INSTRUCTIONS FOR MODEL 2SC

The two station Supreme Communicator consists of two units. The master station is unit #1 and the extension station is unit #2. The master uses two tubes: 1-12A7 and 1-6A7. A three wire cable is used to inter-connect the units. The master unit is connected to the power line. The communicator works equally well on A.C. or D.C., 110 volts.

CONNECTIONS:--
The three terminal strip located on the rear of each unit is used to inter-connect the units. The three wires are connected in numerical sequence, i.e. 1 to 1, 2 to 2, 3 to 3. The line cord incorporates a self contained resistor, hence, must not be tampered with. The line plug is inserted in any source of 110 volts A.C. or D.C. In D.C. operation, if the system fails to operate, reverse the polarity by removing the plug from the receptacle, giving it a half turn, and reinserting. On A.C., if a hum is noticed, reverse plug as explained above.

CONTROLS:--
Master Unit - The switch located on the front panel at the left, controls the power for both units, and is put on or off as denoted by the on-off plate. In the center of each unit there is a plate marked "RELEASE TO LISTEN" and "PRESS TO TALK". Conversation is started by pressing the switch down and is held down while talking. When through talking, release and the switch will automatically come back to "RELEASE TO LISTEN" position. Then, the second party will push the switch and talk. This operation is repeated.

REMARKS:
This amplifier is licensed by agreement with Electrical Research Products, Inc., under patents owned or controlled by Western Electric Co., and American Telephone and Telegraph Co.

CAUTION:-
Do not use any ground or let any of the connecting wires touch any ground, such as water or gas pipes or metal ceilings, etc.

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INSTRUCTIONS FOR MODEL 5SC

The Supreme Communo-Phone is a self powered combination microphone loud speaker system. It operates on either A.C. or D.C. current, 105-125 volts. Each unit draws 35 watts and is designed for continuous service. The tubes used are: 1-25Z6, 1-6J7, 1-6C5, 1-25A6, and 1-25 watt, 120 volt bulb.

The simplest inter-communication system consists of two of these units connecting one office to a second and permitting instantaneous communication. These units may be combined into a more elaborate inter-communication system by using any number of units up to five. The standard Supreme Communicator is equipped with all the switches and a socket so that a five way system may be connected with a minimum of time and difficulty and without the necessity of additional equipment other than the cable and connector box.

System units with a selection of more than five stations can be supplied in accordance with specified requirements.

CONNECTIONS:

These units are connected together by means of the Supreme Communicator connector box. Cables are supplied in any length to meet requirements and come equipped with a six prong male plug on each end. The connector box is supplied with a five foot length of cable and six prong male plug. The cable from the connector box is plugged into the socket marked X", "Y" (Fig. 3) located on the rear of the first station. To connect the other stations insert one plug of the cable into the socket on the rear of the station, and insert the other plug into a socket on the connector box (see-Fig. 3a). When less than five stations are used the cables should be plugged into consecutive sockets on the connector box.

Insert the plugs of the line cords into any source of 110 Volt A.C. or D.C. Snap the line switches on and observe the 25 watt lamp. If the lamp is brilliant, reverse the line plug which will give the correct operating polarity. With each unit at correct polarity the system should be operating. As a check, the line cord should glow slightly warm in operation. Do not attempt to shorten this line cord since the operation of the act is dependent upon a self-contained resistor in it. If you desire to connect your own connector box and cables—refer to Fig. 3.

WHEN USING THESE UNITS ON D.C.:

Wires are plugged in as outlined above, inter-communication may be started among the various stations, making sure that the volume control is turned up. If no sound is heard, the polarity of the units is incorrect and all the plugs must be reversed at the same time. This applied to D.C. only.

NOTE: Do not under any circumstances connect a ground to the chassis.

CONTROLS:

On the panel there are four momentary contact switches, two on each side of the power switch. Each switch is a selector calling another unit or station. All call switches are normally set in the up or listening position. To call another station, press the appropriate switch down and talk. To listen, release the switch. In setting up this system, it may be found that the volume of voice at the listening end is insufficient for efficient operation. To adjust the volume of the loudness use the screwdriver control adjustment on the rear (Fig. 3). A headset may be used if it is undesirable to have others, who may be standing near the station, hear the conversation. A magnetic headset should be used with an ordinary phone plug which can be inserted in the jack on the rear panel (Fig. 3a). The names of the stations can be assigned to the respective switches by writing in the name. For new names remove the name plate, by taking off five nuts, and insert new paper.

The Supreme Communicator should be used at a distance of arm's length from the unit so as to prevent uncomfortable loud speech at the receiving end.

The person speaking should not raise his voice over that used in ordinary conversation so that the Supreme Communicator is designed to have enough sensitivity to pick up low voices of moderate distances.

One of the useful features obtainable with the Supreme Communicator System is the possibility of instantaneous call to all stations by pressing all the switches down, whereupon, all other stations listen to the master station. Any unit can become a master to call any number of stations at once.

