

INSTRUCTION MANUAL

Series 4000
Tape Cartridge Machines

Revised: 1 February 1980

IM No. 839-0400



BROADCAST ELECTRONICS INC. *Spotmaster*® TAPE CARTRIDGE SYSTEMS

a FILMWAY company

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SERIES 4000 TAPE CARTRIDGE MACHINES

INSTRUCTION MANUAL

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SECTION 1

INTRODUCTION

1.1 GENERAL DESCRIPTION AND FEATURES

SPOTMASTER® SERIES 4000 tape cartridge machines prove that a no-nonsense cartridge machine can be innovative without sacrificing reliability. Advanced design features include a solid machined aluminum deck plate that will not warp or bow, assuring consistent head to tape alignment. Styling is clean with a wide, low silhouette cabinet and a die cast front panel. Electronic circuitry is conservatively designed to the proposed 1975 NAB standards. Careful SPOTMASTER manufacturing insures dependable operation with minimum maintenance.

The SERIES 4000 is equipped with an automatic release deck, direct drive motor and air damped solenoid. Power consumption is less than 50 watts for quiet, cool operation even with the optional fast forward.

The SERIES 4000 features the exclusive PHASE LOK III head bracket with independent azimuth adjustment. PHASE LOK III provides stable, reliable phasing in stereo units and the independent azimuth adjustment permits quick, accurate azimuth setting without disturbing height and zenith. Rugged construction and locking provision ensure continued optimum performance. Playback only models are also equipped with a dummy record head.

Both SERIES 4000 record/playback models are equipped for line and microphone inputs as standard features. Record models are available with optional full diagnostic metering in addition to input and output metering. Diagnostic metering permits quick machine inspection and simplifies adjustment.

An optional internal Fault/Splice Detector unit is available for use with the recorders to quickly position splices and locate creases or other problem areas on the tape. The fault detector sensitivity may be regulated to suit your particular quality control requirements.

Fast forward cueing is available as an option to all SERIES 4000 models. Configurations for manual or automatic initiation of this 3 times normal tape speed may be selected. Installation of the optional secondary 150 Hz (QI) auxiliary cue tone provides automatic fast cartridge cueing at the end of message. The QI secondary and QII (8 kHz) tertiary cue tones are available as a pair in either playback only or record/playback models. For use with automation systems, an optional provision for logging encoding/decoding is also available.

SERIES 4000 cartridge machines are available in two sizes for table top or rack mounting. The model 4300 for A, B, and C size cartridges is available in mono or stereo record/playback configurations. The space saving model 4200 for A and B size cartridges is available in mono or stereo playback only versions. Two model 4200 units mount side by side in a 19" rack.

All SERIES 4000 models are equipped with balanced transformer output with FET switching to permit paralleling of machines. Complete remote control capabilities are provided; mating connectors are supplied for all interconnections. Accessory remote control panels are available.

1.2 SPECIFICATIONS

TAPE SPEED	7.5 ips (19.05 cm/s)
TIMING ACCURACY (at 7.5 ips)	0.1%
FAST-FORWARD TAPE (OPTIONAL)	22.5 ips (57 cm/s)
TAPE START/STOP TIME	0.1 second maximum
WOW AND FLUTTER	0.15% peak weighted 0.2% RMS unweighted
NOISE (REPRODUCER)	Monophonic; 62 dB or better below reference of 400 Hz at 3% THD 54 dB below 160 n Wb/m at 1 kHz Stereophonic 60 dB or better below reference of 400 Hz at 3% THD 52 dB below 160 n Wb/m at 1 kHz

DISTORTION	2% or less record to playback at 160 n Wb/m at 1 kHz
EQUILIZATION	NAB, IEC, CCIR as specified
FREQUENCY RESPONSE	± 2 dB from 50 Hz to 15 kHz exclusive of head contour effect
CROSSTALK (MAGNETIC HEAD LIMITED):	Cue channel to program channel, monophonic 150 Hz -50 dB or better 1000 Hz -55 dB or better 8000 Hz -50 dB or better Stereo, crosstalk between program channels; better than 50 dB, 50 Hz to 15 kHz
INPUT IMPEDANCE (RECORDER)	Microphone (optional): 150 ohms (transformer) balanced floating
INPUT LEVELS	Line: 50 k ohms (transformer) balanced floating Microphone (optional): -70 to -24 dBm Line: -24 to +20 dBm (50 mV to 7.7 V)
AUDIO OUTPUT	Maximum adjustable level +8 dBm from 160 n Wb/m at 1 kHz; 600 ohms (transformer) balanced
PEAK OUTPUT LEVEL	+20 dBm before clipping
BIAS OSCILLATOR FREQUENCY	100 kHz
CUE SIGNALS	Relay contact closure for external control (150 Hz, 8 kHz). External cue input/output available at remote control for other control functions
AMBIENT OPERATING TEMPERATURE	0° to 55° C (32° to 132° F)
POWER REQUIREMENTS	105 to 125 V/210 to 230 V; 50 or 60 Hz
POWER CONSUMPTION	45 to 50W maximum
MOUNTING	Desk top standard. Adaptors for rack mounting optional
EXTERNAL CONNECTORS	Mating plugs furnished
DIMENSIONS	4200: 5-1/4" H x 8-1/2" W x 12-1/8" D 4300: 5-1/4" H x 17" W x 12-1/8" D (Add 3/8" to height for rubber feet)
WEIGHT	4200: 25 pounds 4300: 40 pounds
REMOTE CONTROL	Duplication of essential front panel controls and indicators

1.3 WARRANTY

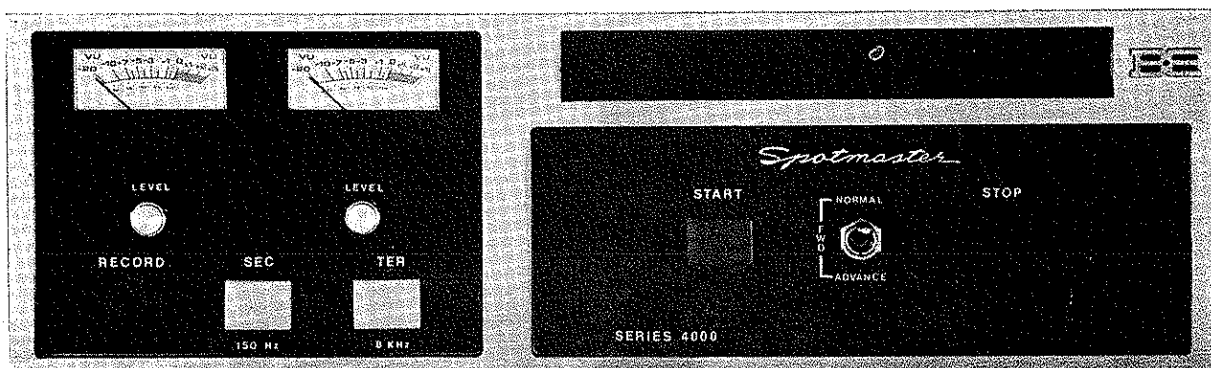
Broadcast Electronics products are guaranteed to be free from defects in workmanship and material for a period of one year after shipping date when subjected to normal usage or service. All warranties are void, A) If equipment has been altered or repaired by others without Broadcast Electronics' specific 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.

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4200P or 4200PS with optional manual fast forward shown.



4300RPS with optional automatic fast forward and Q Trips installed.

Representative Series 4000 Units

SECTION 2 INSTALLATION

2.1 OPTIONAL RACK MOUNTING

SERIES 4000 units are equipped for table-top mounting. However, optional rack mounting adapters are available for use in standard EIA 19" racks. If only one 4200 unit is to be rack mounted, blank filler panels are available in 1/2 rack widths.

To prepare a 4200 unit for rack mounting, remove the top and bottom covers. Install filler panels (as needed) in the front of the adapter shelf and mount the 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.

Place the unit (or units) into the adapter shelf from the front and secure with the captive fasteners installed at the rear of the shelf.

The 4300 unit is completely self-contained and ready for standard 19" rack mounting. The only additional hardware needed are the "Mounting Ears" (part no. 906-4014) to hold the unit securely in the rack.

2.2 AUDIO INPUT AND OUTPUT

Refer to Figure 1.

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 (50K ohms) impedance balanced bridging for signals from -24 to +20 dBm (50mV to 7.7V) level. The input or output may be connected for unbalanced operation by connecting the "-" and shield. If connecting to other than a 600 ohm load, 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 MICROPHONE INPUT

Record models provide for microphone input through a rear panel socket. This input is designed for 150 ohm balanced microphones with an output level of -70 to -24 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 1.

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 (QI 150 Hz and QII 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.

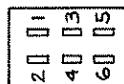
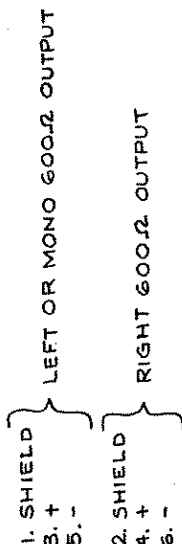
2.5 GROUND TERMINAL

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

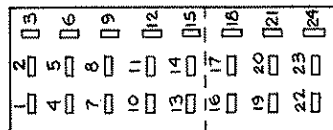
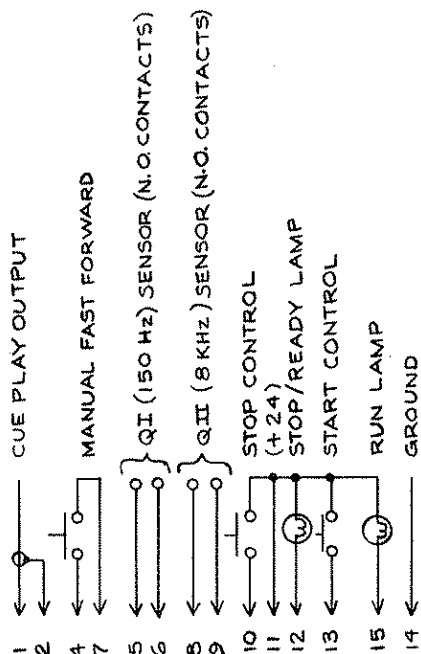
All SERIES 4000 units are equipped with NEMA three-wire grounded AC line cord. Models are available for operation from single phase power sources rated at 117 VAC/60 Hz, 220 VAC/50 Hz, etc., as indicated on the rear panel serial plate.

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



PLAY LINE OUT
(J4)
CINCH NO. P-306-CCT
6 PIN MALE
BEL. NO. 418-0304

PLAY SECTION

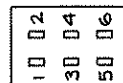
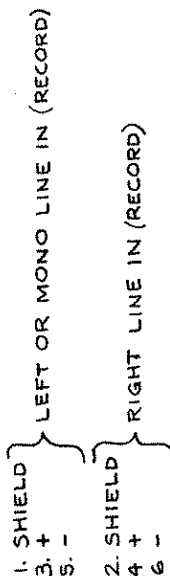


REMOTE
CONNECTOR
(J5)
CINCH NO. P-324-CCT
24 PIN MALE
BEL. NO. 418-0306

RECORD SECTION



* IN DELAY UNITS THIS PIN BECOMES DELAY SET.



RECORD LINE IN
(J7)
CINCH NO. S-306-CCT
6 PIN FEMALE
BEL. NO. 418-0305

REAR VIEW, MATING CONNECTORS

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

REAR PANEL CONNECTOR WIRING
REV
B-906-3104 A

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

Figure 1. Rear Panel Connector Wiring Diagram

SECTION 3 OPERATION

3.1 PLAYBACK

Turn on the AC power with the front panel switch. The motor shaft will 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 4200 models accept both NAB A and B size. The 4300 models accept all three size cartridges: A, B, and C.

Note

The machines 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 will 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 4000 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 4300RP, and 4300RPS 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.

Place the unit in record by depressing the RECORD switch. The lamp in this switch will 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 4000 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 re-cues 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 4000 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 4000 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. 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 PREAMPLIFIER BOARD CIRCUIT DESCRIPTION

4.1.1 Configuration

The Preamplifier Board contains the playback preamplifiers for the program tracks, the cue track amplifier, and the 1 kHz stop cue sensor. When the optional Q Trips are installed, the QI 150 Hz and QII 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 Preamplifier Board as shown in the assembly diagram in Figure 4. The exact configuration used in a particular machine is indicated in the table in Figure 17 or 18. 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 3 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 C2 (C7) 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), R9 (R20), R17 (R18), C5 (C8). The variable high and low frequency trimmers permit adjusting the equalization to match individual heads to NAB or other standards (IEC, CCIR, etc.). Internal DC voltage is supplied to both halves of IC-1 through pin 14 from the decoupling network R16, C17. Bias DC is provided from the voltage divider R12, R15, C13 through R13, R14. The output of the preamplifier is coupled through C14 (C15) and terminal 14 (13) to the Logic Driver Board for further amplification.

4.1.3 Cue Track Audio and 1 kHz Stop Sensor

The cue track of the playback head is coupled through C20 to the input of IC-2A which acts as a preamplifier with gain and equalization comparable to the program preamplifiers as provided by R22, R23, R24 and C19. Bias for IC-2A is supplied through R27 from voltage divider R29, R30.

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 R25 and R26. The amplified signal is coupled through C16 to the cue output (on the rear panel remote control connector) through pin 19 and to the 1 kHz sensor level control (R6).

