MODEL PA.539N

OPERATING MANUAL

PUBLIC ADDRESS AMPLIFIER

SPECIFICATIONS

Power Output :	50 watts.
Input :	Mic — 1 Dynamic Mic — 2 Dynamic AUX Crystal or Ceramic Tape Recorder Tuner
Frequency Response :	30-15.000 CPS,
Input Sensitivity :	Mic Input 5mV AUX 300mV
Input Impedance :	Mic — 1 50 K ohm Mic — 2 50 K ohm AUX 500K ohm
Hum and Noise :	— 50 db or less
Output Impedance :	8, 16, 250 ohm and 100 V line
Tube Complement :	4 — Diode 4 — Transistor 2SC 694 1 — 6AQ8, 4 — 6BQ5
AC Source :	210 — 230 volt, 50 — 60 Cycles
Size :	320 × 140 × 250mm

CONNECTIONS

MICROPHONE

Two microphone input connectors are provided at the rear side of the unit. They are designated MIC-1 and MIC-2. Connect crystal or dynamic microphone to these inputs, using single-conductor shielded cable terminated with matching connectors.

PHONOGRAPH

Connect a crystal or ceramic phonograph pickup to the jack designated "AUX". Use single-conductor shielded cable terminated with matching RCA-type phono plug. This input may also be used for the connection of an FM-AM tuner or other high level program source, such as a tape recorder.

POWER

Connect the AC plug to any power source providing 210-230 volts 50/60 cycle AC. An AC utility outlet for use in supplying power to a tuner or phonograph is provided at the rear of the unit.

SPEAKERS

Impedance taps of 8, 16, 250 ohms and 100 volt line are provided at the rear of the unit. Connections are made between the terminal marked COM and either the 8, 16 or 250 ohm and 100V line terminal.

CONTROLS

Power: Power is applied to the amplifier when the switch is "on".

MIC-1, MIC-2: These are the gain controls for the Mic-1 and Mic-2 inputs, respectively.

AUX: This is the gain control for the AUX input.

MASTER VOLUME: This is the gain control for the Mic-1, Mic-2 and AUX input.

BASS, TREBLE: Setting both controls to their center position will provide flat frequency response from the amplifier. Bass or treble response may be decreased by counter-clockwise rotation of the knob, or increased by clockwise rotation.

