

# BOGEN®

## FLEX-PAK AMPLIFIER

MODEL CHS-60A

### OPERATING AND INSTALLATION MANUAL

#### DESCRIPTION

Bogen Model CHS-60A Flex-Pak public address amplifier is a fully transistorized preamp-mixer-amplifier unit, rated at 60 watts.

Two input channels are provided for high-impedance or low-impedance unbalanced microphone inputs. Both channels may be converted for use with low-impedance balanced microphone inputs by means of Bogen plug-in transformer accessories. One of these channels may also be used for magnetic phono or tape head inputs. An optional accessory designed to mount on the front panel of the amplifier provides two additional microphone input channels. These added channels have all the capabilities of the basic channels, and the same accessories are applicable to them.

Two auxiliary channels, with separate controls, are provided on the amplifier for a tuner, tape recorder, or phonograph with a ceramic cartridge.

One microphone channel and the auxiliary channels may be remotely controlled or overridden (via optional accessories) for special announcements over another microphone channel.

This amplifier features a built-in compressor circuit which operates on the MIC input channels to provide relatively uniform output from the amplifier regardless of variations in the MIC input levels. This is particularly important in speech applications, where a microphone may be used by a number of people with varying voices and microphone techniques. A push-pull switch inserts or disconnects the compressor circuit.

IN and OUT receptacles are provided for easy connection of a reverb unit or acoustic equalizer filters to the amplifier.

Provision is made for using a transformer accessory to feed a signal from a 500/600 ohm telephone line into the amplifier or to connect the output of the amplifier to a 500/600 ohm telephone line.

An output terminal strip at the rear of the amplifier provides standard balanced or unbalanced 8 and 16-ohm speaker taps, as well as connections for 25-volt center-tapped and 70-volt speaker lines. Two jacks provide for rapid and convenient connections to speakers.

The output of the amplifier can also be connected from the tape/booster jack to a tape recorder or booster amplifier.

A bridging output jack provides for increasing the number of input channels by interconnecting the bridging jacks of two CHS-A amplifiers.

#### TECHNICAL SPECIFICATIONS

**POWER OUTPUT (RMS at 1000 Hz):** 60 watts.

**FREQUENCY RESPONSE:**  $\pm 2$  dB 70 Hz to 12 kHz.

**SENSITIVITY (FOR RATED OUTPUT):** AUX, 0.3V; Bridging, 18 mV; HI-Z Mic, 3 mV; Low Z unbalanced, 0.3 mV; Low Z balanced, 0.3 mV.

**HUM AND NOISE (BELOW RATED OUTPUT):** MIC, 60 dB; AUX, 70 dB.

**INPUT IMPEDANCES:** 2 Hi Z (50k) MIC inputs each. Convertible to Low Z unbalanced (300 ohms) and Low Z balanced with plug-in accessory transformers. 2 AUX (500k); Bridging (100k); Reverb input (20k); MIC 2 convertible to magnetic input (50k).

**OUTPUT IMPEDANCES:** 8, 16-ohm speaker taps; 25V center tapped (10.4 ohms) and 70V (82 ohms) balanced lines; TAPE OUT, 650 mV at 1k ohms; TAPE/BOOSTER, 5 V at 10k ohms; WMT-1 output 500/600 ohms; BRIDGING (18 mV at 100k ohms); Reverb output, 650 mV at 1k ohms.

**COMPRESSION:** 5 milliseconds attack time, 2 seconds decay time, max. Compression 15 dB.

**STONE CONTROL ACTION:** BASS 50 Hz + 9 dB to -12 dB; TREBLE 12 kHz + 9 dB to -12 dB.

**CONTROLS AND INDICATORS:** MIC 1, MIC 2 Volume; AUX 1, AUX 2 Volume; MASTER Volume, BASS, TREBLE; Compression Switch; Power Switch; Indicator Lamp.

**SEMICONDUCTORS:** 14 silicon transistors, 2 Zener diodes, 6 silicon diodes.

**POWER REQUIREMENTS:** 120 V, 60 Hz, 1.6 A, 170W.

**DIMENSIONS:** 16-3/8"W x 13-3/4"D x 4-1/4"H.  
**WEIGHT:** 23 lb.

A tape out jack provides for making tape recordings independent of the amplifier master volume and tone controls.

The amplifier operates from a 120 volt, 60 Hz line. A three-prong line cord provides automatic grounding when connected to a three-wire outlet. The output transistors are protected by a thermal breaker, and the circuitry is further protected by a circuit breaker.

# INSTALLATION

## UNPACKING

The amplifier was carefully checked before leaving factory. Inspect shipping container and unit carefully for indication of improper handling. If the unit has been damaged, make an immediate claim to distributor from whom it was purchased. If the amplifier was shipped to you, notify transportation company without delay and place your claim.

## POWER AND GROUNDING

The amplifier is furnished with an ac line cord terminated in a three-prong plug. The line cord should be plugged into a three-wire grounded outlet providing a nominal 120-volt, 60 Hz power source. This will ground the amplifier as well as supply power to it.

It is important to ground the amplifier. Therefore, if a three-wire outlet is not available, an adapter such as Leviton No. 5017 should be used to convert a standard two-wire outlet for use with three-wire plugs. The adapter is provided with a grounding pigtail which should be connected to the screw holding the wall plate to the receptacle.

In some areas, the wall plate screw is not grounded. In this case it will be necessary to connect a grounding wire from the GND terminal on the rear chassis of the amplifier to a water or steam pipe.

