

INSTRUCTION MANUAL

4M50 SERIES AUDIO CONSOLE

June, 1984

IM No. 597-0451

BROADCAST ELECTRONICS, INC.



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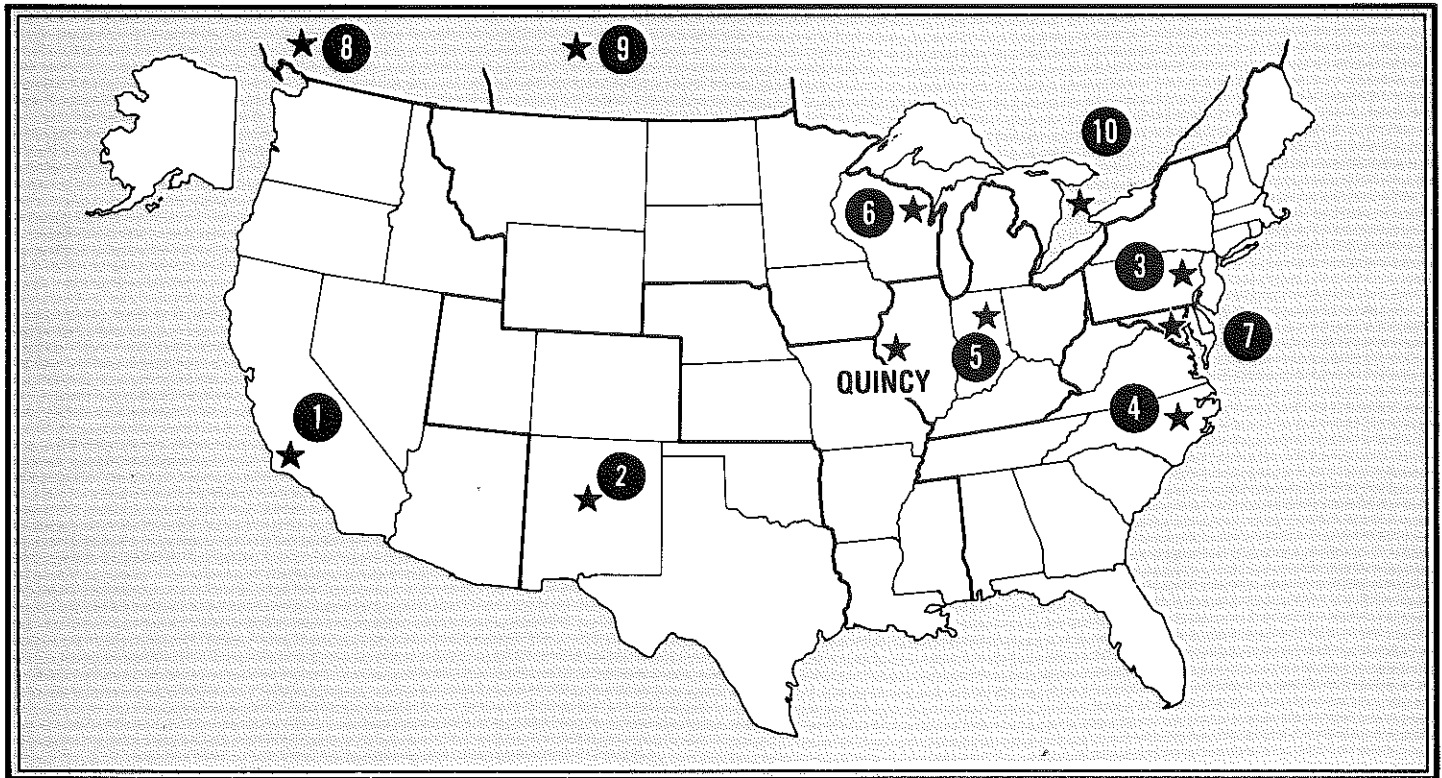
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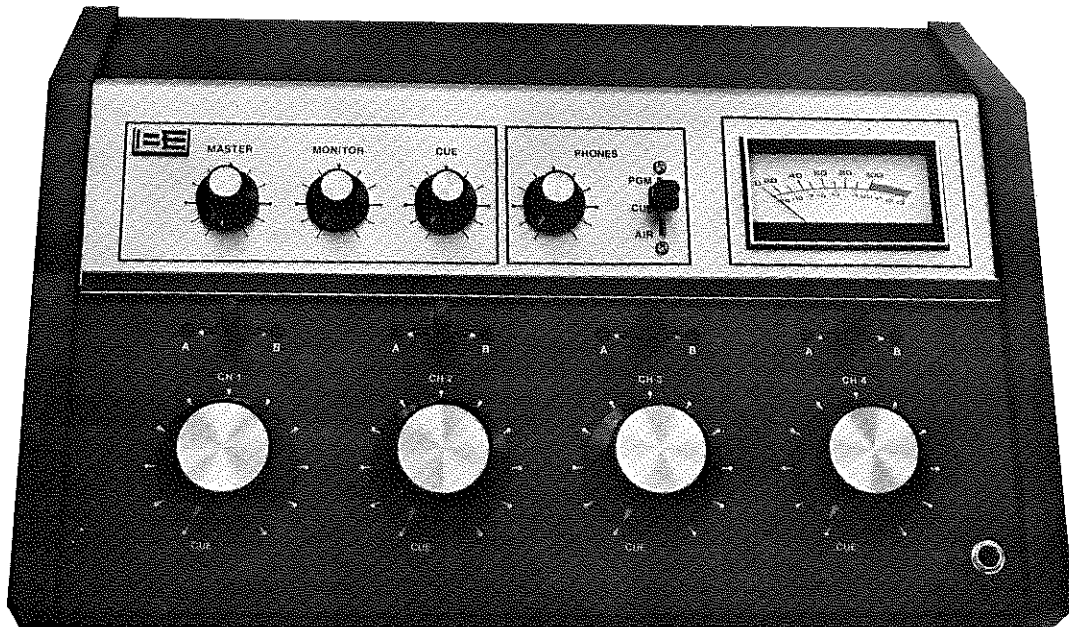
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TECHNICAL MANUAL

597-0451



597-0451-1

MODEL

4M50 - 4 MIXER MONOPHONIC AUDIO CONSOLE
4M50R - 4 MIXER RACK MOUNT MONOPHONIC AUDIO CONSOLE
4M50P - 4 MIXER MONOPHONIC AUDIO CONSOLE
WITH XLR PLUG-IN CONNECTORS

STOCK NO.

938-0450
938-0451
901-0450-020

OPTIONS

REAR CONNECTOR PANEL WITH XLR CONNECTORS
230 VAC 50/60 Hz POWER SOURCE

STOCK NO.

901-0003
838-0201

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SECTION I
GENERAL INFORMATION

1-1. SCOPE OF MANUAL.

1-2. This manual provides installation, operation, and maintenance information for the Broadcast Electronic Model 4M50, 4M50R, and 4M50P Audio Consoles.

1-3. DESCRIPTION AND FEATURES.

1-4. The 4M50 series audio consoles are dual-input, four-mixer monophonic devices designed specifically for use in CATV systems, broadcast production facilities, or newsrooms. The small size of the console makes it ideal for use in remote locations where a larger console is not required. The 4M50 and 4M50P mount on a table or desk top and the 4M50R is equipped for mounting in an EIA standard 19 inch (48.26 cm) rack.

1-5. A cue system is incorporated on all four mixers for previewing inputs. Separate amplifiers are provided for a cue speaker and headphone. The design allows a speaker or headphone to monitor the program or cue channel and the headphone to monitor an external source if desired.

1-6. A built-in amplifier is provided for the monitor speaker. The output is connected through a muting relay for use with a live microphone. Separate contacts are provided for controlling a studio on-the-air light.

1-7. For ease in installation and interconnection, all audio connections are made to screw terminals. All terminals are labeled for quick identification. Since all connections are made inside the cabinet, wiring is protected from dirt, tampering, or accidental damage. In addition, the 4M50P console allows quick connection of audio inputs and outputs from a rear connector panel.

1-8. All models are completely flexible. All four mixers will accept line or microphone level inputs as determined by terminal jumpers within the cabinet. The program output is +8 dBm transformer coupled for a 600 Ohm line.

1-9. SPECIFICATIONS.

1-10. Electrical and physical specifications for the 4M50 series audio consoles are presented in Table 1-1.

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

PARAMETER	SPECIFICATION
POWER REQUIREMENTS	115 Vac, 50/60 Hz, 40 watts maximum (230 Vac optional)
PROGRAM CHANNEL:	
INPUTS	Two per mixer, total: 8
INPUT IMPEDANCES/LEVELS (STRAPPABLE)	Low Mode: 150 Ohms balanced. -62 dBm nominal, -45 dBm maximum High Mode: 36 k Ohms balanced bridg- ing. -20 dBm nominal, 0 dBm maximum
FREQUENCY RESPONSE	±2.0 dB, 80 Hz - 20 kHz
DISTORTION	0.5% or less, 30 Hz - 20 kHz
SIGNAL-TO-NOISE	60 dB (unweighted) below +8 dBm out- put. -50 dBm signal to any low- level input
OVERALL GAIN	90 dB minimum
OUTPUT IMPEDANCE/LEVEL	600 Ohm balanced; +8 dBm for a zero-VU meter indication-- +16 dBm maximum
MONITOR AMPLIFIER:	
FREQUENCY RESPONSE	±2.0 dB, 40 Hz - 20 kHz
DISTORTION	0.75% or less, 40 Hz - 20 kHz at rated output and load
OUTPUT POWER/IMPEDANCE	1.5 watts rms into 8 Ohms load
HEADPHONE AMPLIFIER	0.9 watt rms into 8 Ohms load. Front panel jack. Program/cue/external input
CUE AMPLIFIER	1.0 watt rms into built-in 8 Ohm speaker
MUTING	Assignable by wiring to any channel input combination

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

PARAMETER	SPECIFICATION
DIMENSIONS:	
4M50/4M50P	18 inches wide X 13 inches deep X 7.5 inches high (45.8 cm X 33 cm X 19.1 cm)
4M50R	19 inches wide X 13 inches deep X 7.5 inches high (48.26 cm X 33 cm X 19.1 cm)
SHIPPING WEIGHT:	
PACKED	23 pounds (10.4 kg)
UNPACKED	17.5 pounds (7.9 kg)

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information required for installation of the Broadcast Electronics Models 4M50, 4M50R, and 4M50P Audio Consoles.

2-3. The equipment becomes the property of the customer when the equipment is delivered to the carrier. Carefully unpack all equipment and perform a visual inspection to determine that no apparent damage has been incurred during shipment. All shipping materials should be retained until it is determined that the unit has not been damaged. Claims for damaged equipment must be filed against the carrier promptly or the carrier may not accept the claim.

2-4. The contents of the shipment should include a warranty card, a test certification card, and an instruction manual in addition to the console. If the contents are incomplete, or if the unit is damaged electrically or mechanically, notify both the carrier and Broadcast Electronics, Inc.