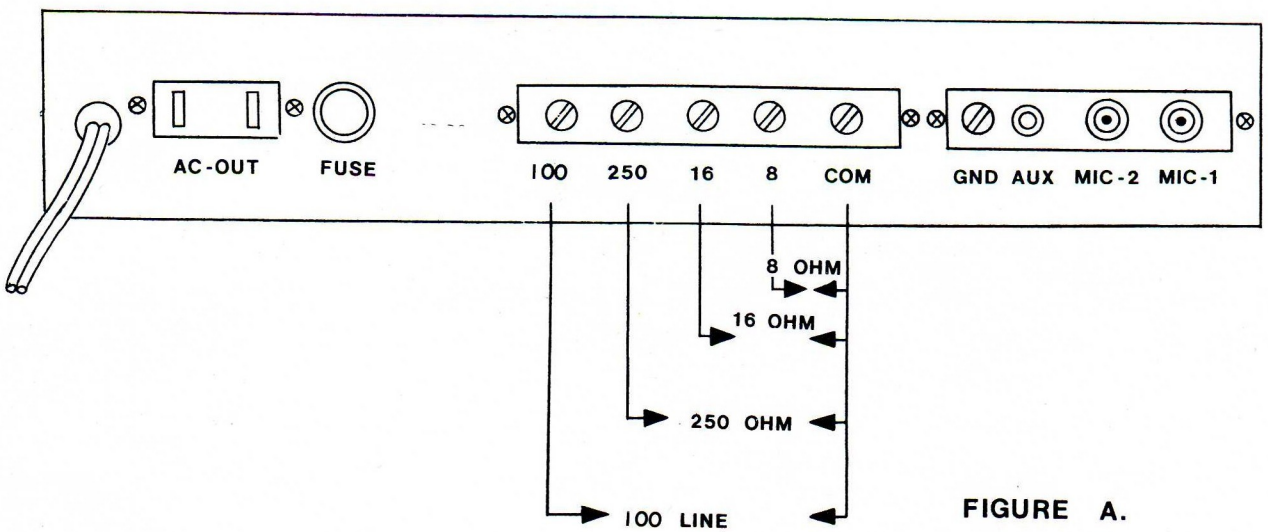


FIGURE A.

OPERATION

Make sure that the microphone, tuner or phonograph are properly connected (as indicated Fig. A). Speaker or speakers should also have been correctly connected. Connect power plug to AC outlet and turn amplifier on. Allow a short period for warm-up.

If there is any noticeable hum, try reversing the AC plug in the outlet. If this does not help, reduce to minimum with HUM ADJUST. Advance gain control to provide the desired volume. If more than one input is used, adjust each gain control for proper mixing or balance. Always turn the control for the input not being used to minimum. Adjust the bass and treble controls to provide the desired tonal response.

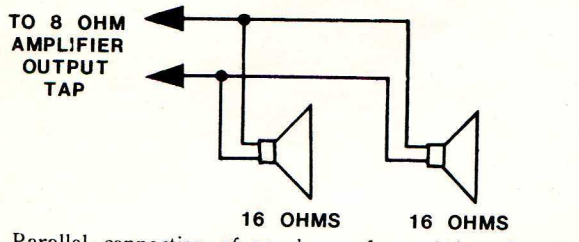
SPEAKER INSTALLATION

The efficiency and performance of a sound system depends, to a very large extent, on the proper selection of loudspeakers and the manner in which they are installed. Incorrectly or poorly arranged speaker installations will result in correspondingly inferior sound reproduction.

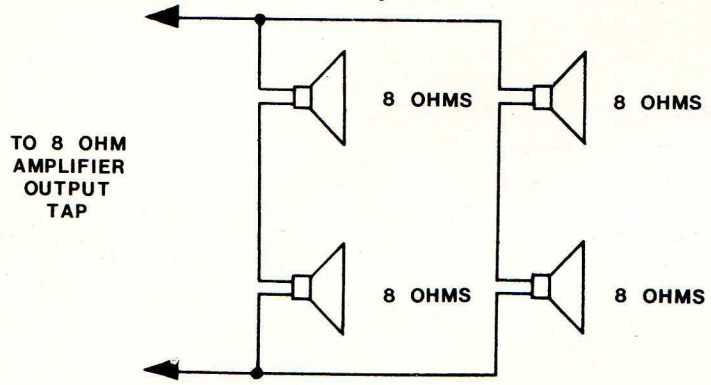
Public address systems range from simple single-speaker installations to large and complex multispeaker systems. The text which follows will provide the information necessary for proper connection of loudspeaker or loudspeakers to the amplifier. It does not cover loudspeaker placement or the selection of units for sound systems. In case of doubt, you are urged to consult a qualified sound technician or more complete text before attempting the installation.

MATCHING VOICE COIL LINES

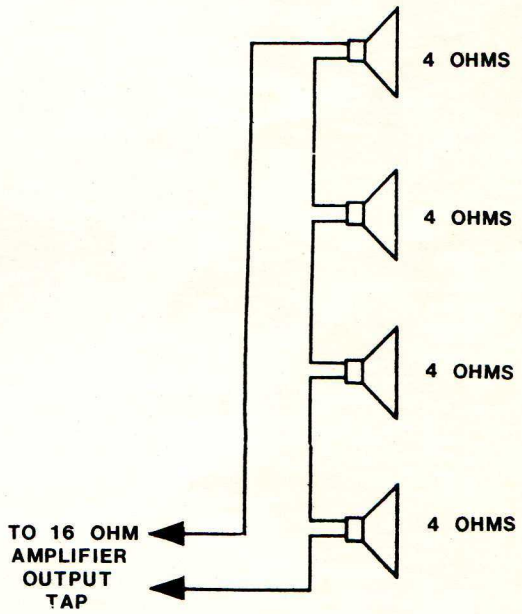
For efficient transfer of power from the amplifier to the speaker or speakers, the voice coil impedance of the speaker (S) must be equal to or "matched" to the output impedance of the amplifier. Some slight mismatch is tolerable (always upward, preferably). The speaker impedance may be as much as 25% greater than the output impedance before excessive power loss or distortion is noticed.