## AUXILIARY POWER

The auxiliary power receptacle on the rear chassis (see figure 1) is a three-wire grounded outlet, which can supply power to accessory or associated equipment in the sound system. Be sure that the auxiliary component does not draw more than 250 watts. The power switch on the front panel of the amplifier controls this receptacle and can be used to turn the auxiliary unit on and off.

Associated equipment connected to the auxiliary receptacle with a three-prong line cord will be grounded, providing the amplifier line cord has been properly grounded as described above. Otherwise, it may be necessary to ground the auxiliary equipment.

## CAUTION

*Use the on-off switch on the phonograph for turning off a record player connected to the auxiliary receptacle. Do not use the amplifier power switch to stop the record player as this may cause flats to develop on the idler wheel of the phonograph.*

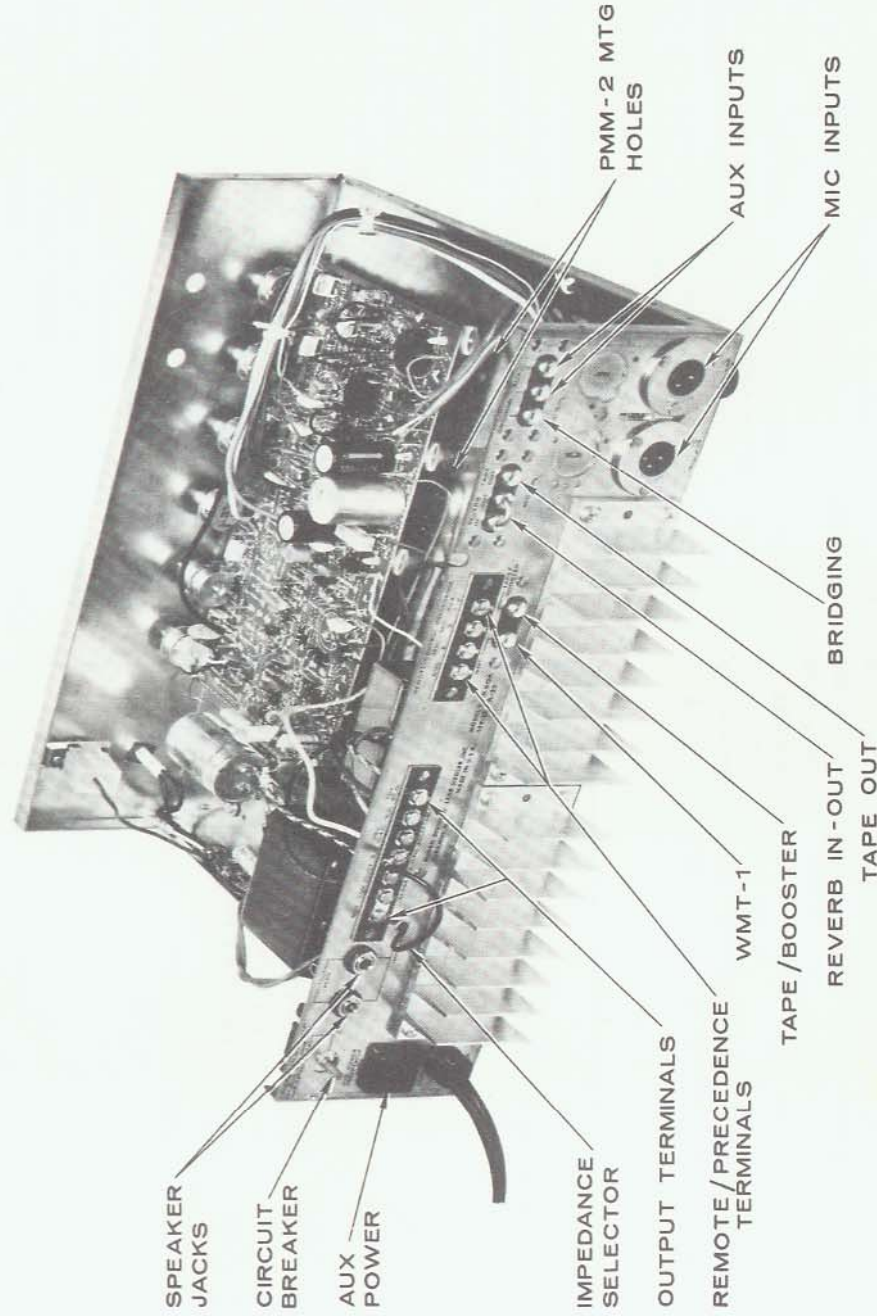


Figure 1—Rear Panel and Top Chassis of Amplifier

## INPUT CONNECTIONS

**HIGH IMPEDANCE MICROPHONES:** The amplifier is shipped in a configuration for direct connection of high impedance microphones (50k ohms) to the two MIC input receptacles of the amplifier. The microphone lead should be a single-conductor shielded cable under 35 feet long and terminated in a Cannon XLR-311C connector (Bogen Part No. 85-0124-01) as shown in figure 2.

**UNBALANCED LOW IMPEDANCE MICROPHONES:** Jumpers with push-on connector lugs are mounted on the printed circuit board assembly for use in converting the mic input channel circuits. See note 5 on the schematic diagram, figure 4. To convert MIC 1 for unbalanced low impedance use, connect jumper between pins 25 and 26; to convert MIC 2, connect jumper between pins 20 and 21. As shown in figure 2, make and connect a jumper between terminals 1 and 2 of the microphone plug. Connect the conductor lead of the microphone to pin 3 of the plug.