2-5. INSTALLATION.

2-6. MOUNTING.

2-7. The 4M50 console is supplied in three versions. The 4M50 and 4M50P are encased in a cabinet for use on a control desk or table. The 4M50R is designed for mounting in a 19 inch (48.26 cm) rack.

2-8. If the unit is installed on a desk, the console should be placed within convenient access of the operator and within easy access of power and digital cabling. An opening for cable access is provided in the bottom and rear of the cabinet.

2-9. Select a height for rack mounting that allows easy operator access. Ventilation must be provided as required to prevent the ambient temperature from exceeding 120°F (48.49°C) for best operation. To minimize noise, equipment having high 50 or 60 Hz radiation should not be mounted directly above or below the unit.

2-10. ASSIGNMENT OF INPUT SOURCES.

2-11. Electrically, the most important consideration in assigning the mixer inputs is the level of the source signal. It is recommended that both inputs to a mixer have the same level (either microphone or line level).

2-12. Operationally, input sources used simultaneously (mixed), cross fades, or input sources used in a rapid sequence should be on separate mixers. Conversely, two inputs rarely or never used in conjunction with each other may be assigned to the same mixer.

2-13. Examples are provided in Figure 2-1. Turntables 1 and 2 (TT1 and TT2) are assigned to separate mixers so that records may be sequenced or mixed easily. Likewise, it is unlikely the reel-to-reel playback will be required while the network line is in use. This arrangement also prevents reverberation accidentally being introduced when recording the network on the reel-to-reel recorder.

WARNING

DO NOT CONNECT AC POWER UNTIL INSTALLATION
IS COMPLETE.

2-14. WIRING.

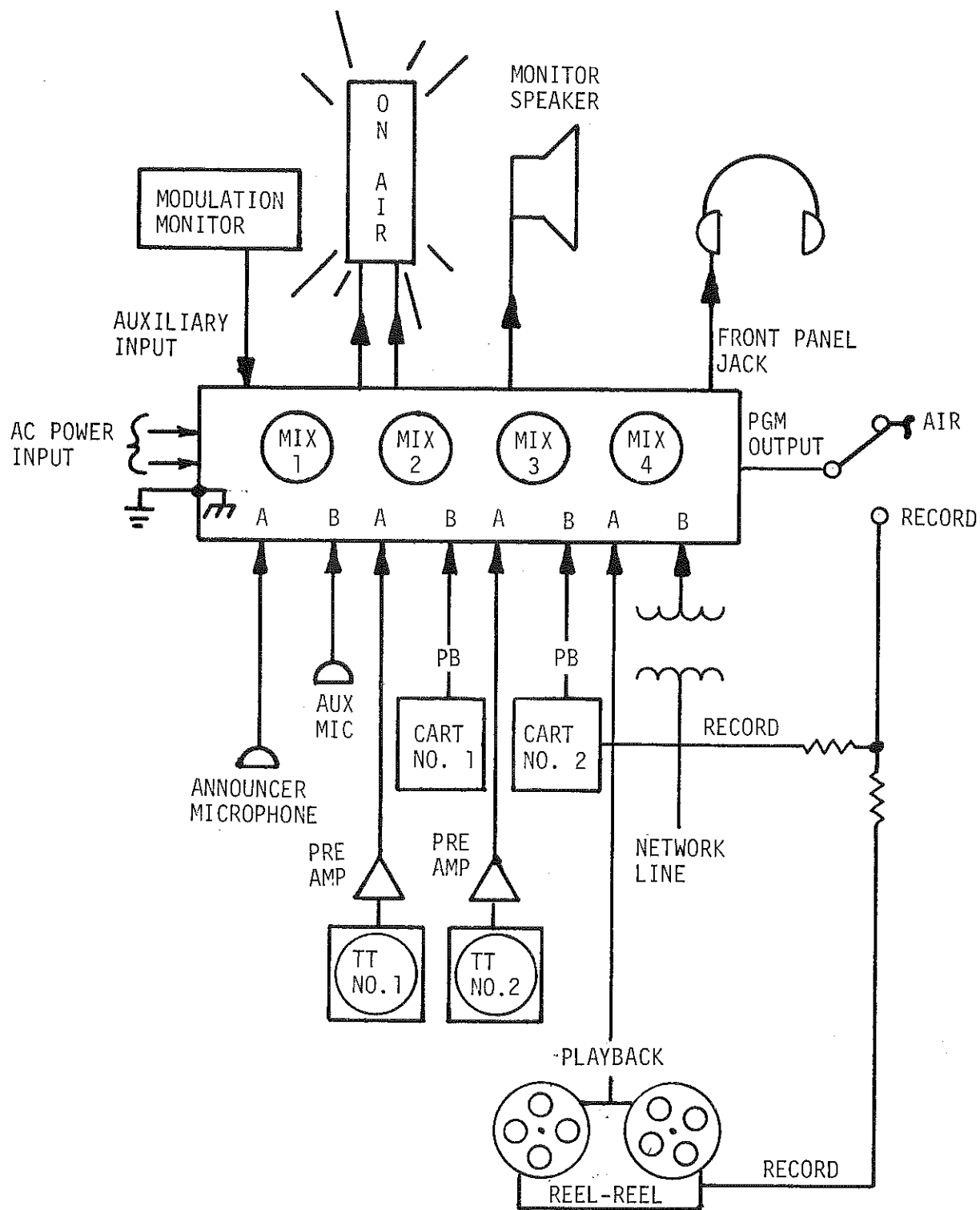
2-15. GENERAL. Audio connections to the console should be made with a 2-conductor shielded cable such as Belden 8441, Alpha 2400, etc. Separate the cables carrying different signal levels (i.e. microphone from high-level and source inputs from speaker wiring) and route the cables to the console keeping as much distance between the cables as possible.

2-16. Similarly, route audio and power cables to the console keeping as much distance between the cables as possible. If practical, wire the power connections with shielded cables to prevent ac coupling to the audio cables.

2-17. GROUNDING. The most important consideration in ensuring low noise performance from the unit is the grounding and shielding of the various interconnections.

2-18. First, it is necessary to achieve a good ground for the console itself. This should be central earth ground. If possible, connect the console to the transmitter RF ground. Alternately, connect it to a power line earth ground. The console ground should be connected with a braided grounding strap (such as Alpha 1235 or Belden 8657) or a solid copper strap.

2-19. Secondly, the grounding of the signal shields is recommended to avoid ground loops (unintended signal paths through shields and grounds). To prevent ground loops, shields are grounded at only one end of the cable. Generally this is done at the console. However, it may be best to ground the shield at the source equipment or even at a point between the console and the source. Particular care must be exercised to avoid unintended grounds at patch panels, at external switching arrangements, through uninsulated (case grounded) jacks on associated equipment, or from grounded racks or cabinets.



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FIGURE 2-1. REPRESENTATIVE STUDIO BLOCK DIAGRAM

2-20. TERMINATIONS. Proper load or termination of transformer coupled equipment is essential to ensure specified frequency response. The program output of the console requires a 600 Ohm termination. This may be installed at the console. Proper terminations should be provided for other transformer coupled equipment connected to the console.

2-21. INPUT SOURCE LEVEL SENSITIVITY. Any mixer will accept low level (microphone) or high level (line) inputs. The input sensitivity is determined by the resistive pads located on the on the input circuit board. The pad for mixer 1 is shipped wired for microphone level inputs as jumpers are installed around the resistors. (See typical jumper arrangement in Figure 2-2).

2-22. INPUT SOURCE WIRING. The input connections are made to the marked terminal strip located inside the cabinet.

2-23. Balanced Inputs. Connect the high input to the \pm terminal and the low input to the COM terminal. Connect the shields to the GND terminal common to the A and B inputs for a given mixer.

2-24. Unbalanced Inputs. Connect the high input to the \pm terminal. Connect the low input to the GND terminal and then connect a wire between the COM and GND terminals.

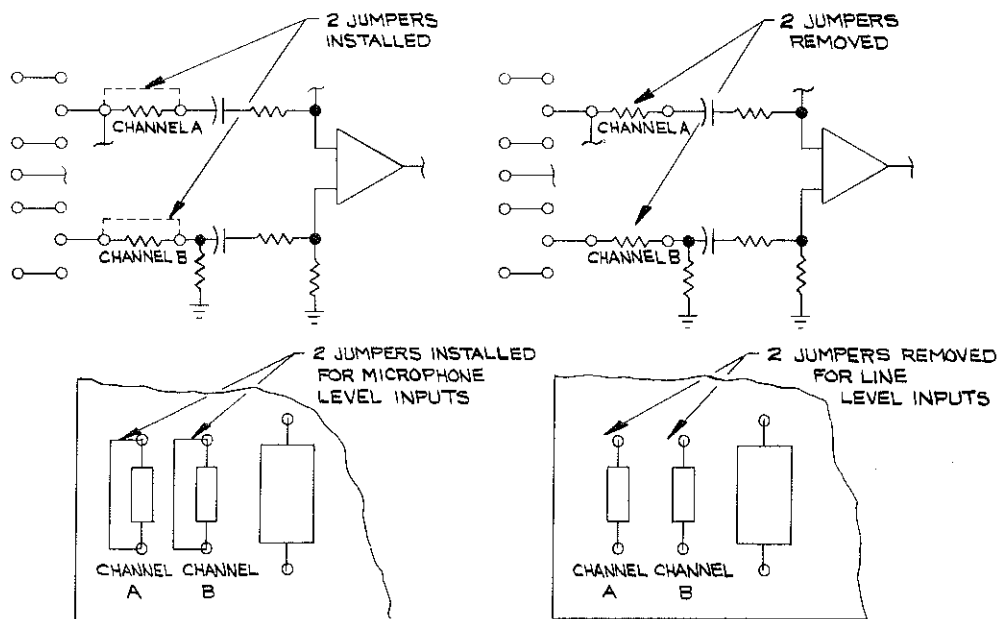
2-25. Auxiliary Air Input. This input to the headphone amplifier is intended to accept the output from a modulation monitor or other auxiliary audio monitor source. It is unbalanced with an impedance of approximately 10 k Ohms. The high input is connected to terminal 21 and the low input to terminal 18 of the input terminal strip.

2-26. It is recommended that the input level be adjusted with an external adjustment so that the headphone level remains constant when switching from cue or program to the auxiliary air input.

2-27. PROGRAM OUTPUT. The program output is balanced, 600 Ohm, transformer coupled. Connect the high input to terminal 1, the low input to terminal 2, and the shield to terminal 3 of terminal strip TS2. For proper level and frequency response, if the output is not connected to an external 600 Ohm load, a 620 Ohm, half-watt termination should be provided at the console.

2-28. SPEAKER CONNECTION. An internal amplifier is provided to drive a monitor speaker located at the console location. For use next to a live microphone, this speaker is connected through the muting relay.