Parallel connection of speakers of equal impedances, resulting in same power in each speaker.



Series-parallel connection of speakers of equal impedances, resulting in same power in each speaker.



Series connection of speakers of equal impedances, resulting in same power in each speaker.

FIGURE 1 TRANSFORMERLESS MULTIPLE-SPEAKER ARRANGEMENTS

Group of speakers may be connected directly to the amplifier in series, parallel, or series parallel arrangements (See Fig. B) where only short cable runs are necessary. Even with short runs however, attention must be given to the gauge (size) of wire used. This becomes increasingly important as the load impedance is lowered (see table A).

Wire Size B & S	4 ohms	8 ohms	16 ohms	100 ohms	250 ohms	above 500 ohms (100V Line)
14	125′	250′	450′	1000′	2500′	5000′
16	75′	150′	300′	750′	1500′	3000′
18	50′	100′	200′	400′	1000′	2000′
20	25′	50′	100′	250′	750′	1500′

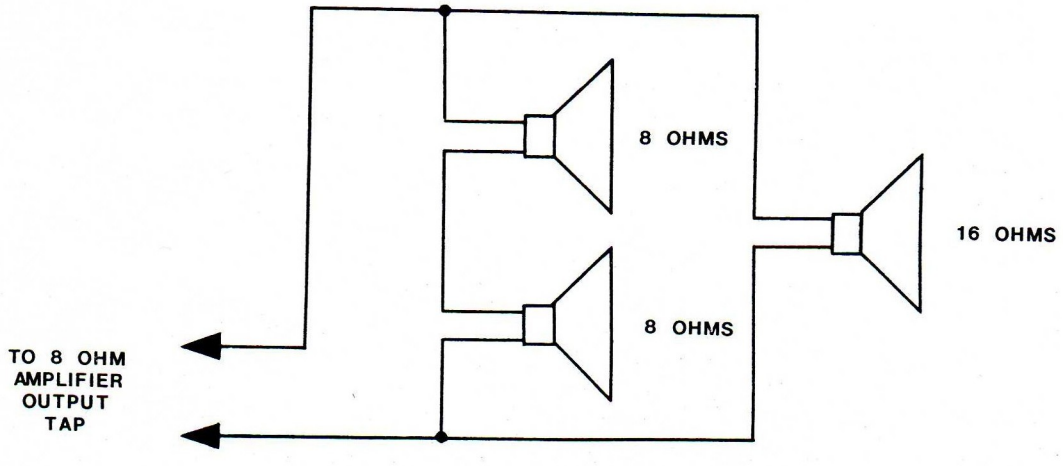
TABLE A – Maximum lengths of various size cable which can be used without imposing excessive power losses.

In general, to calculate which amplifier output tap to use for a group of speakers when all speakers have the same impedance, proceed as follows : For parallel connections, divide the impedance of any one speaker by the total number of speakers. For example, two 16 ohm speakers in parallel : $16 \div 2 = 8$ ohms. For series connections, add all speaker impedance together. For example, four 4 ohm speaker in series : $4+4+4+4=16$ ohms (use 16 ohm output tap, whichever is available).

For all practical purposes, use 4 ohms for speakers rated at 3.2 ohms ; 8 ohms for 6–8 ohm speakers ; 16 ohms for 15 ohm speakers.