**BALANCED LOW IMPEDANCE MICROPHONES:** Low impedance transformer accessories are required to permit the amplifier to accept inputs from microphones rated at 50, 200, or 500 ohms. Use a two-conductor shielded cable for the microphone lead, terminated in a Cannon XLR-311C connector, as shown in figure 2. Before connecting microphone, insert appropriate plug-in transformers and modify connections to transformer sockets as described in the Accessories Section.

**AUXILIARY INPUTS:** Two auxiliary inputs with separate controls are provided for high-level, high impedance inputs. These may be used to connect a radio tuner, tape recorder, record player utilizing a ceramic cartridge, or WMT-1 telephone line matching transformer. An input signal of 0.3 volts is required to obtain full output from the amplifier.

Use single-conductor shielded cable terminated in an RCA phono jack for connecting auxiliary component. If hum is experienced after making connections, run a ground wire between the chassis of the auxiliary unit and the GND terminal of the amplifier.

**MAG PHONO:** The output of a phonograph employing a magnetic cartridge may be connected to the MIC 2 input receptacle on the rear panel. Use a single-conductor shielded audio cable terminated in a Cannon XLR-311C connector as shown in figure 2. A magnetic tape head may also be connected to this input.

To provide the necessary equalization for magnetic phono and tape head inputs, the Berg terminal jumpers on the printed circuit board must be connected, as indicated in note 4 on the schematic diagram, figure 4. Connect a jumper between pins 21 and 22 and between pins 23 and 24.

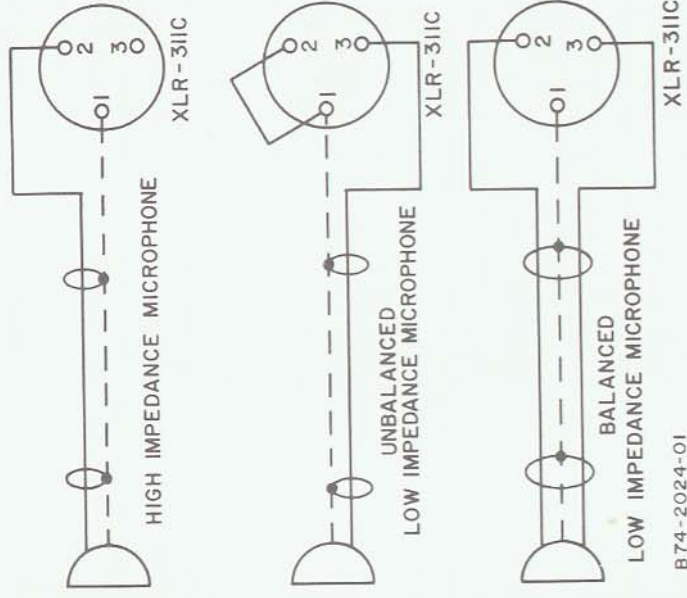


Figure 2—Connecting Microphone Cable Connector

### NOTE

*The MIC 2 input receptacle is designed to accept the output of the playback head of a tape transport mechanism without electronics. A standard tape deck or tape recorder with built-in preamplifier should be connected to either of the AUX input receptacles.*

**BRIDGING:** The amplifier may be bridged to a second amplifier of the CHS-A Series, to double the number of inputs. For bridging, connect a single-conductor shielded cable, terminated in an RCA phono plug at each end, between the rear panel BRIDGING receptacles of the two amplifiers. Any input to either amplifier will then be fed through and available at the output of both amplifiers. The amplifiers must each feed separate speaker systems.

A Bogen CHS-M preamplifier may also be bridged to the amplifier to increase the number of inputs in a system. This is done by connecting a single-conductor shielded cable, terminated in phono plugs at either end, between the BRIDGING jack on the preamp, and the one on the amplifier. As a result, all inputs to either the pre-amp or amplifier will be fed through and available at the amplifier output.

### NOTE

*When two amplifiers are bridged together, any adjustment of the MASTER, BASS, and TREBLE controls in one amplifier will not affect the output of the other amplifier.*

## OUTPUT CONNECTIONS

**SPEAKERS:** For installations where speaker will be connected permanently, output connections are available on the terminal strip at the rear of the amplifier for individual speakers rated at 8 and 16 ohms. Constant-voltage line outputs at 25 CT and 70 volts are also available at the terminal strip for multiple speaker systems. Connections may be made for an unbalanced line or for a balanced line. Make speaker line connections as shown in Table 1 for each of these installations. For detailed information on the installation of multiple speaker systems, see Speaker Installation Manual No. 54-5001 furnished with the amplifier.

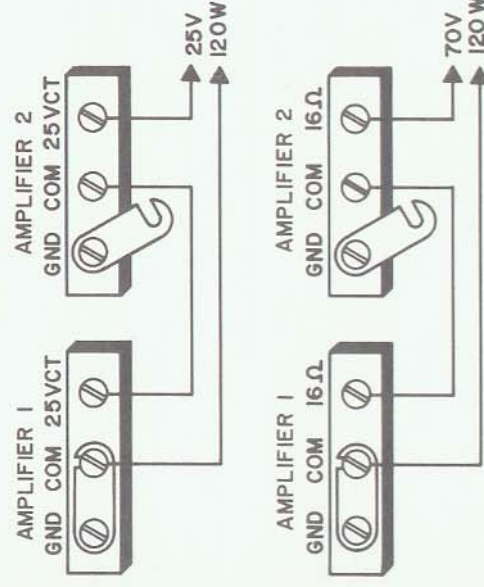
Two OUTPUT jacks are provided on the rear panel to provide quick speaker disconnect in systems that are moved frequently. For making connections to the OUTPUT jack, use a two-conductor cable terminated in a phone plug such as Switchcraft No. 380 (Bogen Part No. 85-1030-01).