It is possible for any station to speak to the listening station, although the latter is listening to another station. The station breaking in cannot, however, eavesdrop on any conversation not being directed to him.

Another feature obtainable with the 5-Way Supreme Communicator System is that any two stations can talk to each other, while all other stations are talking without interfering with each other. In other words, each two units comprise a voice channel very much like a telephone switchboard.

NOTE: CAUTION—DO NOT UNDER ANY CIRCUMSTANCE CONNECT A GROUND TO THIS CHASSIS.

REMARKS:

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DAVID BOGEN CO., INC.

WIRELESS COMMUNO-PHONE

Power Rating:

105 to 125 volts, either A.C. or D.C.
Consumption 32 watts per unit.

The model ZW Bogen Wireless Communophone is an intercommunicating telephone system using the usual power lines both for power and to
 carry the voice currents. Two or more stations may be operated, but
 since this model is not selective, all stations will hear all
 conversations.

Talk-Listen: The knob in the center of the front panel controls the
direction of conversation. It normally holds itself in the "Listen"
position. To call the other station, depress the knob and speak.
Release knob to hear the response from the answering station. The
person at the remote or called station must depress his own "Talk" knob
before speaking.

Connections: Insert the attachment cord plug from each unit into the
nearest electrical outlet of proper voltage. There are no other
connections to make unless the two electrical outlets used are wired on
opposite sides of the common ground. In this case the two circuits
should be bridged at the fuse box or meter with a paper condenser of a
capacity of about 1 mfd. 400 volts. The two "hot" or ungrounded wires
are joined thru the condenser as shown in figure 1.

Adjustments: These units are adjusted at the factory to match each
other. However if there is reason to attempt to improve the match
between the stations, the trimmer condenser screw located on the rear
of the chassis may be adjusted. Turn the screw slightly left or right
until the best results are observed as determined by the volume and
quality of the received voice.

Noise: Some electrical devices such as small motors, flashing signs,
coil burners, etc. radiate "man made static" which in some locations
causes considerable annoyance to radio listeners and may cause a
similar disturbance in the Wireless Communophone. If the source of
the noise can be determined, it can be reduced or entirely eliminated
by the use of condensers or noise filters on the device creating the
noise.

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The model 3A Bogen Selective Communo-Phone provides selective communication between the Master Station and one to four Remote Stations.

Connections: Using a two wire cable connect all the Remote Units so that their #1 terminals connect to #5 on the Master Unit. Then the remaining wire from each Remote Unit (Terminal #2) connects to its own selective terminal numbered 1, 2, 3 or 4 on the Master Unit. Plug line cord into the usual power outlet. If the device is silent when first connected to Direct Current the power line plug should be removed and rotated so that its prongs are reversed - this is done to correct the polarity.

Station Selector: The center knob is used to select the station called. It may be set to communicate with any single Remote Station or to call all at once. It is normally left in the "Silent" position. The Master Station can listen-in on any or all Remote Stations without warning.

Talk-Listen: The lower knob automatically remains in the "Listen" position. When it is desired to speak from the Master Station the knob is pressed down to the "Talk" position. It must be released to hear the reply from the station called. Because of the sensitivity of the Remote Units it is not necessary for the person called to approach the box closer than about 20 feet, thus saving steps and interruption of work. The Remote Stations can only "Talk" or "Listen" when the Master Switch is properly set.

Power Rating:
Master Unit only, 110 volts, A.C. or D.C., consumption 35 watts.
Remote Units, no power connection.
INSTRUCTIONS FOR MODEL B-20

The Supreme Fidelity Model B-20 is a nine tube amplifier operating on 110-125 volts, 50-60 cycles with a drain of 275 watts. The tubes used are: 2-6P6G, 1-6P21, 1-6C50, 1-6F80, 2-6F80, 2-6X40.

INPUT CONNECTIONS:
The five post input strip is used as follows: Terminals 1-2 are channel for phonograph or other low gain input. Terminal 1 is the ground side; terminals 1-3 are channel #4, for another phonograph or low gain input. When using a Crystal microphone connect posts #9 and #6 by a wire. Do not jump these terminals when using a Veltron or Velocity microphone.

MICROPHONE CONNECTIONS:
Above the five post strip are two screw cable connectors. These are the two channel inputs #1 and #3. For Velotron, Velocity or Crystal microphones. For each microphone, a single conductor shielded cable must be employed. The plug that is used on the microphone cable is supplied with each amplifier and is connected as follows:
1. Remove all cotton sleeving which in some cable is present over the metal sheath and insert over the shield the metal sleeve supplied with the connectors.
2. Remove the exposed shielding up to the sleeve making sure to bend back over the sleeve all loose metal wires.
3. Skin second rubber covering about 1/8" from the sleeve exposing about 1/4" of the conductor.
4. Insert the cable thus prepared into one part of the connector, drop the spring washer in the recess, place bakelite washer over it allowing the conductor to pass through eyelet.
5. Clean and solder conductor to eyelet, cut excessive wire, and screw set screw over the sleeve.
6. Do not use soldering paste or acid on any connection on microphone or cable.