Calculating net impedance of series-parallel speaker connections is a combination of the above methods. For example, two 8 ohm speakers connected in series, together with another set of two 8 ohm speakers connected in series, are all connected in parallel (see Fig. B series-parallel connections). Each series-pair of 8 ohm speaker adds up to 16 ohms, giving two equivalent speaker lines of 16 ohms in parallel. $16 \div 2 = 8$ ohms net impedance – – use 8 ohm amplifier output tap.

Where short speaker lines are used, variations of speaker power may be obtained by the method illustrated in Figure C.



Half of the available amplifier power is developed across the 16 ohm speaker and a quarter of the power across each 8 ohm speaker.

FIGURE C SERIES-PARALLEL CONNECTION FOR UNEQUAL SPEAKER IMPEDANCES

Where many variations of individual speaker powers are required, or where long speaker lines are to be run, either one of two standard methods of transformer speaker matching may be used -- the Constant Impedance Method or the Constant Voltage Method.

IMPEDANCE MATCHING

Matching speaker by the Constant Impedance Method involves using a separate matching transformer for each speaker (or speaker-group). The impedance of the transformer's primary winding should equal the output impedance of the amplifier, while the secondary impedance should equal that of the speaker (or speaker group). The power rating of the transformer must be equal to or greater than the proportionate amount of power to be delivered to the speaker (or speaker group). Public Address amplifiers will usually have 125 ohm, 250 ohm, and or 500 ohm output taps for constant impedance speaker lines. The higher the output impedance used, the lower will be the power loss in the interconnecting cables (up to 15% power loss in the cable is usually considered permissible).

This method of matching requires that each speaker or speaker group be fed the same amount of power; transformer primary impedances must all be the same and collectively match the output impedance of the amplifier. To calculate primary impedances, multiply the amplifier output impedance by the number of transformers in use.

For example, four transformers connected to a 250 ohm output tap: 250 × 4 = 1000. Each transformer should have a primary impedance of 1000 ohms. Adding or taking away a speaker (and transformer) from the system calls for changing the impedance connections on all remaining transformer primaries. This system is used mainly to overcome power losses in long speaker lines. See Fig. 3.

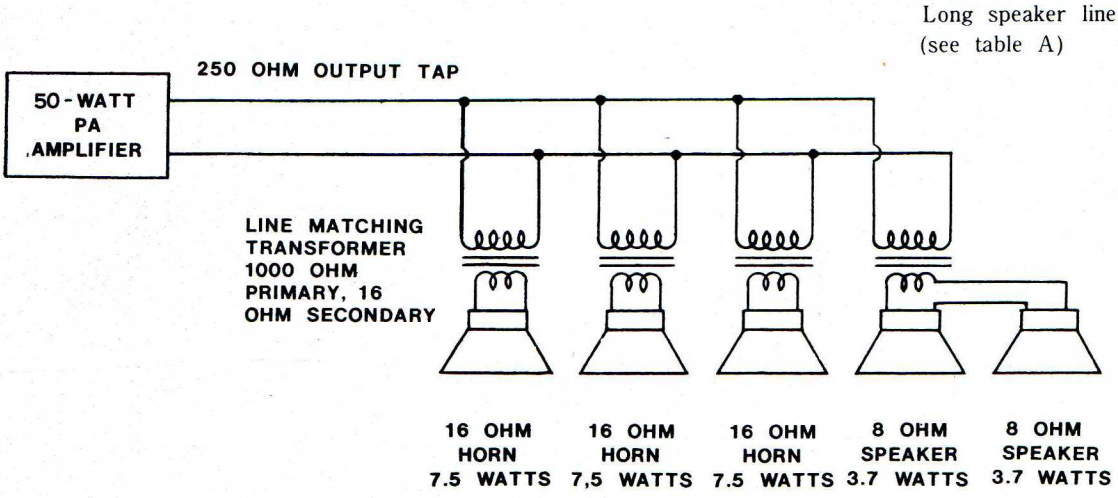


FIGURE 3 TYPICAL PUBLIC ADDRESS SYSTEM USING IMPEDANCE-MATCHING TRANSFORMERS

POWER MATCHING

In the constant Voltage Method of speaker matching we need only to assign a definite amount of power for each speaker (total power demand must not exceed maximum power output rating of amplifier) and connect the matching transformer primary taps, marked in watts, to the amplifier line. Figure 4 shows a typical system. The 100 volt output taps of the amplifier are used for this purpose.