Speakers or constant-voltage lines may be plugged into either or both OUTPUT jacks. After this is done, connect impedance selector lead to the appropriate terminal on the output strip. For example, if a 16-ohm speaker is used, the impedance selector goes to the 16-ohm tap; for a 25-volt line, it is connected to the 25V terminal.

Close the link between the COM and GND terminals for unbalanced line connections to a single speaker or to 25- and 70-volt lines. Open the link for a balanced line installation, and make center-tap connections as shown in Table 1 if desired.

**TAPE/BOOSTER OUTPUT:** Signal voltages from the amplifier may be used to drive a tape recorder or a booster amplifier. Connect a patch cord with a standard phono plug from the TAPE/BOOSTER jack on the rear panel of the amplifier to the input of the tape recorder or booster amplifier. The output at this jack is controlled by the volume and tone controls on the amplifier.

**TAPE OUTPUT:** A tape recorder may also be driven from the TAPE OUT jack on the amplifier. In this case, the output is not subject to the volume or tone setting of the amplifier and is controlled at the tape recorder. A patch cord terminated in a standard phono plug is connected between the TAPE OUT jack on the amplifier and the input of the tape recorder.



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Figure 3—Connecting Amplifiers in Series

**REVERB/ACOUSTIC EQUALIZER FILTERS:** Provision is made to insert a reverb unit or acoustic equalizer filters into the amplifier signal path, using the IN and OUT jacks at the rear of the amplifier. Remove the link connecting these two jacks. Connect a patch cord with a standard phono plug from the IN jack to the input of the reverb or acoustic equalizer filters, and a similar patch cord from the output of the reverb or acoustic equalizer filters to the OUT jack on the amplifier. All input signals to the amplifier will be affected by the reverb or acoustic equalizer filters operation.

## CONNECTING AMPLIFIERS IN SERIES

Pairs of Bogen CHS-60A amplifiers can be connected in series to effectively double the power output into the same loadline. See figure 3 for connection diagram. Be certain to remove the link between COM and GND of amplifier No. 2. Connect a single-conductor shielded cable, terminated in an RCA phono plug at each end, between the rear panel BRIDGING receptacles of both amplifiers.

It is preferable that both CHS-60A volume controls be at maximum gain position. However, in specific installations the gain of each amplifier may be reduced, providing that the gain is set the same for both amplifiers.

TABLE 1 - OUTPUT CONNECTIONS

Speaker Line	Terminal Connections	Other Connections
8Ω Unbalanced 8Ω Balanced	8Ω and COM 8Ω and COM	Close link between COM and GND Open link between COM and GND
16Ω Unbalanced 16Ω Balanced	16Ω and COM 16Ω and COM	Close link between COM and GND Open link between COM and GND
25V Unbalanced 25V Balanced 25 Balanced, CT gnd.	25V and COM 25V and COM 25V and COM	Close link between COM and GND Open link between COM and GND Connect jumper between 25VCT and GND Open link between COM and GND
70V Unbalanced 70V Balanced	70V and COM 70V and COM	Close link between COM and GND Open link between COM and GND

## OPERATION

**POWER:** This switch applies power to the amplifier. It will also turn on any associated equipment which may be connected to the auxiliary power receptacle on the rear panel. The **POWER** indicator lamp will go on to show that power has been applied to the unit.

**MIC VOLUME:** The two individual **MIC** volume controls are used to adjust the level of each microphone input channel. Turn the control clockwise (to the higher numbers) to increase the volume and counterclockwise to reduce it.

**AUX VOLUME:** Separate volume controls are provided for the two **AUX** inputs. They function the same as the **MIC** volume controls.

**MASTER VOLUME:** Rotate the **MASTER** control to maximum clockwise position. Set the **MIC** and **AUX** volume controls to the highest level likely to be used. Use the **MASTER** control to regulate the overall volume of the output signal.

**COMPRESSION:** Push the **MASTER** volume control in to disable the **COMPRESSION** circuit, pull out the control to activate the circuit. The compression circuit is used to obtain a relatively uniform output from the microphone channels, compensating for varying voices and microphone techniques of persons using the microphones.

**BASS/TREBLE:** Concentric knobs control these functions. The outer or larger knob is the **BASS** control and the inner or smaller knob is the **TREBLE** control.

Use the **BASS** control to adjust the tonal balance of the amplifier output. Rotation in the counterclockwise direction reduces the bass response. It may also be used to remove low-frequency noise such as phono rumble or hum. In situations where acoustic feedback is likely, rotate the **BASS** control counterclockwise to reduce the feedback and to obtain higher volume levels than would otherwise be possible.

Rotation of the **TREBLE** control counterclockwise reduces the high frequency response of the amplifier. It may also be used to remove high-frequency noise, such as record scratch.

## ACCESSORIES

### WARNING

*The installation of plug-in accessories requires the removal of the cover, which presents an electrical shock hazard. For this reason, these accessories should be installed by qualified technicians only.*

**PMM-2 MICROPHONE MODULE:** The Bogen **PMM-2** Microphone Module is a preamplifier designed to provide two additional microphone channels for the amplifier. Each preamplifier channel has its own volume control and will accommodate either high impedance or balanced or unbalanced low impedance microphones. These added channels have all the characteristics of the basic channels, and the same accessories are applicable to them. The unit is installed and connected as described in the instruction manual furnished with the **PMM-2** accessory. When installed, the **PMM-2** control shafts protrude through the front panel of the amplifier.