OUTPUT CONNECTIONS:
Two one thousand ohm speakers must be connected to the amplifier by means of sockets marked "SPK" located on the right side of the amplifier. As a safety measure, these sockets are so wire that the A.C. to the amplifier is cut off unless both speaker plugs are inserted. The speakers are wired as shown in Fig. 1. Additional speakers having their own source of field supply may be connected by using the taps on the strip marked "OUTPUT". The terminal connections are as follows: Terminal 1 is common; #2 is four ohms; #3 is nine ohms; #4 is fifteen ohms and #6 is five hundred ohms.

A.C. RECEPTACLE:
An A.C. receptacle is located on the rear panel. This can be used to connect the A.C. for additional speaker exciters, phonographs, etc. The A.C. to this outlet is controlled by the master switch on the front panel.

FIELD SUPPLY:
The built-in field supply will furnish 100 ma., at 125 volts to each channel #1 or #3. This field supply is not taken from the plate voltage supply but has its own source of power.

FUSE:
If the amplifier fails to operate when turned on, examine the fuse clip. A five ampere fuse is used. If this fuse is burned out, examine the connections for a possible short circuit.

CONTROLS:
Mixer Fader - The first control on the left governs the gain for either channel #1 or #3. With this control it is possible to fade from channel #1, a high gain input to channel #3, a low gain input. The second control from the left governs the gain for either channel #3 or #4 similarly. By using both controls simultaneously it is possible to mix the inputs from channels #1 and #3 with those of channels #3 and #4.
Tone - The control marked "Tone" is used for tone correction effects. Master Switch - The switch at the extreme right on the control panel controls all A.C. The pilot light indicates when the amplifier is operating.

REMARKS:
If any hum is noticed, when using the microphone, reverse the line polarity, by pulling out the line plug, giving it a half turn and reinserting.

Hum can be caused by faulty tubes, particularly with a high gain amplifier of this design. Check all tubes carefully before looking elsewhere. In rare cases an external ground may be necessary.
CONNECTIONS

On the left side of the amplifier, there are two sockets marked "MIKE #1" and "MIKE # 2". One or two microphones can be connected to the amplifier by plugging into these sockets. For microphone connections see Fig.1. Shielded cable and plug must be used between the amplifier and the microphone. The metal cover of the plug must be grounded to the shield as shown in Fig.1.

On this same side there is a tip jack marked "PHONO". This jack is used to connect phonographs having tip connectors. Above this jack is a two terminal strip marked "INPUT". These terminals can be used for various input connections such as any low gain input, phonograph, or microphone (dynamic), or radio. The jack and input strip are controlled by the #3 control.

On the right side of the amplifier there are two six prong sockets marked "SPEAKER". These sockets are used to connect the two speakers required by the amplifier. For the speaker plug connections see Fig.2. The built-in field supply will furnish 100 mils, at 125 volts to each speaker. This field supply is not taken from the plate voltage supply, but has its own power supply. A three terminal output strip marked C-4-9, is located at the right of the speaker sockets. These terminals can be used to match the voice coils of any additional speakers. Additional speakers must have their own source of field supply, either built in or external.
The model CX15 is a P.A. amplifier which delivers 15 watts of output power. It has no field supply.

It has four input circuits for two microphones and two phonographs.

**Power Rating:** - 105-125 volts, A.C. 60 cycles, consumes 125 watts.

**Tubes Used:** - Total 7, 2-6J7; 1-6F8G; 1-6G8G; 2-6N6G; 1-5X4G. A close fitting tube shield is supplied for the 6F8G tube.

**Connections: Phonograph:**

There are 2 low gain input channels for use with high impedance type of phonograph pickup. A shielded wire should be used between each phono and the input terminals in order to reduce noise pickup. Connect shield to terminal #1 which is grounded. Use terminal #2 for wire from phono to first channel. Use terminal #3 for wire from phono to second channel.

**Microphone:**

Any high impedance type microphone, such as Velotron, Velocity, Crystal, or Dynamic may be connected to either of the two screw type microphone connectors provided. A shielded microphone cable is essential between each microphone and the amplifier. It may be fitted to the female cable connector supplied with the amplifier by the method described and illustrated on the reverse of this sheet.

**Output:**

The two five prong sockets marked "SPEAKER" on the rear of the amplifier, are for connections to two speakers with their own source of field excitation. Additional speakers may be connected to the terminal strip marked "OUTPUT" as follows: Terminal 1 is common, terminal 2 is two ohms, terminal 3, 4 ohms; terminal 4, 9 ohms; terminal 5, fifteen ohms and terminal 6 is 500 ohms.

**AC Receptacle:**

An AC outlet is located on the rear of chassis so that a phono motor, field exciter or other device may be plugged in if desired. The master switch controls this circuit also.