2-29. The amplifier will drive an 8 Ohm speaker. Connect the high input to terminal 5 and the low input to terminal 4 of terminal strip TS2.



NOTES:

1. ANY MIXER WILL ACCEPT LOW LEVEL INPUTS WITH THE JUMPERS INSTALLED OR HIGH LEVEL INPUTS WITH THE JUMPERS REMOVED.
2. IT IS RECOMMENDED THAT BOTH INPUTS TO A MIXER HAVE THE SAME LEVEL (EITHER MICROPHONE OR LINE LEVEL).

597-0451-2

FIGURE 2-2. LINE LEVEL/MICROPHONE LEVEL JUMPER ARRANGEMENT

2-30. **MUTING RELAY CONTACTS.** These contacts can be used to activate a control room on-the-air light. The contacts are rated at 2 amperes at 24V dc. Connections are made at terminals 6 and 7 of terminal strip TS2.

2-31. A 110V ac lamp must not be connected directly to the relay contacts. The console power supply may be used to operate an external relay which controls the on-the-air light.

2-32. **EXTERNAL CUE SPEAKER CONNECTIONS.** A connection is provided for an external cue speaker if one is desired in place of the internal speaker. It is recommended that the external speaker be a high efficiency device of approximately 8 Ohms impedance or higher. Disconnect the internal speaker. Then connect the high input to terminal 9 and the low input to terminal 8 of terminal strip TS2.

2-33. MUTING RELAY CONTROL. The muting relay may be controlled by any or all inputs to the console. The console is normally shipped wired for muting relay operation when the mixer 1 selector switch is in either A or B position. If muting by all inputs is required, add appropriate wires as shown in Figure 2-3.

2-34. MODEL 4M50P CONNECTIONS.

2-35. The model 4M50P with the rear connector panel allows quick and simple installation of source inputs. Connect the inputs (up to seven microphones, cartridge machines, etc.) to the rear panel input receptacles (refer to Figure 2-4). Then, connect the program output and monitor cables to the receptacles located on the rear panel.

2-36. Mating plugs for the rear connector panel are XLR-3-12C (BE P/N 829-4217) for the panel output and XLR-3-11C (BE P/N 829-4216) for the panel input. The monitor jack accepts a standard 1/4 inch phone plug (BE P/N 418-0367).

2-37. AC POWER.

2-38. The ac power switch and fuse are located inside the console. Ensure the power switch is in the OFF position and connect the console to a proper 117 Vac, 50/60 Hz ac input source. An optional power supply is available for 230 VAC, 50/60 Hz operation.

2-39. INPUT SOURCE LEVEL ADJUSTMENT.

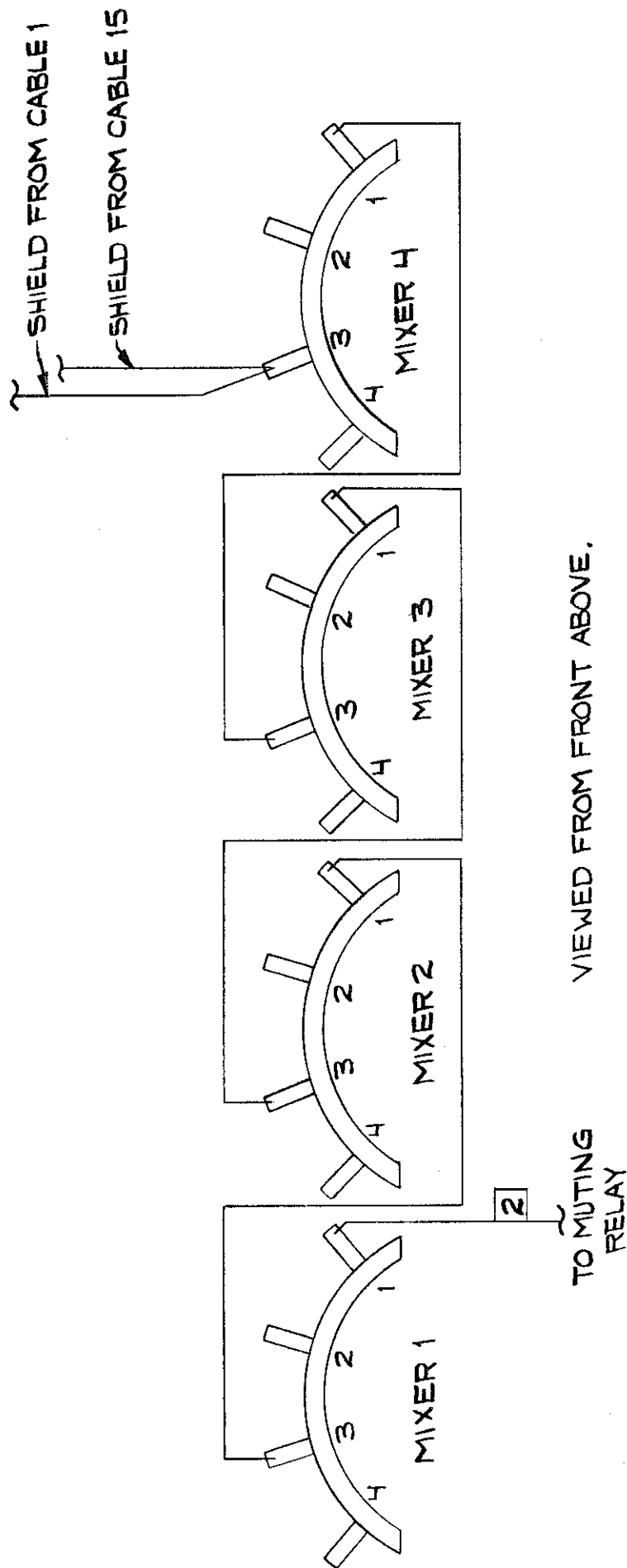
2-40. For maximum console performance the input source level should be adjusted so the mixer controls can operate between the 12 o'clock and 3 o'clock position. To adjust each input source level, refer to the following procedure:

- A. Operate the power switch to ON and adjust the MASTER gain control to the 12 o'clock position (maximum performance is between 10 o'clock and 2 o'clock).
- B. Start the source that is connected to channel 1A and operate the channel 1 selector switch to the A position.
- C. Slowly adjust mixer control CH1 until the VU meter indicates 0 VU (+8 dBm).

WARNING

DISCONNECT POWER PRIOR TO THE INSTALLATION OF A RESISTANCE PAD.

- D. If the mixer control is at the 8 o'clock or 9 o'clock position, disconnect power and install a resistance pad on the input circuit board for channel 1A. The resistance pad lowers the input level so the mixer control can operate between the 12 o'clock and 3 o'clock position for maximum performance.

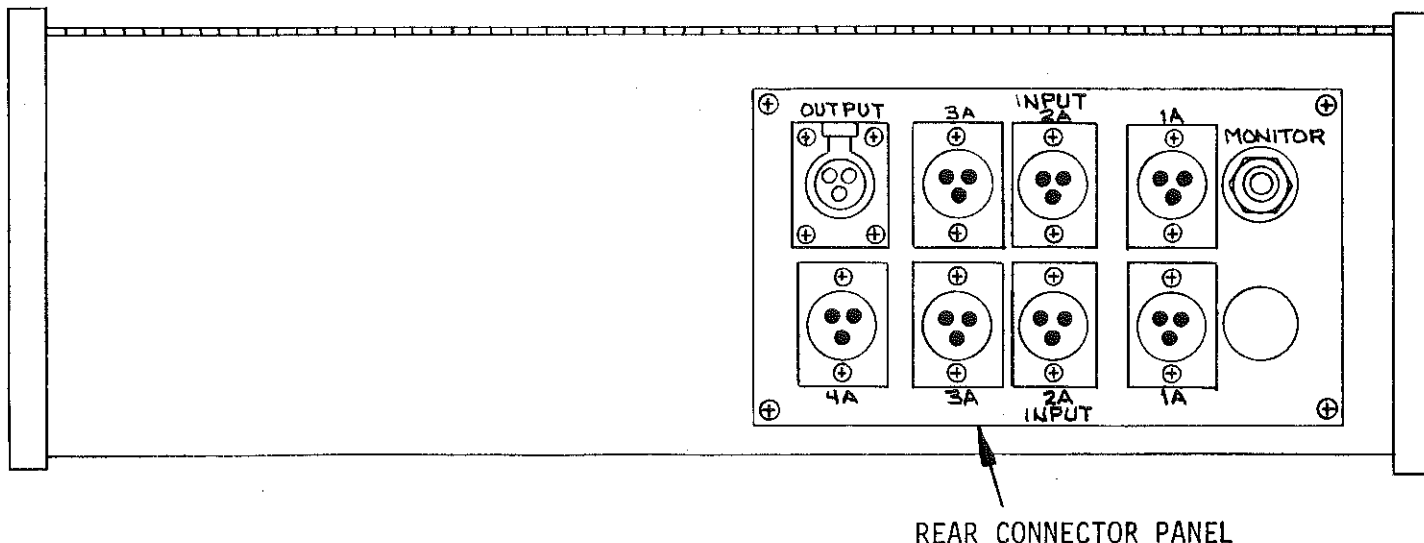


NOTE:

1. ADD WIRES BETWEEN MIXERS AS SHOWN
2. REMOVE THE CONNECTION (SHIELD FROM CABLE 1 AND 15) AT MIXER 1 TERMINAL 3 AND ADD WIRE TO CONNECT THE SHIELD TO MIXER 4 TERMINAL 3.

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FIGURE 2-3. MUTING RELAY CONTROL WIRING.



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FIGURE 2-4. REAR CONNECTOR PANEL MOUNTING
(Model 4M50P and Option 901-0003)

E. Repeat the procedure for each input source.

2-41. OPTIONAL EQUIPMENT INSTALLATION.

WARNING

DISCONNECT POWER PRIOR TO INSTALLATION OF ANY
OPTIONAL EQUIPMENT.