The signal is coupled through C27 to a fixed tuned twin-T filter composed of IC-3A, R36, R37, R38, C28, C29, and C30. The 1 kHz output of the filter is AC coupled to half wave rectifier CR8, CR9. Capacitor C44 provides filtering. The FET Q2 is connected to ground the signal to disable the sensor. In the stop mode, the gate of Q2 grounds to the stop/start logic through CR16 and R74 to turn Q2 on. When the ground is removed as the logic changes to the run mode, C42 keeps Q2 in conduction (and the sensor muted) for approximately three seconds. Similarly, the gate of Q2 can ground through R48 and CR4 to the fast forward cue shift/mute bus. Removing this ground activates the sensor almost immediately.

The DC signal from R64 is connected to comparator IC-5D. When this voltage exceeds the reference from R49, R50, connected through R62, the output of IC-5D goes to +VDC to deliver a pulse through C49 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 (R6) to FET Q1. 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 C23 discharges through R31. 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, Q1 immediately shuts off to disable the 3 kHz sensor.

Following Q1 the audio signal is fed to LC filter L1, C26, and to IC-3B for amplification. The output is rectified, filtered, and fed to comparator IC-5B. With 3 kHz tone present at the filter, the output of IC-5B goes high to deliver a positive pulse through CR14 and C49 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, C45 keeps the reference voltage higher than normal until the circuit stabilizes. At turn-off, C24 and CR2 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-4B, IC-5A while the 8 kHz (QII) tone is sensed by IC-4A, IC-5C.

4.1.6 Logging Cue Tone Output

A high impedance, unbalanced output is located on Pin 1, remote connector J5 providing a one-half volt audio output from the cue track for the NAB standard 3.5 kHz logging tone. All other cue tones will also appear at the output.

Logging cue outputs from several machines can be bussed together for logging purposes without other cue tone interference, although there may be a slight loss of output level.

4.2 LOGIC DRIVER BOARD CIRCUIT DESCRIPTION

4.2.1 Configuration

The Logic Driver Board contains the program track output amplifiers, the stop/start logic, and the solenoid control circuitry. The Logic Driver is manufactured in separate monophonic and stereophonic versions as shown in the assembly diagram in Figure 6. The exact version required in a particular machine is shown in the table in Figure 17 or 18. The schematic diagram in Figure 5 shows the stereophonic configuration.

4.2.2 Program Track Amplifiers

The output of the program track preamplifier is coupled through C17 (C18) to the FET program muting switch Q12 (Q11). 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 R29, R31, C13 through R33, R35, (R32), R34, (R30). FET timing is set by R33 and C16.

The output of the FET is coupled through C15 (C14) to the output level control R39 (R38). The audio signal is also available through board pin 1 (2) for the VU meter installed in record/playback models.

Signal from the level control is coupled through C9 (C8) to the output booster IC-1. This dual amplifier and the complementary symmetry drivers Q7, Q8 (Q9, Q10) provide 28 dB gain to drive the output to a maximum +18 dBm. This gain is determined by R24 (R19), R25 (R18). DC bias for

Q7, Q8 (Q9, Q10) is provided by CR12, CR13, CR14 (CR9, CR10, CR11). Bias for IC-1 is supplied from the divider R22, R23, C10 through R21, R20; and internal voltage directly from the +24 VDC.

The fully amplified signal is coupled through C7 (C6) 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.)

4.2.3 Stop/Start Logic

Stopping and starting are controlled by the flip-flop composed of Q3, Q6. The circuit is a bi-stable multivibrator in which Q3 is conducting and Q6 is off, or Q6 is conducting and Q3 is off. When Q3 is off the collector is not drawing current and is at a 18 VDC level. This voltage is carried through R10 to the base of Q6 to hold Q6 in full conduction. Likewise, when Q6 is off, the voltage from its collector goes to the base of Q3 through R9 to hold Q3 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 R13 and R14. To prevent false triggering, capacitors C3 and C4 shunt short duration transient pulses to ground. When power is first applied, R11 ensures that the flip-flop will set to stop with Q6 conducting. The output voltages from Q3 and Q6 are coupled to driver transistors Q4 and Q5 through R6 and R12. When Q6 is conducting, Q5 is held off. When Q6 is off, the base of Q5 goes high to turn on Q5. A ground is supplied through CR3, CR5, CR6, and CR7 to the logic. Similarly, when Q3 is off, Q4 is conducting to supply a ground to the logic through terminals U and V.

4.2.4 Solenoid Control

When the logic is in the run mode, the base of Q2 is pulled low and Q2 conducts. Transistor Q1 (mounted on the card cage) turns on to provide a ground for the solenoid to draw a full +30 VDC. As Q1 conducts, C2 begins to charge through R5. As C1 charges the base of Q13 is pulled high and Q13 begins conducting. As Q13 begins conducting, Q1 begins to shut off to reduce and stabilize the current through the solenoid.

When the logic returns to the stop mode, Q3 turns off. As the solenoid de-energizes, CR1 suppresses inductive spikes.

4.3 POWER SUPPLY BOARD CIRCUIT DESCRIPTION

4.3.1 Configuration

The Power Supply Board contains the +24 VDC supply for the electronics and the +30 VDC supply for the solenoid and logic. 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 the table in Figure 17 or 18, the Power Supply is manufactured in four versions. The schematic diagram in Figure 7 shows the most complex configuration in which the Q Trip and fast forward options are both included. The assembly diagram and parts lists are incorporated in Figure 8.

4.3.2 Voltage Supplies

Separate secondary windings on the power transformer provide 30 VDC through J5 to diode bridge rectifiers CR1 and CR2. The low current for the amplifiers is supplied by CR1. Diodes CR3 and CR4 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 to terminal 17. Capacitor C1 provides filtering for this high current source.

4.3.3 Fast Forward and Q Trip Relays

The AC voltage for the drive motor is supplied from the power transformer primary through J4 and J5. 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 C4, C5, C6, and C7 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 Q1 and supplying a ground path to R3. Transistor Q1 can turn on by connecting its base through CR8. 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 to the stop/start logic in the playback (run) mode. This can be accomplished in two separate ways.

When the front panel switch is placed in the ADVANCE position R3 is connected directly to CR7 to energize K1. The cue tone sensors on the Preamplifier 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 CR5 prevents the audio muting circuit at terminal 14 from grounding. The unit goes into fast forward and will stop on a 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 Q2 is installed as well as driver Q3 which is controlled by the QI 150 Hz cue tone sensor on the Preamplifier Board. When the 150 Hz Q1 tone is present the Q1 control at terminal 24 goes high to turn on Q3. Relay K2 energizes to supply a ground for the stop lamp and to close the normally open contacts available on the remote control connector. When the tone ends, the control goes low and shuts off Q3. A positive pulse is delivered by C8 through CR9 and S1 to the gate of SCR Q2. This pulse turns Q2 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, the ground is removed from CR7 so that SCR Q2 no longer can conduct current; Q2 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 Q2 and return the unit to normal speed operation without stopping.

Relay K3 associated with the QII 8 kHz cue sensor works in the same manner as K2. When the QII 8 kHz tone is present, the base of Q4 goes high to turn on Q4 and K3. Contacts on K3 supply a ground to the run lamp and provide the closure available on the remote control connector. When the tone ends, the control at terminal 25 goes low to turn off Q4 and K3.

Note

Visual indication of QI presence is provided by the STOP lamp which flashes during tone presence. The START lamp becomes brighter to indicate QII presence. No separate indicator lamps are used.

4.4 RECORD AMPLIFIER/BIAS BOARD

4.4.1 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 10. The schematic diagrams in Figure 9 shows the stereophonic version which incorporates two identical program amplifier circuits.

4.4.2 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.

4.4.3 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 preamplifier 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 the 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 mode, 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 the +24 VDC supply for the record amplifiers.

4.4.4 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.

4.5 RECORD CONTROL AND TONE GENERATOR BOARD

4.5.1 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 QI 150 Hz and QII 8 kHz Q Trips, the generators for these cue tones are also included. 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 12. The schematic diagram in Figure 11 shows the stereo version equipped with Q Trips.

4.5.2 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 inhibit 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 Logic Driver 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.

The STOP switch, 1 kHz (or 3 kHz) cue sensor, or the deck microswitch (if the cartridge is withdrawn) will 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.

4.5.3 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, R57, 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.

4.5.4 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), R81 (R-90), 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.

4.5.5 Logging Cue Tone Input

External Cue Record Level R9 on the Record Control Generator Board can be used to adjust the record level of external cue signals. Recording can be accomplished in either record or playback modes to comply with the latest NAB requirements.

External cue track input (10K unbalanced) is located on Pin 23 of J5. Pins 20 and 21 must be shorted to activate the Cue Track Bias when recording.

CAUTION

The input for recording the NAB Standard 3.5 kHz Logging Cue Tone can be used for almost any audio frequency for test purposes or other specialized functions. Use of other than the 3.5 kHz tone, however, may create interference to the other cue sensors.

4.5.6 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 calibration 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 (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 4000 unit.

5.2 EXTENDER BOARD

As an aid in troubleshooting the plug-in modules, the optional 919-1703 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 or 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 17 and 18. Individual electronic parts are shown on the module assembly diagrams in Figures 4, 6, 8, 10, and

12. 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 Logic Driver 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 Preamplifier 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 15 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 4000 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 stop lamp. During the 8,000 Hz tone, adjust the CUE SENS 8 kHz control so that the sensor just triggers to brighten the run 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 1). Reproduce a prerecorded 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 Preamplifier Board on the 919-1703 extender card. Referring to the assembly diagram (Figure 4), connect the signal generator to the 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 919-1703 extender card. Referring to the assembly diagram (Figure 10), 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 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 0.5V. 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 Bias Board. Referring to Figure 1, 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 1). 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 4000. 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 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 1/4 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

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.

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 13.

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

Note

Replacement motors are supplied with the leads terminated in the proper connector. This wiring is shown in Figure 14.

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 14.

6.3.4 Tape Head Replacement

Refer to Figure 13.

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 56) 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 13.

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 13.

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 13.

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; counterclockwise 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 15. 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

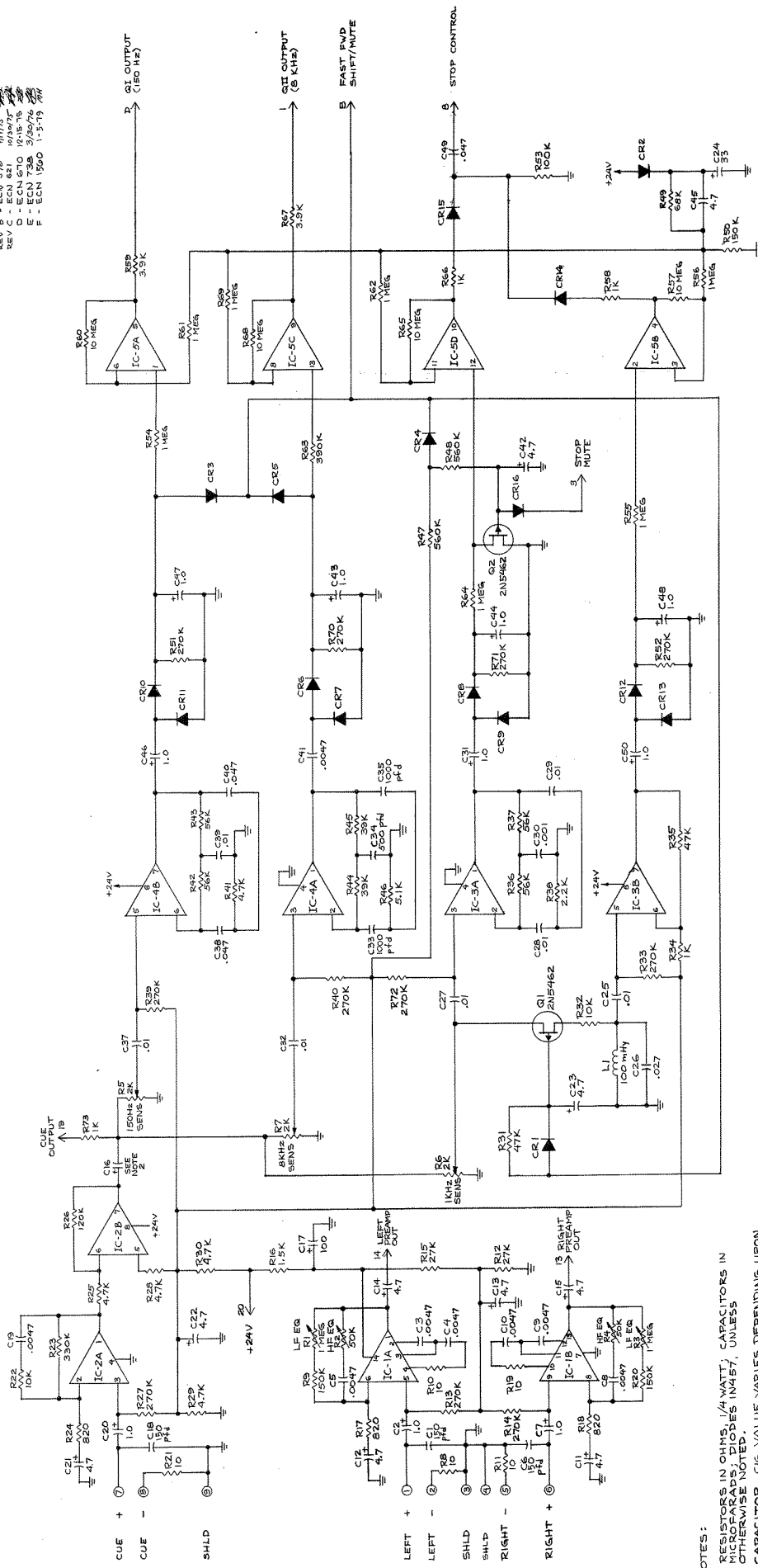
Once the azimuth and height are established as described in paragraphs 6.5.2 and 6.5.3, check the unit's phase response. Connect the right and left playback outputs to an oscilloscope as shown in Figure 15. Reproducing the alignment test cartridge (playback units) or recording from an external signal 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.