**Fuse:**

A 2 ampere fuse is located under the metal cover on rear panel. If the fuse blows, examine wiring and equipment for possible short circuits or other troubles before attempting to operate system again.

**Remarks:**

If any hum is noticed when using the microphone, reverse the line polarity by pulling out the AC line plug, giving it a half turn and reinstating. Hum may be caused by faulty tubes. If hum is noticed with correct polarity check all tubes carefully. In some cases, an external ground may be necessary. Terminal #1 of input or #1 of output may be used to ground the system.
The Model CX-70 is a new type of P.A. amplifier incorporating Bin- sorial Amplification and the Electronic Tone Corrector. It has 5 input channels for 4 high impedance type microphones and 2 phonograph pickups. There are two separate 35 watt output channels, tapped for both voice coil and 500 ohm lines.

POWER RATING: - 105-125 volts AC 60 cycles, consumes 290 watts.

TUBES USED: - Total 17. - 4-5T7G, 2-6CG8, 2-5F5, 2-6P6G, 4-6L6G and 3-5X4G. Close fitting tube shields are supplied for the 4-5T7G and 2-6CG8 tubes and top shields are provided for the 2-5F5 tubes.

CONNECTIONS: Phonograph: - There are two low gain input channels for use with high impedance types of phonograph pickups. A shielded wire should be used between each phono pickup and the amplifier in order to prevent the introduction of foreign sounds. Connect the shield or negative wire from phono pickup #1 to input terminal #1 and the positive wire to terminal #2. The shield or negative wire from pickup #2 connects to terminal #3 and its positive wire goes to terminal #4.

Microphone: - High impedance types of microphones, such as Velotron, Velocity, Crystal, Dynamic and others may be connected to each of the four screw type microphone connectors. Polarizing voltage is automatically supplied for the Velotron.

CAUTION - When a Crystal Microphone is used this voltage should be shorted out by a wire joining terminal #5 on the voltage input strip with the terminal whose number corresponds to the number of the microphone channel to which the Crystal microphone is attached. A shielded microphone cable is essential between each microphone and the amplifier. Female connectors are supplied with the amplifier and should be fitted to the end of the microphone cable.

OUTPUT: - Speakers having their own field supply or FM types should be used. Either speaker voice coils or 500 ohm lines may be connected to the output terminal strips in accordance with the impedance in ohms as shown on the diagram. Use wire size #18 between amplifier and speakers. If the distance is 100 feet #16 or #14 wire should be used to prevent loss of volume and quality of tone. Separate speakers or speaker lines are to be connected to the two output circuits.

CAUTION - Never turn up the Binaural Control on an output channel unless suitable speakers are connected to that channel, to do so may permanently injure the output transformer.

FUSE: - A 5 ampere fuse is located under a metal cover on the lower chassis. If the fuse blows, examine wiring and equipment for possible short circuit or other trouble before attempting to operate system again.

NOTE: - The four shielded tubes on the left of the amplifier are connected in series with the pilot lamp. This is a 6.3 volt .150 ampere bayonet base lamp and has a Brown Bead that can be seen welded to the stem. It is both a pilot light and a protective fuse for these tubes. If any of these tubes or pilot lamp should burn out, the others in this same group will fail to light. If ordinary .250 ampere pilot bulbs are used for replacement they will not act as protective fuses and they will not light brightly. On very loud signals the pilot light may flicker because of the extra current passed by the output tubes but this is normal.

REMARKS - If any hum is noticed when using the microphone, reverse the line polarity by pulling out the AC line plug, giving it a half turn, and reinserting. Hum may be caused by faulty tubes. If hum is noticed with correct line polarity, check all tubes carefully. In some cases, an external ground may be necessary. Terminal #1 of input or #1 of output may be used to ground the system.

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The Model D6 is a 6 watt AC operated amplifier useful especially for small installations.

**POWER RATING:** 105-125 volts AC, 60 Cycles, consumption 50 watts.

**TUBES USED:** Total 4: 2-6C8; 1-6L6; and 1-5Y4G. The tube shields provided should be used on the two 6C8 tubes on the extreme left.

**CONNECTIONS:** Phonograph:

The two post terminal strip on the upper left corner of the front panel is for high impedance type of phonograph pickup. A shielded wire should be used to reduce hum pickup. Connect the shield to terminal #1, which is grounded. Connect the wire itself to terminal #2.

**Microphone:** High impedance type of microphones such as Velotron, Velocity or Crystal, may be connected to the microphone connector on the front panel. Be sure to use shielded microphone cable.

**OUTPUT:**

The speaker is connected to a 6 prong plug, as shown in the diagram marked "MALE". The socket on the chassis is marked "SPKR" (FEMALE). This provides field current for a 1000 ohm speaker field. A cable having four conductors is used. The other two prongs are joined by a jumper wire as a safety measure. If the speaker is removed, the 110 volt supply is cut off.

