification. The output is rectified, filtered, and fed to comparator IC-6B. With 3 KHz tone present at the filter, the output of IC-6B goes high to deliver a positive pulse through CR13 and C39 to the stop control.

#### 4.1.5 Optional Q-Trip Sensors

When equipped with the optional QI 150 Hz and QII 8 KHz auxiliary cue tones, separate sensors are installed. These are similar in operation to the 1 KHz sensor described in 4.1.3. Signal is taken from the output of the cue track booster amplifier (IC-2B) through separate level controls to a fixed tuned active filter. The signal is then rectified and fed to a comparator which delivers a +VDC output during tone presence to drive relays located on the power supply. To prevent chatter by these relays when the AC power is turned on, C36 keeps the reference voltage higher than normal until the circuit stabilizes. At turn-off, C61 and CR24 hold the reference voltage as the power supply shuts down. Muting is accomplished by grounding the input to the comparator by the fast forward cue shift/mute bus. The 150 Hz (QI) tone is sensed by IC-5B, IC-6A while the 8 KHz (QII) tone is sensed by IC-5A, IC-6C.

#### 4.1.6 Stop/Start Logic

Stopping and starting are controlled by the flip-flop composed of Q8, Q9. The circuit is a bi-stable multi-vibrator in which Q9 is conducting and Q8 is off, or Q8 is conducting and Q9 is off. When Q8 is off the collector is not drawing current and is at a 18 VDC level. This voltage is carried through R52 to the base of Q9 to hold Q9 in full conduction. Likewise, when Q9 is off, the voltage from its collector goes to the base of Q8 through R53 to hold Q8 in full conduction. The flip-flop will change state 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 set 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 boards.

### 4.2 POWER SUPPLY BOARD CIRCUIT DESCRIPTION

#### 4.2.1 Configuration

The Power Supply board contains the +24 VDC supply for the electronics, the +30 VDC supply and controlling circuitry for the solenoid, and the logic driver circuits. In units equipped with

the optional Q Trips, the QI 150 Hz and QII 8 KHz relays are mounted here. In units equipped with the optional fast forward provision, the motor control circuitry is incorporated on the Power Supply. As shown in Table 1, the Power Supply is manufactured in four versions. The schematic diagram in Figure 6 shows the most complex configuration in which the Q Trip and fast forward options are both included. The assembly diagram with parts lists is incorporated in Figure 7.

#### 4.2.2 Voltage Supplies

Separate secondary windings on the power transformer provide 30 VDC through J1 to diode bridge rectifiers CR1 and CR2. The low current for the amplifiers is supplied by CR1. Diodes CR16 and CR17 provide reverse voltage protection to regulator IC-1 mounted on the outside of the rear panel. The regulator provides +24 VDC controlled within 24 mV with internal current and thermal overload protection. Voltage for the logic and solenoid are supplied directly from the output of CR2. Capacitor C5 provides filtering for this high current source.

#### 4.2.3 Solenoid Control

When the logic is in the stop mode, the base of Q5 is grounded to the flip flop on the Playback/Logic board. When the logic changes to the run mode, the base of Q5 goes high to turn Q5 on. The run lamp and the record logic ground to Q5 through CR11 and CR12. The base of Q3 is grounded and Q3 conducts. Transistor Q1 (mounted on the rear panel) turns on to provide a ground for the solenoid to draw a full +30 VDC. As Q1 conducts, C9 begins to discharge through R16. As C9 discharges the base of Q4 is drawn to ground and Q4 begins conducting. As Q4 begins conducting, Q1 begins to shut off to reduce the voltage across the solenoid to 24 - 27 VDC.

When the logic returns to the stop mode, Q5 shuts off to turn off Q3. As the solenoid de-energizes, CR14 suppresses inductive spikes. In the stop mode, the base of Q7 goes high from the flip flop on the playback board. Transistor Q7 turns on to provide a ground for the stop lamps and the record logic through CR13 and CR15. (The front panel stop switch lamp +24 VDC supply is connected through the deck microswitch so that this lamp lights only in the stop mode when a cartridge is loaded.)

#### 4.2.4 Fast Forward and Q Trip Relays

The AC voltage for the drive motor is supplied from the power transformer primary through J1 and J2. When equipped for either manual or automatic fast forward, relay K1 is installed to switch power to the normal or high speed windings as required. Capacitors C1, C2, C3, and C4 provide arc suppression during switching.

When K1 is relaxed the normal speed windings are connected. The high speed windings are connected by energizing K1 by turning on Q2 and supplying a ground path to R6. Transistor Q2 can turn on by connecting its base through CR5. In playback units terminal 13 is connected directly to ground. In record models, this point is connected to the record logic so that a ground is supplied only in the playback mode (not in the record mode). The other side of the coil of K1 can only ground through CR7 and Q5 in the playback (run) mode. This can be accomplished in two separate ways.

When the front panel switch is placed in the ADVANCE position R6 is connected directly to CR7 to energize K1. The cue tone sensors on the Playback/Logic board receive a ground through terminal 12 to mute the 1 KHz, 150 Hz, and 8 KHz sensors while enabling the 3 KHz sensor. Diode CR6 prevents the audio muting circuit at terminal 14 from grounding. The unit goes into fast forward and will stop on a stop cue tone. The program material on the tape is not shut-off from the output jack. When the switch is released, K1 de-energizes to return the unit to normal speed.

When equipped with the option for automatic fast forward SCR Q1 is installed as well as driver Q6 which is controlled by the QI 150 Hz cue tone sensor on the Playback/Logic board. When the 150 Hz QI tone is present the QI control at terminal 23 goes high to turn on Q6. Relay K2 energizes to supply a ground for the QI lamps and to close the normally open contacts available on the remote control connector. When the tone ends, the control goes low and shuts off Q6. A positive pulse is delivered by C10 through CR3 and S1 to the gate of SCR Q1. This pulse turns Q1 on to ground relay K1. Both the cue shift/mute and the audio mute buses ground. The unit goes into fast forward and shuts off the audio output. The unit remains in high speed until the stop tone is sensed by the 3 KHz sensor. When the unit stops, Q5 shuts off so that SCR Q1 no longer can conduct current; Q1 turns off to de-energize K1 and

deactivate the cue shift/mute and audio mute buses. Manual operation of the ADVANCE switch in the automatic fast forward mode will turn off Q1 and return the unit to normal speed operation without stopping.

Relay K3 associated with the Q11 8 KHz cue sensor works in the same manner as K2. When the Q11 8 KHz tone is present, the base of Q8 goes high to turn on Q8 and K3. Contacts on K3 supply a ground to the Q11 lamps and provide the closure available on the remote control connector. When the tone ends, the control at terminal 22 goes low to turn off Q8 and K3.

## 4.3 RECORD AMPLIFIER/BIAS BOARD

### 4.3.1 Configurations

The Record Amplifier/Bias Board, installed only in record models, contains the program track record amplifiers, the record input transformers, the 100 KHz record bias oscillator, and the cue track record amplifier. As shown in Table 1, separate versions are manufactured for monophonic and stereophonic machines. The assembly and its parts are shown in Figure 9. The schematic diagrams in Figure 8 shows the stereophonic version which incorporates two identical program amplifier circuits.

### 4.3.2 Bias Oscillator

Transistors Q1 and Q2 form a push-pull oscillator providing a 100 KHz sine wave voltage. The primary of T3 and C5 form a tuned circuit resonant at 100 KHz. Positive feedback is provided by C38 and C39. To ensure smooth cut-off and minimize distortion, negative feedback is supplied to the non-conducting transistor by C40. Bias voltages for the transistors are supplied by R9, R11, R26, R27. Emitter dropping resistors R8 and R10 provide a small amount of negative feedback to maintain purity of the 100 KHz output.

Transistor Q3 controls the oscillator. When the base of Q3 is grounded through CR1 to the record flip flop, Q3 turns on to supply +24 VDC to the oscillator. To minimize starting transients, C37 provides a gradual turn-on. The oscillator runs whenever the unit is in the record mode.

To provide isolation and minimize cross talk, the secondary of T3 is divided into two parts. Bias for the program tracks is taken from transformer terminal 5; bias for the cue track is taken from terminal 7.

### 4.3.3 Program Track Record and Bias Control Circuitry

The rear panel line and optional microphone input jacks are connected to separate windings of T2 (T1). The secondary of the transformer is directly coupled to the input of the preamplifier IC-1A (IC-1B). Gain in this stage is switchable 0 dB (LO) for use with line level sources or 35 dB (HI) for microphone input. The gain is determined by R45 (R54), R46 (R55) as selected by S1. The frequency response of the preamplifier is flat. The network R44 (R53), C30 (C32), C31 (C33) provides compensation for the integrated circuit. Bias is provided through R28, R47 (R51) from the voltage divider R43, R48, C29, C34.

The output of IC-1A (IC-1B) is coupled through C36 (C35) to the front panel record level control. The output of the level control is returned to the Record Amplifier/Bias board and to the VU meter amplifier (on the Record Control and Generator board). The record equalization network is composed of R4 (R5), R34 (R31), R35 (R32), R36 (R33), C26 (C25). The high frequency trimmer R4 (R5) permits adjusting the equalization for the individual head, type of tape used, and the various standards (NAB, IEC, CCIR, etc.).

The equalized signal is coupled through C22 (C24) to the head driver amplifier Q15 (Q12), Q14 (Q11). This stage provides sufficient current to drive the record head. The amplified signal is coupled through C20 (C23), R23 (R30) to the program record control FET Q13 (Q10). This P channel FET is held off by voltage supplied to its gate through R21 and R20. When the unit is in the record mode, the gate grounds to the record flip flop through CR5. The FET conducts to allow the program signal to reach the record head. At all other times the signal is shut off.

Following the FET, the program signal is coupled through the bias trap C18 (C17), L2 (L1) which prevents the high level bias from overloading the record amplifiers. The variable inductor permits tuning the bias trap to the exact frequency of the bias oscillator. Following the bias trap, the audio signal

is mixed with the bias supplied through R2 (R3) and C2 (C3). The variable bias control permits adjusting the bias level for optimum recording from the particular tape used.

To prevent bias from appearing on the program track of the record head except in the record mode, the switching circuit Q7 (Q6), Q9 (Q8) is installed. When Q7 (Q6) is conducting C10 (C11) shunts the bias to ground. The base of Q7 (Q6) is connected through zener diode CR3 (CR4) and R17 (R16) to +24 VDC to permit Q7 (Q6) to conduct. In the record mode the base of Q9 (Q8) is drawn towards ground through CR6 to the record logic. Transistor Q9 (Q8) begins conducting to bring down the base of Q7 (Q6) to shut this device off and to restore the bias. When the record logic is not in the record mode, the base of Q9 (Q8) is held high through R19 and R18 to keep Q9 (Q8) turned off. The bias is again shunted as Q7 (Q6) is held in conduction.

#### 4.3.4 Cue Circuitry Bias Control

The audio signal for the cue track is supplied from the Record Control and Tone Generator Board to terminal 19. The audio is coupled through the bias trap (C8, L3, C9) as in the program circuitry. The audio is mixed with the bias from R1, C1 and supplied to the cue track of the record head. As in the program circuitry switching transistors Q4 and Q5 are employed to shunt the bias except when cue tones are actually being recorded. When Q4 is conducting, the bias is shunted. When Q4 is turned off by Q5 drawing the base of Q4 low, the bias is supplied to the head.

Transistor Q5 is turned on by a positive voltage supplied to its base through R15. This voltage is supplied by the cue bias switch control on the Record Control Cue Generator Board when any of the cue generators are running or when the external cue record is activated.

### 4.4 RECORD CONTROL AND TONE GENERATOR BOARD

#### 4.4.1 Configurations

The Record Control and Tone Generator Board installed in record models incorporates the record logic flip flop, the VU meter amplifier, and the 1 KHz stop cue generator. In units equipped with the Q1 150 Hz and Q11 8 KHz Q Trips, the generators for these cue tones are also included. Shown in Table 1, the board is built in four different configurations depending on whether monophonic or stereophonic and whether or not Q Trips are installed. These versions are shown in the assembly diagram (with parts lists) in Figure 11. The schematic diagram in Figure 10 shows the stereo version equipped with Q Trips.

#### 4.4.2 Record Logic Flip Flop

Transistors Q8 and Q9 form a bi-stable multivibrator (flip flop) which enable the record electronics in the record mode and disable the record electronics at all other times. The two states of the flip flop are Q9 conducting, Q8 off or Q8 conducting, Q9 off. When Q8 is off the collector is not drawing current and is at a 18 VDC level. This voltage is carried through R40 to the base of Q9 to hold Q9 in full conduction. Likewise when Q9 is off, the voltage from its collector goes to the base of Q8 through R41 to hold Q8 in full conduction.

The flip flop will change state when a positive voltage is applied to the base of the non-conducting transistor. This is accomplished through coupling resistors R43 and R69. Capacitors C16 and C17 prevent false triggering by shunting short duration pulses. Resistor R42 sets the flip flop to stop (not-record) when power is first applied.

When the record switch is depressed, a positive pulse is delivered to R45. If the unit is in the run mode this pulse will ground through CR15 to the run logic on the Power Supply Board. If the unit is in the stop mode the pulse will be conducted through CR14 to set the flip flop to record (Q8 conducting). With Q9 off Q13 turns on to supply a ground to the record indicator lamp and the program record circuitry on the Record Amplifier/Bias board.

When the STOP switch, 1 KHz (or 3 KHz) cue sensor, or the deck microswitch (if the cartridge is withdrawn) supply a positive pulse to R69, Q9 will begin to conduct and Q8 will turn off. The base of Q12 will go high to supply a ground to the F.F. record interlock. Transistor Q13 turns off to remove the grounds to the record lamp and program control.

#### 4.4.3 1 KHz Stop Cue Generator and Control

The stop cue tone generator is composed of IC-2A and IC-2B which oscillate at 1 KHz 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 taken through R55, C18, level control R6, R46, and C12 to Q5. This emitter follower stage acts as a current source to drive the cue record head. The cue output is taken from terminal 7 to the Record Amplifier/Bias Board.

The 1 KHz generator is controlled automatically to record 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 are comparators in cascade to form a mono-stable multivibrator. A 12 VDC 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.

A positive 24 VDC is available on S1. Normally S1 is set to the ON position. (The OFF position allows starting the unit in the record mode without recording a stop tone. This might be required in editing, for example.) In the ON position +24 VDC is applied to R29. If the record logic is not set for record, the voltage will ground through CR8 to Q12. Similarly, the voltage will ground to the 1 KHz record interlock through CR9 if the unit is in the stop mode (tape not running). If these conditions are met the voltage will be applied through CR7 and CR18 to IC-2C. This causes IC-2C to go high; this is carried through C28 and R63 to send IC-2D high. When C28 charges fully, the DC path to IC-2D is blocked. The output of IC-2D goes low and remains low until IC-2C is unlatched and relatched.