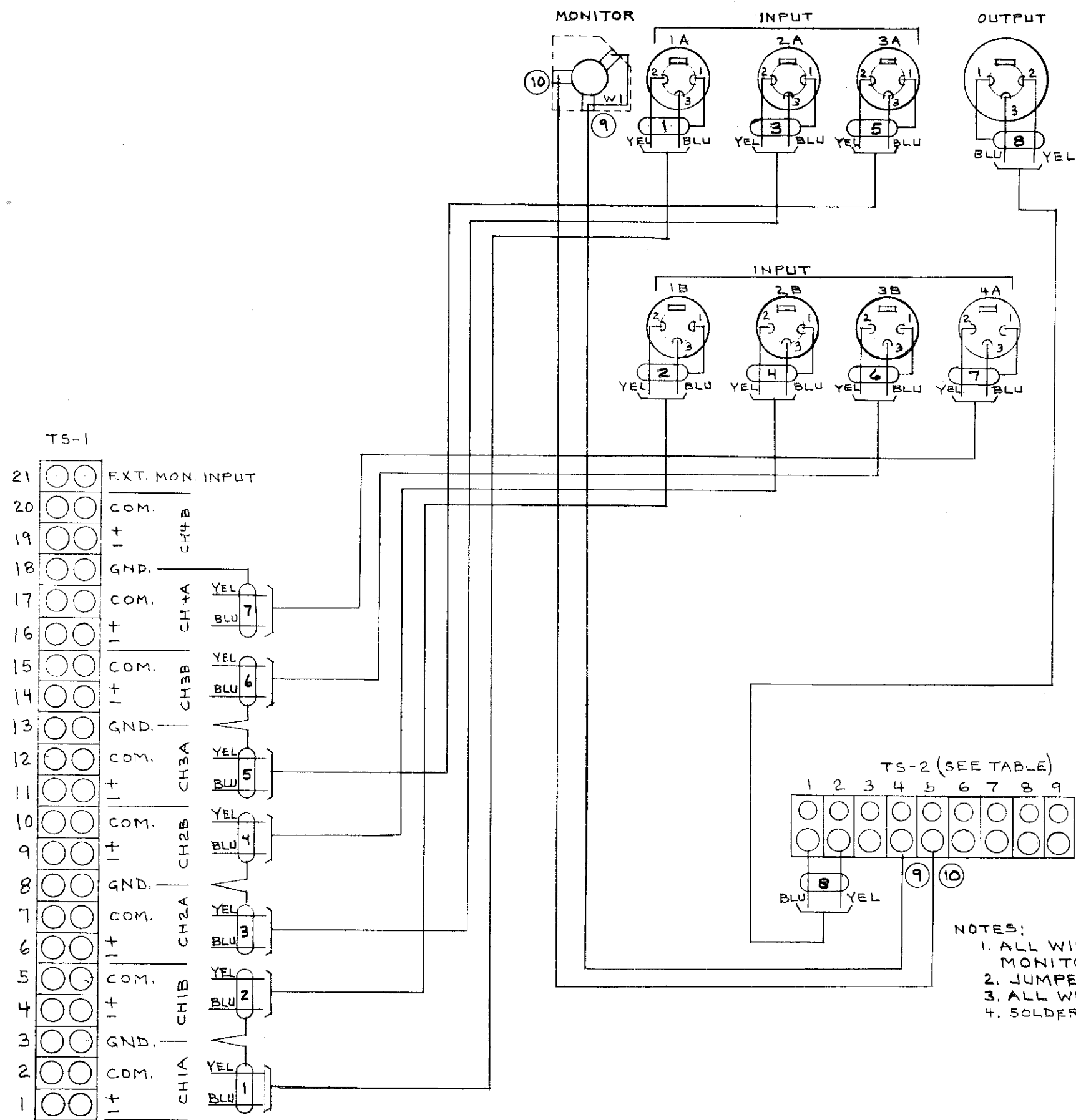
2-42. REAR CONNECTOR PANEL. Disconnect ac power from the console. Remove and retain the four Phillips head screws from the cover plate located on the right side of the unit's rear panel.

2-43. Insert the connector panel into the opening and secure with the original hardware. Refer to Figure 2-4.

2-44. The rear connector panel wiring harness is numbered for ease of installation. Make the connections per Figure 2-5.

2-45. Connect the console to the proper ac power source only after all connections have been made and unit cover is replaced.

2-46. Mating plugs for the panel are XLR-3-12C (BE P/N 829-4217) for the panel output and XLR-3-11C (BE P/N 829-4216) for the panel input. The monitor jack accepts a standard 1/4 inch phone plug (BE P/N 418-0367).



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FIGURE 2-5. REAR CONNECTOR PANEL
(Model 4M50P and Option 901-0003)

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section provides operating procedures for the 4M50 series audio consoles.

3-3. OPERATION.

NOTE OPERATE THE POWER SWITCH TO ON BEFORE PROCEEDING.

3-4. INPUT SOURCE SELECTION.

3-5. Two input sources may be connected to each channel mixer. Operate the selection switch to either the A or B position to feed the desired input to the mixer.

3-6. LEVEL CONTROL.

NOTE DO NOT ADJUST THE MASTER CONTROL DURING NORMAL OPERATION.

3-7. PROGRAM OUTPUT LEVEL. The program output level is controlled by the front panel MASTER control. Operate the MASTER control to a position between 10 o'clock and 2 o'clock for maximum performance. Once the MASTER control is operated to a position, the control must not be adjusted during normal operation.

NOTE BEST PERFORMANCE WILL BE OBTAINED WITH THE MIXER CONTROLS ADJUSTED TO A POSITION BETWEEN 12 O'CLOCK AND 3 O'CLOCK.

3-8. MIXER CONTROLS. The mixers can be used to control level in two ways:

- 1) To keep each input at approximately the same volume.
- 2) To combine signals from two or more inputs in a desired relationship.

3-9. VU METER. The meter is connected to the program output. It is factory calibrated to indicate 0 VU (100), when the program output is +8 dBm.

3-10. The VU meter is an aid in determining the proper levels or volumes. Adjust the mixer(s) of active sources for a peak level indication of 0 VU (100). When mixing two or more inputs, adjust the mixers to yield the desired sound while maintaining a peak level indication of 0 VU (100).

3-11. MONITORING.

3-12. CUE SYSTEM. All mixer controls have a CUE position at the extreme counterclockwise stop. An input is connected to the CUE system by placing the selector in the appropriate position (A or B) and rotating the mixer to the CUE position.

3-13. An internal amplifier and speaker are provided for monitoring the cue system. The volume of the cue speaker is determined by the setting of the upper front panel CUE level control. The cue speaker is muted when the muting relay is activated.

3-14. The cue system can also be monitored by the headphones. The headphone is connected to the cue system when the phone selector switch is operated to the CUE position.

CAUTION

HEADPHONE AMPLIFIER LOAD IMPEDANCE SHOULD NOT BE LESS THAN 8 OHMS.

3-15. HEADPHONES. The headphone jack is designed to accept a wide variety of headphone sets including low impedance stereo headphones. Only one channel of the stereo headphones will be activated. Low impedance stereo headphones can be used with the 4M50 consoles with one of the following modifications:

1. The headphone plug can be rewired so that the left and right channels are in series (isolate the wire(s) originally connected to the plug sleeve, and move the ring connection to the sleeve).
2. If the two channels are to be paralleled (the tip and ring of the headphone plug shorted), a 4 Ohm, 2 watt resistor must be added in series with the headphones.

3-16. The headphones can be switched to monitor the program output (PGM), the cue system (CUE), or an auxiliary input (AIR) as determined by the PHONES selector switch. Headphone volume is controlled by the operation of the PHONES level control.

3-17. MONITOR SPEAKER. An internal amplifier is provided to drive a control room speaker. The speaker will be muted when the muting relay is activated, for use with a live microphone. The volume of the speaker is controlled by the positioning of the upper front panel MONITOR level control.

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This section provides theory of operation for the Broadcast Electronics Model 4M50 Series Audio Consoles. Refer to Figure 4-1 for the following discussion.

4-3. FUNCTIONAL DESCRIPTION.

4-4. Each channel/mixer circuit operates in an identical manner, therefore only channel/mixer circuit CH2 will be described in detail.

4-5. POWER SUPPLY.

4-6. The console operates from a primary input potential of 117V ac. Primary ac is applied to power transformer T1 through fuse F1 which provides overload protection and the internal power switch (S10) which allows on/off control.

4-7. The secondary of power transformer T1 produces 12.6V ac which is full-wave rectified and filtered by a single pi-section filter into a +20V dc supply. The +20V dc is supplied to all components when the ON/OFF switch is set to ON.

4-8. AUDIO CIRCUIT PROGRAM BUS.

4-9. Selection of input A or B is accomplished by a three-position wafer switch. Depending upon the position of the switch, audio from the A or B input will be applied to the line/microphone level jumpers. Audio will be applied through a resistor for high-level inputs or through a conductor for low-level inputs. Audio from the line/microphone level jumpers will then be applied to the balanced input of preamplifier IC-2 which has an approximate gain of 1000.

4-10. The output of preamplifier IC-2 is applied through front-panel mixer control CH2 to the program bus. Audio is then applied to mixing amplifier IC-5 which has an approximate gain of 18.

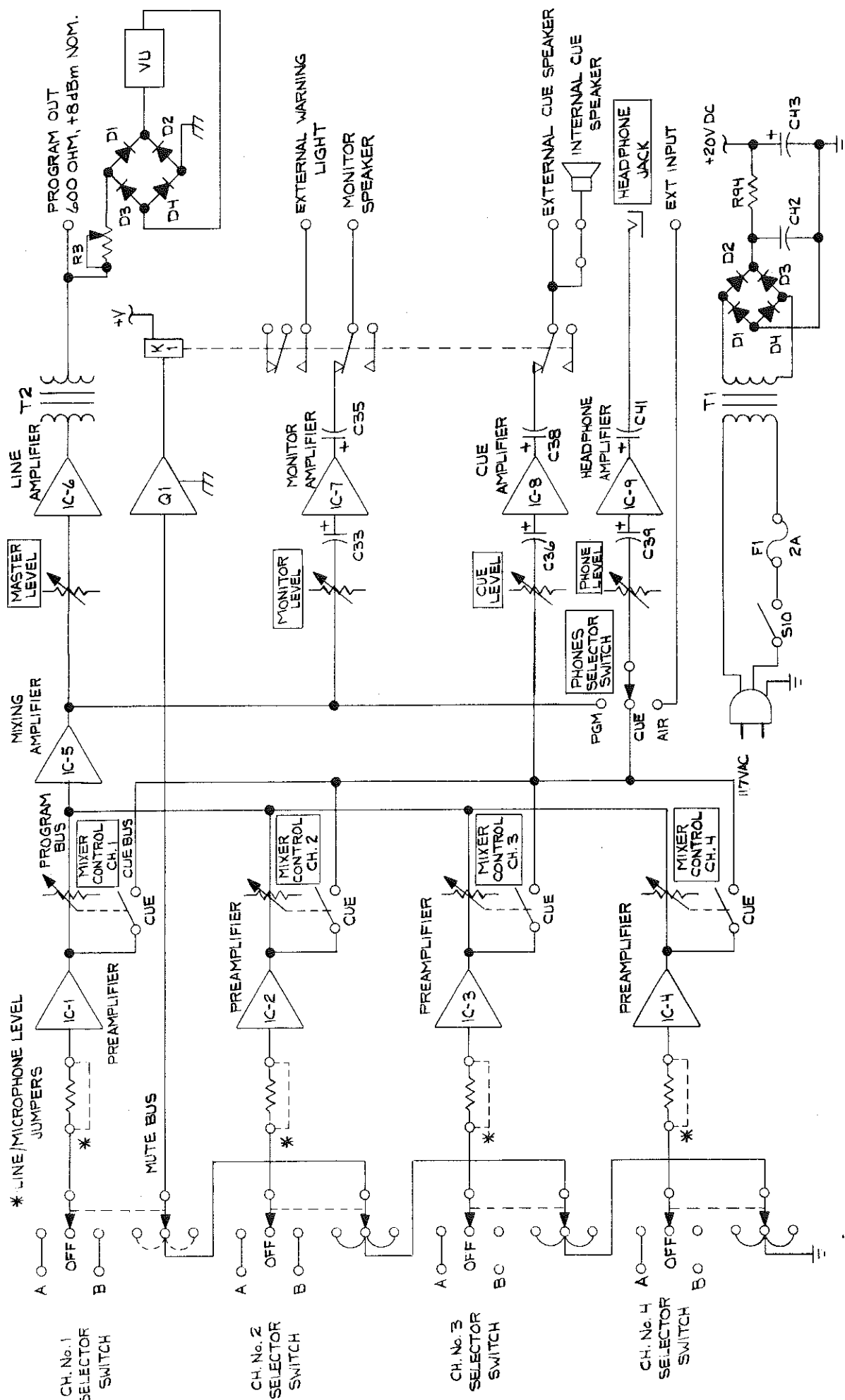


FIGURE 4-1. 4M50 SERIES AUDIO CONSOLE BLOCK DIAGRAM.