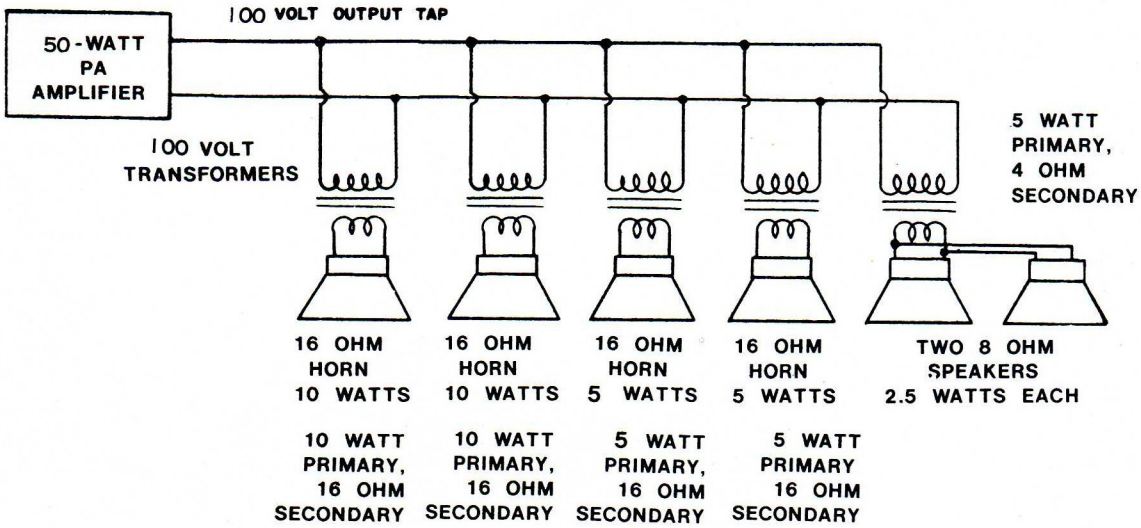


FIGURE 4 MULTIPLE-SPEAKER MATCHING USING THE CONSTANT-VOLTAGE METHOD

Long speaker lines may be run, speakers may be added or removed without changing taps on remaining transformers, and speakers of different power requirements may be used in this matching system. This public address amplifier has 100 volt taps.

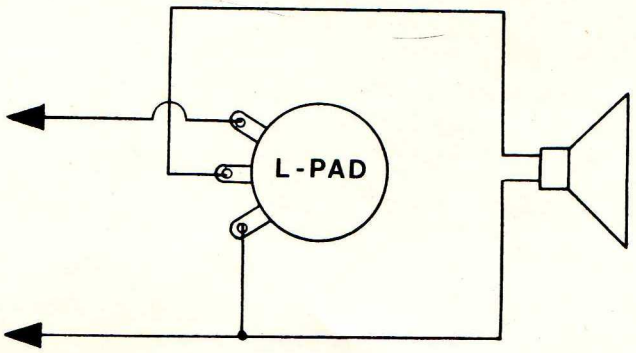
To use standard matching transformers, not marked in watts, for the 100-volt constant voltage matching system, convert impedance to watts by using the following formula:

$$\frac{10000}{\text{Power (watts)}} = \text{Transformer primary impedance needed.}$$

Thus, for 10 watts, $10000 \div 10 = 1000$ ohm transformer primary; for 1 watt, $10000 \div 1 = 10000$ ohm transformer primary; etc.