When the multivibrator goes high, this voltage is supplied through CR17 and CR24 to the cue bias switching circuit on the Record Amplifier/Bias Board. This turns on the recording bias to the cue track. The output of the multivibrator also turns on the 1 KHz generator by turning on FET Q10. Voltage is applied to the gate of Q10 through R67 but is shunted to ground through CR20 and R68. The FET is held non-conducting and the generator is held off. When the multivibrator goes high, CR20 is back biased through CR16 to allow Q10 to turn on. When the multivibrator goes low, Q10 turns off and shuts down the generator. Since the multivibrator has a time constant of approximately three quarters second, a stop tone burst that length is recorded on the cue track.

#### 4.4.4 Auxiliary Cue Tone Generators and Control

When the optional Q Trips are installed, 150 Hz and 8 KHz generators which are similar in operation to the 1 KHz generator are employed. These are two stage operational amplifier oscillators, IC-3A - IC-3B (150 Hz), IC-3C - IC-3D (8 KHz). The frequency is determined by the network R10 (R12), R50 (R92), R51 (R91), C22 (C24), C23 (C25). Oscillation occurs when positive feedback is supplied by R73 (R93, R94). The output of the generator is supplied through the level control R8 (R7) to the cue head driver Q5.

To permit recording from an external generator, the rear panel external cue input is connected through a separate level control (R9) to Q5.

The Q Trip generators are not automatically controlled by the machine, but manually by the front panel switches or through the remote control connector. 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 Q 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 shut off.

When the Q 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/Bias Board). To supply bias to record an external signal on the cue track, positive voltage must be supplied from the remote control connector through CR25 to the cue bias switch.

To permit recording the Q Trips or an external tone in the playback mode, transistor Q14 is installed. 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 turns on to supply a ground to terminal 6 to turn on 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 is undisturbed, since the program bias and audio are not turned on.

#### 4.4.5 VU Meter Amplifier

The front panel VU meter (two in stereo models) display the output level in playback and input level in record. The input signal is brought in from the Record Amplifier/Bias Board through cali-

bration trimmer R2 (R4) to P channel FET Q2 (Q4). The output signal is brought in from the Playback/Logic Board through calibration trimmer R1 (R3) to N channel FET Q1 (Q3). These FET's are used to switch the input signal to the meter amplifier.

Bias voltage (+12 VDC) is supplied to the FET's from the voltage divider R30, R31 through R13 (R22), R15 (R23), R17 (R24). This keeps Q1 (Q3) in conduction and Q2 (Q4) shut 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 FET's through CR1 (CR6) to Q13. FET Q1 (Q3) turns off and Q2 (Q4) turn on to connect the record signal and disconnect the playback.

The output of the FET switching is direct coupled through R18 (R26) to the amplifier IC-1A (IC-1B). Capacitors C1 (C3) and C5 (C9) act as blocking capacitors for the DC bias on the FET's. Bias for IC-1A (IC-1B) is supplied from R17 (R24). After amplification, the signal is rectified by bridge rectifier CR2 (CR10), CR3 (CR11), CR4 (CR12), CR5 (CR13) to drive the VU meter.

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.

## SECTION 5

# ELECTRONIC MAINTENANCE AND ADJUSTMENTS

### 5.1 ROUTINE MAINTENANCE

Routine cleaning of the printed circuit board and connector contacts is not necessary. In case of intermittent operation, however, clean the contacts by spraying with an aerosol contact cleaner. Do not use a cleaner with abrasives. To work grime free, polish the contacts lightly with a soft pencil eraser. Be sure the power is disconnected.

Accumulated dust should be cleaned out of the chassis with a soft brush. Fingerprints and smudges can be removed from the chassis with a cloth moistened with a household ammonia solution.

At least quarterly, the performance of the electronics should be checked and compared with the Acceptance Test Results supplied by Broadcast Electronics with each SERIES 3000 unit.

### 5.2 EXTENDER BOARD

As an aid in troubleshooting the plug-in modules, the optional 919-1504 extender board is available. This accessory raises any module approximately 3 inches above the chassis.

### 5.3 COMPONENT REPLACEMENT ON PRINTED CIRCUIT BOARDS

#### Note

AC power must be turned off when printed circuit boards are removed or replaced.

Great care should be exercised when working on printed circuit boards, since excessive heat may cause the foil to peel off. The Broadcast Electronics warranty on printed circuit boards is void if boards are damaged by improper handling.

When replacing components on a printed circuit board, use a small soldering iron (15 to 30 watts) with a small tip. Use a brush or de-soldering tool to remove excess solder. Protect the board contacts with masking tape and mount gently in a small vise.

Touch the iron to the connection to be unsoldered. When heated, quickly remove the iron and brush away the excess solder. Be careful that no solder splatters onto the board. Unbend the leads with a small pair of needle nose or diagonal cutting pliers and remove the component.

#### Note

When replacing multi-pin components (transformers, connectors, etc.) de-solder individually all the pins before attempting to remove the component. It is virtually impossible to heat all the pins simultaneously.

Check the mounting holes in the board to be sure they are clear of solder and open before mounting the replacement. Put the leads through the holes and trim the leads to about 1/8 inch. Bend the leads over so they touch only the foil strips the leads are to be soldered to.

Touch the iron to the leads and let the solder flow onto the foil. Always use a fine rosin core solder such as No. 20 gauge. Check for "bridges" of solder between adjacent foil strips.

Clean the flux off the connection with alcohol. Solder flux left on the printed circuit board may cause noise in the circuit. If the contacts were covered with masking tape, clean them also with alcohol.

### 5.4 MODULE LOCATIONS AND ADJUSTMENT POINTS

The locations of the electronic modules are shown in the assembly diagrams, Figures 16 and 17. Individual electronic parts are shown on the module assembly diagrams in Figures 5, 7, 9 and 11. The electronic adjustments are accessible through the card cage cover immediately behind the tape deck. All adjustments are labeled for easy reference.



## 5.5 ELECTRONIC ADJUSTMENTS

### 5.5.1 General Considerations

Before adjusting the electronics, clean the tape head (s) with BE-903 cleaning fluid or isopropyl alcohol. Be sure the playback (and record) head is properly aligned as described in paragraph 6.5.

In record models, the playback electronics should be adjusted before adjusting the record section.

An NAB standardized test and alignment cartridge is required for proper adjustment of the unit. The electronics may be adjusted to another standard (such as IEC, CCIR) by use of an alignment cartridge recorded to that standard. In all cases, refer to the manufacturer's instructions supplied with the cartridge.

#### CAUTION

Be certain 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.

### 5.5.2 Program Playback Adjustments

#### 1. Output Level

While reproducing the operating level tone from the test cartridge, adjust the R OUT and L OUT controls on the Playback/Logic board for the desired output as measured on an external VU meter connected to the output.

#### 2. Playback Equalization

While reproducing the frequency response series of tones from the test cartridge, adjust the PLAY EQ controls located on the Playback/Logic board. Adjust the LF R and LF L controls so that no tone between 50 Hz and 1,000 Hz rises more than 1 dB above the frequency response reference tone. Adjust the HF R and HF L so that the tones between 10 KHz and 18 KHz are within +1, -2 dB of the reference tone.

#### 3. VU Meter Calibration (Record Units Only)

Once the output level is set as described in Step 1, adjust the METER CAL R PLAY and L PLAY for a front panel VU meter indication of 0 VU while reproducing the operating level tone.

### 5.5.3 Cue Sensitivity Adjustment

The cue tone sensors are adjusted to operate on a tone at a level below the NAB standard cue tone levels. This allows for variations in tone level caused by tape wear, etc. At the factory, SERIES 3000 units are adjusted to sense tones 6 dB below the NAB standard levels.

When a cue tone test cartridge is available with tones recorded at a level below the NAB standard cue tone level, the sensors may be adjusted while reproducing the cue tone test cartridge.

During the 1,000 Hz stop tone, adjust the CUE SENS 1 KHz control so that the sensor just triggers and stops the unit. During the 150 Hz tone, adjust the CUE SENS 150 Hz control so that the sensor just triggers to light the Q1 150 Hz indicator lamp. During the 8,000 Hz tone, adjust the CUE SENS 8 KHz control so that the sensor just triggers to light the Q11 8 KHz indicator lamp.

#### Note

When adjusting the 1 KHz control wait 3 seconds after the cartridge starts. This sensor is disabled for this time.

If a cue tone test cartridge is not regularly available, tones from an audio signal generator may be used to adjust the sensors. However, a cue tone test cartridge or cue tone recording of known quality must be available initially to determine the signal levels required. Proceed as follows:

1. Connect an oscilloscope to the cue playback output (refer to Figure 2). Reproduce a pre-recorded cue tone known to be recorded at NAB cue tone level. Measure the peak to peak amplitude of the tone on the oscilloscope. Record this measurement for future reference.



2. Disconnect the AC power and mount the Playback/Logic board on the 919-1504 extender card. Referring to the assembly diagram (Figure 5), connect the signal generator to terminal 7 with the generator shield to terminal 6. (A 10 ohm load is provided, so install a 560 ohm resistor in series with the generator if its output impedance is 600 ohms.) Reconnect the AC power. Observing the oscilloscope, adjust the generator output to yield an amplitude one-half that measured in Step 1.
3. Do not load a cartridge in the unit, but manually actuate the microswitch on the deck and operate the controls. Set the CUE SENS controls to minimum (extreme counter-clockwise). Adjust the controls until the sensor just triggers.

#### 5.5.4 Program Record Adjustments

##### 1. Bias Trap Tuning

Disconnect the AC power and mount the Record/Amplifier Bias printed circuit board on the 919-1504 extender card. Referring to the assembly diagram (Figure 9), connect an oscilloscope between the junction of FET Q10 and capacitor C17, and ground. Reconnect the AC power and place the unit in the record mode. With a non-metallic screwdriver, tune L1 for minimum 100 KHz signal as observed on the oscilloscope. In stereo units, reconnect the oscilloscope between FET Q13, capacitor C18 and tune L2. When finished, disconnect the AC power, remove the extender board, remount the Record Amplifier/Bias board in the unit, and replace the card cage cover.

##### 2. Program Bias Level

#### Note

The bias supplied to the record head is most important in providing optimum frequency response. Bias requirements vary between brands of tape (and between series of one brand). If more than one type of tape is in use, check the performance of each type at its optimum bias level against its performance at the optimum bias level for other types. Where older and newer types are both in use (such as 3M154 and 3M156), bias just less than the optimum for the newer type usually is an acceptable compromise.

Load a bulk-erased cartridge in the unit. Connect an audio signal generator to the line record input. Set the generator for 1,000 Hz at a level of 0.5 mV. Adjust the record level control for -10 VU on the front panel meter. Connect an oscilloscope to the output and begin recording. Observe the oscilloscope and adjust the BIAS LEVEL L and R controls for the peak output with no distortion of the 1,000 Hz wave form.

##### 3. VU Meter Calibration

While recording the 1,000 Hz tone, adjust the record level control until the external meter indicates the output level set in 5.5.2. Now adjust the METER CAL R REC and L REC so that the front panel VU meter indicates 0 VU.

##### 4. Record Equalization

Set the signal generator for 15 KHz and reduce the generator output level 10 dB. DO NOT ADJUST THE FRONT PANEL LEVEL CONTROL. While recording the 15 KHz tone, adjust the REC EQ L and R for 10 dB below the output level set in 5.5.2.

#### 5.5.5 Cue Record Adjustments

##### 1. Bias Trap Tuning

Referring to Step 1 of 5.5.4, connect an oscilloscope between the junction of capacitors C8, C9 and ground on the Record Amplifier Bias board. Referring to Figure 2, activate the external cue record control by connecting remote control terminal 21 to 20. With a non-metallic screwdriver, tune L3 for minimum 100 KHz signal as observed on the oscilloscope.

## 2. Cue Bias Level

Connect an audio signal generator to the external cue input and reconnect the oscilloscope to the cue playback output (refer to Figure 2.) Set the generator for 1,000 Hz at a level 10 dB below the reference amplitude determined in Step 1 of 5.5.3. Load a bulk-erased cartridge in the unit, activate the external cue record control, and begin recording the 1,000 Hz tone from the signal generator. Observing the oscilloscope, adjust the BIAS LEVEL Q control for the peak output with no distortion of the 1,000 Hz wave form.

## 3. Cue Tone Record Level

Deactivate the external cue record control and the signal generator. Adjust the CUE RECORD LEVEL controls, while recording the cue tones, for the reference amplitude determined in Step 1 of 5.5.3. The internal 1 KHz generator is activated each time the unit starts in the record mode. The optional QI 150 Hz and QII 8 KHz generators are activated by depressing the appropriate front panel switch. To set the external cue record level, supply tone to the external cue input and activate the external cue record control.

## 4. Cue Tone Generator Frequency

The frequency of the 1 KHz, optional QI 150 Hz, and optional QII 8 KHz cue generators are adjusted by trimmers R11, R10, and R12 on the Record Control and Tone Generator board. These controls are set at the factory and should not require subsequent adjustment.

## SECTION 6

### MECHANICAL DESCRIPTION

### MAINTENANCE AND ADJUSTMENTS

#### 6.1 MECHANICAL SYSTEM

A hysteresis, synchronous motor provides direct capstan drive for the SERIES 3000. Normally equipped with a single speed motor, a two speed motor is installed in models equipped for optional fast forward cueing. The motor is attached directly to the underside of the tape deck with the capstan shaft extending up above the deck surface.

The pressure roller in combination with the capstan shaft drives tape. Movement of tape is initiated by a DC air damped solenoid connected to the roller shaft with a chain.

The tape head or heads are mounted on a bracket attached to the top surface of the deck. All models are equipped with the unique PHASE-LOK III head bracket which permits independent azimuth adjustment with full three plane head movement. Three independent tape guides are mounted to the deck surface adjacent to the head bracket (s). A cartridge hold down clip mounted above the tape guides applies pressure to the top of the cartridge at the head openings to prevent cartridge movement. Side cartridge movement is prevented by an adjustable left hand guide bracket.

#### 6.2 MAINTENANCE

##### 6.2.1 Cleaning

Once a day the heads, capstan, and pressure roller should be cleaned with BE-903 cleaning fluid or isopropyl alcohol.

##### 6.2.2 Demagnetizing

At least once every six months the heads should be demagnetized with a SPOTMASTER® head Degausser.

##### 6.2.3 Cartridge Maintenance

The cartridge is the second half of the tape cartridge system. The cartridge needs regular care just like the cartridge recorder or reproducer. Check the cartridge before adjusting the machine.

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. If possible only one type of tape should be in use in an installation. Different brands, and even different types of the same brand, 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.

A deformed shell can adversely affect frequency response by distorting the path the tape travels. 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.

Periodically the cartridge center post should be cleaned. Gummy deposits on the post, in effect, increase tape tension by not allowing the tape hub to turn freely. Equally important to free movement of the hub is the teflon washer. Periodically check the pressure pads to see that they are lined up squarely with the tape.

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 ¼ 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.

#### 6.3 MECHANICAL PARTS REPLACEMENT



Be certain 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.

### 6.3.1 Motor Replacement

#### Note

Care must be exercised in handling and storing motors to avoid damaging the bearings. Store spare motors in the original packaging. Do not handle the motor by the shaft, but by the case. Do not subject the motor to sharp blows or rough handling.