597-0451-8

4-11. Audio from mixing amplifier IC-5 at this point is routed to three different circuits:

- A. Audio is routed through the MASTER level control to line amplifier IC-6 which has an approximate gain of 22. The output of line amplifier IC-6 is then transformer-coupled through T2 to the program output line. A sample is routed from the output line through potentiometer R3 and full-wave rectified for application to the console VU meter.
- B. Audio from the mixing amplifier is applied through the front-panel MONITOR level control and ac-coupled through capacitor C33 to monitor power amplifier IC-7. The output of monitor amplifier IC-7 is then ac-coupled through capacitor C35 to the contacts of muting relay K1. With the contacts open, audio is applied to the monitor speaker connection.
- C. Audio from the mixing amplifier is applied to the PHONES selector switch. When the switch is in the PGM position, audio is applied through the front-panel PHONES LEVEL control and ac-coupled through capacitor C39 to the headphone power amplifier IC-9. The output of headphone power amplifier IC-9 is then ac-coupled through capacitor C41 to the headphone jack.

4-12. AUDIO CIRCUIT CUE BUS.

4-13. When mixer control CH2 is operated to the cue position, audio from either input sources A or B is applied to the cue bus. The cue audio is then routed to two different circuits:

- A. Audio from the cue bus is applied through the front-panel CUE level control and ac-coupled through capacitor C36 to cue power amplifier IC-8. The output of cue power amplifier IC-8 is then ac-coupled through capacitor C38 to the contacts of muting relay K1. With the contacts open, audio is applied to the internal cue speaker and the external cue speaker connection.
- B. Audio from the cue bus is applied to the PHONES selector switch. When the switch is operated to the CUE position, audio is applied through the front-panel PHONES level control and ac-coupled through capacitor C39 to the headphone power amplifier IC-9. The output of headphone power amplifier IC-9 is then ac-coupled through capacitor C41 to the headphone jack.

4-14. EXTERNAL INPUT.

4-15. When the PHONES selector switch is operated to the AIR position, audio from an external source is applied through the PHONES level control and ac-coupled through capacitor C39 to the headphone power amplifier IC-9. The output of headphone power amplifier IC-9 is then ac-coupled through capacitor C41 to the headphone jack.

4-16. MUTING.

4-17. Muting is accomplished when channel 1 selector switch is in either the A or B position. The muting relay is provided to switch off the monitor and cue speakers and switch on a warning (on-the-air) light in the studio.

4-18. When channel 1 selector switch is in the A or B position, a ground is opened which allows voltage to be applied to switching transistor Q1. The voltage biases on transistor Q1 which energizes relay K1 and closes the contacts. This action switches off the cue and monitor speakers and switches on the warning light.

SECTION V

MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides general maintenance information, electrical adjustment procedures and component replacement procedures for Model 4M50 Series Audio Consoles.

5-3. SAFETY CONSIDERATIONS.

5-4. Low voltage is used throughout the 4M50 circuitry, however maintenance with power energized is always considered hazardous and caution should be observed. Good judgement, care, and common sense are the best accident preventives. The procedures contained in this section should be performed only by trained and experienced maintenance personnel.

5-5. FIRST LEVEL MAINTENANCE.

5-6. First level maintenance of the 4M50 series audio consoles fall into the category of good housekeeping, which consists of procedures performed on a regular basis to maintain the correct operational environment for the console.

WARNING

ENSURE ALL POWER IS DISCONNECTED FROM THE UNIT
BEFORE ATTEMPTING PREVENTIVE MAINTENANCE.

5-7. CLEANING.

5-8. Use a soft cloth moistened with a mild household cleaner to remove fingerprints and other marks from the machine chassis and other surfaces. Remove dust from the interior with a soft-bristled brush. The mixer controls are sealed units and do not require cleaning.

5-9. VISUAL INSPECTION.

5-10. Regularly inspect the console for loose connections and hardware, damaged or improperly seated semi-conductors, components damaged by overheating, and mechanical surfaces requiring lubrication.

5-11. SPECIFICATION MEASUREMENTS.

5-12. A specification test performed periodically is a good way to check for the proper operation of the console. A copy of the original factory specifications test results can be obtained from Broadcast Electronics by returning the test certification card which is supplied with each unit.

5-13. Specification tests are performed at the factory during final test with a -50 dBm signal supplied to a low level input. The gain controls are adjusted to yield a +8 dBm output from the console. Active inputs and outputs are terminated with the proper load.

5-14. SECOND LEVEL MAINTENANCE.

5-15. Second level maintenance consists of procedures required to restore the unit to proper operation after a fault has occurred.

5-16. TROUBLESHOOTING.

5-17. The troubleshooting philosophy for the 4M50 series audio consoles consists of isolating a problem to a specific circuit board or component. If desired, an entire defective assembly may be returned to the factory for repair or exchange. Refer to the following information and Table 5-1 for the 4M50 series audio console troubleshooting.

WARNING

REMOVE ALL JEWELRY BEFORE PROCEEDING.

WARNING

DO NOT TOUCH ANY COMPONENTS WITHIN THE EQUIPMENT WITH THE POWER ENERGIZED THAT MAY CAUSE AN ELECTRICAL SHOCK. GOOD JUDGEMENT, CARE, AND COMMON SENSE MUST BE PRACTICED TO PREVENT ACCIDENTS.

WARNING

WARNING

CAUTION

DO NOT TOUCH ANY CONNECTIONS OR INTEGRATED CIRCUIT PINS THAT MAY CAUSE AN ACCIDENTAL SHORT AND DAMAGE THE COMPONENT OR CIRCUIT BOARD.

CAUTION

CAUTION

TO AVOID DAMAGE TO THE INTEGRATED CIRCUITS, USE AT LEAST A 20,000 OHMS/VOLT METER FOR TROUBLESHOOTING THE 4M50 SERIES CONSOLES.

CAUTION

TABLE 5-1. 4M50 SERIES AUDIO CONSOLE TROUBLESHOOTING

PROBLEM	ITEMS TO CHECK
Complete failure in console operation with missing VU meter lamp illumination.	Line fuse, power supply circuitry.
Missing program output.	Power supply to IC5 and IC6, mixing amplifier IC5, line amplifier IC6, master level control R71, capacitors C30 or C32, and transformer T2.
Missing monitor output.	Power supply to IC7, monitor level control R82, monitor amplifier IC7, capacitors C33 or C35, and relay K1.
Missing headphone output.	Power supply to IC9, headphone amplifier IC9, headphone level control R88, and capacitors C39 or C41.
Missing cue audio.	Power supply to IC8, cue audio amplifier IC8, cue level control R85, cue switch in mixer controls, capacitors C36 or C38, and relay K1.
Missing audio from any one mixer control.	Audio source, power supply to the preamplifier, preamplifier, mixer control, coupler capacitor, and A-B selector switch.
No muting.	Transistor Q1 and relay K1.

5-17. ADJUSTMENTS.

5-18. VU METER CALIBRATION. The console VU meter is calibrated at the factory to indicate 0 VU (100) when the output is +8 dBm. If the console is to be operated at a different level, the VU meter may be recalibrated as follows:

WARNING DISCONNECT POWER AND REMOVE ALL JEWELRY BEFORE PROCEEDING.

- A. Disconnect power from the console and connect a 1kHz sine wave signal to any input for use as a test signal.
- B. Connect an external VU meter to the output of the console.
- C. Provide a 600 Ohm termination for the output.
- D. Apply power and adjust the output level to the desired level as indicated by the external meter.
- E. Adjust the VU meter calibration control R3 on the VU meter circuit board for a 0 VU indication on the console VU meter (refer to drawing C918-0001).

5-19. COMPONENT REPLACEMENT.

WARNING DISCONNECT AC POWER WHEN REMOVING OR REPLACING CIRCUIT BOARDS OR COMPONENTS.

5-20. The circuit boards used in the 4M50 are double-sided boards with plated through-holes. Because of the plated through-holes, solder fills the holes by capillary action. These conditions require that defective components be removed carefully to avoid damage to the board.

5-21. On all circuit boards, the adhesion of the copper trace to the board fails at almost the same temperature as solder melts. A circuit board trace can be destroyed by excessive heat or lateral movement during soldering. Use of a small iron with steady pressure is required for circuit board repairs.

5-22. To remove a component from a board such as the type used in the 4M50, cut the leads from the body of the defective component while the device is still soldered to the board.

5-23. Grip each component lead, one at a time, with long nose pliers. Turn the board over and touch the soldering iron to the lead at the solder connection. When the solder begins to melt, push the lead through the back side of the board and cut off the clinched end of the lead. Each lead may now be heated independently and pulled out of each hole. The holes may be cleared of solder by carefully re-heating with a low wattage iron and removing the residual solder with a soldering vacuum tool.

5-24. Install the new component and apply solder from the bottom side of the board. If no damage has been done to the plated through-holes, soldering of the top side is not required.

WARNING

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

WARNING

WARNING

WARNING

OBSERVE THE MANUFACTURER'S CAUTIONARY INSTRUCTIONS.

5-25. After soldering, remove residual flux with a cotton swab moistened with a suitable solvent. Rubbing alcohol is highly diluted and is not effective. Solvents are available from electronic supply houses which are useful.

5-26. The board should be checked to ensure the flux has been removed and not just smeared about. Rosin flux is not normally corrosive, but it will absorb enough moisture in time to become conductive and cause problems.

SECTION VI
PARTS LIST

6-1. INTRODUCTION.