ADDING L-PAD VOLUME CONTROLS

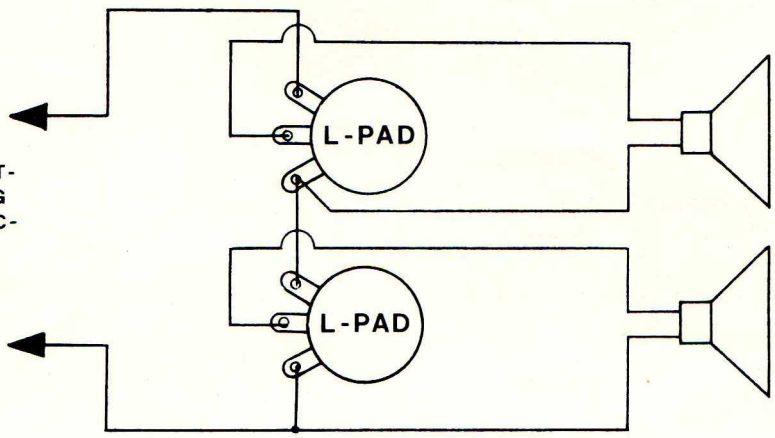
Where control of the volume of an individual speaker is needed, an L-Pad is required. Such a control maintains a constant load on the amplifier and the volume may be changed without affecting other speakers. The resistance of an L-Pad must equal the impedance of the speaker voice coil, and if there is a matching transformer being used, the control is connected between the transformer secondary and the speaker, as illustrated in Fig. 5.



TO AMPLIFIER OUTPUT OR MATCHING TRANSFORMER SECONDARY

Value of Pad matches Voice Coil impedance of speaker, or net impedance of speaker group.

FIGURE 5 L-PAD FOR SINGLE SPEAKER.



TO AMPLIFIER OUTPUT OR MATCHING TRANSFORMER SECONDARY

Pad matches Voice Coil impedance of each speaker.

FIGURE 6 L-PADS FOR INDIVIDUAL CONTROL OF SERIES-CONNECTED SPEAKERS

SPEAKER PHASING

PUBLIC ADDRESS INSTALLATIONS

Where speakers are installed fairly close to each other, interaction of the sound waves can result in either reinforcement (speakers in phase) or "dead spot" (speakers out of phase) effects in the area between them.