Refer to Figure 12.

Disconnect the AC power cord and remove the top and bottom covers.

Place the unit on its left side. Disconnect the motor leads connector from the Power Supply PCB. Grasp the motor in one hand, unscrew the two 10-32 mounting screws on the top of the deck, and remove the motor. Remove the motor mounting bracket from the motor and reinstall the bracket on the replacement motor. Install the replacement motor and reconnect the motor leads to the Power Supply printed circuit board. Perform the deck adjustments described in paragraph 6.4.

When these adjustments are complete, reconnect and turn on the AC power. The motor shaft should rotate counter-clockwise. Finally, test operate the unit with a cartridge in both normal and fast forward (if so equipped).

#### Note

Replacement motors are supplied with the leads terminated in the proper connector. This wiring is shown in Figure 13.

### 6.3.2 Pressure Roller Replacement

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

Remove the E ring, teflon washer, and pressure roller. Perform the deck adjustments described in paragraph 6.4. Fit on the replacement roller with the teflon washer on top. Secure with the E ring.

### 6.3.3 Power Transformer Replacement

Disconnect the AC power cord. Remove the top and bottom covers. Unplug the power transformer from the Power Supply printed circuit board. Remove the four screws which mount the transformer to the side of the chassis.

Install the replacement transformer and secure the four screws with LOCTITE or similar compound. Plug the transformer leads into the Power Supply board. Replace the covers and reconnect the AC power cord.

#### Note

Replacement transformers are supplied with the leads terminated in the proper connector. This wiring is shown in Figure 13.

### 6.3.4 Tape Head Replacement

Refer to Figure 12.

To replace either the playback or record head, disconnect the AC power and open the top cover. Remove the cartridge spring (item 31). Remove the clamp screw(s) (item 55) and withdraw the head from the clamp. Unplug the head and connect the replacement head. Insert the head in the clamp and replace the clamp screw(s). Reconnect the AC power. Referring to paragraph 6.5, check the tracking and zenith adjustments; perform the azimuth adjustment. When these are accomplished, reinstall the cartridge spring.

### 6.3.5 Solenoid Replacement

Refer to Figure 12.

Disconnect the AC power cord and remove the top and bottom covers. Mark and disconnect the solenoid leads. Loosen the lock nut on the solenoid plunger and unscrew the chain link and modified screw (items 7 and 12) from the plunger. Dismount the solenoid from the deck by removing the two 10-32 screws

driven from underneath the deck. Mount the replacement solenoid on the deck. Reconnect the solenoid leads. Reinsert the modified screw and chain link in the plunger. Perform the deck adjustments described in paragraph 6.4.

### **6.3.6 Solenoid Chain Replacement**

Refer to Figure 12.

Disconnect the AC power cord and remove the top and bottom covers. Unhook the spring from the chain underneath the deck, remove the master chain link (item 12) and slip the chain out of the modified screw (item 7). Manually raise the pressure roller and remove the screw (item 57) from the roller shaft. Insert the replacement chain in the modified screw. With a small pair of needle nose pliers, fit on the master link and secure it with the lock. Manually raise the pressure roller and reinsert the screw through the chain. Feed the chain through the deck opening and around the chain mounting clamp. Underneath the deck reconnect the spring and chain. Finally, perform the tape deck adjustments described in paragraph 6.4.

## **6.4 TAPE DECK ADJUSTMENTS**

### **6.4.1 Pressure Roller Adjustment**

Refer to Figure 12.

Disconnect the AC power cord and open the top cover. Loosen the locking nut on the solenoid plunger. While holding the chain link (item 12), rotate the plunger so that the pressure roller is just below the deck surface when the solenoid is fully relaxed. Clockwise rotation lowers the pressure roller; counter-clockwise rotation raises it. Retighten the locking nut.

Remove the pressure roller and install the pressure roller adjustment gage (stock number 836-0005). Loosen the two #10 screws which mount the motor. Press in on the solenoid plunger and raise the pressure roller gage until the roller shaft and the motor shaft are parallel. Position the motor so that its shaft just touches the gage. Tighten the rear, and then the front, motor mounting screw. Reinstall the pressure roller in place of the adjustment gage. Reconnect the AC power.

#### **Note**

To avoid damage to the motor shaft, never operate the unit when the pressure roller adjustment gage is installed.

### **6.4.2 Release Speed Adjustment**

The speed with which the solenoid releases (and engages) is determined by the escape valve on the rear of the solenoid. Since this adjustment directly affects the solenoid operating noise, it is set at the factory for a moderate operating rate and noise. If desired, it may be re-adjusted to suit the individual installation.

Disconnect the AC power and open the top cover. Loosen the locking nut on the REAR of the solenoid. To increase the release speed (and noise), screw the valve out of the solenoid. To decrease the release speed (and noise), screw the valve into the solenoid. Tighten the lock nut and reconnect the AC power. Test operate a cartridge in the unit and readjust, if required.

## **6.5 TAPE HEAD ALIGNMENT**

### **6.5.1 General Considerations**

Head alignment requires setting the tracking height, head zenith, and head azimuth. Stereophonic units also require performance of a track phasing test. Because of the unique construction of the PHASE-LOK III head bracket employed, generally only the azimuth adjustment is required unless the head has been replaced. In record units, the record head is adjusted after the reproduce head.

An NAB standardized alignment cartridge is required. Two different styles are available from Broadcast Electronics: stock numbers 808-0003 (monophonic NAB type 3) and 808-0004 (monophonic/stereophonic FIDELIPAC 350 STA). The adjustment screws required both 5/64 and 3/32-inch Allen wrenches (supplied with each unit).

### 6.5.2 Tracking Height and Zenith

Check the tracking height visually with a test cartridge such as is shown in Figure 14. Observe the tape as it passes across the head. The tape should just cover the top and bottom of the head pole pieces.

To adjust the tracking height, loosen the two lock screws (3/32-inch Allen wrench). Adjust the front height screw (5/64-inch Allen wrench). With a square, adjust the back height (zenith) so that the face of the head is perpendicular with the surface of the deck. Since these two adjustments interact, check the height again. When complete, tighten the adjustment locks.

### 6.5.3 Azimuth

Playback head azimuth is adjusted while reproducing a 15 KHz tone from the alignment cartridge. Record head azimuth is adjusted while recording a 15 KHz tone from an external signal generator at a level of -10 VU on the front panel meter. Adjust the azimuth screw (5/64-inch Allen wrench) for peak 15 KHz output as measured on an external VU meter. Remove and reinsert the cartridge several times and repeat the adjustment.

### 6.5.4 Stereo Phasing Test

Once the azimuth and height are established as described in paragraphs 6.5.2 and 6.5.3, check the unit's phase response. Connect the right and left playback outputs to an oscilloscope as shown in Figure 14. Reproducing the alignment test cartridge (playback units) or recording from an external signal generator connected to both inputs (record units), observe the Lissajous pattern produced on the oscilloscope. Alternately check the phase response at 400 Hz and at 4,000 Hz. Make minor adjustments to yield the best overall stereo response. The 4,000 Hz tone can easily be phased 360 degrees rather than 0 degrees, so check the 400 Hz tone after adjusting the azimuth (4,000 Hz tone).

Remove and reinsert the cartridge and perform the phasing test several times.

3000 SERIES  
ELECTRONIC FUNCTIONAL DIAGRAM

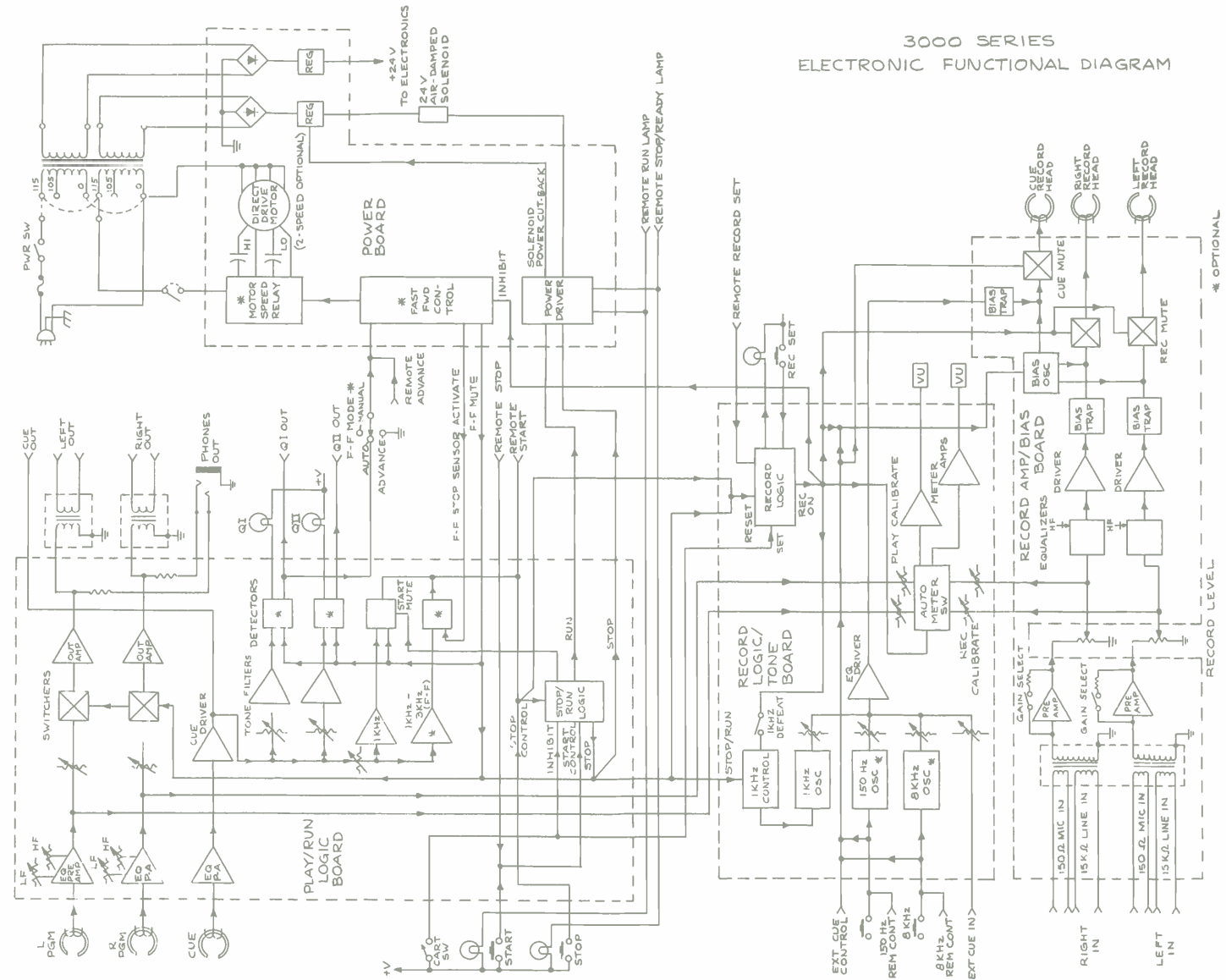


Figure 3.  
Electronic Functional Diagram

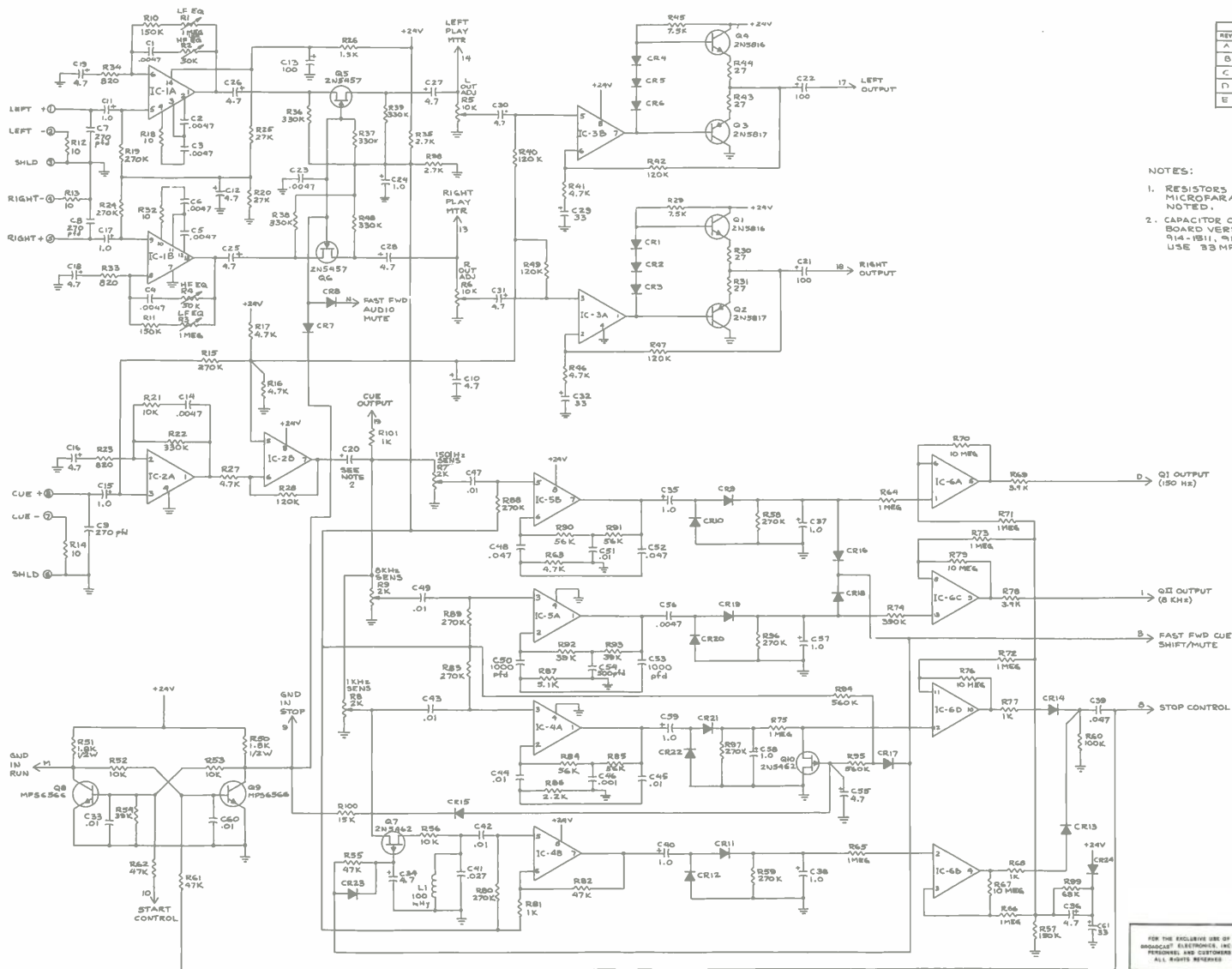
Model	Option Installed	Playback/Logic PCB	Power Supply PCB	Record Amp/Bias PCB	Record Control/Cue Generator PCB
3100P 3200P 3300P Mono, Playback Only	None	914-1501	914-1500	—	—
	Manual FF	914-1511	914-1520	—	—
	Q Trips Only	914-1521	914-1510	—	—
	FF + Q Trips	914-1531	914-1530	—	—
3100PS 3200PS 3300PS Stereo, Playback Only	None	914-1541	914-1500	—	—
	Manual FF	914-1551	914-1520	—	—
	Q Trips Only	914-1561	914-1510	—	—
	FF + Q Trips	914-1571	914-1530	—	—
3200RP 3300RP Mono, Record/Playback	None	914-1501	914-1500	914-1502	914-1503
	Manual FF	914-1511	914-1520	914-1502	914-1503
	Q Trips Only	914-1521	914-1510	914-1502	914-1513
	FF + Q Trips	914-1531	914-1530	914-1502	914-1513
3200RPS 3300RPS Stereo, Record/Playback	None	914-1541	914-1500	914-1512	914-1523
	Manual FF	914-1551	914-1520	914-1512	914-1523
	Q Trips Only	914-1561	914-1510	914-1512	914-1533
	FF + Q Trips	914-1571	914-1530	914-1512	914-1533