6-2. This section provides descriptions and part numbers of parts and assemblies required for maintenance of the Broadcast Electronics Model 4M50 Series Audio Consoles. Each table entry in this section is indexed by the reference designators of the applicable schematic diagram.

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

TABLE 6-1. REPLACEABLE PARTS LIST INDEX

TABLE NO.	DESCRIPTION	PART NO.	PAGE
6-2	MONO FOUR CHANNEL CONSOLE, ALL MODELS	938-0450/ -0451 901-0450- 020	6-2
6-3	VU METER CIRCUIT BOARD ASSEMBLY	918-0001	6-3
6-4	OUTPUT AMPLIFIER CIRCUIT BOARD ASSEMBLY	918-0003	6-3
6-5	INPUT AMPLIFIER CIRCUIT BOARD ASSEMBLY	918-0002	6-4
6-6	REAR CONNECTOR PANEL (Standard on Model 4M50P and Optionally Available)	901-0003	6-6

TABLE 6-2. MONO FOUR CHANNEL CONSOLE, ALL MODELS
938-0450/0451, 901-0450-020

REF. DES.	DESCRIPTION	PART NO.	QTY.
C42,C43	Capacitor, Electrolytic, 5500 uF, 40V	024-5584	2
F1	Fuse, AGC, 2 Amperes, Slow-Blow	334-0200	1
J1	Phone Jack, 1/4 inch (0.635 cm)	417-0111	1
LS1	Speaker, 3 inch (7.62 cm) 8 Ohm	414-0001	1
M1	Meter, VU, 3.5 inch (8.89 cm) with Bezel, dc Microammeter Type, 1900 Ohm	319-1003	1
R19	Potentiometer, 10 k Ohm, with Switch, Modified (CH1 MIXER Control)	193-1053	1
R21	Resistor, 1 k Ohm $\pm 5\%$, 1/4W (across CH1 CUE Control)	100-1043	1
R33	Potentiometer, 10 k Ohm, with Switch, Modified (CH2 MIXER Control)	193-1053	1
R35	Resistor, 1 k Ohm $\pm 5\%$, 1/4W (across CH2 CUE Control)	100-1043	1
R47	Potentiometer, 10 k Ohm, with Switch, Modified (CH3 MIXER Control)	193-1053	1
R49	Resistor, 1 k Ohm $\pm 5\%$, 1/4W (across CH3 CUE Control)	100-1043	1
R61	Potentiometer, 10 k Ohm, with Switch, Modified (CH4 MIXER Control)	193-1053	1
R63	Resistor, 1 k Ohm $\pm 5\%$, 1/4W (across CH4 CUE Control)	100-1043	1
R71,R82, R85,R88	Potentiometer, 10 k Ohm Audio Taper (MASTER, MONITOR, CUE, and PHONES Controls)	191-1053	4
S1 THRU S5	Switch, Lever, 3 Pole, 3 Position (A-B Selector Switches)	343-3001	5
S10	Switch, Toggle, SPST (Power ON/OFF)	348-0110	1
T1	Transformer, Power: Primary: 117V ac, 50/60 Hz Secondary: 12.6V CT at 2 Amperes	376-0003	1
TB1	Barrier Strip, 21 Terminals	412-0021	1
XF1	Fuse holder, AGC	415-2012	1
----	Knob, Slide Switch	482-0003	5
----	Knob, Round	482-0002	4
----	Knob, Round, Modified, with Stop (CUE Control)	482-0011	4
----	VU Meter Circuit Board Assembly	918-0001	1
----	Output Amplifier Circuit Board Assembly	918-0003	1
----	Input Amplifier Circuit Board Assembly	918-0002	1
----	Rear Connector Panel (Model 4M50P or Option)	901-0003	1

TABLE 6-3. VU METER CIRCUIT BOARD ASSEMBLY - 918-0001

REF. DES.	DESCRIPTION	PART NO.	QTY.
D1 THRU D4	Diode, 1N34, 60V @ 75 mA Germanium	202-0034	4
R1	Resistor, 3.9 k Ohm $\pm 5\%$, 1/4W	100-3943	1
R2	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R3	Potentiometer, 10 k Ohm $\pm 10\%$, 1/2W, with Locknut	178-1054	1
----	Blank Circuit Board	518-1502	1

TABLE 6-4. OUTPUT AMPLIFIER CIRCUIT BOARD ASSEMBLY - 918-0003
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C30,C31	Capacitor, Electrolytic, 22 μ F, 25V	013-2574	2
C32	Capacitor, Electrolytic, 100 μ F, 40V	014-1084	1
C33,C34	Capacitor, Electrolytic, 22 μ F, 25V	013-2574	2
C35	Capacitor, Electrolytic, 1000 μ F, 25V	013-1095	1
C36,C37	Capacitor, Electrolytic, 22 μ F, 25V	013-2574	2
C38	Capacitor, Electrolytic, 100 μ F, 40V	014-1084	1
C46,C47	Capacitor, Ceramic, 0.1 μ F, 100V	000-1054	2
C50	Capacitor, Ceramic, 20 pF $\pm 10\%$, 1 kV	002-2013	1
C52	Capacitor, Silvered Mica, 1000 pF, 100V,	041-1032	1
C53	Capacitor, Electrolytic, 4.7 μ F $\pm 10\%$, 35V, Tantalum	064-4763	1
C54	Capacitor, Silvered Mica, 1000 pF, 100V,	041-1032	1
C55	Capacitor, Electrolytic, 4.7 μ F $\pm 10\%$, 35V, Tantalum	064-4763	1
D1 THRU D5	Diode, 1N4004, 400V @ 1 Ampere, Silicon	203-4004	5
IC6	Integrated Circuit, NE5534AN, Low Noise Operational Amplifier, 8-Pin DIP	221-5534	1
IC7,IC8	Integrated Circuit, LM380N, Power Amplifier, 14-Pin DIP	222-3800	2
K1	Relay, Socket Mount Coil: 24V Contact: 4 SPDT, 2 Amperes, 24V dc	270-0007	1
Q1	Transistor, 2N3904, Silicon, NPN	211-3904	1
R72	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R74	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R75,R76	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	2
R77	Resistor, 220 k Ohm $\pm 5\%$, 1/4W	100-2263	1
R84	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	1

TABLE 6-4. OUTPUT AMPLIFIER CIRCUIT BOARD ASSEMBLY - 918-0003
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R86	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R87	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	1
R91 THRU R93	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	3
R94	Resistor, 5 Ohm $\pm 5\%$, 5W, W/W	133-5013	1
R98,R99	Resistor, 2.7 Ohm $\pm 5\%$, 1/4W	100-2713	2
T2	Output Transformer (Broadcast Electronics manufactured part)	371-0001	1
TS2	Barrier Strip, 9 Terminal	412-0009	1
XK1	Relay Socket	270-0008	1
----	Spring, Hold Down (for Relay)	270-0017	1
----	Blank Circuit Board	518-0003	1

TABLE 6-5. INPUT AMPLIFIER CIRCUIT BOARD ASSEMBLY - 918-0002
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1,C2	Capacitor, Electrolytic, 100 μ F, 40V	014-1084	2
C4	Capacitor, Ceramic, 20 pF $\pm 10\%$, 1 kV	002-2013	1
C5,C6	Capacitor, Electrolytic, 22 μ F, 25V	013-2574	2
C7,C8	Capacitor, Electrolytic, 100 μ F, 40V	014-1084	2
C10	Capacitor, Ceramic, 20 pF $\pm 10\%$, 1 kV	002-2013	1
C11,C12	Capacitor, Electrolytic, 22 μ F, 25V	013-2547	2
C13,C14	Capacitor, Electrolytic, 100 μ F, 40V	014-1084	2
C16	Capacitor, Ceramic, 20 pF $\pm 10\%$, 1 kV	002-2013	1
C17	Capacitor, Electrolytic, 22 μ F, 25V	013-2574	1
C18,C19	Capacitor, Electrolytic, 100 μ F, 40V	014-1084	2
C21	Capacitor, Electrolytic, 22 μ F, 25V	013-2574	1
C22	Capacitor, Ceramic, 20 pF $\pm 10\%$, 1 kV	002-2013	1
C23	Capacitor, Electrolytic, 22 μ F, 25V	013-2574	1
C24	Capacitor, Electrolytic, 100 μ F, 40V	014-1084	1
C26	Capacitor, Ceramic, 33 pF $\pm 10\%$, 1 kV, NPO	000-3302	1
C28,C29, C39	Capacitor, Electrolytic, 22 μ F, 25V	013-2574	3
C40,C41, C44	Capacitor, Electrolytic, 100 μ F, 40V	014-1084	3
C45	Capacitor, Electrolytic, 22 μ F, 25V	013-2574	1
C48	Capacitor, Ceramic, 0.1 μ F, 100V	000-1054	1
C49	Capacitor, Electrolytic, 4.7 μ F $\pm 10\%$, 35V, Tantalum	064-4763	1
C51	Capacitor, Silvered Mica, 1000 pF $\pm 5\%$, 100V,	041-1032	1
D10	Diode, 1N4744A, Zener, 15V $\pm 5\%$, 1W	200-0015	1

TABLE 6-5. INPUT AMPLIFIER CIRCUIT BOARD ASSEMBLY - 918-0002
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
IC1 THRU IC4	Integrated Circuit, NE5534AN, Low Noise Output Amplifier, 8-Pin DIP	221-5534	4
IC5	Integrated Circuit, uA748, High Performance Operational Amplifier, 8-Pin DIP	221-7480	1
IC9	Integrated Circuit, LM380N, Power Amplifier, 14-Pin DIP	222-3800	1
R1 THRU R8	Resistor, 18 k Ohm $\pm 5\%$, 1/4W	100-1853	8
R9,R10	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	2
R11,R12	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	2
R13,R14	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	2
R16,R17	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	2
R18	Resistor, 56 Ohm $\pm 5\%$, 1/4W	100-5623	1
R20	Resistor, 1.5 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R22	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R23,R24	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	2
R25,R26	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	2
R27,R28	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	2
R29,R30	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	2
R32	Resistor, 56 Ohm $\pm 5\%$, 1/4W	100-5623	1
R34	Resistor, 1.5 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R36	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R37,R38	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	2
R39,R40	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	2
R41,R42	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	2
R44,R45	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	2
R46	Resistor, 56 Ohm $\pm 5\%$, 1/4W	100-5623	1
R48	Resistor, 1.5 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R50	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R51,R52	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	2
R53,R54	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	2
R55,R56	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	2
R58,R59	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	2
R60	Resistor, 56 Ohm $\pm 5\%$, 1/4W	100-5623	1
R62	Resistor, 1.5 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R64	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R66	Resistor, 27 k Ohm $\pm 5\%$, 1/4W	100-2753	1
R69,R70	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	2
R78 THRU R80	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	3
R81	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	1
R90	Resistor, 1.5 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R100	Resistor, 2.7 Ohm $\pm 5\%$, 1/4W	100-2713	1
----	Ferrite Beads	360-0001	16
----	Blank Circuit Board	518-0002	1