**REMARKS:** - If any hum is noticed when using the microphone, reverse the line polarity by pulling out the AC line plug, giving it half turn and reinserting. Hum may be caused by faulty tubes. If hum is noticed with correct line polarity, check all tubes carefully. In some cases, an external ground may be necessary. Terminal #1 of phono input may be used to ground the system.

**FITTING MICROPHONE CABLE CONNECTOR**

1. Skin off about 1/2 inch of outer rubber covering, exposing shielding.
2. Cut shielding back so that only 1/4 inch is exposed.
3. Clinch sheet metal sleeve around whole cable so that small ends clinch upon shielding. Trim off any whiskers which might cause short.
4. Remove inner rubber insulation from wire, within 1/8 inch of metal sleeve.
5. Tin wire with solder and cut to about 1/8 inch.
6. Slip cable through connector body and solder wire into hollow end of center contact.
7. Draw cable back into connector body. Force bakelite washer into recessed seat. Tighten set screw into metal sleeve.
8. Never use soldering paste or acid on any microphone connection. Use Rosin core solder.

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The D12-3 is identical to the D12 with the exception of speaker field provision. The D12-3 no longer will excite electro dynamic speaker fields, consequently PM speakers must be used.

The Model D12-3 is a 12 watt P.A. amplifier having high impedance input stages for one microphone and one phonograph pickup.

**Power Rating:** - 105-125 volts, AC, 60 cycles consumes 80 watts.

**Tubes Used:** - Total 6, 1-6F5; 2-6CG6, 2-6N6G; and 1-5Y4G.

**Connections:** - Phonograph:

A high impedance type of phono pickup may be connected by means of a shielded wire to the input terminal strip on the left of the chassis. Ground the shield to terminal #1 and connect the wire to terminal #2.

**Microphone:**

Any high impedance type microphone, such as Velotron, Velocity, Crystal or Dynamic may be connected to the screw type microphone connector provided. A shielded microphone cable is essential and may be fitted to the female cable connector supplied with the amplifier by the method described and illustrated on the reverse of this sheet.

**Output:**

The two speaker sockets are mounted on the rear of the chassis, additional speakers having their own field supply or other PM types may be connected to the output terminal strip in accordance with the impedance values shown in the diagram. Use wire #18 between speakers and amplifier. If the distance is over 100 feet, use #16 or #14 to prevent loss of volume and quality of tone.

**Fuse:**

A 1 ampere fuse is located under metal cover on top chassis. If fuse blows, examine wiring and equipment for possible short circuits or other troubles before attempting to operate system again.

**Remote Control:**

When provided on special order, an 8 prong socket is mounted on the rear of the amplifier. It is marked "Remote" and will accommodate any type of Bogen Remote Control Unit.

**Remarks:**

If any hum is noticed when using the microphone, reverse the line polarity by pulling out the AC line plug, giving it a half turn, and reinserting. Hum may be caused by faulty tubes. If hum is noticed with correct line polarity, check all tubes carefully. Some microphones tend to pick up hum when placed near stray electrical fields. Try disconnecting microphone temporarily to determine whether hum comes from this source. It may be necessary to use the microphone in a slightly different location. In some cases, an external ground may be necessary. Terminal #1 of output may be used to ground the system.
The Model D28-3 is a P.A. amplifier which may be operated either on 117 volt AC or a 6 volt storage battery. It is provided with: three input channels, two for microphone and one for phonograph; duo-stage electron mixing between channels; tone control; Universal output for various speakers.

**POWER RATING:** Six volt storage battery drain under load 26 amperes (filaments 3.4 amp., genemotor 19 amp., phono-motor 3.5 amp.)

**TUBES:** Total 7: 2-6F5M, 1-6G8G, 1-6F8G, 2-6L6G and 1-5X4G.

**OUTPUT:** The five prong sockets marked "Speaker" on the rear of the amplifier are for connections to two speakers having their own FM fields or exciters. Only the two voice coil leads are used as shown in the diagram. Any combination of speakers or lines may be connected to the terminal strip marked "output" as follows: - Terminal #1 is "Common", #2 is two ohms, #3 is four ohms, #4 is nine ohms, #5 is fifteen ohms and #6 is 500 ohms.

**NOTES:** Noise or hum may be caused by faulty tubes. On AC it may be cleared at times by reversing the plug in the electrical outlet. The system may be grounded at #1 of output.

**IMPORTANT:** Turn "Master" switch on for one minute before turning "Generator" switch on.

**FITTING MICROPHONE CABLE CONNECTOR:**

1. Skin off about 1/2 inch of outer rubber covering, exposing shielding.
2. Cut shielding back so that only 1/4 inch is exposed.
3. Clinch sheet metal sleeve around whole cable so that small ends clinch upon shielding. Trim off any whiskers which might cause short.
4. Remove inner rubber insulation from wire, within 1/8 inch of metal sleeve.
5. Tin wire with solder and cut to about 1/8 inch.
6. Slip cable through connector body and solder wire into hollow end of center contact.
7. Draw cable back into connector body. Force bakelite washer into re-cessed seat. Tighten set screw into metal sleeve.
8. Never use soldering paste or acid on any microphone connection. Use Rosin core solder.
The Bogen Model D30 amplifier operates on 110-125 volts, 50-60 cycles AC, with a power consumption of 125 watts. The tubes used are 2-6F5G, 1-6C5G, 1-6F8G, 2-6L6G and 1-5X4G.