## Notes

- 1) FF = Fast Forward
- 2) Q Trips = QI 150 Hz and QII 8 KHz Auxiliary Cues

TABLE 1. SERIES 3000 PRINTED CIRCUIT BOARD COMPLEMENT





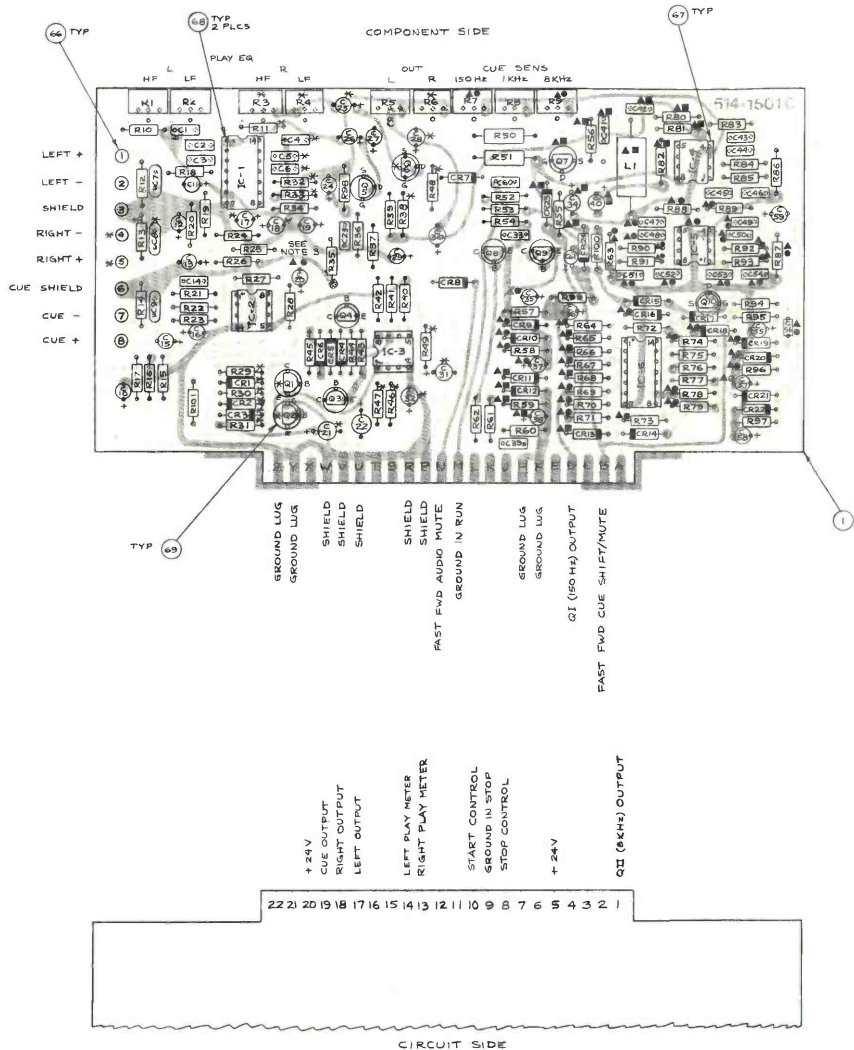
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ADDED R100, C61 & CR11	1/1/77	
B	PER ECN # 497	5/19/78	
C	PER ECN # 543	1/1/79	
D	PER ECN # 571	1/1/79	
E	PER ECN # 654	1/1/79	

- NOTES:
- RESISTORS IN OHMS, 1/4 WATT; CAPACITORS IN MICROFARADS; DIODES IN 457, UNLESS OTHERWISE NOTED.
  - CAPACITOR C20 VALUE VARIES DEPENDING UPON BOARD VERSION: 4.7 MFD IS USED WITH 914-1501, 914-1511, 914-1541, 914-1551. ALL OTHER VERSIONS USE .33 MFD.

LAST COMPONENTS USED: R101, C61, CR11, Q10, IC-6 & L1.

BROADCAST ELECTRONICS INC.			
DESIGN NO.	DATE	TITLE	SCALE
906-3111	1/1/77	SCHEMATIC	
PLAYBACK LOGIC PCB			
REV NO.	DATE	BY	CHK
D	906-3111		E
TREATMENT OR FINISH		SCALE	SHEET 1 OF 1
---		---	---

Figure 4. Schematic Diagram, Playback/Logic PCB



- NOTES:
- PART NUMBER 514-1501 = MONO, NO OPTIONS
    - 514-1511 = MANUAL FAST FORWARD
    - 514-1521 = Q-TRIPS ONLY
    - 514-1531 = FAST FORWARD & Q-TRIPS
    - 514-1541 = STEREO, NO OPTIONS
    - 514-1551 = MANUAL FAST FORWARD
    - 514-1561 = Q-TRIPS ONLY
    - 514-1571 = FAST FORWARD & Q-TRIPS
  - \* ITEMS NOT USED ON MONO VERSIONS
    - MONO & STEREO VERSIONS WITH NO OPTIONS
    - MANUAL FAST FORWARD VERSIONS
    - Q-TRIPS ONLY VERSIONS
  - CAPACITOR C20 VALUE VARIES DEPENDING UPON BOARD VERSION. ITEM #44, 4.7MFD, IS USED WITH 914-1501, 914-1511, 914-1541, & 914-1551. ALL OTHER VERSIONS USE ITEM #43, .33MFD.

REV	REVISIONS		
	DESCRIPTION	DATE	APPROVED
A	GENERAL UPDATE TO REV. A P.O.L.	4/23/78	[Signature]
B	PER ECN # 447	5/17/78	[Signature]
C	PER ECN # 543	7/12/78	[Signature]
D	PER ECN # 644	11/26/78	[Signature]
E	PER ECN # 671	1/16/79	[Signature]

33					3.9K 1/4W RESISTOR (R69, R76)
32	1	100-1553			15K 1/4W RESISTOR (R100)
31		100-3963			390K 1/4W (R74)
30		178-5054			50K Ω RESISTOR, TRIMMER (R2, R4)
29		178-2044			2K Ω (R7, R8, R9)
28		178-1074			1 MEGA Ω (R1, R3)
27		178-1054			10K Ω RESISTOR, TRIMMER (R5, R6)
26	2	110-1843			1.8K Ω, 1/2W RESISTOR (R50, R51)
25		100-8233			820 Ω, 1/4W (R23, R33, R34)
24		100-7542			7.5K Ω (R29, R45)
23	1	100-6853			68K Ω (R99)
22	2	100-5663			560K Ω (R04, R95)
21		100-5653			56K Ω (R84, R85, R90)
20		100-5143			5.1K Ω (R87)
19		100-4753			47K Ω (R82, R85, R61, R62)
18		100-4743			4.7K Ω (R41, R46, R63)
17		100-3953			39K Ω (R64, R82, R83)
16		100-3363			330K Ω (R22, R36, R37)
15		100-2763			270K Ω (R15, R19, R24)
14	2	100-2753			27K Ω (R20, R25)
13	2	100-2743			2.7K Ω (R35, R38)
12		100-2723			2.7K Ω (R30, R31, R43)
11	1	100-2243			2.2K Ω (R86)
10		100-1563			150K Ω (R10, R11, R57)
9	1	100-1543			1.5K Ω (R28, R50)
8		100-1263			120K Ω (R40, R42, R47)
7		100-1083			10 MEGA Ω (R67, R70, R76)
6		100-1073			1 MEGA Ω (R77, R81)
5	1	100-1063			100K Ω (R64, R65)
4		100-1053			10K Ω (R21, R22, R53)
3		100-1043			1K Ω (R56, R77)
2		100-1023			10 Ω, 1/4W, RESISTOR (R12, R13, R14)
1		514-1501			BLANK P.C. BOARD
(SEE NOTE 1)					PLAYBACK PCB ASSY

ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE																
22		20		19		18		17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

**BROADCAST ELECTRONICS INC.**

THE PLAYBACK LOGIC BOARD ASSY.

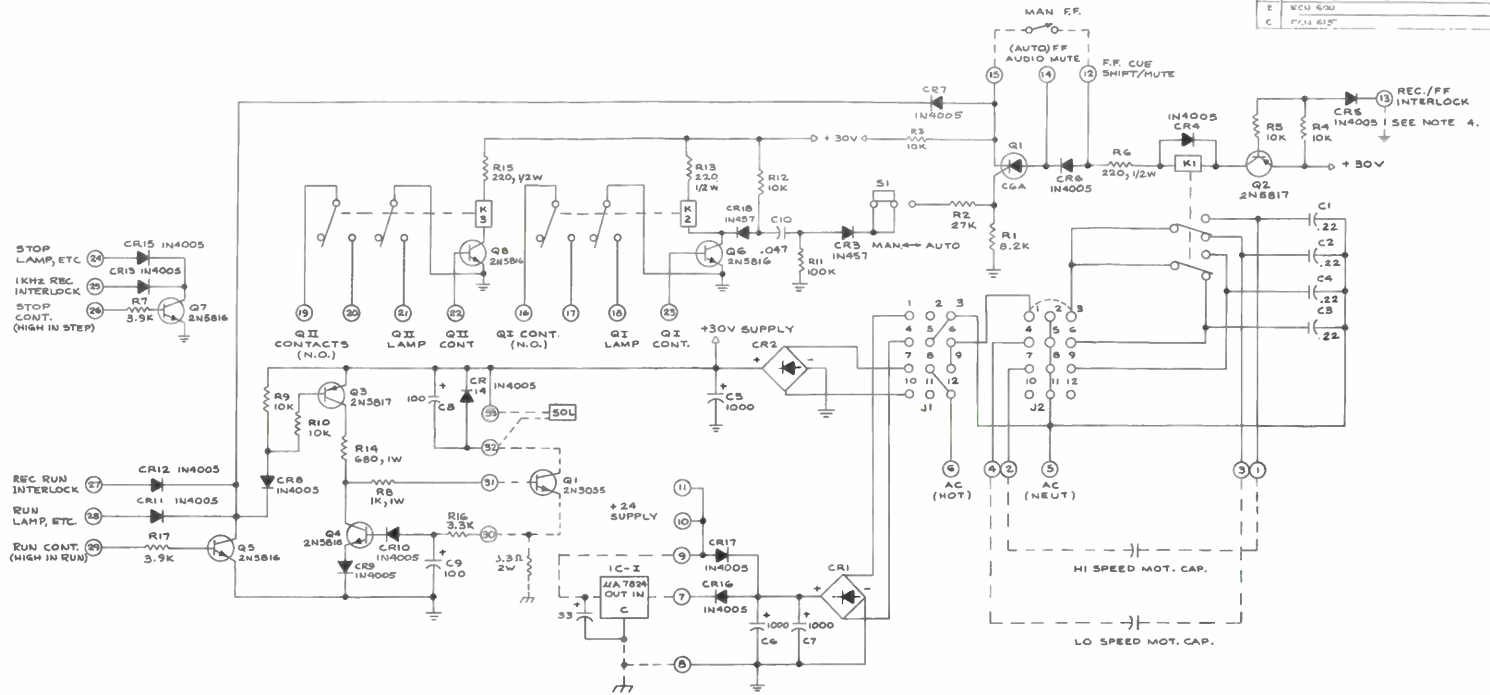
3000 SERIES

SHEET 1 OF 1

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Figure 5. Assembly Diagram and Parts List, Playback/Logic PCB

REV	DESCRIPTION	DATE	APPROVED
A	PER. C. 24 II S.I.C.	1/1/55	
B	KCU 500	1/2/55	
C	P. 10 615	1/2/55	

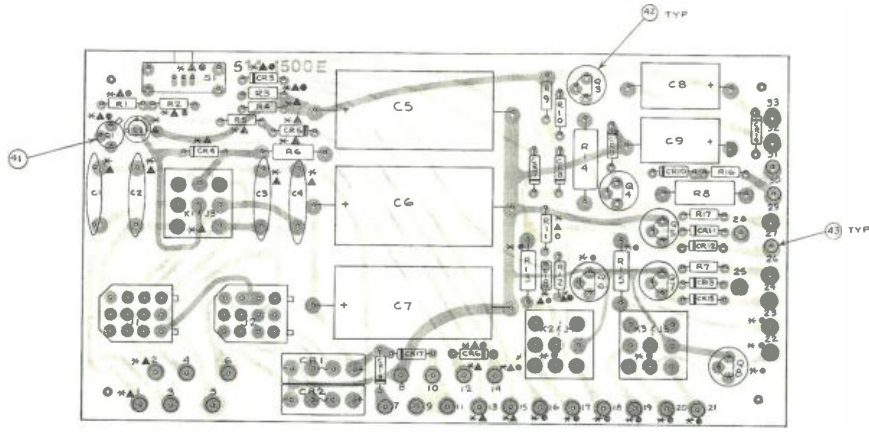


- NOTES:
1. ALL RELAYS SHOWN RELAXED
  2. ALL RESISTORS IN OHMS, 1/4W; CAPACITORS IN MICROFARADS UNLESS OTHERWISE SHOWN.
  3. DASHED LINES INDICATE COMPONENTS OFF P.C. BOARD.
  4. IN PLAY-ONLY MACHINES, TERMINAL 13 MUST BE JUMPERED TO GROUND TO ALLOW FAST-FORWARD OPERATION.
  5. ↓ P.C. BOARD GROUND
- ⏏ CHASSIS GROUND

FOR THE EXCLUSIVE USE OF BROADCAST ELECTRONICS, INC. PRODUCTION AND CUSTOMERS ALL RIGHTS RESERVED		LIST OF MATERIAL		BROADCAST ELECTRONICS, INC. - A FILMWAYS COMPANY -	
TOLERANCE UNLESS OTHERWISE SPECIFIED	DATE	BY	DATE	REV.	DESCRIPTION
FRACTIONAL 1/16 INCHES UP TO 1/8 INCHES TO FULL SIZE	1/17/55	W.A.	1/17/55	D	POWER SUPPLY BOARD
MATERIAL	TREATMENT OR FINISH	QUANTITY	DATE	REV.	DESCRIPTION
					3006-3109
					3000 SERIES
					SHEET 1 OF 1