TABLE 6-6. REAR CONNECTOR PANEL - 901-0003
(Standard on Model 4M50P and Optionally Available)

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Receptacle, XLR-3-32, Male	829-4213	7
----	Receptacle, XLR-3-31, Female	829-4214	1
----	Phone Jack	417-0311	1

SECTION VII
DRAWINGS

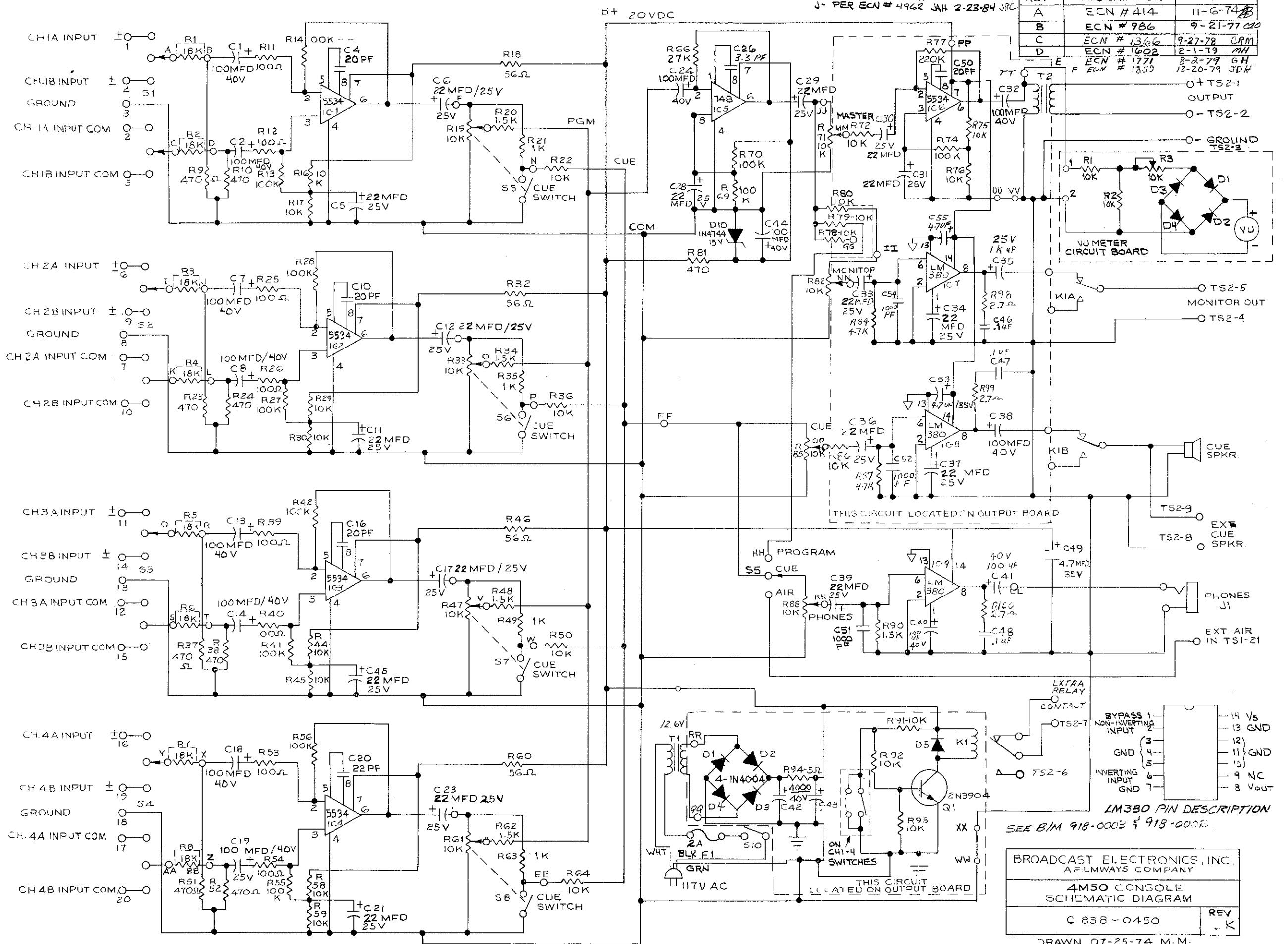
7-1. INTRODUCTION.

7-2. This section provides drawings and schematics to aid in troubleshooting.

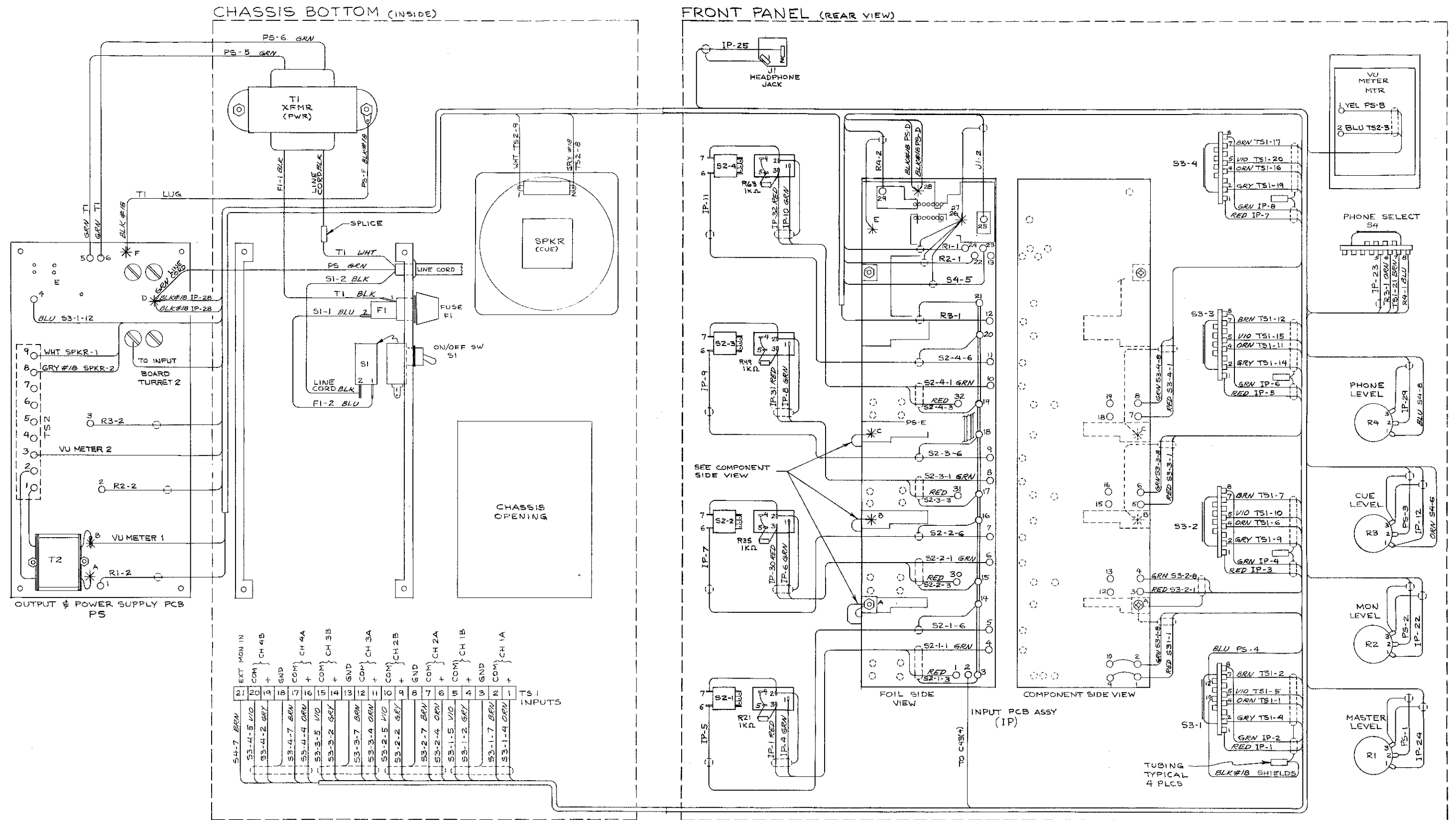
<u>FIGURE</u>	<u>DESCRIPTION</u>	<u>DRAWING</u>
7-1	OVERALL SCHEMATIC DIAGRAM	C838-0450
7-2	WIRING DIAGRAM	D946-0104
7-3	OUTPUT AMPLIFIER CIRCUIT BOARD ASSEMBLY	C918-0003
7-4	INPUT AMPLIFIER CIRCUIT BOARD ASSEMBLY	D918-0002
7-5	VU METER CIRCUIT BOARD SCHEMATIC AND ASSEMBLY	A918-0001

K - PER ECN # 5041 ME 5-3-84 JRC
 G - PER ECN 3850 10-21-82 JRC
 H - PER ECN # 4092 MH 2-16-83 JRC
 J - PER ECN # 4942 JAH 2-23-84 JRC

REV	DESCRIPTION	DATE
A	ECN # 414	11-6-74 JRC
B	ECN # 986	9-21-77 JRC
C	ECN # 1366	9-27-78 CRM
D	ECN # 1602	2-1-79 MH
E	ECN # 1771	8-2-79 GH
F	ECN # 1859	12-20-79 JDN