[illegible]

6-5/6-6

REV A - ECN 244 7/4/72
 REV B - ECN 278 7/11/72
 REV C - ECN 621 8/29/72
 REV D - ECN 570 12/15/75
 REV E - ECN 738 3/29/76
 REV F - ECN 1590 1/3/77 AM



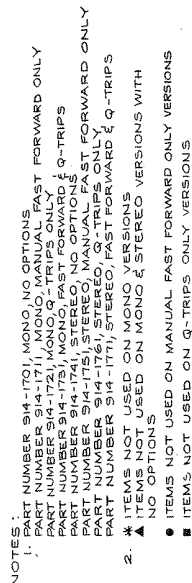
- NOTES:
1. RESISTORS IN OHMS, 1/4 WATT; CAPACITORS IN MICROFARADS; DIODES IN 4157, UNLESS OTHERWISE NOTED.
 2. CAPACITOR C16 VALUE VARIES DEPENDING UPON BOARD VERSIONS USED: 1.0 MFD (1741, 1742, 1743, 1744, 1745, 1746, 1747, 1748, 1749, 1750, 1751, 1752, 1753, 1754, 1755, 1756, 1757, 1758, 1759, 1760, 1761, 1762, 1763, 1764, 1765, 1766, 1767, 1768, 1769, 1770, 1771, 1772, 1773, 1774, 1775, 1776, 1777, 1778, 1779, 1780, 1781, 1782, 1783, 1784, 1785, 1786, 1787, 1788, 1789, 1790, 1791, 1792, 1793, 1794, 1795, 1796, 1797, 1798, 1799, 1800, 1801, 1802, 1803, 1804, 1805, 1806, 1807, 1808, 1809, 1810, 1811, 1812, 1813, 1814, 1815, 1816, 1817, 1818, 1819, 1820, 1821, 1822, 1823, 1824, 1825, 1826, 1827, 1828, 1829, 1830, 1831, 1832, 1833, 1834, 1835, 1836, 1837, 1838, 1839, 1840, 1841, 1842, 1843, 1844, 1845, 1846, 1847, 1848, 1849, 1850, 1851, 1852, 1853, 1854, 1855, 1856, 1857, 1858, 1859, 1860, 1861, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869, 1870, 1871, 1872, 1873, 1874, 1875, 1876, 1877, 1878, 1879, 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000).
 3. LAST COMPONENTS USED: R74, C50, CR16, Q2, IC-5 & L1. C36 NOT USED.

SEE PC ASSY DWGS #914-1701, 1711, 1721, 1731, 1741, 1751, 1761, 1771, 1781, 1791, 1801, 1811, 1821, 1831, 1841, 1851, 1861, 1871, 1881, 1891, 1901, 1911, 1921, 1931, 1941, 1951, 1961, 1971, 1981, 1991, 2001

DESIGN NO.	DATE	BY	CHKD	APP'D	TITLE
1000	7/11/72	J. J. J.	J. J. J.	J. J. J.	SCHEMATIC
1000	7/11/72	J. J. J.	J. J. J.	J. J. J.	PREAMP PCB
1000	7/11/72	J. J. J.	J. J. J.	J. J. J.	4000 SERIES
1000	7/11/72	J. J. J.	J. J. J.	J. J. J.	906-4106
1000	7/11/72	J. J. J.	J. J. J.	J. J. J.	REV F
1000	7/11/72	J. J. J.	J. J. J.	J. J. J.	SHEET 1 OF 1

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Figure 3
 Schematic Diagram, Preamplifier PCB 6-7/6-8

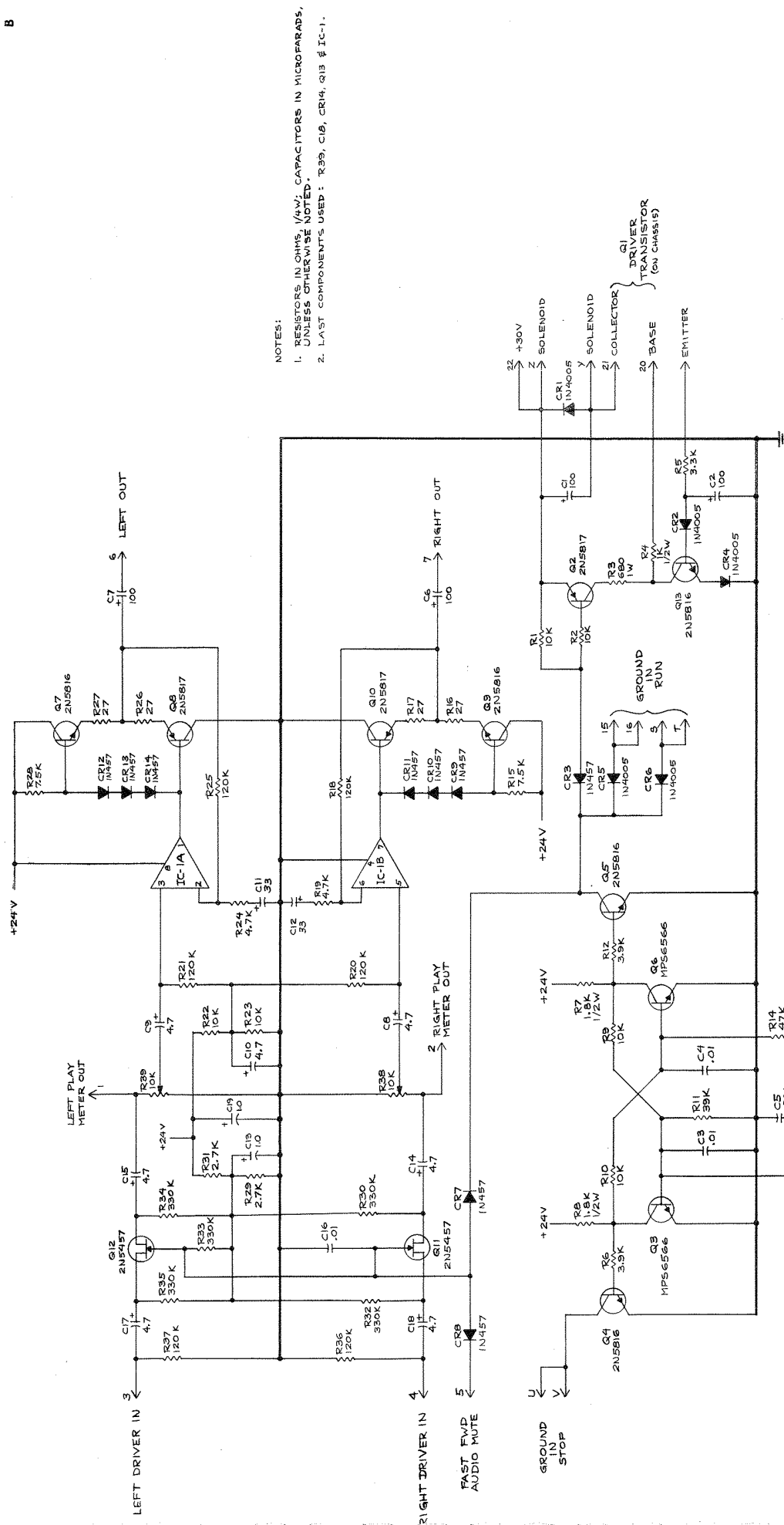


REV	REVISIONS DESCRIPTION	DATE	APPROVED
A	ECN 544	7/21/75	<i>[Signature]</i>
B	ECN 621	10/10/76	<i>[Signature]</i>
C	ECN 644	1/25/78	<i>[Signature]</i>
D	ECN 670	12-18-78	<i>[Signature]</i>
E	ECN 738	3/29/79	<i>[Signature]</i>
F	ECN 774	4/27/79	<i>[Signature]</i>
G	ECN 1560	1-5-79	<i>[Signature]</i>

60	REF	D-906-4106	SCHEMATIC	ITEM	QTY	DESCRIPTION	NOTE
36	7	Q30-1043		36	1	CAPACITOR, .01 mfd, 100 V (C25, C27, C28, C29, C30, C31, C32)	
35	1	Q63-1083		35	1	100 mfd, 20V (C17)	
34	2	Q64-9373		34	2	93 mfd, 35V (C16, C24)	
						* C12, C45	
						C14, C15, C21, C22, C23,	
						4.7 mfd, 35 V (C11, C12, C13,	
						C16, C17, C18, C19, C20)	
33	10	Q84-4763		33	10	.0047 mfd, 50V (C3, C4, C5)	
						C31, C32, C44, C46, C47, C48	
32	8	Q82-4753		32	8	1 mfd, 35V (C2, C7, C20)	
						CAPACITOR, 150 mfd, 500V (C1, C6, C18)	
31	10	Q84-1063		31	10	RESISTOR 3.9K Ω , 1/4W (R5, R6)	
30	3	Q80-1522		30	3	390K Ω , 1/4W (R63)	
29				29		R65, R66	
28	2	100-3943		28	2	10 MEG, 1/4W (R57, R60, R58, R59, R62, R64)	
27	1	100-3963		27	1	390K Ω , 1/4W (R63)	
26	4	100-1083		26	4	1 MEG, 1/4W (R8, R55, R56)	
25	7	100-1073		25	7	100K Ω , 1/4W (R4, R45, R46)	
24	1	100-1063		24	1	100K Ω , 1/4W (R83)	
23				23			
22	1	100-6853		22	1	68K Ω , 1/4W (R49)	
21	2	100-5663		21	2	560K Ω , 1/4W (R47, R48)	
20	1	100-5143		20	1	51K Ω , 1/4W (R62)	
19	2	100-3393		19	2	39K Ω , 1/4W (R44, R45)	
18	1	100-2243		18	1	2.2K Ω , 1/4W (R2, R43)	
17	4	100-5653		17	4	56K Ω , 1/4W (R36, R37, R38, R39)	
16	3	100-1043		16	3	1K Ω , 1/4W (R24, R25, R26)	
15	2	100-4753		15	2	47K Ω , 1/4W (R3, R35)	
14	1	100-1263	(L1)	14	1	120K Ω , 1/4W (R26)	
13	5	100-4743		13	5	47K Ω , 1/4W (R23, R28, R29, R30, R31)	
12	1	100-3363		12	1	330K Ω , 1/4W (R33)	
11	2	100-1053	(IC5)	11	2	82K Ω , 1/4W (R22, R23, R24)	
10	3	100-8233	(IC2, IC3, IC4)	10	3	820 Ω , 1/4W (R17, R18, R24)	
9	1	100-1543	(IC1)	9	1	15K Ω , 1/4W (R16)	
8			TRANSISTOR, 2N3662 (31, Q2)	8		2N3662, 1/4W (R32, R33, R34, R35, R36, R37, C58, C59, C60, C61, C62, C63, C64)	
7	2	100-2763		7	2	270K Ω , 1/4W (R13, R14, R27,	
6	3	100-1863		6	3	180K Ω , 1/4W (R20, R50, R51)	
5	5	100-1023	(C33, C35)	5	5	10 Ω , 1/4W (R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19)	(R21)
4	3	178-2044	.047 mfd, 100V (C8, C9, C10)	4	3	TRIMMER, 2K Ω (R5, R6, R7)	
3	1	178-5054	500 pfd, 50V (C6)	3	1	RESISTOR, 50K Ω (R2, R3, R4)	
2	2	178-1074		2	2	RESISTOR, TRIMMER, 1MEG (R1, R2)	
1	1	514-1701	.001 mfd, 100V (C30)	1	1	PRE AMP BOARD	
X	X	SEE NOTE 1		X	X	PRE AMP ASSY	

[illegible]

Figure 4
Assembly Diagram and Parts List,
Preamplifier PCB



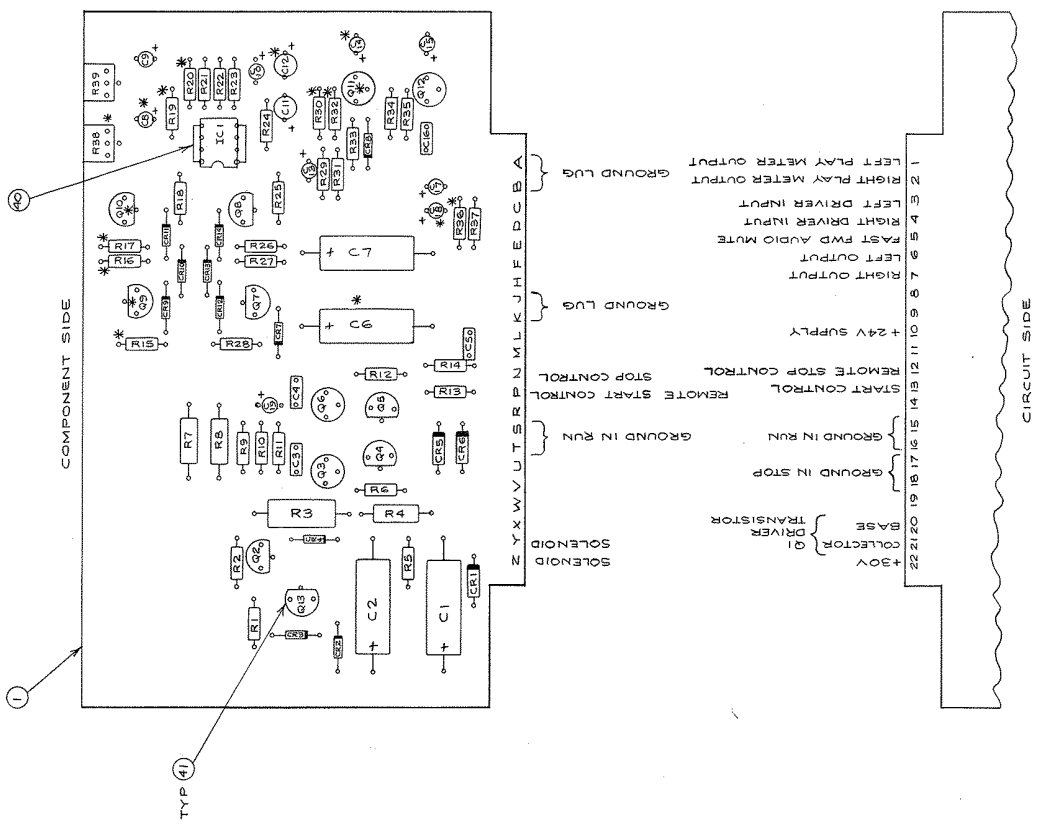
NOTES:

1. RESISTORS IN OHMS, 1/4W; CAPACITORS IN MICROFARADS, UNLESS OTHERWISE NOTED.
2. LAST COMPONENTS USED: R39, C10, CR14, Q13 & IC-1.