Figure 6.  
Schematic Diagram, Power Supply PCB

REV'SIONS			
REV	DESCRIPTION	DATE	APPROVED
...	...	...	...
A	SEMI UPDATE TO REV A FOL	11/1/78	LD
B	REV A FOL	11/1/78	LD
C	REV B FOL	11/1/78	LD



NOTES:

- PART NUMBER 914-1500 - NO OPTIONS
  - 914-1510 - WITH Q-TRIPS ONLY
  - 914-1520 - WITH MANUAL FAST FORWARD ONLY
  - 914-1530 - WITH Q-TRIPS & AUTOMATIC FAST FORWARD
- \* ITEMS NOT USED WITH 914-1500
  - 914-1510
  - 914-1520

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
44				
43	413-1597		TURRET TERMINALS, DOUBLE SHOULDER	
42	409-1814		TRANSISTOR PAD (2NS1816, 2NS817)	
41	409-0005		TRANSISTOR PAD (SCR) *A	
40	345-0120		SWITCH, SPDT, P.C. MOUNT *A (51)	
39				
38				
37	271-0005		RELAY, DPDT, 24V *A, K2, K5	
36				
35				
34	271-0006		RELAY SOCKET (J3, J4, J5)	
33	695-1211V		HEADER, 12-PIN, AMP (J1, J2)	
32				
31				
30				
29	211-5816		TRANSISTOR, 2NS816 (Q1, Q2, Q6, Q7, Q8)	
28	210-5817		TRANSISTOR, 2NS817 (Q3, Q5)	
27	257-0006		SCR (2GA) *A (Q1)	
26				
25				
24				
			CR3, CR10, CR16, CR17	
			CR1, CR2, CR3, CR4, CR5	
25	205-6008		DIODE 1N4005 (CR4, CR5, CR6, CR7, CR8)	
22	201-0457V		DIODE 1N457 (CR9, CR10)	
21	239-0003		BRIDGE RECTIFIER (CR1, CR2)	
20				
19				
18	030-4743A		CAPACITOR, .047 MFD 100V *A (C10)	
17	014-1084		100 MFD 40V (C8, C9)	
16	014-1084		1000 MFD, 50V (C5, C6, C7)	
15				
14	031-2254		CAPACITOR, .22 MFD, 600V (C1, C2, C3, C4)	
13				
12				
11	120-6833		RESISTOR, 680Ω, 1W (R14)	
10	120-1043		1KΩ, 1W (R8)	
9	110-2233		220Ω, 1/2W (R6, R7, R15)	
8	100-3343		3.3KΩ, 1/4W (R16)	
7	100-1063		100KΩ, 1/4W (R11)	
6	100-3943		3.9KΩ, 1/4W (R7, R17)	
5	100-1053		10KΩ, 1/4W (R1, R2, R3, R4, R5, R12, R13, R14, R15, R16, R18)	
4				
3	100-2753		27KΩ, 1/4W (R2)	
2	100-8243		RESISTOR, 8.2KΩ, 1/4W (R1)	
1	514-1500		BLANK P.C. BOARD	
1	(SEE NOTE 1)		POWER SUPPLY BOARD ASSY	

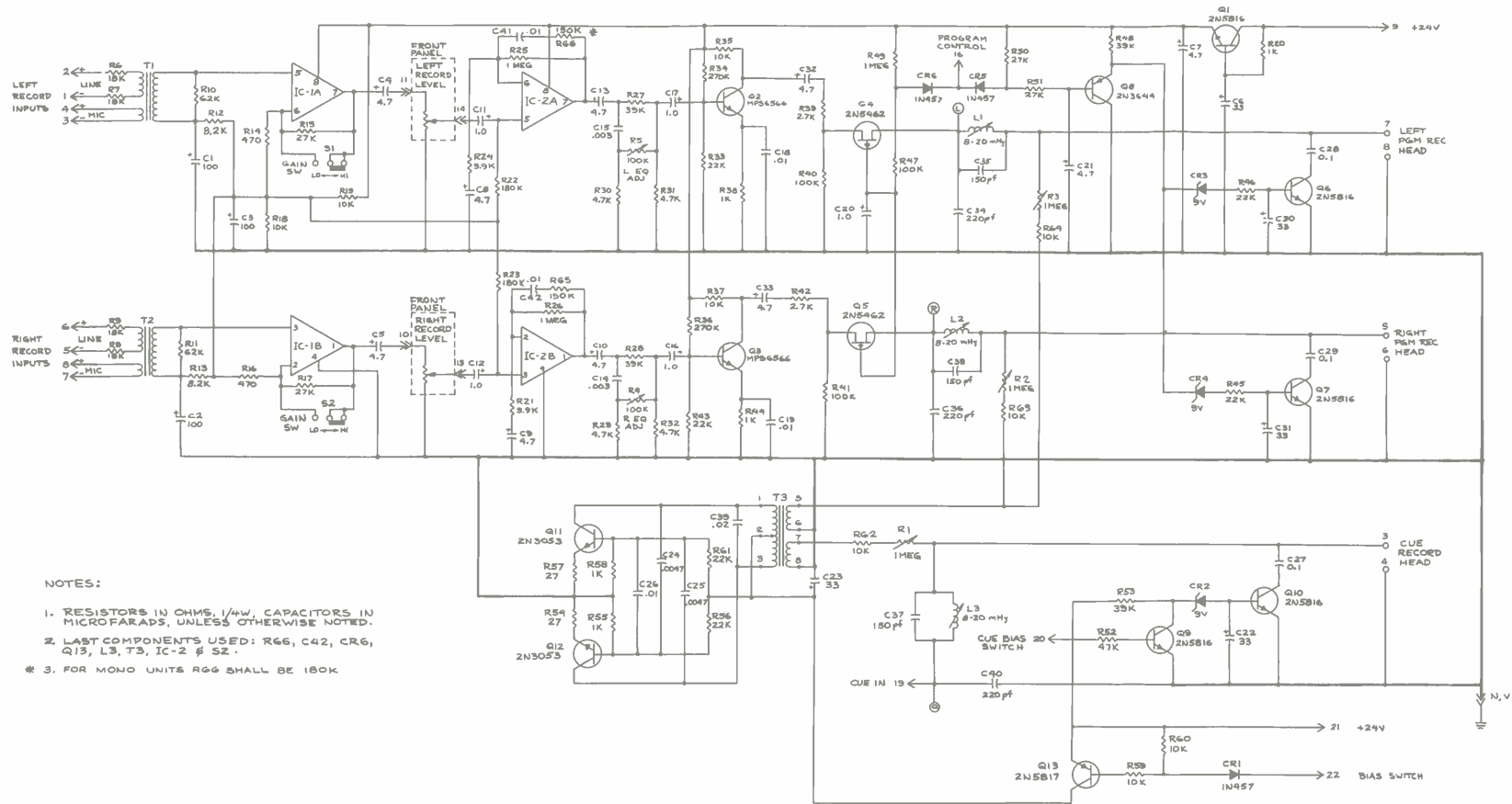
LIST OF MATERIAL			
TOLERANCE UNLESS OTHERWISE SPECIFIED	QUANTITY	DATE	REVISIONS
FRAC TIONAL 1/16	1		
DECIMAL 0.1	1		
ANGLE 1/2°	1		
SHAPE EDGE TO EDGE	1		
FINISH	1		
TREATMENT OR FINISH	1		

BROADCAST ELECTRONICS INC.  
- 4 FLEMING COMPANY -

TITLE POWER SUPPLY P.C.B. ASSY

D 914-1500 Q 150, 1520 & 1530 (REV C)  
3000 SERIES (REV 2/1) SHEET 1 OF 1

Figure 7.  
Assembly Diagram and Parts List, Power Supply PCB



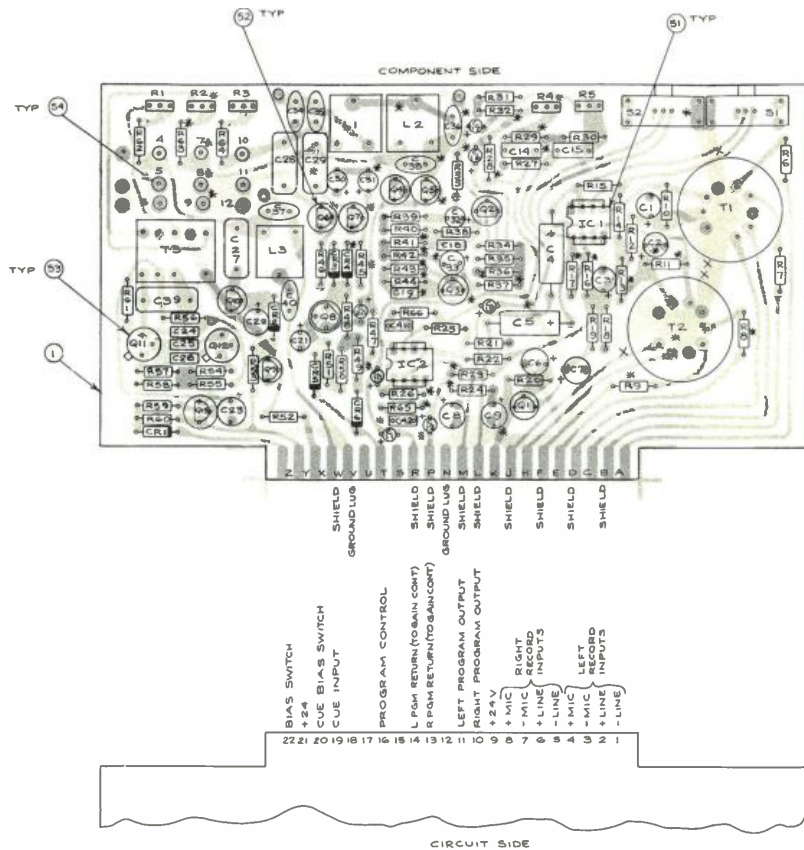
NOTES:

1. RESISTORS IN OHMS, 1/4W, CAPACITORS IN MICROFARADS, UNLESS OTHERWISE NOTED.
2. LAST COMPONENTS USED: R66, C42, CR6, Q13, L3, T3, IC-2 & S2.
- \* 3. FOR MONO UNITS R66 SHALL BE 180K

TELEPHONE USE ONLY RECORDS SHOULD BE MAINTAINED IN ORIGINAL FILE DATE		REVISED DATE	DIFFERENCE DATE	BROADCAST ELECTRONICS INC. - A FILMWAYS COMPANY -
REVISED DATE		REVISED DATE	REVISED DATE	TITLE RECORD AMPS BIAS PCB BOARD
B	PER ECN # 496	11/17/75		REVISED DATE
A	PER ECN # 955	7-9-74		REVISED DATE
REV	DESCRIPTION	DATE	APPROVED	FOR THE EXCLUSIVE USE OF BROADCAST ELECTRONICS, INC. PERSONNEL AND CUSTOMERS ALL RIGHTS RESERVED
D	906-3110			TREATMENT OR FINISH
	3000 S 4000 BALT			SHEET 1 OF 1

Figure 8.  
Schematic Diagram, Record Amplifier/Bias PCB





NOTES:

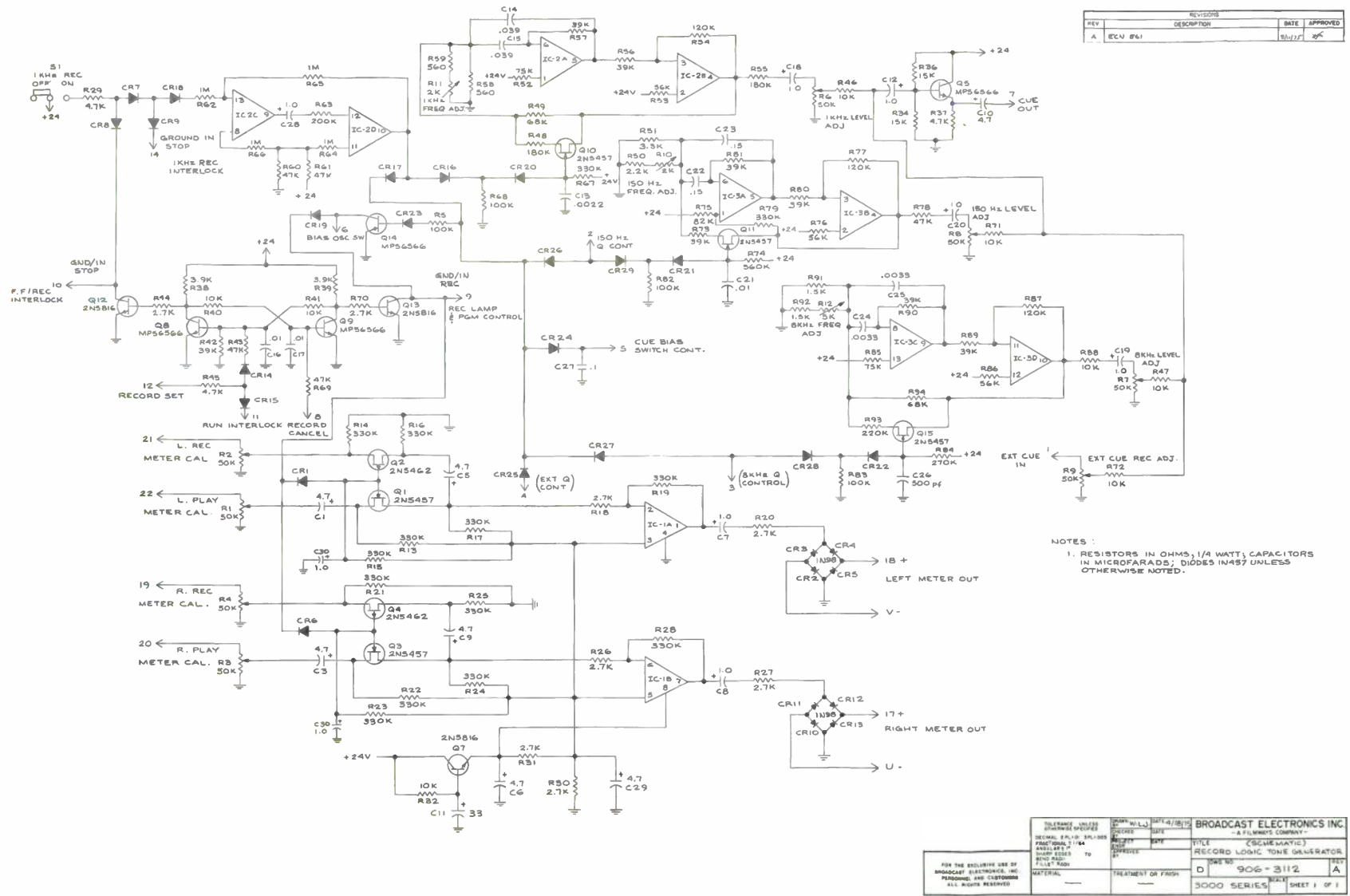
1. PART NUMBER 914-1502 - MONOPHONIC  
PART NUMBER 914-1512 - STEREOPHONIC
2. \* ITEMS NOT INCLUDED IN 914-1502.
3. SOLDER CASE OF INPUT TRANSFORMER (B) TO FOIL AT LOCATIONS MARKED 'X'. USE 60-75 WATT SOLDERING IRON WITH LARGE CHISEL POINT. HEAT NO MORE THAN SIX (6) SECONDS.
4. FOR MONO UNITS REG SHALL BE 180K.