OUTPUT:

Speakers having their own field supply or P.M. type should be used. The voice coil of one or two speakers may be connected to the "R" and "F" prongs of the 5 prong plugs, which are then inserted into the 5 prong "Speaker" socket. Speakers may also be connected to the output terminal strip in accordance with their impedance in ohms as indicated in the circuit diagram. Use wire size #18 between amplifier and speakers. If the distance is over 100 feet, #14 or #18 wire should be used to prevent loss of volume and quality of tone. 110 volts for field exciter is provided on the 2 "F" prongs of the speaker sockets, as shown in the diagram. Take care to keep this 110 volts out of the voice coil circuit.

REMARKS:

If any hum is noticed when using the microphone, reverse the line polarity by pulling out the A.C. line plug, giving it a half turn, and reinserting into the A.C. outlet. Hum may be caused by faulty tubes. If hum is noticed with correct line polarity, check all tubes carefully. In some cases, an external ground connection may be necessary.

FITTING MICROPHONE CABLE CONNECTOR:

1. Skin off about 1/2 inch of outer rubber covering, exposing shielding.
2. Cut shielding back so that only 1/4 inch is exposed.
3. Clinch sheet metal sleeve around whole cable so that small ends clinch upon shielding. Trim off any whiskers which might cause short.
4. Remove inner rubber insulation from wire, within 1/8 inch of metal sleeve.
5. Tin wire with solder and cut to about 1/8 inch.
6. Slip cable through connector body and solder wire into hollow end of center contact.
7. Draw cable back into connector body. Force bakelite washer into recessed seat. Tighten set screw into metal sleeve.
3. Never use soldering paste or acid on any microphone connection. Use Rosin core solder.

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The Bogen Model D-100 amplifier is a booster supplying 100 watts of undistorted audio power. It requires a signal of only 3 watts to drive it, so that any existing small public address system may easily be converted into a super-power system.

**POWER RATING:** - 105-125 volts, AC, 60 cycles, Consumption 300 watts.

**TUBES USED:** - Total 7:- 4-6L6; 3-5X4 (G type).

**CONNECTIONS:** - The input terminals are arranged as follows:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Common and Ground</td>
<td>#3</td>
<td>50 ohms</td>
</tr>
<tr>
<td>#2</td>
<td>15 ohms</td>
<td>#4</td>
<td>250 ohms</td>
</tr>
<tr>
<td>#5</td>
<td>500 ohms</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All Bogen amplifiers that may be used for drivers for this booster are provided with tapped output terminals so that the proper match can be effected.

The following table indicates the connections for using any Bogen amplifier as driver for the D-100 Booster. As the booster does not require the entire output of the driving amplifier (except the SM6) the remaining driving power should be dissipated in a loading resistor or additional speaker load of the indicated impedance. This will insure proper matching and terminating impedance on the driving amplifier.

<table>
<thead>
<tr>
<th>DRIVER</th>
<th>OUTPUT TERMINALS</th>
<th>CONNECT TO</th>
<th>ADDITIONAL LOAD (SPEAKER OR RESISTOR)</th>
<th>CONNECT ADDITIONAL OUTPUT TERMINALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM6</td>
<td>1-6</td>
<td>1-5</td>
<td>- - -</td>
<td>- - - - - - - - -</td>
</tr>
<tr>
<td>E10</td>
<td>8 ohms</td>
<td>1-2</td>
<td>1000 ohms</td>
<td>500 ohm conn</td>
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<tr>
<td>E14</td>
<td>1-3</td>
<td>1-2</td>
<td>750</td>
<td>1-6</td>
</tr>
<tr>
<td>E20</td>
<td>1-5</td>
<td>1-2</td>
<td>750</td>
<td>1-6</td>
</tr>
<tr>
<td>E25</td>
<td>1-2</td>
<td>1-2</td>
<td>650</td>
<td>1-6</td>
</tr>
<tr>
<td>E35</td>
<td>1-4</td>
<td>1-3</td>
<td>650</td>
<td>1-6</td>
</tr>
<tr>
<td>EX35</td>
<td>1-2</td>
<td>1-2</td>
<td>650</td>
<td>1-6</td>
</tr>
<tr>
<td>EX70(1 channel)</td>
<td>1-2</td>
<td>1-2</td>
<td>650</td>
<td>1-6</td>
</tr>
</tbody>
</table>