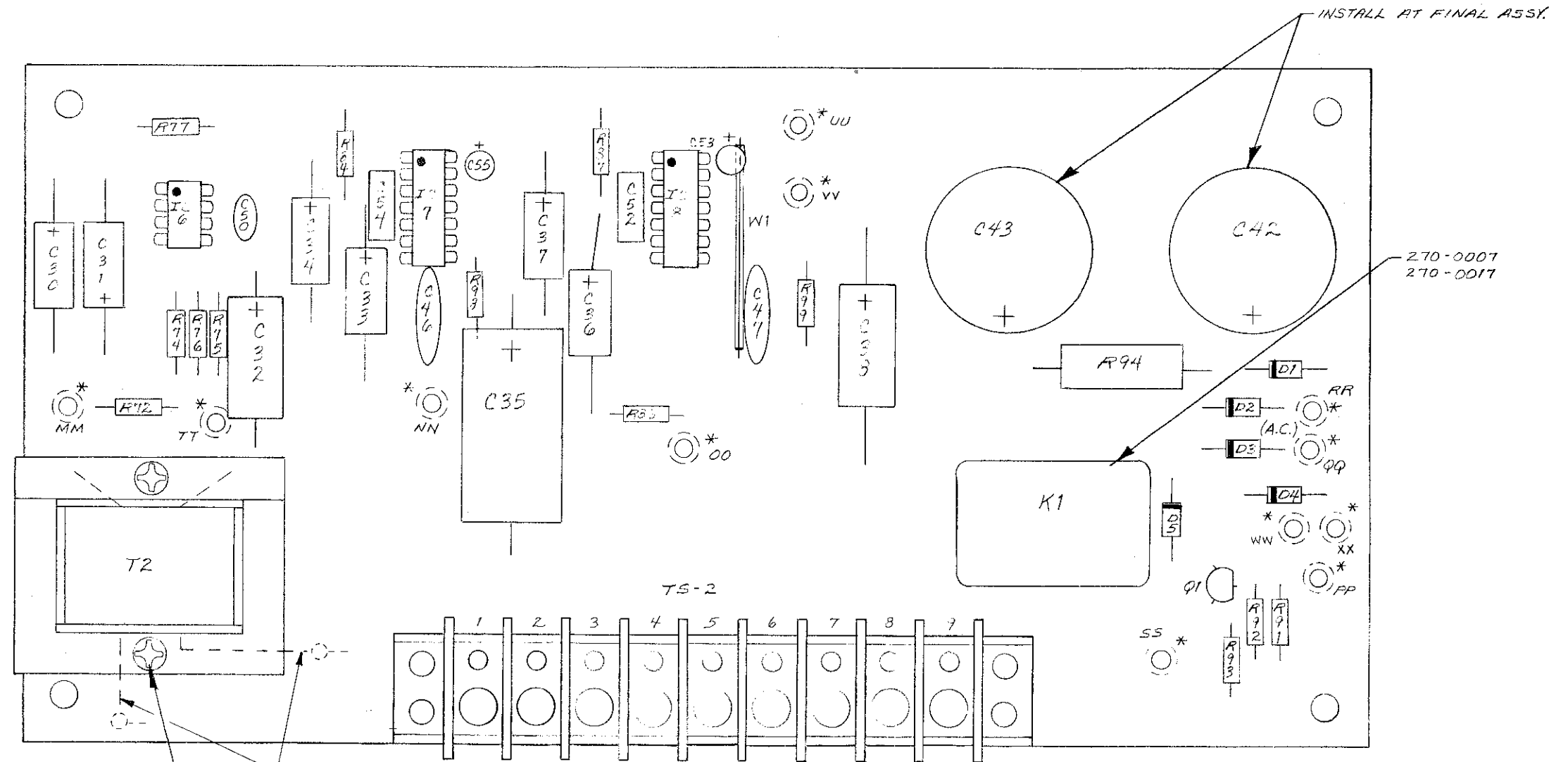
BROADCAST ELECTRONICS, INC.
 A FILMWAYS COMPANY
4M50 CONSOLE
 SCHEMATIC DIAGRAM
 C 838-0450
 DRAWN 07-25-74 M.M.



A	PER ECN 4962	JAH	2-23-84	JEC	DATE	ENGR	TREATMENT OR FINISH	D	DWG NO.	REV	SCALE	SHEET 1 OF 1

DRAWN BY		DATE		BROADCAST ELECTRONICS INC.	
CHECKED BY		DATE		- A FILMWAYS COMPANY -	
PROJECT ENGR		DATE		TITLE	
APPROVED BY		DATE		WIRING DIAGRAM	
				D	
				946-0104	
				A	

REVISIONS				
REV.	DESCRIPTION	DATE	APPROVED	
H	PER ECN #3850 REDRAWN	07/21/82	JLT	
J	PER ECN 4068-A	3/22/83	JLT	
K	PER ECN 4948	2-18-84	JRC	



420-4114
423-4004
423-4001*
423-4002*
423-4003*
(2 PLCS.)

SLEEVE TRANSFORMER
LEADS (4 PLCS.)

NOTES:
1) TS-2:

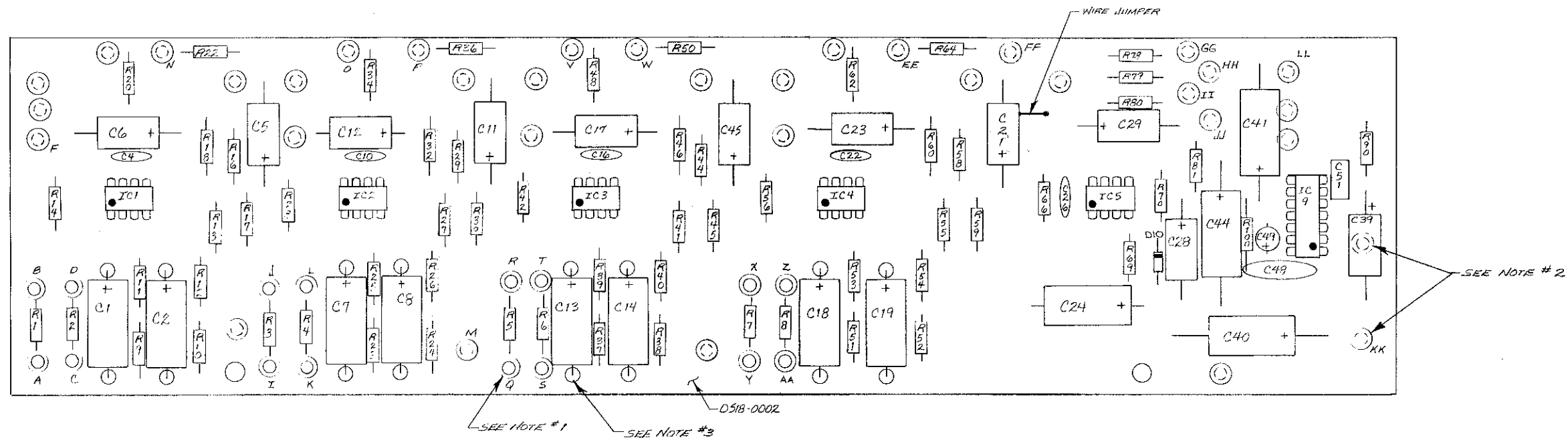
- 1] BALANCED OUTPUT
- 2] GROUND
- 3] GND
- 4] MONITOR
- 5] +
- 6] EXTRA RELAY CONTACTS
- 7] GND
- 8] EXTERNAL CUE SPEAKER
- 9] +

2) * - LOCATED ON
CIRCUIT SIDE OF PCB

SEE E/M #918-0003
SEE SCHEM. #838-0450

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		MATERIAL		DATE		REV. K	

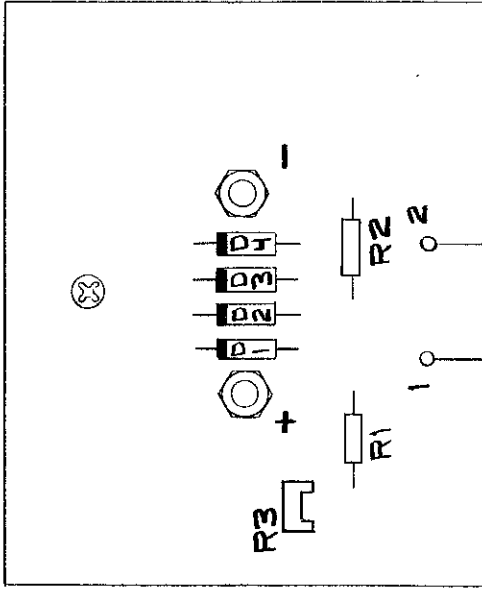
REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
H	PER ECN # 3853	OFF	10-22-82
J	PER ECN # 4068	MERKEL	1-31-83 JLT
K	PER ECN # 4092	MN	2-16-83 JLT
L	PER ECN 4068-A	J.D.S.	3/22/83 JLT
M	PER ECN 5041	MSE	5-3-84 JLT



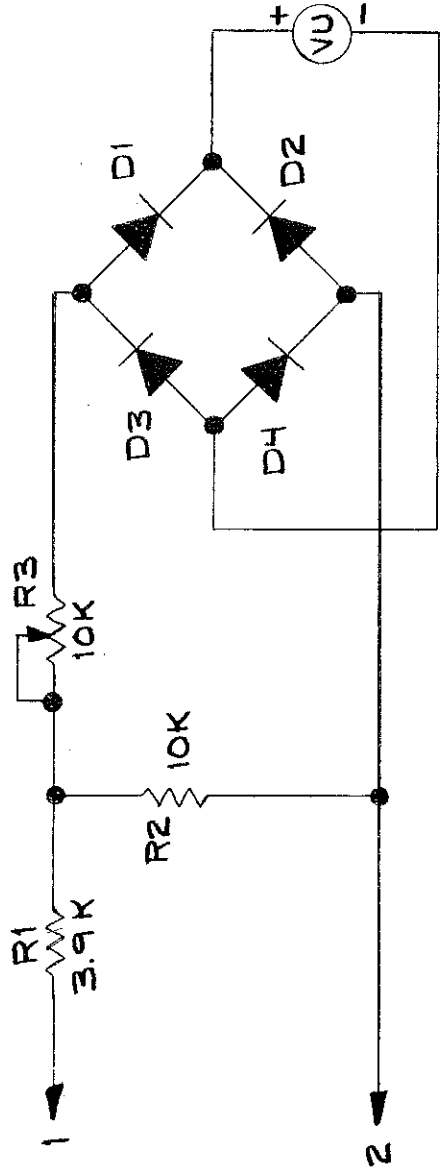
- NOTES:
- 1) 16 TURRETS MOUNTED ON COMPONENT SIDE OF PCB. (⊙)
 - 2) 36 TURRETS MOUNTED ON CIRCUIT SIDE OF PCB. (⊙)
 - 3) ASSEMBLE FERRITE BEADS TO BOTH LEADS OF C1, C2, C7, C8, C13, C14, C18 & C19.
- SEE SCHEMATIC #C838-0450
SEE B/M # 918-0002

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		MATERIAL		TREATMENT OR FINISH	SCALE 2/1 SHEET 1 OF 1
		4M50-CONSOLE		4M50-CONSOLE	
		4M50-CONSOLE		4M50-CONSOLE	

REV			DATE			DESCRIPTION			REVISIONS			DFTSMN			ENGR			ECN		
A			8-18-83			REDRAWN W/O CHG						JAH								
B			1-25-84			PER ECN 4881						MSE			JH					




RED GREEN



NOTE:

1 ALL DIODES IN98
OR EQUIVALENT

 BROADCAST ELECTRONICS INC. 4100 N. 24TH ST. QUINCY, IL 62305 217/224-9600 TELEX 250142 CABLE BCST ELECT QUI		TITLE		METER RECTIFIER CARD VU-1	
		TYPE		A	
SIZE		A		DWG. NO.	
				918-0001	
MODEL				SCALE	
				SHEET 1 OF 1	

DWN. BY		JAH 8-18-83		MATERIAL	
CHKD				FINISH	
ME				NEXT ASSY.	
PROJ. ENGR.					
MFG.					

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

PRODUCT WARRANTY

LIMITED ONE YEAR

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

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

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

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

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

BROADCAST ELECTRONICS, INC.

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