ITEM	QTY	ROD	PART NUMBER	DESCRIPTION	NOTE
37	3		200-0009	DIODE, ZENER, 7.5V (CR2, CR5, CR4)	
36	3		201-0457	DIODE, 1N457 (CR1, CR3, CR6)	
35					
34	1		030-2043	CAPACITOR, .02 MF, 100V (C9)	
33	3		040-1522	150 PF, 50V (C8, C13, C14)	
32	3		040-2223	220 PF, 50V (C3, C4, C6)	
31	2		030-3033	.003 MF, 100V (C8, C15)	
30	3		030-1053	.1 MF, 100V (C27, C28, C29)	
29	2		032-4733	0.047 MF, 100V (C4, C28)	
28	5		030-1043	.01 MF, 100V (C18, C19, C11, C12)	
27	5		064-1063	1 MF, 35V (C16, C17, C20, C23, C30, C31)	
26	5		064-3373	33 MF, 35V (C9, C22)	
25	2		015-5064	4.7 MF, 50V (C4, C5)	
24	5		064-4763	4.7 MF, 35V (C7, C8, C5)	
23	5		063-1063	CAPACITOR, 100 MF, 20V (C1, C2, C5)	
22					
21	1		100-4755	RESISTOR, 47K, 1/4W (R52)	
20	2		100-2723	27K (R54, R57)	
19	3		100-1073	1MEG (R25, R26, R49)	
18	2		100-1563	150K (R63, R66)	
17	3		100-1063	100K (R40, R41, R47)	
16	2		100-2743	2.7K (R30, R32)	
15	6		100-2253	22K (R45, R46, R61) (R33, R43, R56, R32)	
14	4		100-4743	4.7K (R29, R30, R31, R48)	
13	4		100-3953	39K (R27, R28, R53)	
12	2		100-2763	270K (R34, R36)	
11	2		100-1863	180K (R22, R25)	
10	3		100-1043	1K (R10, R38, R44)	
9	11		100-1053	10K (R18, R19, R24, R2, R35, R37, R59)	
8	4		100-2753	27K (R5, R7, R30, R5)	
7	2		100-4733	470K (R14, R16)	
6	2		100-8243	8.2K (R12, R15)	
5	2		100-6253	62K (R10, R11)	
4	4		100-1853	RESISTOR, 18K, 1/4W (R6, R7, R5)	
3	2		178-1064	100K TRIMMER (R1, R5)	
2	3		178-1074	1MEG TRIMMER (R1, R2, R5)	
1	1		314-1502	BLANK P.C. BOARD	
39	1		210-5817	TRANSISTOR, 2N5817 (Q13)	SEE NOTE 1

ITEM	QTY	ROD	PART NUMBER	DESCRIPTION	NOTE
LIST OF MATERIAL					
BROADCAST ELECTRONICS INC					
- A FLUOROS COMPANY -					
RECORD AMP BIAS BOARD					
PART NO: 914-1502 E 914-1512 D					
SERIES: 3000 & 4000					
2/1 SHEET 1 OF 1					

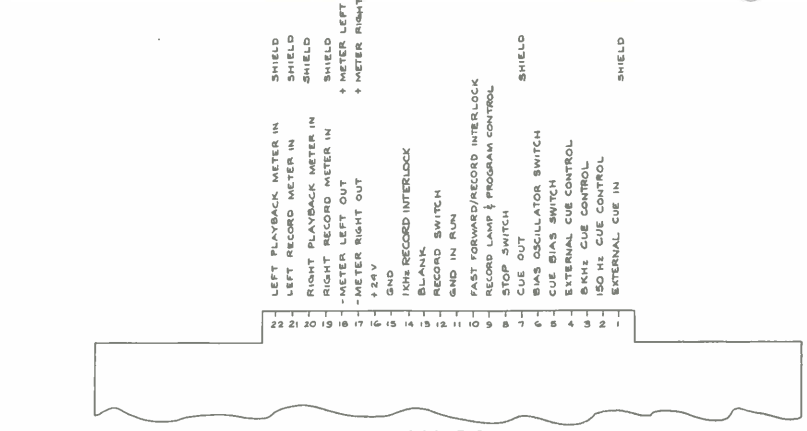
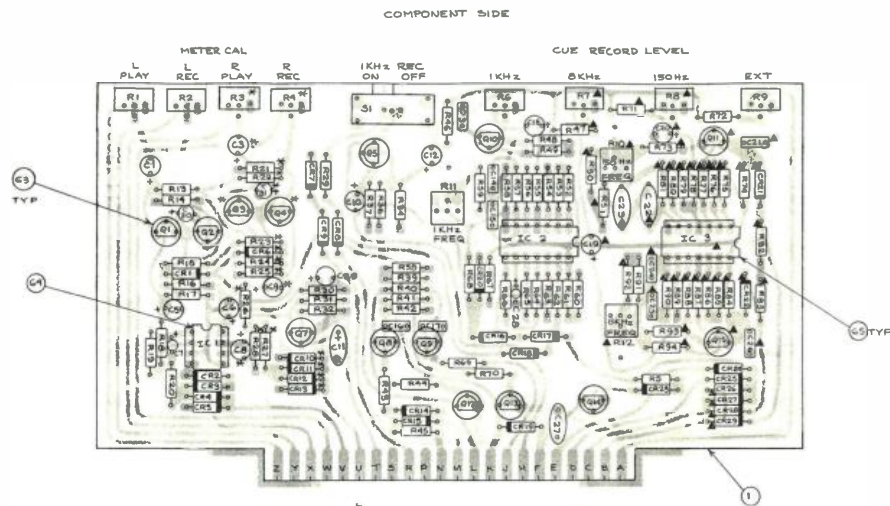
Figure 9. Assembly Diagram and Parts List, Record Amplifier/Bias PCB

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ECN #61	11/17	OK



TOLERANCE UNLESS OTHERWISE SPECIFIED		DATE 4/18/15	BROADCAST ELECTRONICS INC. - A FILMERS COMPANY -	
REV	DESCRIPTION	DATE	TITLE	REV
A	ECN #61	11/17	RECORD LOGIC TONE GENERATOR	A
FOR THE EXCLUSIVE USE OF BROADCAST ELECTRONICS, INC. PERSONNEL AND CUSTOMERS. ALL RIGHTS RESERVED.			3000 SERIES	SHEET 1 OF 1

Figure 10.  
 Schematic Diagram, Record Control and Tone Generator PCB



SHIELD  
SHIELD  
SHIELD  
SHIELD  
SHIELD

LEFT PLAYBACK METER IN  
LEFT RECORD METER IN  
RIGHT PLAYBACK METER IN  
RIGHT RECORD METER IN  
- METER LEFT OUT  
- METER RIGHT OUT  
+ METER LEFT  
+ METER RIGHT

24V

1KHz RECORD INTERLOCK  
BLANK RECORD SWITCH  
GND IN RUN  
FAST FORWARD/RECORD INTERLOCK  
RECORD LAMP & PROGRAM CONTROL  
STOP SWITCH  
CUE OUT  
BIAS OSCILLATOR SWITCH  
CUE BIAS SWITCH  
EXTERNAL CUE CONTROL  
150 Hz. CUE CONTROL  
EXTERNAL CUE IN

NOTES:

1. PART NUMBER 914-1503 - MONOPHONIC  
" " 914-1513 " W/O TRIPS  
" " 914-1523 - STEREPHONIC  
" " 914-1533 " "
2. \* ITEMS NOT USED WITH MONO VERSIONS  
914-1503 & 914-1513  
▲ ITEMS NOT USED WITH STANDARD  
VERSIONS 914-1503 & 914-1523.

REV	REVISION			DATE	APPROVED
DESCRIPTION					
A	GENERAL UPDATE TO REV. A FOIL			4/28/59	JDE
B	ECN 554			8/11/57	
C	ECN 649			4/4/57	

ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
38		030-1043	.01 MFD	(C16, Q7, C27)				
37	2	030-3942	.039 MFD	(C14, C18)				
36	1	030-2033	.022 MFD 100V	(C13)				
35	1	064-3373	33 MFD	(C11)				
34		064-1063	1 MFD	C30, C31, C15, C24, C28				(C7, C8, C12, C18)
33	7	064-4763	4.7 MFD 35V CAPACITOR	(C1, C5, C6, C9, C10, C20)				
32								
31	2	100-3943	3.9K, 1/4W	RESISTOR (R9, R10)				
30								
29		100-7553	75K	(R12, R13)				
28		100-3343	3.3K	(R5, R6)				
27	2	100-5653	560	(R14, R15)				
26								
25	1	100-2062	200K	(R63)				
24	4	100-1075	1MEG	(R12, R14, R15, R16)				
23		100-5663	560K	(R7, R8)				
22		100-8253	82K	(R7, R8)				
21		100-2763	270K	(R8, R9)				
20		100-5653	56K	(R13, R17, R18)				
19		100-1263	120K	(R14, R17, R18)				
18		100-1543	1.5K	(R9, R10)				
17		100-2263	220K	(R12)				
16		100-2243	2.2K	(R10)				
15		100-6853	68K	(R12, R13)				
14	1	100-1863	180K	(R10)				
13		100-4753	47K	(R10, R11)				
12		100-3953	39K	(R10, R11)				
11	2	100-1553	15K	(R10, R11)				
10								
9	0	100-1053	10K	(R10, R11, R12)				
8	3	100-4743	4.7K	(R10, R11, R12)				
7		100-2743	2.7K	(R10, R11, R12, R13)				
6		100-1063	100K	(R10, R11, R12)				
5		100-3363	330K 1/4W	(R10, R11, R12, R13, R14)				
4		178-8054	50K. RESISTOR, TRIMMER	(R12, R13)				
3	1	177-2044	5K 1/2 " "	(R12)				
2		041-5023	500 PFD 500V CAPACITOR (C25)					
1	1	030-1053	.1 MFD 100V	(C27)				
0	1	177-2044	2K RESISTOR, TRIMMER (R10, R11)					
0	1	030-3933	.0033 MFD " "	(C24, C26)				
0	1	030-1553	.15 MFD 100V CAPACITOR (C20, C22)					

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
50		212-5457	2N5457 TRANSISTOR (Q1, Q3, Q10)	
49		212-5462	2N5462 MPS 6566 (Q5, Q8)	
48			CR25, CR26, CR27, CR28, CR29, CR31, CR32, CR23, CR24, CR30, CR14 THRU CR20	
47			CR25, CR26, CR27, CR28, CR29, CR14 THRU CR20	
46		201-0457	1N457 DIODE (CR1, CR5, CR7, CR8)	
45			CR10, CR11, CR12, CR13	
44			CR10, CR11, CR12, CR13	
43		702-0098	1N 9B DIODE (CR2, CR3, CR4, CR5)	
42	1	041-5023	500 PFD 500V CAPACITOR (C25)	
41	1	030-1053	.1 MFD 100V	
40	2	030-3933	.0033 MFD " "	(C24, C26)
39	2	030-1553	.15 MFD 100V CAPACITOR (C20, C22)	

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
1	1	514-1503	BLANK P.C. BOARD	
1	1	(SEE NOTE 1)	RECORD CONTROL & TONE GENERATOR ASSY. BD.	

LIST OF MATERIAL

DESIGNED BY	W.L. GARY	CHECKED BY	W.L. GARY	BROADCAST ELECTRONICS INC
DESIGNED DATE	5/20/57	CHECKED DATE	5/20/57	A FILMWAY COMPANY
ISSUED BY	W.L. GARY	ISSUED DATE	5/20/57	TITLE
ISSUED TO	5/20/57			RECORD CONTROL &
				TONE GENERATOR

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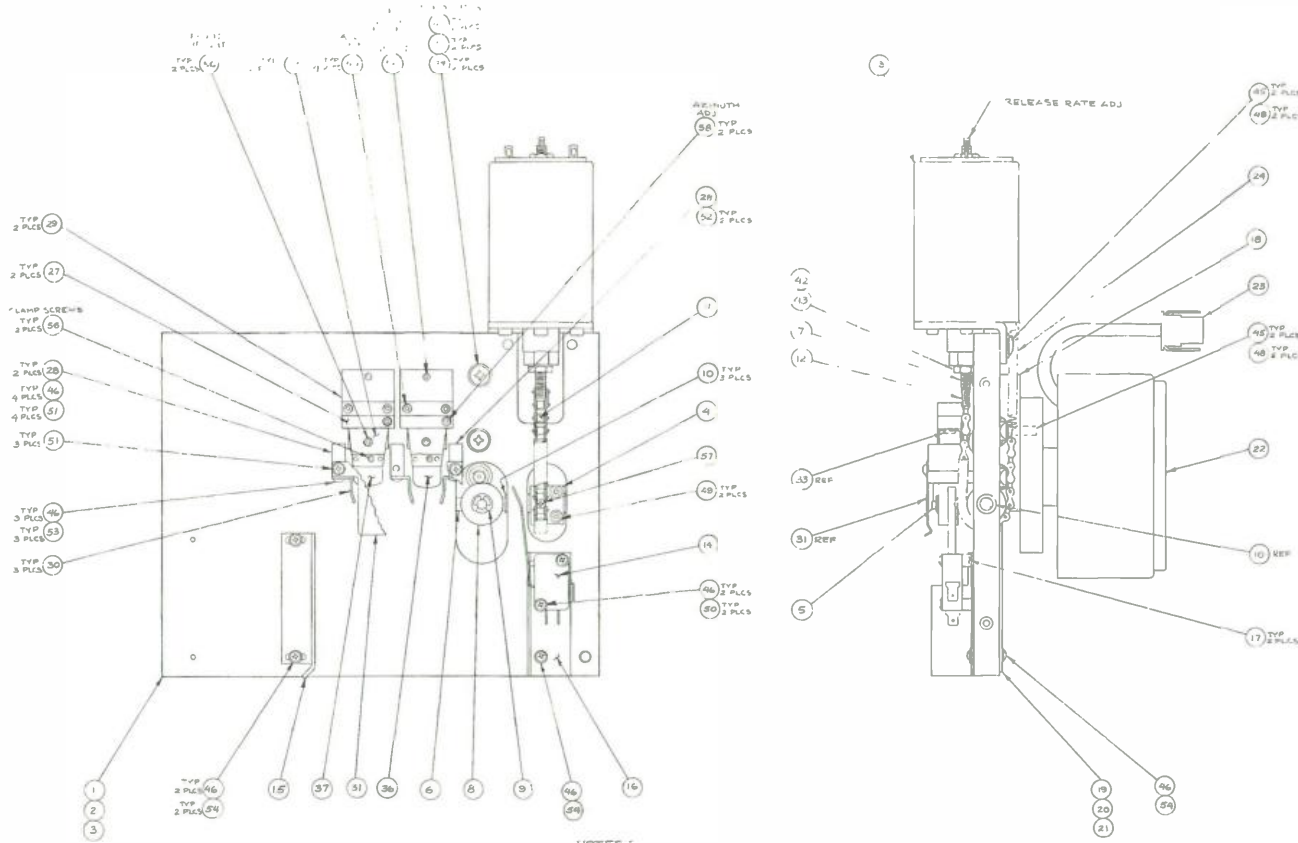
MATERIAL	TREATMENT OR FINISH	DATE	BY
		5/20/57	W.L. GARY