**MIC INPUT TRANSFORMERS:** Bogen **TM50**, **TM200**, and **TM500** plug-in transformer accessories are designed to match the input impedance of the amplifier to a low impedance microphone. The Model **TM50** is intended for microphones of 50 ohms impedance, the **TM200** for 200-ohm mics, and the **TM500** for 500/600-ohm mics. To convert either of the microphone inputs to balanced low impedance use, proceed as follows:

1. Remove the amplifier cover by loosening four screws on each side and lifting it away from the chassis.
2. Note that the printed circuit board, now accessible, has two nine-pin accessory sockets (**X1** for **MIC 2**, and **X2** for **MIC 1**). Plug the selected **TM** transformer into the appropriate socket if you wish to convert either or both of these **MIC** inputs to low impedance use.
3. Secure transformers firmly in place on accessory sockets by means of spring clips, Bogen Part No. 02-9073-01, furnished in a coin envelope with the amplifier.
4. For **MIC 1** conversion, remove jumper between pins 11 and 19 on printed circuit board **A1** and connect jumper between pins 10 and 12. For **MIC** conversion, remove jumper between pins 8 and 18, and connect it between pins 7 and 9. See note 3 on the schematic diagram, figure 4.

**LVP-1 (MIC PRECEDENCE):** The Bogen **LVP-1** is a plug-in accessory which provides microphone precedence over the **MIC 2** input channel, and the **AUX 1** and **AUX 2** inputs. Remove the amplifier cover as described above. To mute the **MIC 2** channel, plug an **LVP-1** into the socket on the printed circuit board marked **MIC LVP-1**. To mute the **AUX** channel, plug another **LVP-1** into the adjacent socket marked **AUX LVP-1**.

Make connections from an external switch to the appropriate **MIC 2** or **AUX** terminal and to **GND** terminal on the Remote Control Precedence terminal strip on the rear panel. The switch on the paging microphone may be used for this purpose, if it has a normally open pair of

contacts for the precedence function as on the Shure 450 microphone. Otherwise, an external single-pole, single-throw switch may be installed near the microphone. When the switch contacts are closed, the controlled channel is muted. For detailed information on MIC precedence connections, see the instruction sheet furnished with the LVP-1 accessory.

**LVP-1 AND RVC-2 (REMOTE VOLUME CONTROL):** Plug an LVP-1 accessory into each channel to be remotely controlled, as described above. Connect the RVC-2 remote volume control to the Remote Control Precedence terminal strip on the rear of the amplifier. Connect one lead from the accessory to the appropriate MIC 2 or AUX terminal and the other lead to GND. Complete installation instructions are supplied with the RVC-2 accessory.

After connecting the RVC-2, turn its control knob fully clockwise and the volume control for the appropriate amplifier channel counterclockwise. Advance the volume control on the amplifier to the loudest position likely to be used, or to the point where feedback begins. Reduce the output level at the RVC-2 control to the desired level, and adjust the control as necessary during operation.

**WMT-1 TELEPHONE LINE:** The Bogen Model WMT-1 input/output matching transformer is an accessory which has been designed especially for matching either inputs from or outputs to a 500/600-ohm line. As an input matching transformer, it may be used with the Bogen amplifier for distributing background music which has been transmitted over leased telephone lines. The accessory also

functions as an output matching transformer in feeding special program material over a 500/600-ohm telephone line for transmission to a local broadcast studio.

The WMT-1 accessory is mounted on the chassis of the amplifier, adjacent to the printed circuit board. See the instruction sheet furnished with the WMT-1 for detailed installation procedure.

**LPC-4 PHONO PLAYER:** The Model LPC-4 is a phono player top, designed for mounting on the amplifier. The LPC-4 is an ac-operated four-speed record player which is normally used with the amplifier. It is furnished complete with all necessary hardware, and only a screwdriver is required to install it on the amplifier. A tone arm housing a dual-stylus flip-over cartridge is furnished with the unit.

**LK-12 CONTROL GUARD LOCKING PLATE:** The Bogen Model LK-12 is designed to prevent unauthorized tampering with the controls of the amplifier. It comes complete with two sets of keys. The key cannot be removed when the lock is in open position.

**RPK-33A RACK PANEL:** The Bogen Model RPK-33A rack panel is designed to mount the amplifier (with or without the PMM-2 preamplifier) in a standard 19-inch sound rack. The rack panel is finished in gray enamel.

**CC12S CARRYING CASE AND SPEAKER:** A Bogen Model CC12S carrying case with two speakers is available for portable systems. Each section of the case contains a high-efficiency 12-inch PM speaker and 2.5 feet of interconnecting cable with plug.

## MAINTENANCE

### CAUTION

*There are no user replaceable parts within the unit. Have all internal servicing done by a qualified technician.*

### BOGEN SERVICE

We are interested in your Bogen equipment for as long as you have it. If trouble ever develops, do not hesitate to ask our advice or assistance. Information can be obtained by writing to Service Department, Bogen Division, P.O. Box 500, Paramus, N.J. 07652.

When communicating with us, give the model and series designation of your unit. Describe the difficulty and include details on the electrical connections to associated equipment, and list such equipment. When we receive this information, we will send you service information if the trouble appears to be simple. If the trouble requires servicing, we shall send you the name and address of the nearest Bogen authorized service agency to which you can send your unit for repairs.