BROADCAST ELECTRONICS INC.		DATE	7/6/72
DESIGNED BY	DATE	7/6/72	7/6/72
CHECKED BY	DATE	7/6/72	7/6/72
APPROVED BY	DATE	7/6/72	7/6/72
TITLE	SCHEMATIC PCB		
PROJECT NO.	D 906-4108		
REV	E		
TREATMENT OR FINISH		SHEET 1 OF 1	

Figure 5
Schematic Diagram, Logic Driver PCB 6-11/6-12

NOTES.
 1. PART NUMBER 914-1702, MONO
 PART NUMBER 914-1712, STEREO
 2. * ITEMS NOT USED ON MONO VERSION
 914-1702



REVISIONS		REVISIONS	
REV	DESCRIPTION	REV	DESCRIPTION
1	ECN 10%	1	ECN 10%
2	ECN 10%	2	ECN 10%

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
41	12	409-1814	TRANSISTOR PADS	
40	1	417-0800	SOCKET, I.C. 8 PIN	
39				
38	1	221-4558	IC RC4558	(IC 1)
37				
36	2	212-5457	TRANSISTOR, 2N5457 (Q1, Q2)	
35	2	211-6566	MP56566 (Q3, Q4)	
34	2	210-5817	665817 (Q7, Q8, Q9)	
33	3	211-5916	TRANSISTOR, 2N5916 (Q4, Q5, Q6, Q7, Q8, Q9)	
32	5			
31				
30				
29				
28	9	201-0457	DIODE, 1N457 (CR3, CR7, CR8)	
27	5	203-4005	DIODE, 1N4005 (CR1, CR2, CR4, CR5, CR6)	
26				
25				
24	2	064-1063	CAPACITOR, 1mF, 35V (C13, C19)	
23	2	064-3575	35mF, 35V (C11, C12)	
22	7	064-4763	4.7mF, 35V (C6, C9, C10)	
21	1	030-1033	.001mF, 100V (C5)	
20	3	030-1043	.01mF, 100V (C3, C4, C16)	
19	4	014-1084	CAPACITOR, 100mF, 50V (C12, C27)	
18				
17				
16	2	178-1054	RESISTOR, TRIMMER, 10K (R35)	
15	5	100-3368	330K, 1/4W (R30, R32, R33, R34, R35)	
14	2	100-2743	2.7K, 1/4W (R29, R31)	
13	2	100-4743	47K, 1/4W (R15, R24)	
12	6	100-1263	120K, 1/4W (R18, R20, R21, R22, R23, R27)	
11	4	100-2723	27K, 1/4W (R17, R26)	
10	2	100-7543	7.5K, 1/4W (R15, R28)	
9	2	100-4753	47K, 1/4W (R13, R14)	
8	1	100-3953	39K, 1/4W (R11)	
7	2	110-1843	1.8K, 1/2W (R7, R8)	
6	2	100-3943	3.9K, 1/4W (R6, R12)	
5	1	100-3343	3.3K, 1/4W (R5)	
4	1	110-1043	1K, 1/2W (R4)	
3	1	120-6933	680K, 1W (R3)	
2	6	100-1053	RESISTOR, 10K, 1/4W (R1, R2, R9, R10, R22, R23)	
1	1	514-1702	LOGIC DRIVER BOARD	
			LOGIC DRIVER ASSY.	
			SEE NOTE 1	

Figure 6
 Assembly Diagram and Parts List,
 Logic Driver PCB

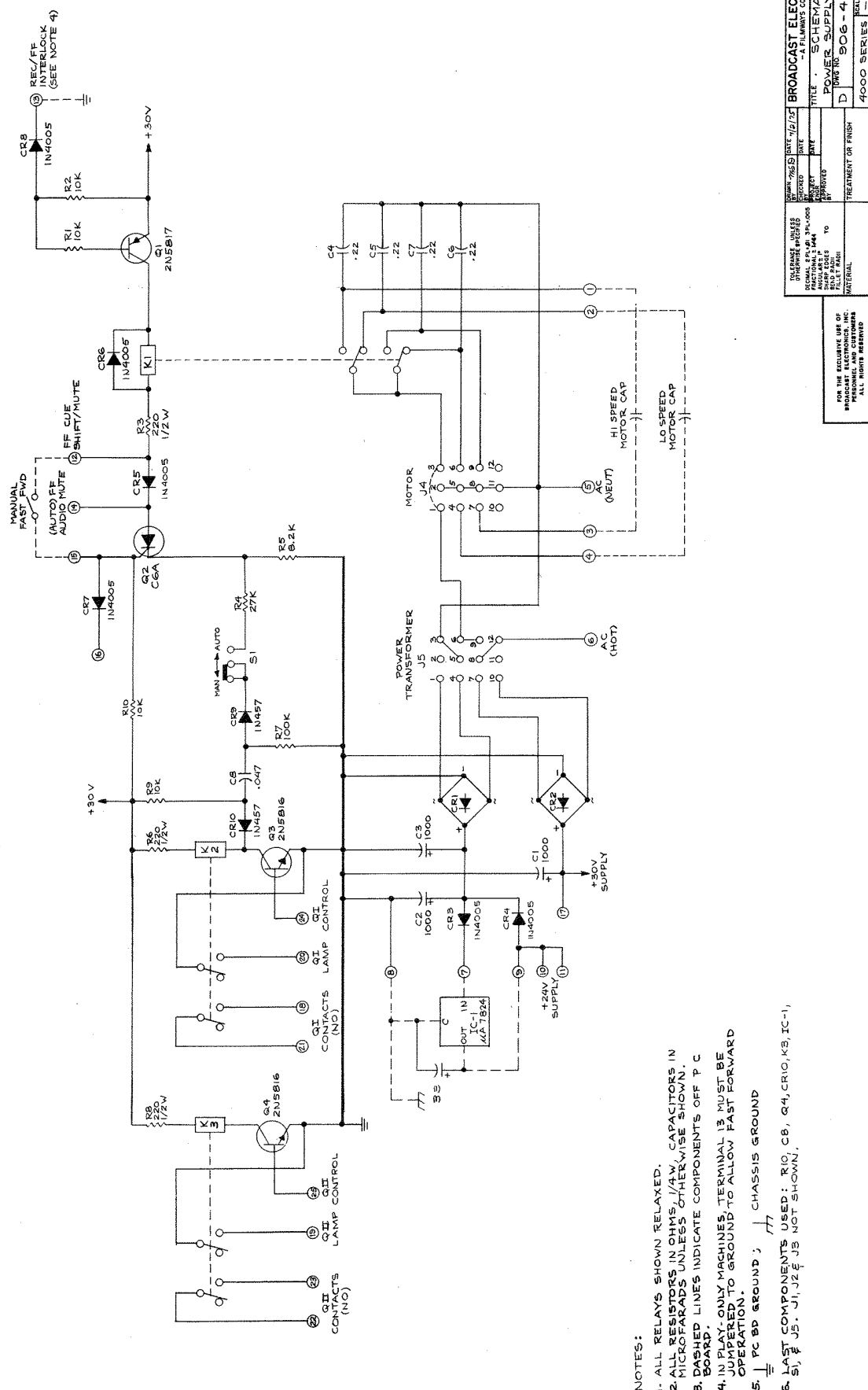
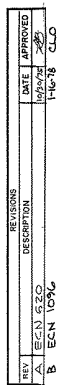


Figure 7
Schematic Diagram, Power Supply PCB 6-15/6-16

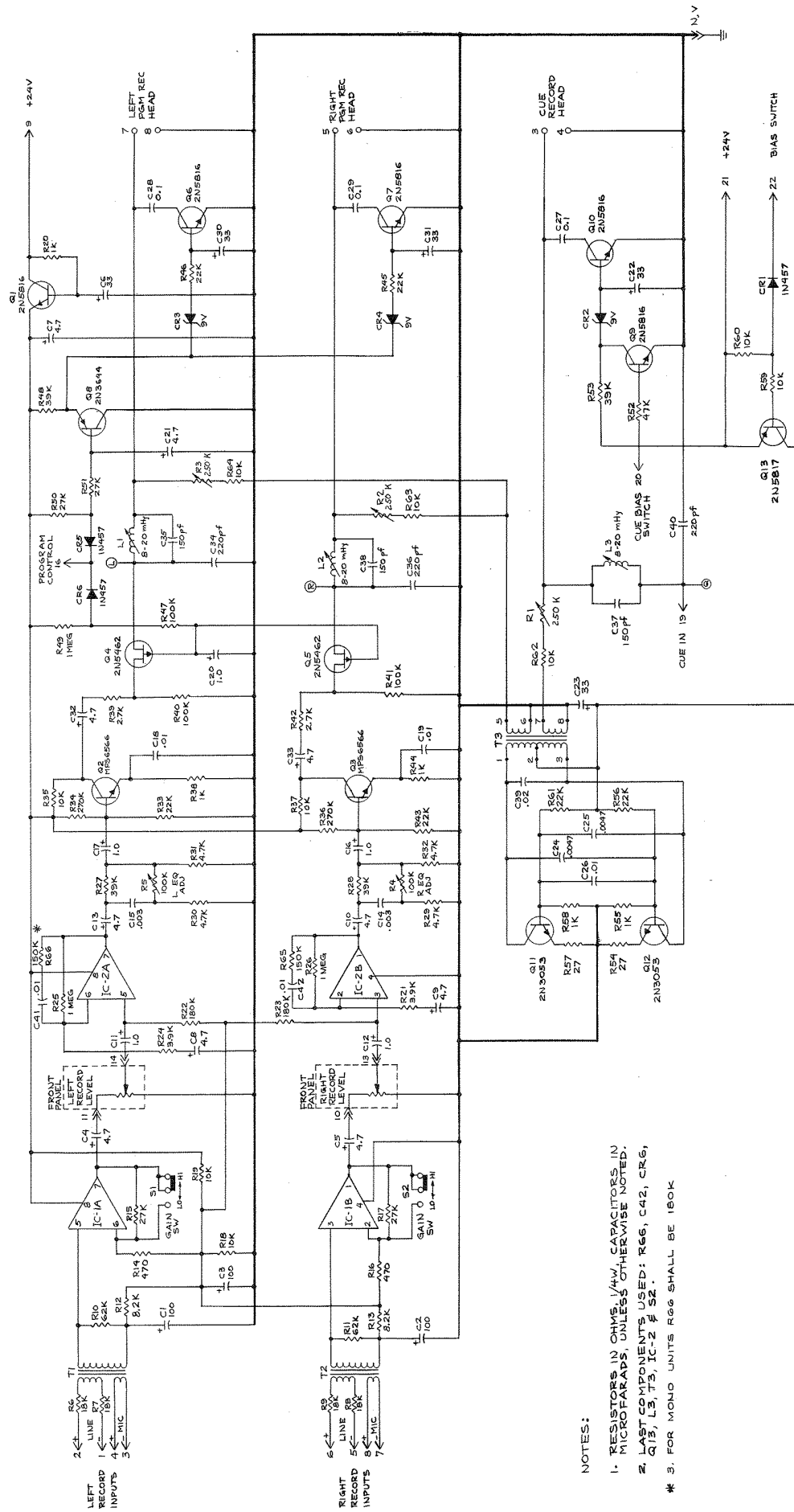


1. PART NUMBER 914-1700, NO OPTIONS
PART NUMBER 914-1710, WITH MAPS ONLY
PART NUMBER 914-1720, WITH MANUAL FAST
FORWARD.
PART NUMBER 914-1730, WITH Q-TRIPS &
AUTOMATIC FAST FORWARD

2. * ITEMS NOT USED WITH 914-1700
▲ ITEMS NOT USED WITH 914-1710
● ITEMS NOT USED WITH 914-1720

[illegible]

Figure 8
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.