**OUTPUT:** - The output terminals are arranged in two rows numbered as follows:

**UPPER ROW**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Common Gnd.</td>
<td>#1</td>
<td>84 ohms</td>
</tr>
<tr>
<td>2</td>
<td>2 ohms</td>
<td>2</td>
<td>100 ohms</td>
</tr>
<tr>
<td>3</td>
<td>4 ohms</td>
<td>3</td>
<td>125 ohms</td>
</tr>
<tr>
<td>4</td>
<td>9 ohms</td>
<td>4</td>
<td>166 ohms</td>
</tr>
<tr>
<td>5</td>
<td>15 ohms</td>
<td>5</td>
<td>250 ohms</td>
</tr>
<tr>
<td>6</td>
<td>72 ohms</td>
<td>6</td>
<td>500 ohms</td>
</tr>
</tbody>
</table>

**LOWER ROW**

**FUSE:** - A 5 ampere fuse is located on the rear of the chassis under the protective cover.
The Model D615 is a Public Address Amplifier which may be operated on either 110 V. A.C. or a 6 V. storage battery. It is provided with: two input channels - one for microphone and one for phonograph, Duo-stage electron mixing between both channels. Tone Control, Universal output for various speakers.


TUBES USED: Total 7: 1-6T7, 2-6C8, 2-6V6, 2-6X5. "G" type recommended.

MICROPHONE: A high impedance type of microphone such as Velotron, Velocity or Crystal may be connected directly to input microphone connector.

OUTPUT: Only the 2 voice coil leads are used as shown in the diagram. Any combination of speakers or lines may be connected to the terminal strip marked "output" as follows: Terminal #1 is "Common", #2 is two ohms, #3 is four ohms, #4 is nine ohms, #5 is fifteen ohms and #6 is 500 ohms.

NOTES: Noise or hum may be caused by faulty tubes. On 110 volt A.C., it may be cleared at times by reversing the plug in the electrical outlet. The system may be grounded at terminal #1 of input or #1 of output.

FITTING MICROPHONE CABLE CONNECTOR:
1. Skin off about 1/2 inch of outer rubber covering, exposing shielding.
2. Cut shielding back so that only 1/4 inch is exposed.
3. Clinch sheet metal sleeve around whole cable so that small ends clinch upon shielding. Trim off any whiskers which might cause short.
4. Remove inner rubber insulation from wire, within 1/8 inch of metal sleeve.
5. Tin wire with solder and cut to about 1/8 inch.
6. Slip cable through connector body and solder wire into hollow end of center contact.
7. Draw cable back into connector body. Force bakelite washer into recessed seat. Tighten set screw into metal sleeve.
8. Never use soldering paste or acid on any microphone connection. Use Rosin core solder.

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The Model D615-2 is a public address amplifier which may be operated on either 117 volts AC or a 6 volt storage battery. It is provided with two input channels - one for microphone and one for phonograph; dual-stage electron mixing between both channels; tone control; universal output for various speakers.

**Power Rating:**
- 6 Volt Storage Battery - Consumption 9 amperes for amplifier, 3.5 amperes for phonograph.
- 117 Volts AC - Consumption 85 watts for amplifier, 20 watts for phonograph.

**Tubes Used:**
- Total 7, 1-6T7; 2-6G8; 2-6V6; 2-6X5. "G" type recommended.

**Connections:**

On six volt storage battery use the power cord with battery clips and insert its plug into the 9 prong "Power" socket. See that the vibrator is in the "VIB" socket. If the UT15 phonograph assembly is used with the system, its four and five prong plugs should be inserted into the "Phono" and "Power" sockets. Fasten the clips on the positive and negative poles of the battery according to their markings; red for positive - black for negative. Throw AC-DC switch to DC.

On AC use the power cord with the usual attachment plug and insert its 9 prong plug into the 9 prong "Power" socket. Throw AC-DC switch on front panel to AC. The master power switch on right controls the entire amplifier whether on AC or DC. The phonograph motor is controlled by its own toggle switch mounted on top adjacent to the turntable.

**Phonograph:**

The phonograph motor is a standard 110 volt AC synchronous type. When the amplifier is operated on AC, this motor is fed directly from the supply line. When the amplifier is operated on six volts DC and the AC-DC switch is thrown to DC position, this motor operates through a converter mounted adjacent to it inside the screen.

This converter unit utilizes a special vibrator. If the motor fails to operate on DC, contact of the vibrator should be checked by pressing it into its socket. If it does not vibrate replacement is necessary. An external phonograph may be connected to the terminal strip on the left side of the amplifier. Terminal #1 is "Ground", and Terminal #2 is "Grid".

**Microphone:**

A high impedance type of microphone such as Velotron, Velocity or Crystal may be connected directly to input microphone connector. A shielded microphone cable is essential and may be fitted to the female cable connector supplied with the amplifier by the method described and illustrated on the reverse side of this sheet.