When shipping your unit, pack the amplifier well, using the original shipping carton, or a similar container and filler material, to prevent damage in transit. Send the unit, fully

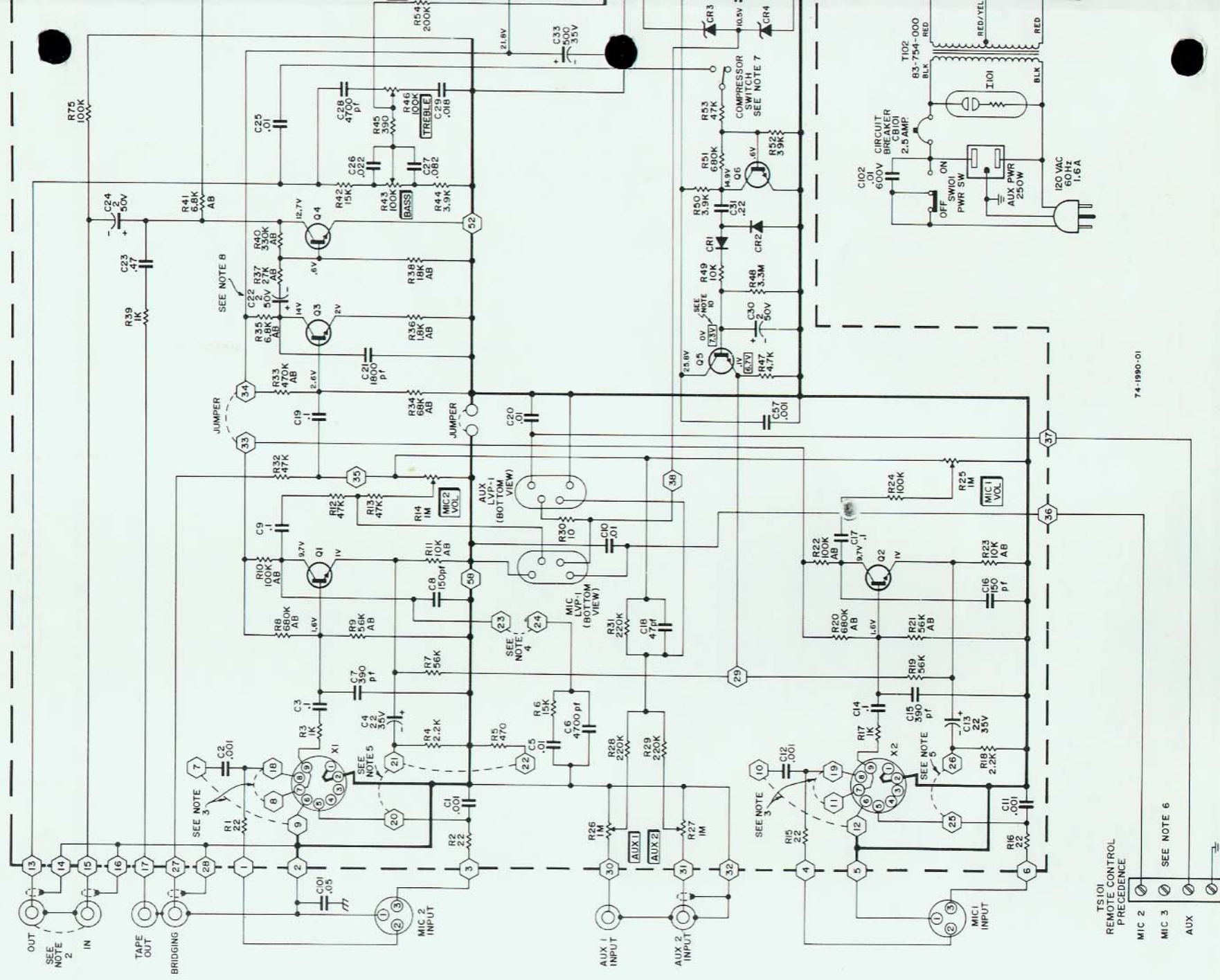
insured and prepaid, via railway express. Do not ship via parcel post unless so instructed. The unit will be promptly repaired and returned to you express collect.