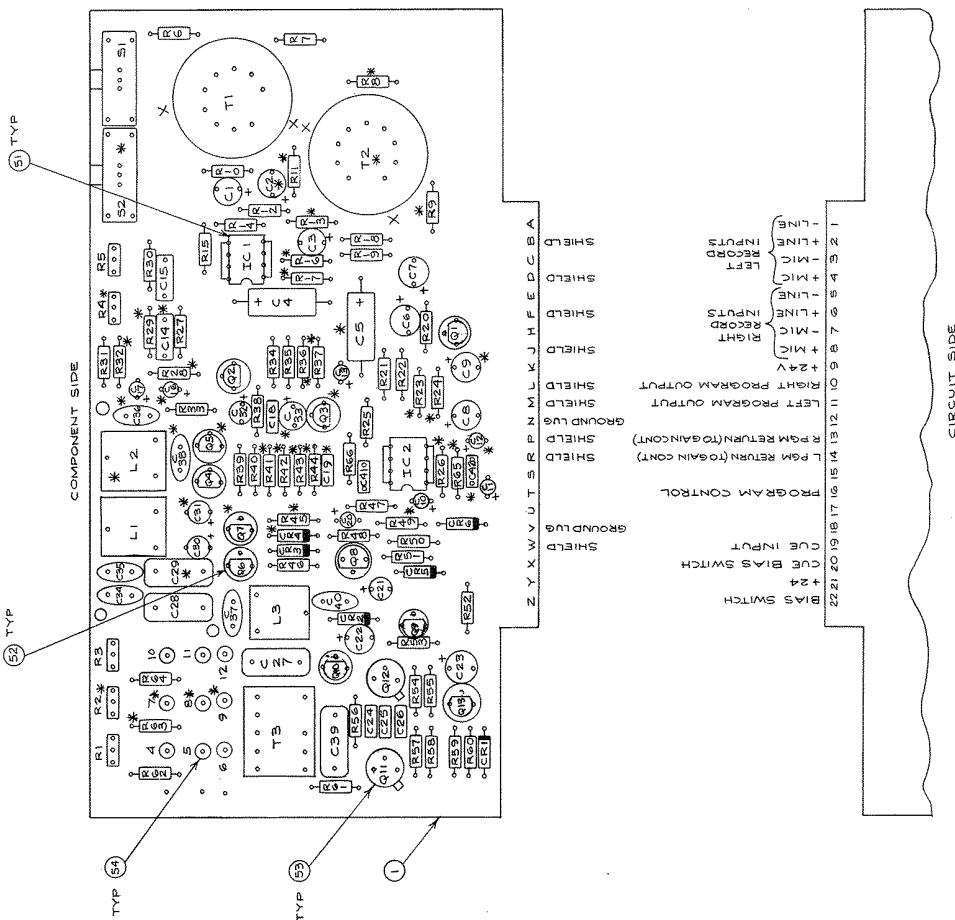
* 3. FOR MONO UNITS R66 SHALL BE 180K

BROADCAST ELECTRONICS INC.			
TO: BROADCAST ELECTRONICS INC.	DATE: 6/20/73	BY: JWH	REV: 1
FROM: JWH	DATE: 6/20/73	BY: JWH	REV: 1
TITLE: SCHEMATIC	PROJECT: 1000	DESIGN: 1000	REV: 1
RECORD: ANP-BIAS PCB	RECORD: ANP-BIAS PCB	RECORD: ANP-BIAS PCB	REV: 1
DRAWING NO: 1000	DESIGN NO: 1000	DESIGN NO: 1000	REV: 1
SERIES: 1000	SERIES: 1000	SERIES: 1000	REV: 1
DATE: 6/20/73	DATE: 6/20/73	DATE: 6/20/73	REV: 1
DESIGNED BY: JWH	DESIGNED BY: JWH	DESIGNED BY: JWH	REV: 1
CHECKED BY: JWH	CHECKED BY: JWH	CHECKED BY: JWH	REV: 1
APPROVED BY: JWH	APPROVED BY: JWH	APPROVED BY: JWH	REV: 1
DATE: 6/20/73	DATE: 6/20/73	DATE: 6/20/73	REV: 1
DATE: 6/20/73	DATE: 6/20/73	DATE: 6/20/73	REV: 1

Figure 9
Schematic Diagram, Record Amplifier/
Bias PCB

REV	DESCRIPTION	DATE	APPROVED
C	REV 372	7/1/75	38
D	ECN 645	1/24/75	38
E	ECN 715	4-9-76	38
F	ECN 715	4-9-76	38
G	REV 26747/253	1-11-78	38
H		7-17-77	38

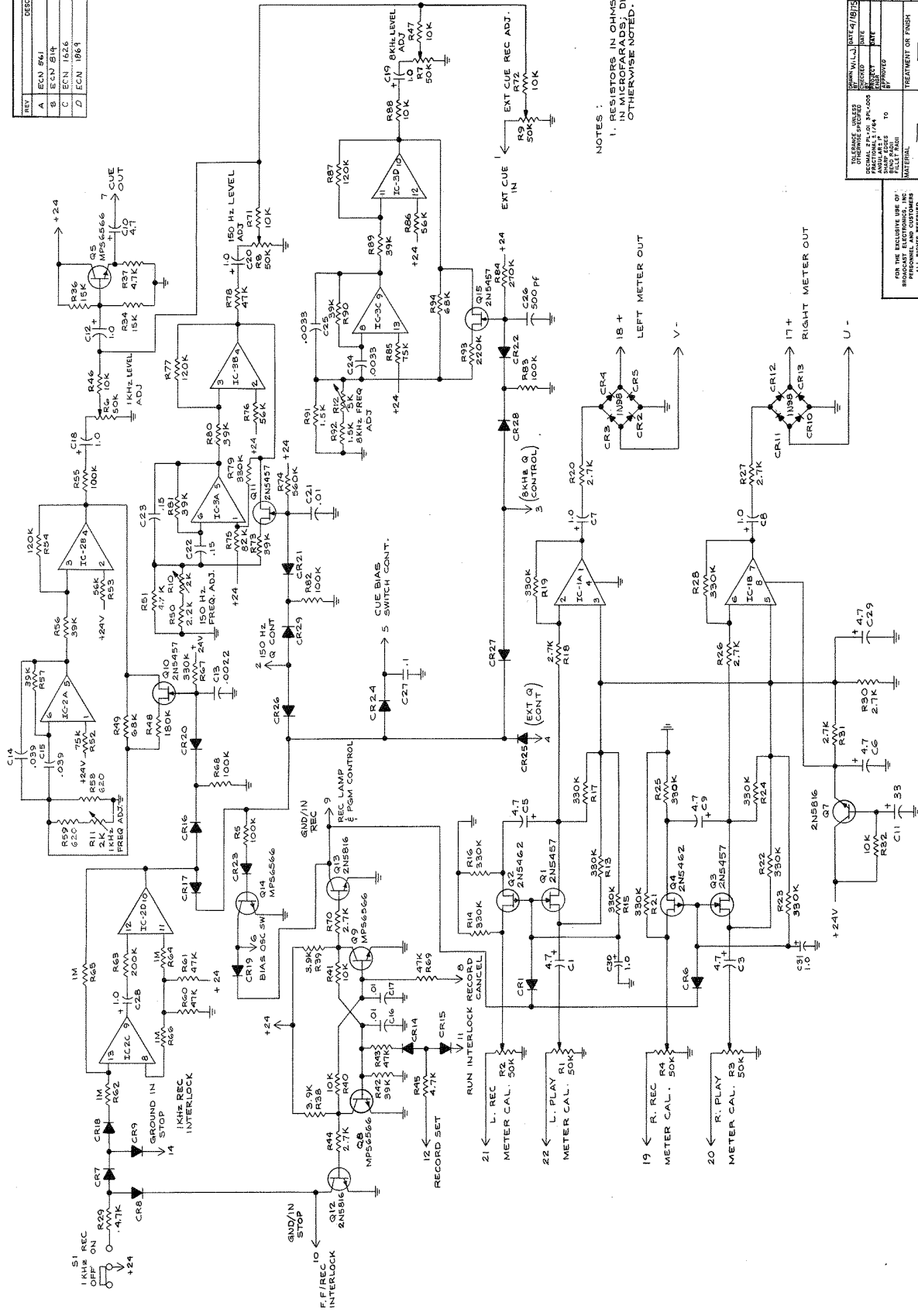
- NOTES:
- PART NUMBER 914-1502-MONOPHONIC
 - PART NUMBER 914-1512-STEREPHONIC
 - *ITEMS NOT INCLUDED IN 914-1502.
 - SOLDER CASE OF INPUT TRANSFORMER (S) TO FOIL AT LOCATIONS MARKED 'X'.
 - USE 60-75 WATT SOLDERING IRON WITH LARGE CHISEL POINT. HEAT NO MORE THAN SIX (6) SECONDS.
 - FOR MONO UNITS REG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



ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
55	2	345-0120	SPST SWITCH	(S1, S2)
54	9	418-0161	TERMINALS	(4-12, 1-3)
53	3	409-0005	TRANSISTOR PAD	(2N5053, 2N3644)
52	10	409-1814	TRANSISTOR PAD	(2N5053, 2N3644)
51	2	417-0800	8 PIN I.C. SOCKET	
50	2	221-4558	I.C. DUAL O.P. AMP	(IC1, IC2)
49	1	372-0095	Bias OSCILLATOR XFMR	(T3)
48	2	370-0020	INPUT XFMR	(T1, T2)
47				
46	3	365-3061	INDUCTOR ADJUSTABLE	8-20 MHY
45	2	212-5462	TRANSISTOR	(2N5462, 2N3644)
44	2	211-5566	TRANSISTOR	(2N5566, 2N3644)
43	2	210-5644	TRANSISTOR	(2N5644, 2N3644)
42	1	210-5644	TRANSISTOR	(2N5644, 2N3644)
41	5	211-5816	TRANSISTOR	(2N5816, 2N3644)
40	2	210-5053	TRANSISTOR	(2N5053, 2N3644)
39	1	210-5817	TRANSISTOR	(2N5817, 2N3644)

Figure 10
Assembly Diagram and Parts List,
Record Amplifier/Bias PCB

REV	DESCRIPTION	DATE	APPROVED
A	ECN 561	5/1/57	
B	ECN 514	2/2/57	
C	ECN 1424	2/2/57	
D	ECN 1461	1-9-58	



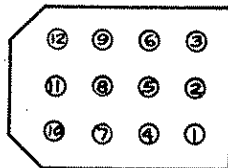
NOTES:
1. RESISTORS IN OHMS, 1/4 WATT, CAPACITORS IN MICROFARADS, DODGES IN437 UNLESS OTHERWISE NOTED.

BROADCAST ELECTRONICS INC.		DATE 4/18/58	
DESIGNER	DATE	DATE	DATE
REVIEWER	DATE	DATE	DATE
TESTER	DATE	DATE	DATE
FOR THE EXCLUSIVE USE OF:	BROADCAST ELECTRONICS, INC.		
MATERIAL	ALL RIGHTS RESERVED		
TREATMENT OR FINISH	9000 SERIES		
SHEET 1 OF 1	SHEET 1 OF 1		

Figure 11
Schematic Diagram, Record Control and
Tone Generator PCB

MOTOR WIRING (3000)

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

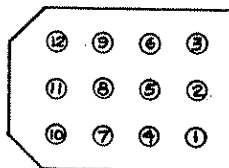


PIN	SINGLE SPEED	TWO SPEED
1	*	*
2	VIO	VIO
3	*	*
4	BLU	BLU
5	ORN	ORN
6	YEL	YEL
7	(OPEN)	GRN
8		BLK
9		RED
10		(OPEN)
11		WHT
12	(OPEN)	(OPEN)

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 14. Motor Wiring and Power Transformer Diagrams