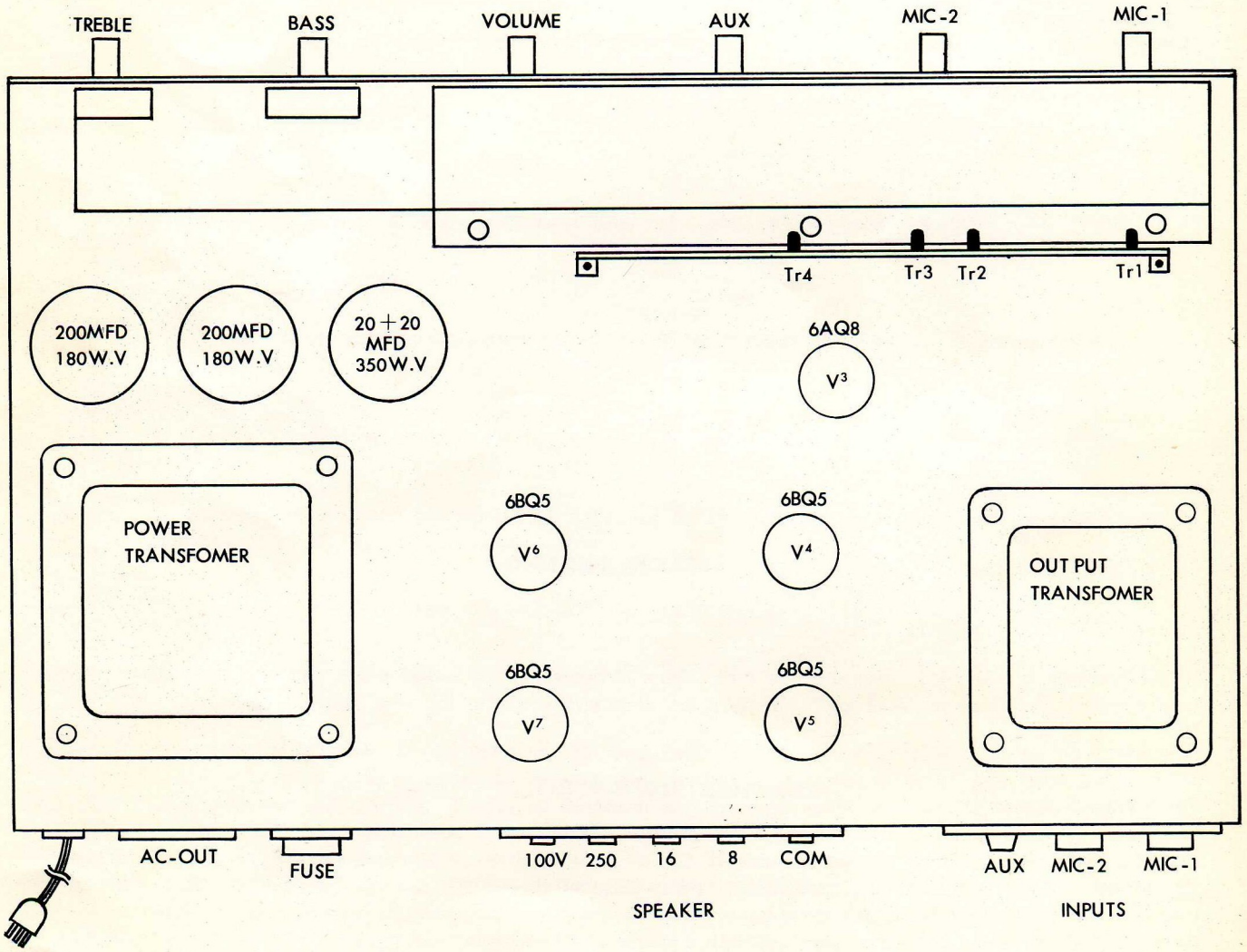
If speakers are to be installed facing each other, they must be connected out of phase; if speakers are to be installed next to each other and facing in the same direction, they must be connected in phase.
To determine phasing of speakers whose terminals are unmarked as regards polarity, face two units toward each other, and play a tone record through the amplifier and speakers (preferably at about 100 cps) If they are in phase, low frequencies will be reduced in volume, or absent. Or, as an alternative method, connect a flashlight battery momentarily across the voice coil terminals and observe the polarity of the battery and the direction of motion of the speaker cone (this method is good for cone-type speakers with freely-moving cones only). Speakers are in phase when both cones move in the same direction (in or out) with the same applied battery polarity.