D 914-1503, 1513, 1523, 1533 C

3000 SERIES 2/11 SHEET 1 OF 1

Figure 11. Assembly Diagram and Parts List, Record Control and Tone Generator PCB





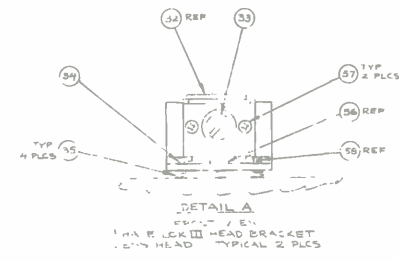
61	4	8-94-0008	PCB SOURCE BOLT-LER ADJUSTMENT W/KE	7
60	---	---	---	---
59	4	---	SOCKET HEAD SET SCREW #4-40 X 1/4	---
58	2	---	SOCKET HEAD CAP SCREW #2-56 X 1/8	---
57	5	---	PHMS #2-56 X 1/4	3
56	6	---	SOCKET HEAD CAP SCREW #2-56 X 1/2	---
55	---	---	---	---
54	4	---	PHMS #4-40 X 1/4	---
53	3	---	PHMS #4-40 X 3/8	---
52	2	---	PHMS #4-40 X 5/8	---
51	7	---	PHMS #4-40 X 5/8	---
40	2	---	PHMS #4-40 X 7/8	---
45	2	---	SOCKET HEAD CAP SCREW #4-40 X 1/2	---
48	8	---	PHMS #10-32 X 1/2	---
47	2	---	PHMS #10-32 X 1"	---
46	13	---	L/W #4	---
45	6	---	L/W #10	---
48	2	---	F/W #10	---
43	1	---	L/W #10, EXT TEETH	---
42	1	---	HEX NUT #10	---
41	---	---	---	---
40	---	---	---	---

37	1	252-0005	HEAD, HIF (MONO, RECORD)	---
37	1	252-0006	HEAD, SIR (STEREO, RECORD)	---
36	1	252-0007	HEAD, HIF (MONO, PLAYBACK)	---
36	1	253-0004	HEAD, SIR (STEREO, PLAYBACK)	---
38	8	430-0047	SPRING, PHASE LOCK III	5'
34	2	430-0120	SPRING	5
33	2	4-420-1H00	SHOULDER SCREW	5
32	2	B-452-0034	CLAMP, HEAD	---
31	1	B-452-0033	SPRING, CARTRIDGE	---
30	3	B-452-0032	TAPE GUIDE	---
29	2	B-459-0092	BASE PLATE	---
28	3	B-459-0091	MOUNTING BLOCK, TAPE GUIDE	---
27	2	B-459-0090	PIVOT BLOCK	---
26	---	---	---	---
25	---	---	---	---
24	1	B-452-0045	SPRING	---
23	1	605-1271V	12-PIN CONNECTOR	---
22	1	---	MOTOR	6
21	1	C-471-0092	DECK PLATE SHIELDING 'C' SIZE	4
20	1	C-471-0091	DECK PLATE SHIELDING 'B' SIZE	3
19	1	C-471-0090	DECK PLATE SHIELDING 'A' SIZE	2
18	1	B-459-0085	MOTOR MOUNT	---
17	2	441-3223	SPACER, 1/4" OD X 1/4" LONG	---
16	1	A-452-0031	GUIDE, RIGHT	---
15	1	A-452-0030	GUIDE, LEFT	---
14	1	304-8100	HIBO SWITCH	---
13	1	389-2565	AIR DAMPED SOLENOID	---
12	1	440-0036	CHAIN LINK	---
11	1	489-0035	CHAIN	---
10	3	A-442-1000	BRONZE BUSHING	---
9	1	458-3318	E-RING	---
8	1	404-0001	PRESSURE ROLLER	---
7	1	A-459-0083	SCREW, MODIFIED	---
6	1	A-459-0082	SHAFT, ROLLER MOUNT	---
5	1	A-459-0081	ROLLER SHAFT	---
4	1	B-459-0080	CHAIN MOUNTING CLAMP	---
3	1	C-491-3000	DECK PLATE FOR MODEL 3300	4
2	1	C-491-2000	DECK PLATE FOR MODEL 3200	3
1	1	C-491-1000	DECK PLATE FOR MODEL 3100	2
---	---	---	DECK ASSEMBLY (3000 SERIES)	1

NOTES:

- PART NO. 906-3122-1 - DECK ASSY FOR MODEL 3100  
PART NO. 906-3122-2 - DECK ASSY FOR MODEL 3200  
PART NO. 906-3122-3 - DECK ASSY FOR MODEL 3300
- USED ON 906-3122-1 ONLY
- USED ON 906-3122-2 ONLY
- USED ON 906-3122-3 ONLY
- SEE DETAIL A FOR FRONT VIEW OF HEAD BRACKET.
- POWER SPEED OPTIONS: (DUAL SPEED MOTOR USED W/FAST FWD OPTION)  

MOTOR PART NO.	POWER	SPEED
382-1020	115V/60 HZ	SINGLE
382-2030	115V/60 HZ	DUAL
382-1060	115V/50 HZ	SINGLE
382-2010	115V/50 HZ	DUAL
- ITEMS NOT SHOWN ON DRAWING.



FOR THE EXCLUSIVE USE OF BROADCAST ELECTRONICS, INC. PERSONNEL AND CUSTOMERS. ALL RIGHTS RESERVED.		LIST OF MATERIALS		BROADCAST ELECTRONICS, INC. A FILMSTRIP COMPANY	
DATE	BY	REV	DATE	REV	DESCRIPTION
					3 1/2" X 1 1/2" DECK ASSEMBLY 3000 # 3100
MATERIALS		TREATMENT OR FINISH		REV	DATE
				1	906-3122
				3000 SERIES	1/1 SHEET 1 OF 1

Figure 12. Deck Assembly

MOTOR WIRING (3000)

TOP VIEW  
WIRE ENTRY SIDE  
PART NO. 695-1271V



PIN	SINGLE SPEED	TWO SPEED
1	*	*
2	VIO	VIO
3	*	*
4	BLU	BLU
5	ORN	ORN
6	YEL	YEL
7	(OPEN)	GRN
8		BLK
9		RED
10		(OPEN)
11		WHT
12	(OPEN)	(OPEN)

NOTE: \* 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.

POWER TRANSFORMER (376-7656) WIRING

TOP VIEW  
WIRE ENTRY SIDE  
PART NO. 695-1271V



PIN	120V	105V	240V	210V
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

Figure 13. Motor Wiring and Power Transformer Diagrams

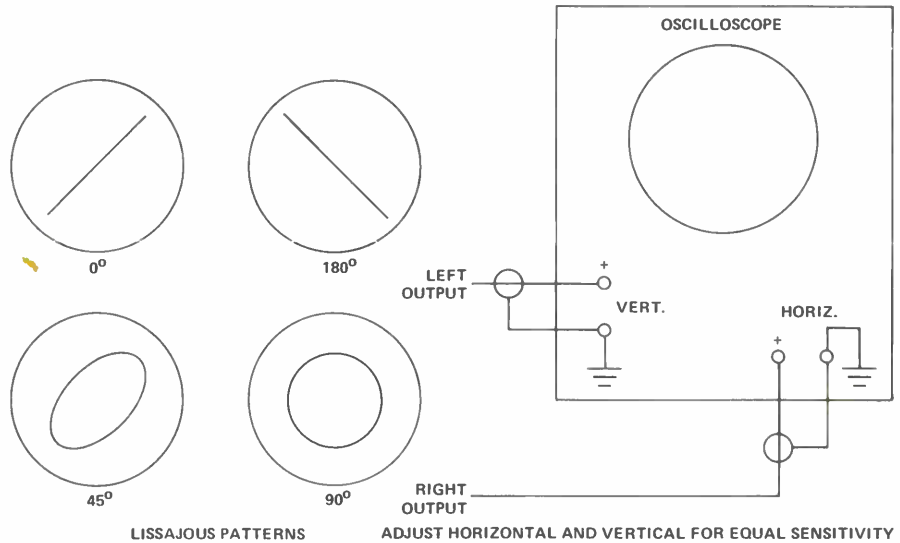
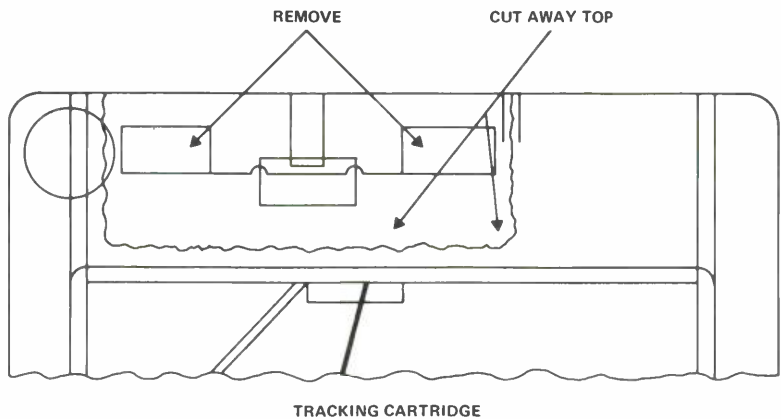


Figure 14. Tracking Cartridge and Stereo Phasing Test

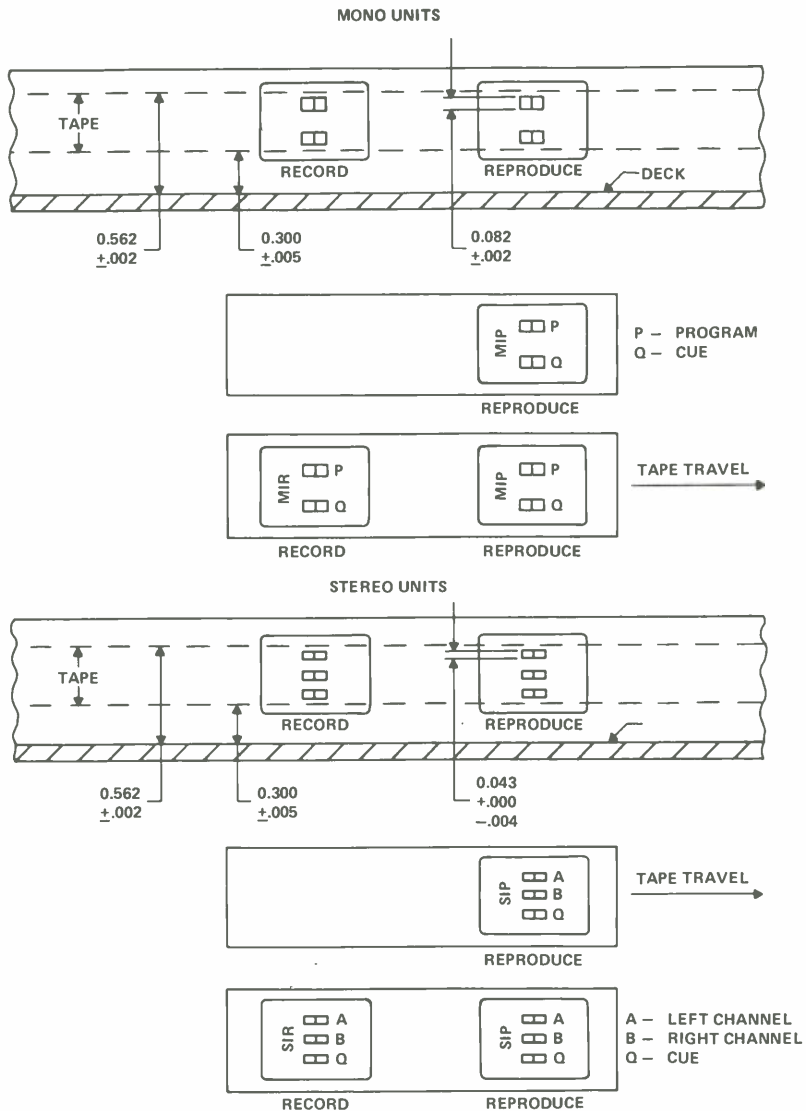
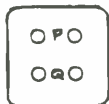


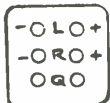
Figure 15. Head Position and Track Configuration

REAR VIEW

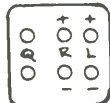


M1P MONO PLAY (252-0007)  
M1R MONO RECORD (252-0008)

FRONT VIEW



S1P STEREO PLAY (253-0004)  
S1R STEREO RECORD (253-0005)

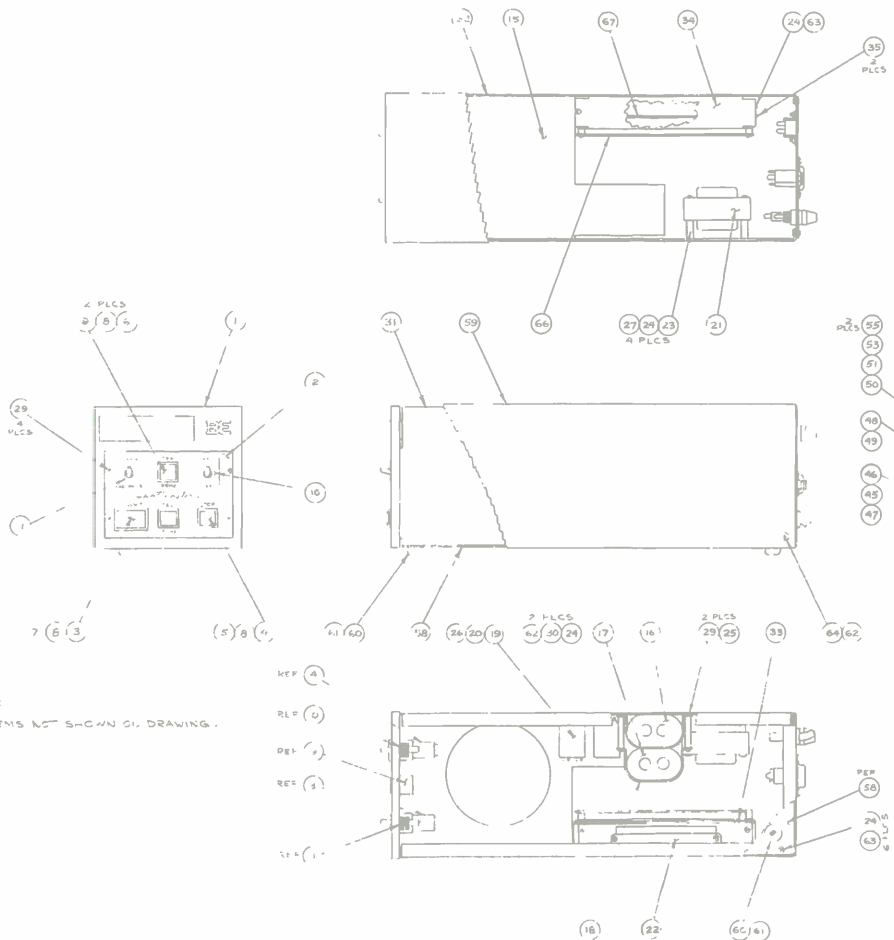


ALTERNATE CONFIGURATION  
S1P ≠ S1R



P = PROGRAM (MONO) TRACK  
Q = CUE TRACK  
L = LEFT PGM TRACK (STEREO)  
R = RIGHT PGM TRACK (STEREO)

Figure 15 (Cont.). Tape Head Connections



NOTES:  
 1. \* ITEMS NOT SHOWN ON DRAWING.