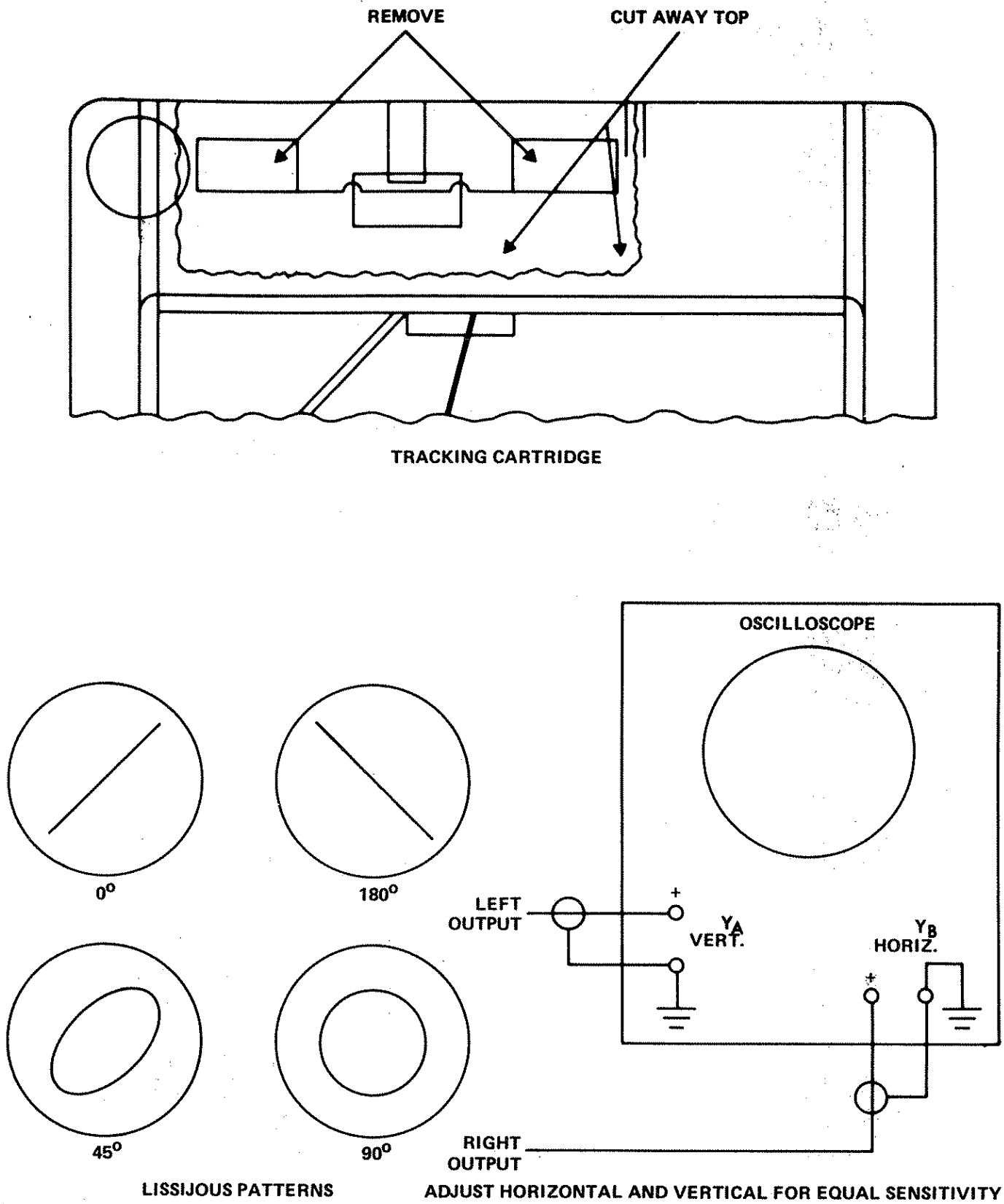


Figure 15. Tracking Cartridge and Stereo Phasing Test

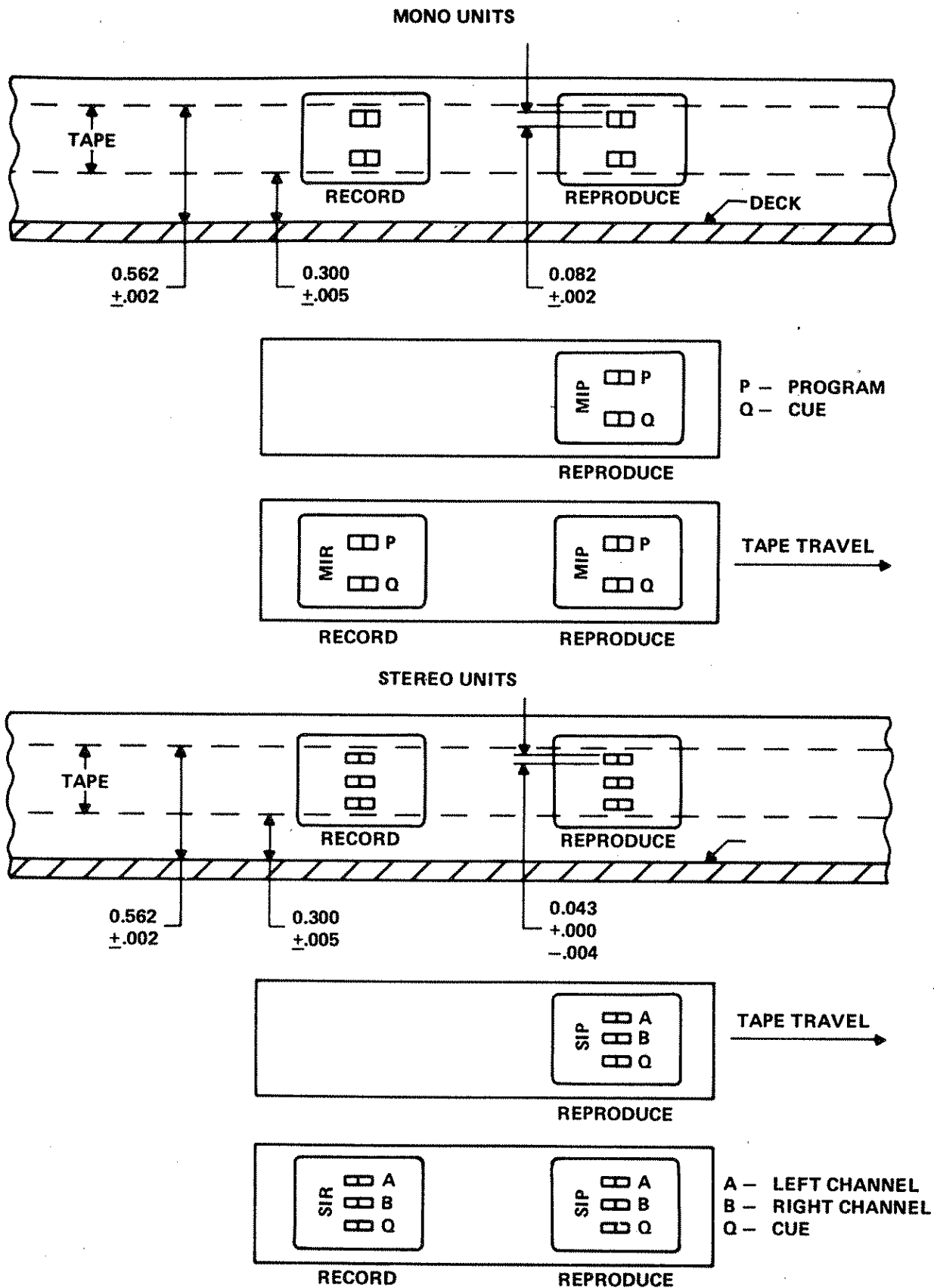


Figure 16. Head Position and Track Configurations

REV A - EQU 127 11/1/77
 B - EQU 341 11/1/77
 C - EQU 348 11/1/77
 D - EQU 348 11/1/77
 E - EQU 348 11/1/77

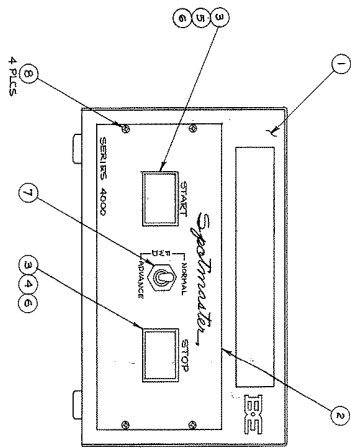
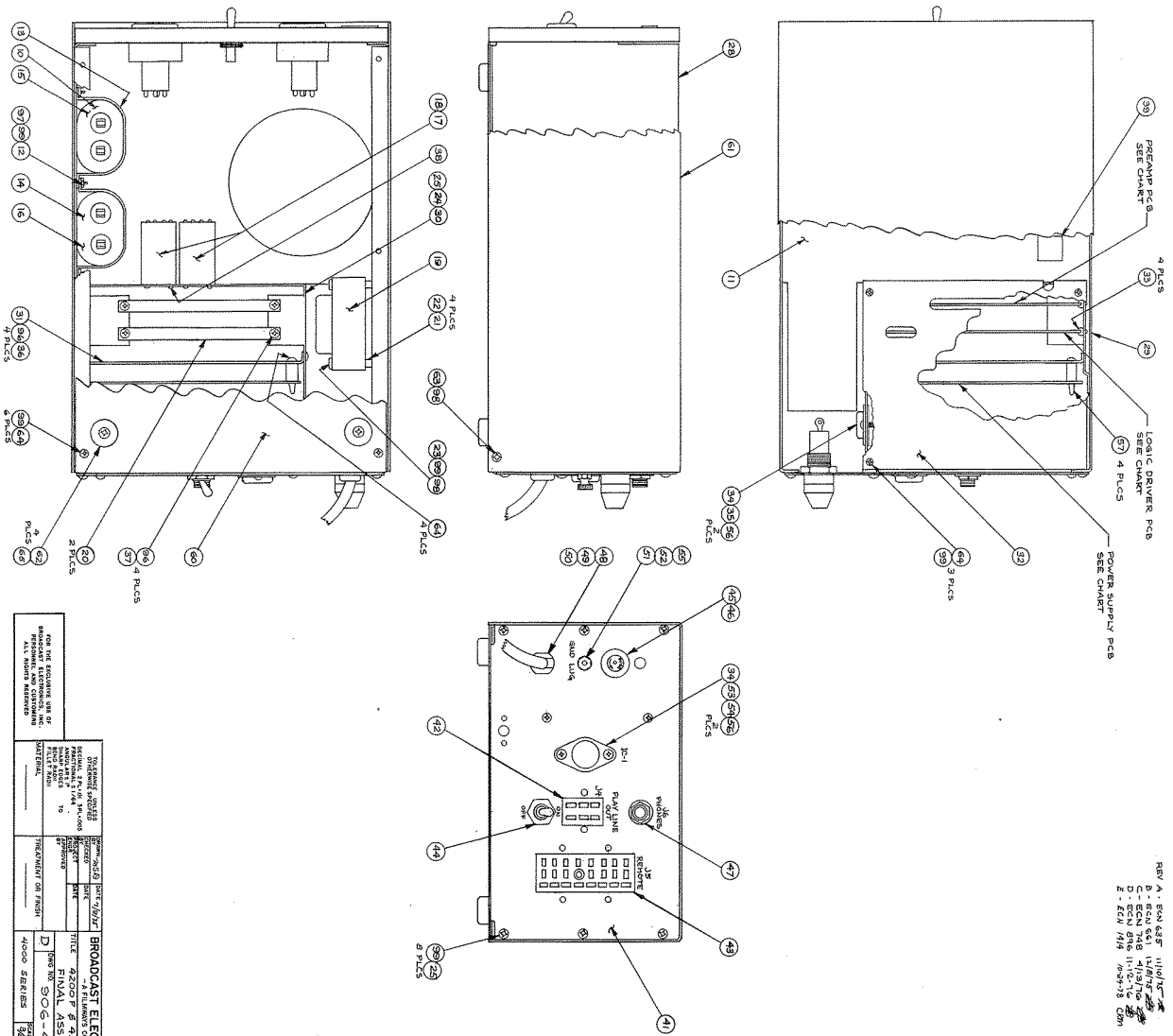


Figure 17
 Sheet 1
 4200 Models Assembly Diagram
 6-33/6-34



FOR THE EXCLUSIVE USE OF BROADCAST ELECTRONICS INC. ALL OTHERS PROHIBITED		BROADCAST ELECTRONICS INC. 4200 SERIES	
REVISIONS		REVISIONS	
REV	DATE	REV	DATE
1	11/1/77	1	11/1/77
TREATMENT OR FINISH		TREATMENT OR FINISH	
D 100% 3006-4109		D 100% 3006-4109	
FINAL ASSEMBLY		FINAL ASSEMBLY	
E		E	
4200 SERIES		4200 SERIES	
3/4 SHEET 1 OF 2		3/4 SHEET 1 OF 2	

ITEM #	ITEM	PART NUMBER	DESCRIPTION	TEST SET	DESCRIPTION
111		24	1	014-3274	CAPACITOR, 33 MED. 35V
110		52	1	227-7824	24V REGULATOR, 1C-1
109		52	1		KURLER NUT
108		51	3	410-14116	SPADE LUG, #6
107		50	1	419-0071	WIRE NUT
106		49	1	401-0005	STRAIN RELIEF
105		48	1	681-1723	LINE CORD
104		47	1	417-0311	PHONE JACK
103		46	1	330-0100	FUSE, 1 AMP
102		45	1	415-2012	FUSE HOLDER
101		44	1	347-7101	SWITCH, MINI TOGGLE SPST, 5A, ON/OFF
100		43	1	418-0303	24-PIN CONNECTOR, CINCH (F), JS REMOTE
99	A/R	42	1	418-0302	6-PIN CONNECTOR, CINCH (F), JA PLAY OUT
98	6	41	1	471-0111	REAR PANEL
97	A/R	40			CABLE TIE MOUNT
96	B	39	1	402-0006	PHMS #2-56 X 3/16
95		38	A/R		PHMS #4-40 X 1/2
94		37	4		PHMS #4-40 X 1/4
93	1	36	4		POWER TRANSISTOR, Q1
92	1	35	1	219-3055	TRANSISTOR SOCKET (Q1 & IC-1)
91	1	34	2	417-0298	P C CARD GUIDE
90	1	33	4	695-00206	COVER, WRAPAROUND
89	1	32	1	471-0106	SHIELD, P C BDS
88	1	31	1	471-0105	WRAPAROUND, P C BDS
87	1	30	1	471-0112	SIDE PLATE, LEFT
86	1	29	1	471-0101	SIDE PLATE, RIGHT
85		28	1	471-0100	
84		27			
83		26			PHMS #6-32 X 1/4
82	1	25	B		PHMS #6-32 X 1/4
81	1	24	2		PHMS #6-32 X 1-3/8
80	1	23	4		PHMS #6-32 X 3/16
79	1	22	4	441-8159	PHMS #6-32 X 3/16
78	1	21	4		STANDOFF 1/4 X 1/8 Lg. X 6-32 TAP
77	1	20	2	417-2100	22-PIN CARD EDGE CONN
76	1	19	1	376-7656	POWER XFMR
75	1	18	A/R	370-0017	XFMR SHIELD
74	1	17	A/R	370-0025	OUTPUT XFMR
73	1	16	1	029-10655	MOTOR CAPACITOR, 1 MFD
72	1	15	1	029-10655	MOTOR CAPACITOR, 3 MFD
71	1	14	1	028-2063	MOTOR CAPACITOR, 2 MFD
70	1	13	A/R	453-0007	MOUNTING CLAMP, CAPACITOR
69	1	12	A/R		PHMS #6-32 X 1/2
68	1	11			DECK ASSEMBLY, MONO
67	1	10	1	029-4064	DECK ASSEMBLY, STEREO
66		9			MOTOR CAPACITOR, 4 MFD
65	4	8			PHMS #4-40 X 3/8
64	13	7	1	347-7108	SWITCH, MINI TOGGLE SPST, 5A FAST FWD
63	2	6	1	450-1700	HOLE PLUG
62	4	5	2	321-0327	LAMP
61	1	4	1	343-0152	SWITCH CAP, GREEN
60	1	3	1	343-0151	SWITCH CAP, RED
59		2	1	343-0150	SWITCH, ILLUMIN PB, 51-START, 52-STOP
58		1	1	503-0017	FRONT PANEL
57	4		1	460-0006	FRONT PANEL MOUNT
56	1		1	D-906-4109	FINAL ASSEMBLY, MODELS 4200P & 4200PS
55	4				TEST SET
54					DESCRIPTION