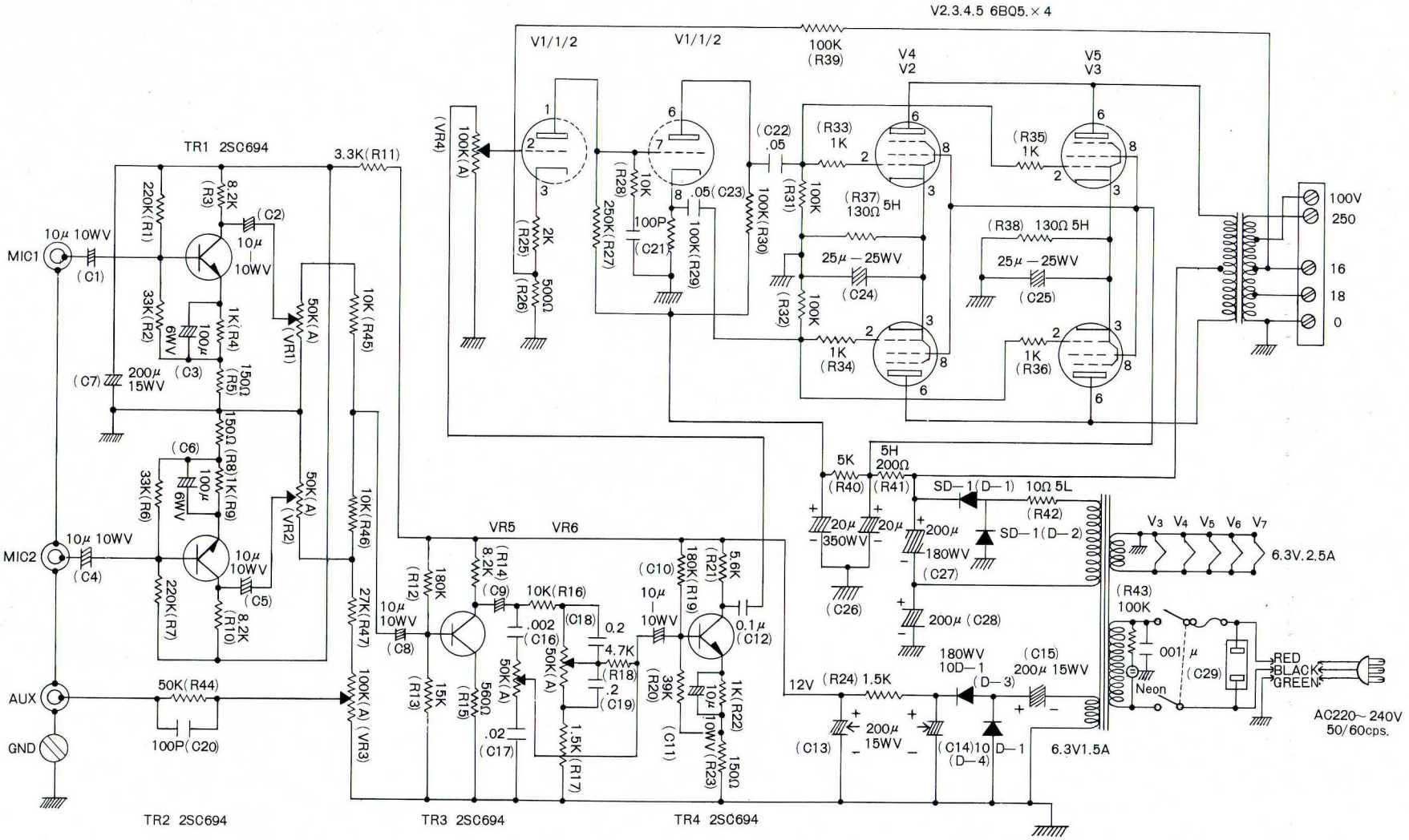
VOLTAGE CHART

VOLTAGE ARE DC. UNLESS OTHERWISE SPECIFIED, MEASURED WITH RESPECT TO GROUND WITH A VTVM : ± 20% VARIATION IS WITHIN TOLERANCE.

		B	E	C						
Tr1	2SC694	1.1	0.5	5						
Tr2	2SC694	1.1	0.5	5						
Tr3	2SC694	0.85	0.25	7						
Tr4	2SC694	2.1	1.5	4.5						
	TUBE	1	2	3	4	5	6	7	8	9
V^1	6AQ8	75	0	1.8	3.1AC	3.1AC	175	55	75	0
V^2	6BQ5		0	10.5	0	6.3AC		305		300
V^3	6BQ5		0	10.5	0	6.3AC		305		300
V^4	6BQ5		0	10.5	0	6.3AC		305		300
V^5	6BQ5		0	10.5	0	6.3AC		305		300

LAYOUT OF COMPONENTS





50 WATT PUBLIC ADDRESS AMPLIFIER **MODEL PA. 5 3 9 N**