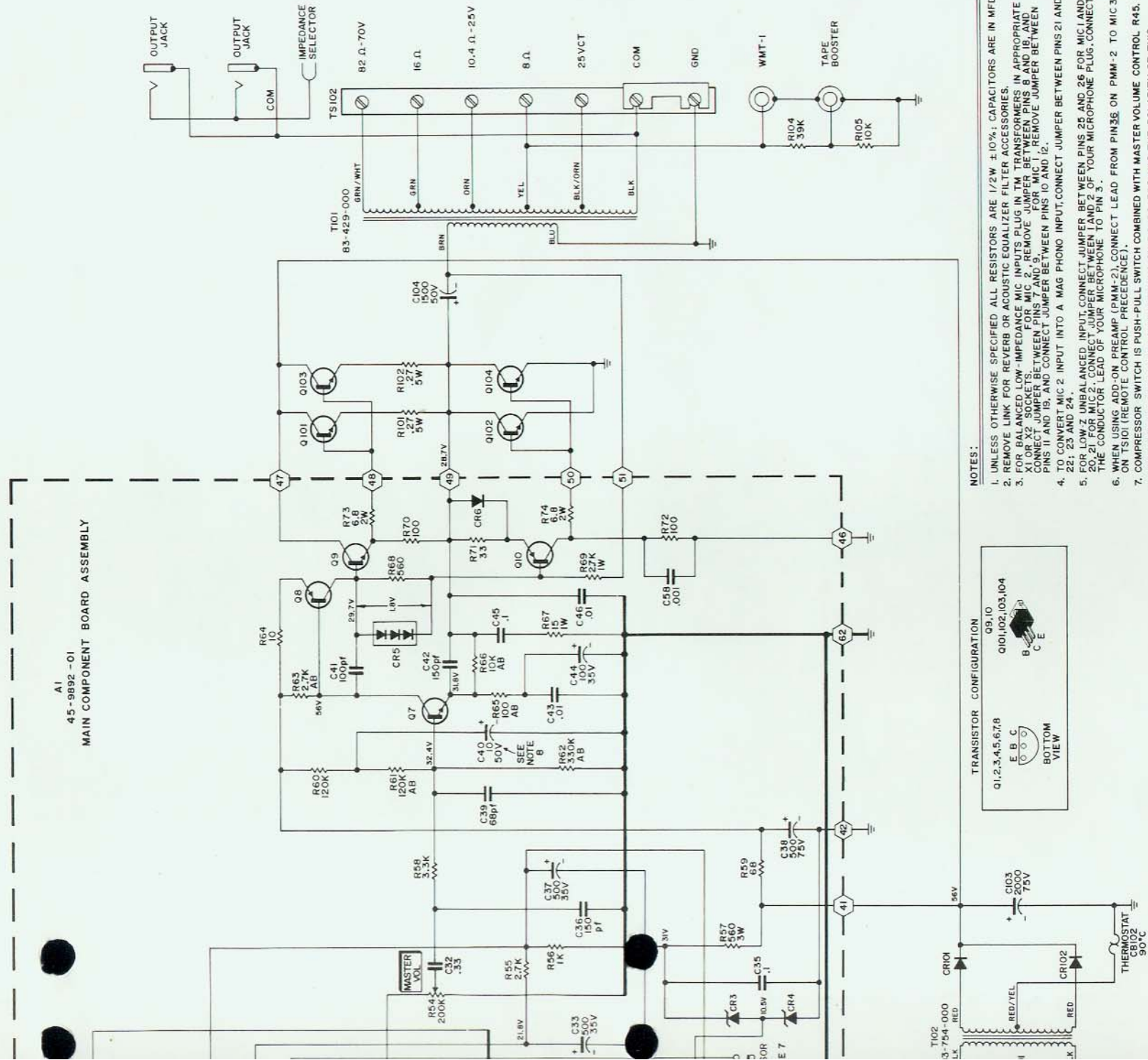
### CIRCUIT BREAKER

If the circuit breaker opens, the ac power lamp will go out and the amplifier will have no output, but there will be power at the AUX POWER receptacle at the rear panel. Set the ac power switch to off and momentarily depress the red button on the circuit breaker to reset it. Return the ac power switch to on. If the breaker trips again, do not attempt to reset it but have the trouble investigated by a qualified technician.

### THERMAL BREAKER

If the thermal breaker opens, there will be no audio output but the ac power lamp will remain on. Wait approximately two minutes for the breaker to reset. If the breaker resets and then opens again, investigate the cause of the temperature overload. This may be due to improper connections at the output terminals or to excessive environmental heat with inadequate ventilation. The thermal breaker will open when the temperature at the output transistor heat sink reaches 90°C. (194°F.).





NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE 1/2W ±10%; CAPACITORS ARE IN MFD.
2. REMOVE LINK FOR REVERB OR ACOUSTIC EQUALIZER FILTER ACCESSORIES.
3. FOR BALANCED LOW-IMPEDANCE MIC INPUTS PLUG IN TM TRANSFORMERS IN APPROPRIATE X1 OR X2 SOCKETS. BETWEEN MIC 2, REMOVE JUMPER BETWEEN PINS 1 AND 2. BETWEEN MIC 1 AND 2, REMOVE JUMPER BETWEEN PINS 10 AND 19 AND CONNECT JUMPER BETWEEN PINS 10 AND 12.
4. TO CONVERT MIC 2 INPUT INTO A MAG PHONO INPUT, CONNECT JUMPER BETWEEN PINS 21 AND 22, 23 AND 24.
5. 25VCT UNBALANCED INPUT, CONNECT JUMPER BETWEEN PINS 25 AND 26 FOR MIC 1 AND 2. FOR MIC 2, CONNECT JUMPER BETWEEN PINS 1 AND 2 OF YOUR MICROPHONE PLUG, CONNECT THE CONDUCTOR LEAD OF YOUR MICROPHONE TO PIN 3.
6. WHEN USING ADD-ON PREAMP (PMM-2), CONNECT LEAD FROM PIN36 ON PMM-2 TO MIC 3.
7. COMPRESSOR SWITCH IS PUSH-PULL SWITCH COMBINED WITH MASTER VOLUME CONTROL R45.
8. THE SCHEMATIC REFERENCE SCREENING ON P.C. BOARDS HAS THE POLARITY OF THIS CAPACITOR REVERSED; THE SCHEMATIC SHOWS THE POLARITY CORRECTLY.
9. UNLESS OTHERWISE SPECIFIED ALL VOLTAGES ARE +DC MEASURED TO GROUND WITH A V.T.V.M. AND MAY VARY ±20%. VOLTAGES NOT IN RECTANGLE ARE DC VOLTAGES WITH NO SIGNAL INPUT.
10. VOLTAGES IN RECTANGLE ARE DC VOLTAGES WITH 1kHz SIGNAL INTO MIC1 INPUT AND AMPLIFIER AT RATED OUTPUT. PULL COMPRESSOR SWITCH OUT AFTER MEASURING RATED OUTPUT.

TRANSISTOR CONFIGURATION



Figure 4—CHS-60A Amplifier, Schematic Diagram



## REPLACING TRANSISTORS

Transistors show little, if any, deterioration with age and are considerably more reliable than the best vacuum tubes. This is why some transistors are soldered into equipment like resistors or capacitors. If the unit is inoperative, it generally is safe to assume that the transistors have not failed and that the trouble is elsewhere in the equipment.