67		411-1002	COVER
68		411-0075	BOTTOM PLATE
69			
70	A/R		SELF-TAPPING SCREW #6 X 1/2
71	A/R	407-3000	TRANSISTOR COVER
72		214-1274	CAPACITOR, 33MFD, 35V
73		227-1624	24 VOLT REGULATOR, 1C1
74		219-3055	POWER TRANSISTOR, Q1
75		417-0298	TRANSISTOR SOCKET
76			SKWIDLE NUT #6-32
77		410-1416	SLIDE LUG #6
78		415-0071	WIRE NUT
79		410-0035	STRAIN RELIEF
80		681-1723	LINE CORD
81		430-0100	FUSE, 1 AMP
82		415-2012	FUSE HOLDER
83		417-0311	PHONE JACK
84		418-0303	24-PIN CONNECTOR-CINCH, JS
85		418-0302	6-PIN CONNECTOR-CINCH, JS
86		471-0076	REAR PANEL

35		418-0306	24-PIN PLUG CINCH 1" REMOTE *
36		418-0304	6-PIN PLUG CINCH 1/4" PLAY OUT *
37		319-1504	EXTENDER P.C. BOARD *
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48		314-1571	PLAYBACK LOGIC P.C. ASSY, STEREO W/RF & G
49		314-1561	W/G
50		314-1551	W/JEF
51		314-1541	STEREO
52		314-1531	MONO W/RF & G
53		314-1521	W/G
54		314-1511	W/RF
55		314-1501	PLAYBACK LOGIC P.C. ASSY, MONO
56		314-1530	POWER SUPPLY P.C. ASSY, W/RF & STRIPS
57		314-1520	W/RF
58		314-1510	W/G, TRIPS
59		314-1500	POWER SUPPLY P.C. ASSY
60			
61			
62	A/R		L/WASHER #6
63	A/R		F.H.M.S. #6-32 X 3/16
64	A/R		F.H.M.S. #6-32 X 3/8
65	A/R		F.H.M.S. #6-32 X 2/8
66	A/R		HEX W/UT #6-32 (NOT USED IN RF UNITS) *

70		450-1700	INDF 1 LUG
71		347-7108	SWITCH, MIN TOGGLE, SPST (RF ONLY)
72		347-7101	SWITCH, MIN TOGGLE, SPST 33 OX/DFE
73		324-0128	INDICATOR LAMP HOLDER (Q TRIPS ONLY)
74		321-4127	1 AMP
75		343-0152	SWITCH CAP, GREEN
76	A/R	343-0014	SWITCH CAP, WHITE (Q TRIPS ONLY)
77		343-0013	SWITCH CAP, RED
78		343-0012	SWITCH, ILLUM PB, 5/2 STOP
79		343-0150	SWITCH, ILLUM PB, 51 START
80		503-0012	FRONT PANEL (Q TRIP)
81		503-0001	FRONT PANEL
82		460-1065	FRONT PANEL MOUNT
83			FRONT PANEL MOUNT, MODEL 3100

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TOLERANCE UNLESS OTHERWISE SPECIFIED	
FRACTIONAL PARTS PER THOUSAND	FRACTIONAL PARTS PER THOUSAND
DECIMALS TO	DECIMALS TO
FRACTIONAL PARTS PER THOUSAND	FRACTIONAL PARTS PER THOUSAND
BROADCAST ELECTRONICS INC.	
A FILMWAYS COMPANY	
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Figure 16.  
 3100 Models Assembly Diagram

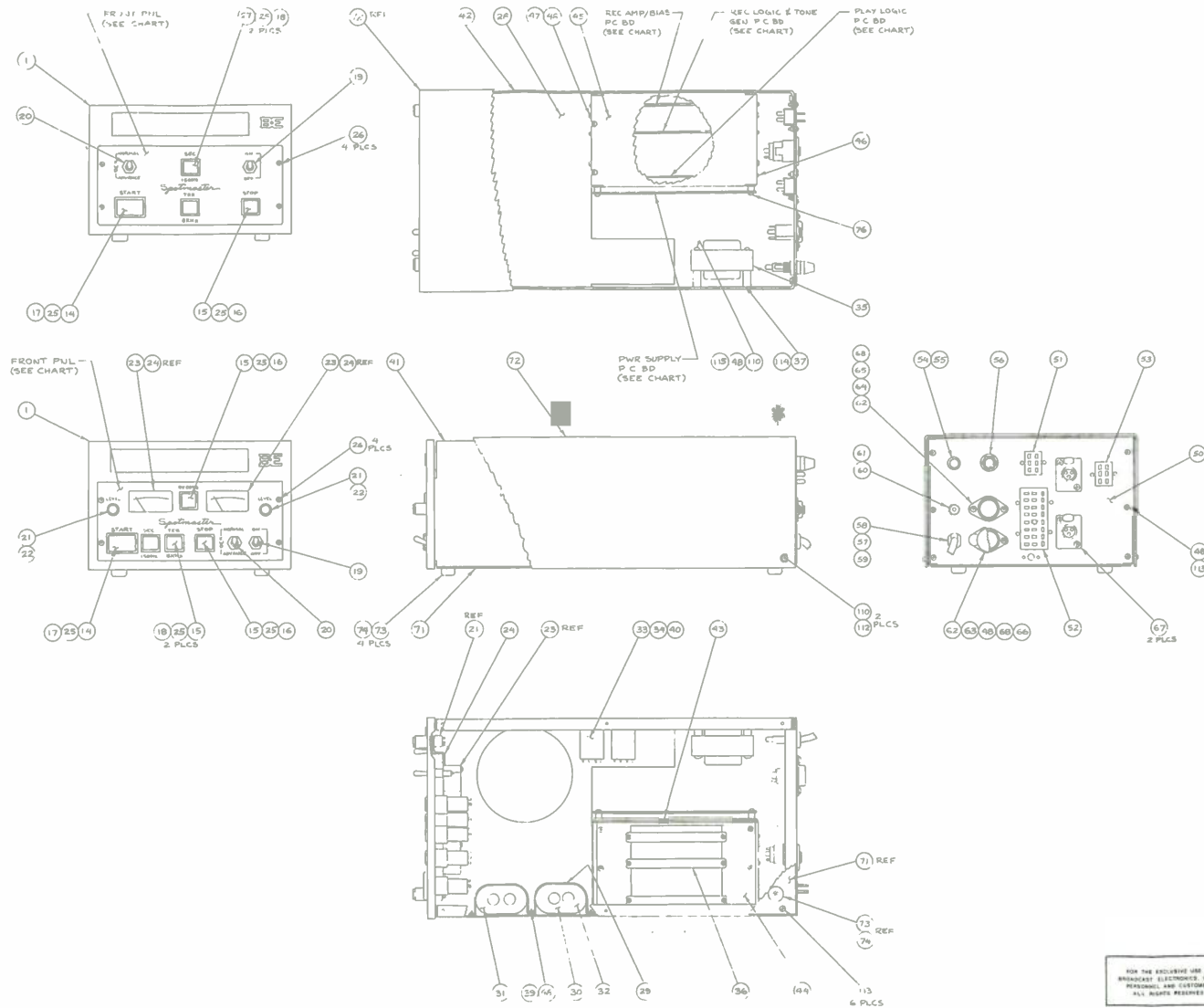
LIST OF MATERIALS		LIST OF MATERIALS	
PART NUMBER	DESCRIPTION	ITEM QTY	PART NUMBER DESCRIPTION
51	651-1723	1	410-0006 FINAL ASSEMBLY, MODELS 3200, 3300
52	401-0005	1	480-0007 FRONT PANEL MOUNT, MODEL 3200
53	419-0071	1	403-0052 FRONT PANEL MOUNT, MODEL 3300
60	410-1416	2	503-0013 FRONT PANEL
61		3	503-0013
62	417-0298	4	503-0014
63	219-3055	5	503-0005
64	227-7824	6	503-0006
65	044-3274	7	503-0007
66	407-3000	8	503-0008
67	417-0303A	9	503-0015
68	751-1200	10	503-0010
69		11	503-0011
70		12	503-0015
71	471-0080	13	503-0004 FRONT PANEL
71	471-0081	14	343-0150 SWITCH, ILLUMINATED P.B. 1/1 START
71	471-0082	15	343-0012 SWITCH, ILLUMINATED P.B. 2, 3, 4, 5, 6, 5, 7 QD
72	471-0083	16	343-0013 CAP. RED
72	471-0084	17	343-0152 CAP. 4RN
73	403-2194	18	343-0014 CAP. WHT
74		19	347-7101 MIN. TOMBLE, SPST, 25 ON/OFF
75		20	347-7108 SWITCH, MIN. TOMBLE, SPST 5/4 FF
76		21	450-1700 HOLE PLUG
77	914-1500	22	191-1023 POTENTIOMETER, 10K
78	914-1510	23	484-0500 KNOB
79	914-1520	24	319-0081 VU METER
80	914-1530	25	459-0018 VU METER CLAMP
81	914-1501	26	321-C327 LAMP
82	914-1511	27	324-0125 INDICATOR LAMP HOLDER, 5/8" Ø (PLAY ONLY UNITS)
83	914-1521	28	453-0007 DECK ASSEMBLY, MODEL 3300
84	914-1531	29	453-0007 MOTOR CAPACITOR, CLAMP
85	914-1541	30	029-2063 2 MFD
86	914-1551	31	029-3066 3 MFD
87	914-1561	32	029-1068 MOTOR CAPACITOR, 1 MFD
88	914-1571	33	370-0025 OUTPUT TRANSFORMER
89	914-1502	34	370-0017 TRANSFORMER SHIELD
90	914-1512	35	376-7656 POWER TRANSFORMER
91	914-1503	36	417-2100 22-PIN CARD EDGE CONNECTOR
92	914-1513	37	441-8158 STANDOFF, 1/4" X 5/8" LG X 6-32 TAP
93	914-1523	38	
94	914-1533	39	HEX NUT #8-32
95	919-1504	40	FHMS #2-36 X 3/16
96		41	471-0070 SIDE PLATE RIGHT
97		42	471-0071 SIDE PLATE LEFT
98	718-0304	43	471-0072 WRAPAROUND, P.C. CARD CAGE
99	418-0306	44	471-0074 MOUNTING PLATE, CONN
100	418-0308	45	471-0086 COVER, P.C. CARD
101		46	695-0020V GUIDE, P.C. CARD
102		47	FHMS #6-32 X 1/4
103		48	L/WASHER #6
104		49	
105		50	471-0077 REAR PANEL, MODEL 3200
106		51	471-0078 REAR PANEL, MODEL 3300
107		52	418-0302 6-PIN CONNECTOR, CINCH (F), J4
108		53	418-0303 24-PIN CONNECTOR, CINCH (F), J5
109		54	418-0301 6-PIN CONNECTOR, CINCH (M), J7
110		55	415-1200 HOLE PLUG
111		56	415-2012 FUSE HOLDER
112			350-0000 FUSE, LAMP
113			417-0311 PHONE JACK, .36
114			
115			

NOTES:  
1. \* ITEMS NOT SHOWN ON DRAWING.

MODEL	STANDARD	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					
MODEL 3200P 906-3200	MANUAL FAST FWD	906-3008	2	77	81	89	91	30					
	Q-TRIPS	906-3000	12	78	83	89	91	32					
	AUTO FWD & Q TRIPS	906-3006	12	80	84	89	92	31					
	STANDARD		3	77	81	89	91	30					
MODEL 3200RP 906-3201	MANUAL FAST FWD	906-3005	3	79	82	87	91	31					
	Q-TRIPS	906-3001	4	78	83	89	92	30					
	AUTO FWD & Q TRIPS	906-3007	4	80	84	89	92	31					
	STANDARD		2	77	81	89	91	30					
MODEL 3202 906-3202	MANUAL FAST FWD	906-3005	2	79	86	90	93	31					
	Q-TRIPS	906-3000	12	78	87	90	94	30					
	AUTO FWD & Q TRIPS	906-3006	12	80	88	90	94	31					
	STANDARD		5	77	85	90	93	30					
MODEL 3200RPS 906-3203	MANUAL FAST FWD	906-3005	5	79	86	90	93	31					
	Q-TRIPS	906-3001	6	78	87	90	94	30					
	AUTO FWD & Q TRIPS	906-3007	6	80	88	90	94	31					
	STANDARD		7	77	81	89	91	30					
MODEL 3300P 906-3300	MANUAL FAST FWD	906-3005	7	79	82	89	91	31					
	Q-TRIPS	906-3000	13	78	83	89	92	30					
	AUTO FWD & Q TRIPS	906-3007	13	80	84	89	92	31					
	STANDARD		8	77	81	89	91	30					
MODEL 3300RP 906-3301	MANUAL FAST FWD	906-3005	8	79	82	89	91	31					
	Q-TRIPS	906-3001	9	78	83	89	92	30					
	AUTO FWD & Q TRIPS	906-3007	9	80	84	89	92	31					
	STANDARD		7	77	85	90	93	30					
MODEL 3300PS 906-3302	MANUAL FAST FWD	906-3005	7	79	86	90	93	31					
	Q-TRIPS	906-3000	13	78	87	90	94	30					
	AUTO FWD & Q TRIPS	906-3006	13	80	88	90	94	31					
	STANDARD		10	77	85	90	93	30					
MODEL 3300RPS X6-1303	MANUAL FAST FWD	906-3005	10	79	86	90	93	31					
	Q-TRIPS	906-3001	11	78	87	90	94	30					
	AUTO FWD & Q TRIPS	906-3007	11	80	88	90	94	31					
	STANDARD		10	77	85	90	93	30					

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Figure 17.  
Sheet 1  
3200 and 3300 Models Assembly Diagram



TOLERANCE UNLESS OTHERWISE SPECIFIED		DATE	BY	BROADCAST ELECTRONICS INC - A FILMWAYS COMPANY -	
DESIGNER	DATE	DATE	DATE	TITLE	3200 & 3300
APPROVED BY	DATE	DATE	DATE	TITLE	FINAL ASSEMBLY
DATE	DATE	DATE	DATE	DWG NO	306-3123
MATERIAL		TREATMENT OR FINISH	2000 SERIES 1/4 SHEET 1 OF 2		

Figure 17.  
Sheet 2  
3200 and 3300 Models Assembly Diagram