ITEM NUMBERS	POWER SUPPLY P C BD	PREAMP P C BD	7.5 IPS MOTOR CAPACITOR (220V/50HZ)	7.5 IPS MOTOR CAPACITOR
MODEL 4200P 906-4200	STANDARD	68 72 14 14	14 14	14 14
	MANUAL FAST FWD	906-4005	70 73 15 14	14 14
	Q TRIPS	906-4000	69 74	14 14
MODEL 4200PS 906-4202	AUTO F FWD & Q TRIPS	906-4006	71 75 15 14	14 14
	STANDARD	68 76 14 14	14 14	14 14
	MANUAL FAST FWD	906-4005	70 77 15 14	14 14
MODEL 4200P 906-4202	Q TRIPS	906-4000	69 78 14 14	14 14
	AUTO F FWD & Q TRIPS	906-4006	71 79 15 14	14 14

[illegible]

Figure 17
Sheet 2
4200 Models Assembly Diagram
6-35/6-36

REV A - REV 435 - WHITE
 B - REV 431 - WHITE
 C - REV 430 - WHITE
 D - REV 433 - WHITE
 E - REV 434 - WHITE
 F - REV 435 - WHITE
 G - REV 436 - WHITE
 H - REV 437 - WHITE
 I - REV 438 - WHITE
 J - REV 439 - WHITE
 K - REV 440 - WHITE
 L - REV 441 - WHITE
 M - REV 442 - WHITE
 N - REV 443 - WHITE
 O - REV 444 - WHITE
 P - REV 445 - WHITE
 Q - REV 446 - WHITE
 R - REV 447 - WHITE
 S - REV 448 - WHITE
 T - REV 449 - WHITE
 U - REV 450 - WHITE
 V - REV 451 - WHITE
 W - REV 452 - WHITE
 X - REV 453 - WHITE
 Y - REV 454 - WHITE
 Z - REV 455 - WHITE

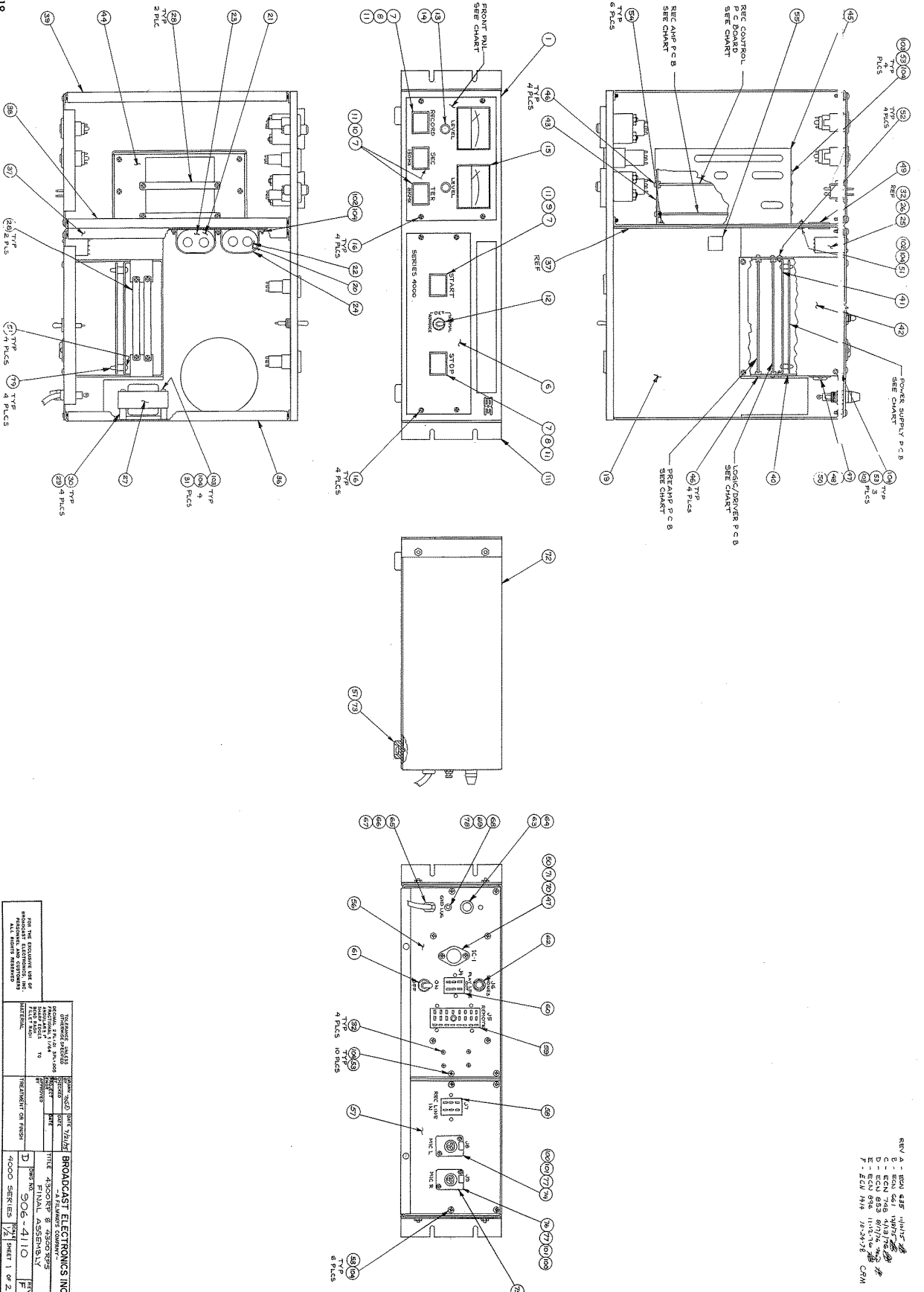


Figure 18
 Sheet 1
 4300 Models Assembly Diagram 6-37/6-38

FOR THE EXCLUSIVE USE OF BROADCAST ELECTRONICS, INC. ALL RIGHTS RESERVED		BROADCAST ELECTRONICS, INC. 10000 144TH AVE. N.E. REDMOND, WA 98073 TEL: (206) 881-1111 FAX: (206) 881-1112	REVISED: 11/17/87 BY: J. J. JENSEN CHECKED: J. J. JENSEN APPROVED: J. J. JENSEN DATE: 11/17/87	BROADCAST ELECTRONICS, INC. 10000 144TH AVE. N.E. REDMOND, WA 98073 TEL: (206) 881-1111 FAX: (206) 881-1112	D 10000 144TH AVE. N.E. REDMOND, WA 98073 TEL: (206) 881-1111 FAX: (206) 881-1112	D 10000 144TH AVE. N.E. REDMOND, WA 98073 TEL: (206) 881-1111 FAX: (206) 881-1112	D 10000 144TH AVE. N.E. REDMOND, WA 98073 TEL: (206) 881-1111 FAX: (206) 881-1112
--	--	---	--	---	--	--	--