If a transistor must be unsoldered for testing or replacement, be certain to remove all power from the unit to prevent possible voltage transients in the circuit which might damage the transistor. To prevent overheating the transistor when soldering or unsoldering a lead, grip the

lead between the point of heat and the case with pliers or tweezers. These will act as a heat sink to conduct heat away from the transistor. Do not bend a transistor lead closer than 1/16 inch from the transistor case.

Power transistors must be properly mounted to insure good heat dissipation. Make certain there is no foreign matter on the contact surfaces between the transistor and the heat sink and brush a thin coating of heat transfer compound (such as Dow Corning No. 340 Compound silicone grease or equivalent) on both surfaces. Similarly, coat any insulators used between the transistor and the heat sink and secure the transistor firmly to the heat sink.

## REPLACEMENT PARTS

Most components used in the amplifier are standard parts available through reputable parts jobbers. The parts listed here may be obtained from Bogen distributors, service agencies or directly from the factory. When ordering a part, specify a part number and description of the part as listed. Specify the model of the unit and give the series designation, which is a letter followed by numbers, screened on the chassis. For parts on circuit boards, also

give the component board assembly number, which begins with "45."

When replacing transistors, use those made by the specified manufacturers. Transistors from other suppliers may not be satisfactory. Certain resistors must be Allen-Bradley. These are designated by "AB" on the schematic diagram.

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>A1 — COMPONENT BOARD ASSEMBLY,</b>					
<b>PART NO. 45-9892-01</b>					
C4, 13	79-008-046	Capacitor, Electrolytic, 22 $\mu$ F, 35V	R43, 46	77-001-734	Control, 100k $\Omega$ , Coax (BASS, TREBLE)
C22, 24, 30	79-008-054	Capacitor, Electrolytic, 2 $\mu$ F, 50V	R54	77-001-732	Control, 200k $\Omega$ , w/switch (MASTER Volume, Compressor)
C33, 37	79-008-049	Capacitor, Electrolytic, 500 $\mu$ F, 35V	R57	75-842-561	Resistor, 560 $\Omega$ , 3W
C38	79-112-001	Capacitor, Electrolytic, 500 $\mu$ F, 75V	R73, 74	76-107-107	Resistor, 6.8 $\Omega$ , 2W
C40	79-008-058	Capacitor, Electrolytic, 10 $\mu$ F, 50V	<b>CHASSIS ELECTRICAL PARTS</b>		
C44	79-008-053	Capacitor, Electrolytic, 100 $\mu$ F, 35V	C103	79-509-052	Capacitor, Electrolytic, 2000 $\mu$ F, 75V
CR1, 2, 6	96-5333-01	Diode, 400 PIV, 1A	C104	79-509-017	Capacitor, Electrolytic, 1500 $\mu$ F, 50V
CR3	96-5249-06	Diode, Zener, 20V, 2W	CB101	94-0008-04	Circuit Breaker, 2.5A
CR4	96-5249-05	Diode, Zener, 10V, 2W	CB102	94-0014-04	Thermal Breaker, 90°C
CR5	96-5202-01	Diode, HVR3	CR101, 102	96-5241-01	Diode, 300 PIV, 3A
Q1, 2, 5, 6	96-5335-01	Transistor, TP109C (Sprague) or Transistor, BC149C (Siemens) or Transistor, 2N5089 (Motorola)	I101	94-0302-05	Pilot Light Assembly
Q3, 4	96-5305-01	Transistor, Selected or Transistor, Selected or Transistor, Selected or Transistor, Selected	Q101, 102, 103, 104	96-5232-02	Transistor
Q7	96-5298-01	Transistor, SPS1910 (Motorola)	R101, 102	76-113-099	Resistor, .27 $\Omega$ , 5W
Q8	96-5283-01	Transistor, MPSA55 (Motorola)	SW101	81-003-057	Switch, Power
Q9	96-5287-01	Transistor, D42C7(GE)	T101	83-429-000	Transformer, Output
Q10	96-5286-01	Transistor, D43C7(GE)	T102	83-754-000	Transformer, Power
R14, 25, 26, 27	77-001-711	Control, 1 Meg $\Omega$ (MIC 1, MIC 2; AUX 1, AUX 2 Volume)	<b>MECHANICAL PARTS</b>		
				02-9078-01	Clip Spring (for TM xfmrs.)
				03-0646-01	Knob (4)
				03-0592-01	Knob and Skirt Assy., 0-10
				03-0649-01	Knob and Skirt Assy., Coax
				03-0650-01	Knob, Coax, Front

**OWNER'S WARRANTY**

Bogen solid state sound and intercom equipment is guaranteed against defects in material and workmanship for one year from the date of sale to the original purchaser, provided that the equipment has not been subjected to abuse or accident or altered in any way. Any part of the equipment covered by this warranty which, with normal installation and use, becomes defective will be repaired or replaced by Bogen, provided the equipment is delivered or shipped prepaid and insured to our authorized service station or to the Bogen Factory Service Department, Route 4 and Forest Avenue, Paramus, New Jersey 07652. The equipment may be picked up by you personally, or will be returned to you freight prepaid.

Models containing vacuum tubes carry the same warranty as above, except that it does not apply to the vacuum tubes, which are guaranteed for 90 days.

*The registration card enclosed with the equipment must be completed and mailed within five days of purchase to place the warranty in effect.*



LEAR SIEGLER, INC.

BOGEN DIVISION

PARAMUS, NEW JERSEY 07652