ITEM #	ITEM	DESCRIPTION	QTY	UNIT	PRICE	AMOUNT	TOTAL	REMARKS
101	101	WASHER #6	1	EA	1.50	1.50		
102	102	WASHER #6	1	EA	1.50	1.50		
103	103	WASHER #6	1	EA	1.50	1.50		
104	104	WASHER #6	1	EA	1.50	1.50		
105	105	WASHER #6	1	EA	1.50	1.50		
106	106	WASHER #6	1	EA	1.50	1.50		
107	107	WASHER #6	1	EA	1.50	1.50		
108	108	WASHER #6	1	EA	1.50	1.50		
109	109	WASHER #6	1	EA	1.50	1.50		
110	110	WASHER #6	1	EA	1.50	1.50		
111	111	WASHER #6	1	EA	1.50	1.50		
112	112	WASHER #6	1	EA	1.50	1.50		
113	113	WASHER #6	1	EA	1.50	1.50		
114	114	WASHER #6	1	EA	1.50	1.50		
115	115	WASHER #6	1	EA	1.50	1.50		
116	116	WASHER #6	1	EA	1.50	1.50		
117	117	WASHER #6	1	EA	1.50	1.50		
118	118	WASHER #6	1	EA	1.50	1.50		
119	119	WASHER #6	1	EA	1.50	1.50		
120	120	WASHER #6	1	EA	1.50	1.50		
121	121	WASHER #6	1	EA	1.50	1.50		
122	122	WASHER #6	1	EA	1.50	1.50		
123	123	WASHER #6	1	EA	1.50	1.50		
124	124	WASHER #6	1	EA	1.50	1.50		
125	125	WASHER #6	1	EA	1.50	1.50		
126	126	WASHER #6	1	EA	1.50	1.50		
127	127	WASHER #6	1	EA	1.50	1.50		
128	128	WASHER #6	1	EA	1.50	1.50		
129	129	WASHER #6	1	EA	1.50	1.50		
130	130	WASHER #6	1	EA	1.50	1.50		
131	131	WASHER #6	1	EA	1.50	1.50		
132	132	WASHER #6	1	EA	1.50	1.50		
133	133	WASHER #6	1	EA	1.50	1.50		
134	134	WASHER #6	1	EA	1.50	1.50		
135	135	WASHER #6	1	EA	1.50	1.50		
136	136	WASHER #6	1	EA	1.50	1.50		
137	137	WASHER #6	1	EA	1.50	1.50		
138	138	WASHER #6	1	EA	1.50	1.50		
139	139	WASHER #6	1	EA	1.50	1.50		
140	140	WASHER #6	1	EA	1.50	1.50		
141	141	WASHER #6	1	EA	1.50	1.50		
142	142	WASHER #6	1	EA	1.50	1.50		
143	143	WASHER #6	1	EA	1.50	1.50		
144	144	WASHER #6	1	EA	1.50	1.50		
145	145	WASHER #6	1	EA	1.50	1.50		
146	146	WASHER #6	1	EA	1.50	1.50		
147	147	WASHER #6	1	EA	1.50	1.50		
148	148	WASHER #6	1	EA	1.50	1.50		
149	149	WASHER #6	1	EA	1.50	1.50		
150	150	WASHER #6	1	EA	1.50	1.50		
151	151	WASHER #6	1	EA	1.50	1.50		
152	152	WASHER #6	1	EA	1.50	1.50		
153	153	WASHER #6	1	EA	1.50	1.50		
154	154	WASHER #6	1	EA	1.50	1.50		
155	155	WASHER #6	1	EA	1.50	1.50		
156	156	WASHER #6	1	EA	1.50	1.50		
157	157	WASHER #6	1	EA	1.50	1.50		
158	158	WASHER #6	1	EA	1.50	1.50		
159	159	WASHER #6	1	EA	1.50	1.50		
160	160	WASHER #6	1	EA	1.50	1.50		
161	161	WASHER #6	1	EA	1.50	1.50		
162	162	WASHER #6	1	EA	1.50	1.50		
163	163	WASHER #6	1	EA	1.50	1.50		
164	164	WASHER #6	1	EA	1.50	1.50		
165	165	WASHER #6	1	EA	1.50	1.50		
166	166	WASHER #6	1	EA	1.50	1.50		
167	167	WASHER #6	1	EA	1.50	1.50		
168	168	WASHER #6	1	EA	1.50	1.50		
169	169	WASHER #6	1	EA	1.50	1.50		
170	170	WASHER #6	1	EA	1.50	1.50		
171	171	WASHER #6	1	EA	1.50	1.50		
172	172	WASHER #6	1	EA	1.50	1.50		
173	173	WASHER #6	1	EA	1.50	1.50		
174	174	WASHER #6	1	EA	1.50	1.50		
175	175	WASHER #6	1	EA	1.50	1.50		
176	176	WASHER #6	1	EA	1.50	1.50		
177	177	WASHER #6	1	EA	1.50	1.50		
178	178	WASHER #6	1	EA	1.50	1.50		
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187	187	WASHER #6	1	EA	1.50	1.50		
188	188	WASHER #6	1	EA	1.50	1.50		
189	189	WASHER #6	1	EA	1.50	1.50		
190	190	WASHER #6	1	EA	1.50	1.50		
191	191	WASHER #6	1	EA	1.50	1.50		
192	192	WASHER #6	1	EA	1.50	1.50		
193	193	WASHER #6	1	EA	1.50	1.50		
194	194	WASHER #6	1	EA	1.50	1.50		
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196	196	WASHER #6	1	EA	1.50	1.50		
197	197	WASHER #6	1	EA	1.50	1.50		
198	198	WASHER #6	1	EA	1.50	1.50		
199	199	WASHER #6	1	EA	1.50	1.50		
200	200	WASHER #6	1	EA	1.50	1.50		
201	201	WASHER #6	1	EA	1.50	1.50		
202	202	WASHER #6	1	EA	1.50	1.50		
203	203	WASHER #6	1	EA	1.50	1.50		
204	204	WASHER #6	1	EA	1.50	1.50		
205	205	WASHER #6	1	EA	1.50	1.50		
206	206	WASHER #6	1	EA	1.50	1.50		
207	207	WASHER #6	1	EA	1.50	1.50		
208	208	WASHER #6	1	EA	1.50	1.50		
209	209	WASHER #6	1	EA	1.50	1.50		
210	210	WASHER #6	1	EA	1.50	1.50		
211	211	WASHER #6	1	EA	1.50	1.50		
212	212	WASHER #6	1	EA	1.50	1.50		
213	213	WASHER #6	1	EA	1.50	1.50		
214	214	WASHER #6	1	EA	1.50	1.50		
215	215	WASHER #6	1	EA	1.50	1.50		
216	216	WASHER #6	1	EA	1.50	1.50		
217	217	WASHER #6	1	EA	1.50	1.50		
218	218	WASHER #6	1	EA	1.50	1.50		
219	219	WASHER #6	1	EA	1.50	1.50		
220	220	WASHER #6	1	EA	1.50	1.50		
221	221	WASHER #6	1	EA	1.50	1.50		
222	222	WASHER #6	1	EA	1.50	1.50		
223	223	WASHER #6	1	EA	1.50	1.50		
224	224	WASHER #6	1	EA	1.50	1.50		
225	225	WASHER #6	1	EA	1.50	1.50		
226	226	WASHER #6	1	EA	1.50	1.50		
227	227	WASHER #6	1	EA	1.50	1.50		
228	228	WASHER #6	1	EA	1.50	1.50		
229	229	WASHER #6	1	EA	1.50	1.50		
230	230	WASHER #6	1	EA	1.50	1.50		
231	231	WASHER #6	1	EA	1.50	1.50		
232	232	WASHER #6	1	EA	1.50	1.50		
233	233	WASHER #6	1	EA	1.50	1.50		
234	234	WASHER #6	1	EA	1.50	1.50		
235	235	WASHER #6	1	EA	1.50	1.50		
236	236	WASHER #6	1	EA	1.50	1.50		
237	237	WASHER #6	1	EA	1.50	1.50		
238	238	WASHER #6	1	EA	1.50	1.50		
239	239	WASHER #6	1	EA	1.50	1.50		
240	240	WASHER #6	1	EA	1.50	1.50		
241	241	WASHER #6	1	EA	1.50	1.50		
242	242	WASHER #6	1	EA	1.50	1.50		
243	243	WASHER #6	1	EA	1.50	1.50		
244	244	WASHER #6	1	EA	1.50	1.50		
245	245	WASHER #6	1	EA	1.50	1.50		
246	246	WASHER #6	1	EA	1.50	1.50		
247	247	WASHER #6	1	EA	1.50	1.50		
248	248	WASHER #6	1	EA	1.50	1.50		
249	249	WASHER #6	1	EA	1.50	1.50		
250	250	WASHER #6	1	EA	1.50	1.50		
251	251	WASHER #6	1	EA	1.50	1.50		
252	252	WASHER #6	1	EA	1.50	1.50		
253	253	WASHER #6	1	EA	1.50	1.50		
254	254	WASHER #6	1	EA	1.50	1.50		
255	255	WASHER #6	1	EA	1.50	1.50		
256	256	WASHER #6	1	EA	1.50	1.50		
257	257	WASHER #6	1	EA	1.50	1.50		
258	258	WASHER #6	1	EA	1.50	1.50		
259	259	WASHER #6	1	EA	1.50	1.50		
260	260	WASHER #6	1	EA	1.50	1.50		
261	261	WASHER #6	1	EA	1.50	1.50		
262	262	WASHER #6	1	EA	1.50	1.50		
263	263	WASHER #6	1	EA	1.50	1.50		
264	264	WASHER #6	1	EA	1.50	1.50		
265	265	WASHER #6	1	EA	1.50	1.50		
266	266	WASHER #6	1	EA	1.50	1.50		
267	267	WASHER #6	1	EA	1.50	1.50		
268	268	WASHER #6	1	EA	1.50	1.50		
269	269	WASHER #6	1	EA	1.50	1.50		
270	270	WASHER #6	1	EA	1.50	1.50		
271	271	WASHER #6	1	EA	1.50	1.50		
272	272	WASHER #6	1	EA	1.50	1.50		
273	273	WASHER #6	1	EA	1.50	1.50		
274	274	WASHER #6	1	EA	1.50	1.50		
275	275	WASHER #6	1	EA	1.50	1.50		
276	276	WASHER #6	1	EA	1.50	1.50		
277	277	WASHER #6	1	EA	1.50	1.50		
278	278	WASHER #6	1	EA	1.50	1.50		
279	279	WASHER #6	1	EA	1.50	1.50		
280	280	WASHER #6	1	EA	1.50	1.50		
281	281	WASHER #6	1	EA	1.50	1.50		
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NOTES:
1. * ITEMS NOT SHOWN ON DWG.

[illegible]

FOR THE RECURSIVE USE OF THESE FORMS, PLEASE PRINT ALL RIGHTS RESERVED		TELEPHONE 400-635-1545 CREDIT 400-635-1545 DEBIT 400-635-1545 FRACTION 1/1000 TO FULL PAGES MATERIAL		ORDER NO. 400-635-1545 DATE ORDERED DATE ORDERED DATE ORDERED DATE	BROADCAST ELECTRONICS INC. -A FILM & VIDEO CO. TITLE #3006-4110 RECURSIVE FINAL ASSEMBLY DOW NO. 4110 4000 SERIES SHEET 2 OF 2	
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Figure 18
Sheet 2
4300 Models Assembly Diagram
6-39/6-40

PRODUCT WARRANTY

LIMITED ONE YEAR

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Broadcast Electronics, Inc. ("BEI"), 4100 North 24th Street, P.O. Box 3606, Quincy, Illinois 62301, hereby warrants cartridge machines, consoles, and other new equipment manufactured by Broadcast Electronics, Inc., against any defects in material or workmanship at the time of delivery thereof, that develop under normal use within a period of one (1) year from the date of shipment. Other manufacturers' equipment, if any, shall carry only such manufacturers' standard warranty. This warranty extends to the original user and any subsequent purchaser during the warranty period. BEI's sole responsibility with respect to any equipment or parts not conforming to this warranty is to replace such equipment or parts upon the return thereof F.O.B. BEI's factory or authorized repair depot within the period aforesaid.

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

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

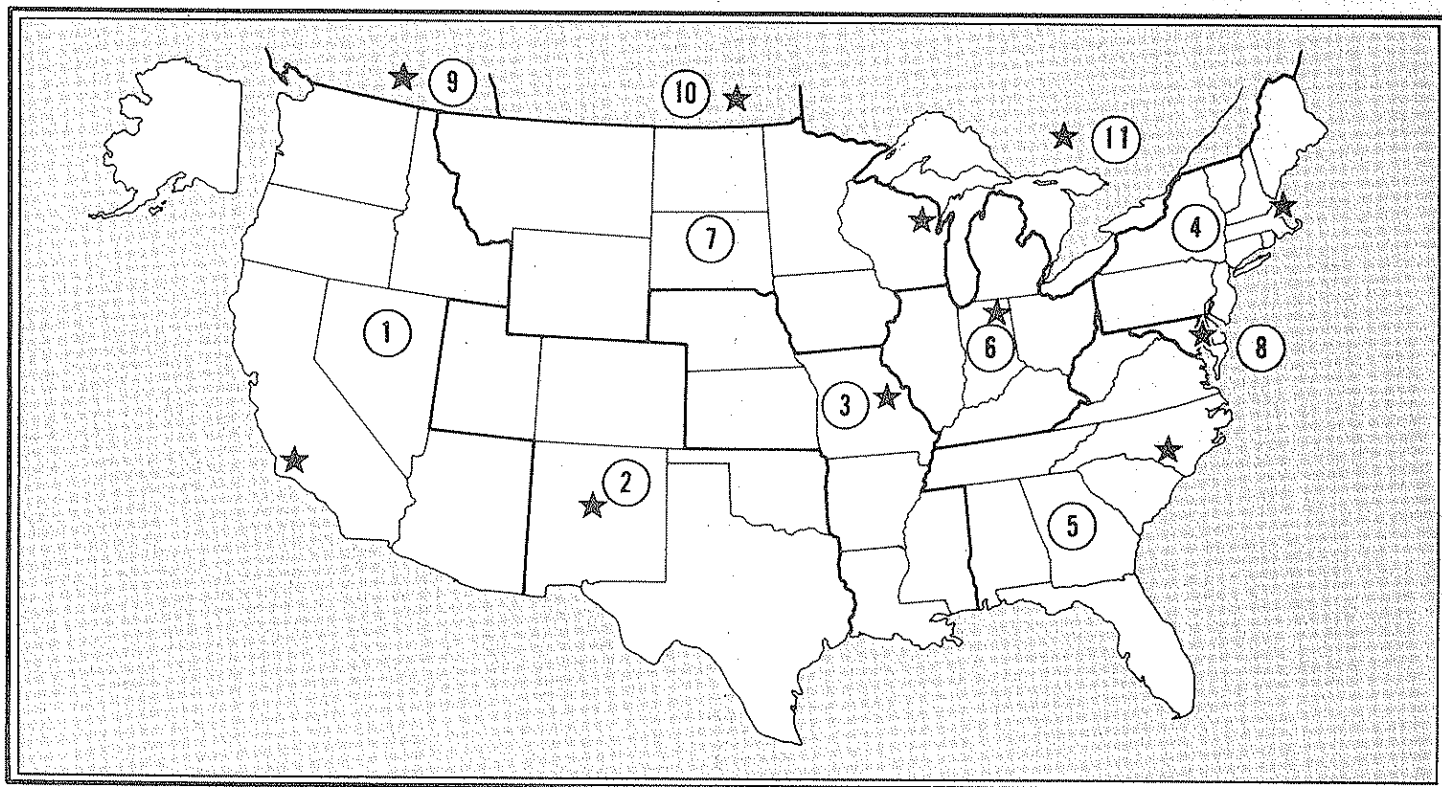
BROADCAST ELECTRONICS, INC.

4100 North 24th Street, Quincy, Illinois 62301

AUTHORIZED SERVICE CENTERS

• Equipped to serve you with *Spotmaster*® parts and repairs — both in and out of warranty

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



UNITED STATES

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

States Covered:

Alaska
Arizona
California
Hawaii
Nevada
Oregon
Washington

2. **Dyma Engineering**
Route 1, Box 51
Taos, NM 87571
Ph: (505) 758-2686

States Covered:

Colorado
New Mexico
Oklahoma
Texas
Utah

3. **TV Engineering Corporation**
519 Rudder Road
Fenton, MO 63026
Ph: (314) 343-5605

States Covered:

Arkansas Missouri
Kansas Mississippi
Louisiana Nebraska

4. **Lebow Labs**
424 Cambridge St.
Allston, MA 02134
Ph: (617) 782-0600

States Covered:

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

5. **Broadcast Services, Inc.**
Micro Road
Micro, NC 27555
Ph: (919) 284-2102

States Covered:

Alabama
Florida
Georgia
North Carolina
South Carolina
Tennessee
Virginia
West Virginia

6. **Allied Broadcasting Equipment**
635 South E. St.
Richmond, IN 47374
Ph: (317) 962-8596

States Covered:

Illinois
Indiana
Kentucky
Michigan
Ohio

7. **Electronic Industries**
19 East Irving St.
Oshkosh, WI 54901
Ph: (414) 235-8930

States Covered:

Iowa
Minnesota
Montana
North Dakota
South Dakota
Wisconsin
Wyoming

8. **Midwest Telecommunications**
4700 G. Boston Way
Lanham (Wash. D.C.) MD 20801
Ph: (301) 577-4903

States Covered:

District of Columbia
Delaware
Maryland

CANADA

9. **Nortec West, Ltd.**
325 West Fifth Avenue
Vancouver 10, B.C., Canada
Ph: (604) 872-8525

Provinces Covered:

British Columbia
Yukon Territory

10. **Nortec West, Ltd.**
7056B Farrell Road
Calgary, Alta., Canada
Ph: (403) 252-8141

Provinces Covered:

Alberta
Manitoba
NW Territory
Saskatchewan

11. **J-Mar Electronics, Ltd.**
6 Banigan Drive
Toronto 17, Ontario, Canada
Ph: (416) 421-9080

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New Brunswick
Nova Scotia
Ontario
Quebec



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