**Output:**

Only the two voice coil leads are used as shown in the diagram. Any combination of speakers or lines may be connected to the terminal strip marked "Output" as follows: - Terminal #1 is "Common", #2 is two ohms, #3 is four ohms, #4 is nine ohms, #5 is fifteen ohms and #6 is 500 ohms.
Remote Control:

An 8 prong octal socket is mounted on the left side of the amplifier. It is marked "Remote" and will accommodate any type of Bogen Remote Control Unit.

Notes: Noise or hum may be caused by faulty tubes. On AC it may be cleared at times by reversing the plug in the electrical outlet. The system may be grounded at terminal #1 of input or #1 of output.

FITTING MICROPHONE CABLE CONNECTOR

1. Skin off about 1/2 inch of outer rubber covering, exposing shielding.
2. Cut shielding back so that only 1/4 inch is exposed.
3. Clinch sheet metal sleeve around whole cable so that small ends clinch upon shielding. Trim off any whiskers which might cause short.
4. Remove inner rubber insulation from wire, within 1/8 inch of metal sleeve.
5. Tin wire with solder and cut to about 1/8 inch.
6. Slip cable through connector body and solder wire into hollow end of center contact.
7. Draw cable back into connector body. Force bakelite washer into recessed seat. Tighten set screw into metal sleeve.
8. Never use soldering paste or acid on any microphone connection. Use Rosin core solder.
The Model DX15 is a PA amplifier which delivers 15 watts of output power. It is provided with four input circuits for two microphones or two phonographs or one of each.

**POWER RATING:** - 105-125 volts, AC 60 cycles, consumes 125 watts.

**TUBES USED:** - Total 7: 2-6J7; 1-6F8G; 1-6CG8; 2-6N6G; 1-5X4G. A close fitting tube shield is supplied for the 6F8G tube.

**CONNECTIONS:** - Phonograph: There are two low gain input channels for use with high impedance type of phono pickup. A shielded wire should be used between each phono and the input terminals in order to reduce noise pickup. Connect shield to terminal #1 which is grounded. Use terminal #2 for wire from phono to first channel. Use terminal #3 for wire from phono to second channel.

**Microphone:** - Any high impedance type microphone, such as Velotron, Velocity, Crystal, or Dynamic, may be connected to either of the two screw type microphone connectors provided. A shielded microphone cable is essential between each microphone and the amplifier. It may be fitted to the female cable connector supplied with the amplifier by the method described and illustrated.

**Output:** - The two five prong sockets marked "SPEAKER" on the rear of the amplifier, are for connections to two speakers with their own source of field excitation. Additional speakers may be connected to the terminal strip marked "OUTPUT" as follows: - Terminal 1 is common, terminal 2 is two ohms, terminal 3, 4 ohms; terminal 4, 9 ohms; terminals 5, 15 ohms; and terminal 6 is 500 ohms.

**Fuse:** - A 2 ampere fuse is located under the metal cover on rear panel. If the fuse blows, examine wiring and equipment for possible short circuits or other troubles before attempting to operate system again.

**Remote Control:** - When provided on special order, an 8 prong socket is mounted on the rear of the amplifier. It is marked "Remote" and will accommodate any type of Bogen Remote Control Unit.

**Remarks:** - If any hum is noticed when using the microphone, reverse the line polarity by pulling out the AC line plug, giving it half turn and reinserting. Hum may be caused by faulty tubes. If hum is noticed with correct polarity check all tubes carefully. In some cases, an external ground may be necessary. Terminal #1 of input or #1 of output may be used to ground the system.

**FITTING MICROPHONE CABLE CONNECTOR**

1. Skin off about 1/2 inch of outer rubber covering, exposing shielding.
2. Cut shielding back so that only 1/4 inch is exposed.
3. Clinch sheet metal sleeve around whole cable so that small ends clinch upon shielding. Trim off any whiskers which might cause short.
4. Remove inner rubber insulation from wire, within 1/8 inch of metal sleeve.
5. Tin wire with solder and cut to about 1/8 inch.
6. Slip cable through connector body and solder wire into hollow end of center contact.
7. Draw cable back into connector body. Force bakelite washer into recessed seat. Tighten set screw into metal sleeve.
8. Never use soldering paste or acid on any microphone connection. Use Rosin core solder.

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The Model DX-18 is an unusual 18 watt P.A. amplifier incorporating the new Electronic Tone Corrector. It has 4 input circuits for 2 microphones and 2 phonograph pickups and universal output for speakers.

**POWER RATING:** - 105-125 volts, A.C., 60 cycles, consumes 125 watts.

**TUBES USED:** - Total 10: 2-6T7, 4-6L5, 1-6C8, 2-6N6, 1-5X4. "g" type tubes are recommended throughout.

**CONNECTIONS:** Phonograph: - There are 2 low gain input channels for use with high impedance type of phono pickup. A shielded wire should be used to reduce hum pickup. Connect shields from both circuits to terminal #1 which is grounded. Use terminal #2 for wire from phono to first channel. Terminal #3 for wire from phono to second channel.

**MICROPHONE:** - High impedance type microphones such as Velotron, Velocity or Crystal may be connected to the two screw type microphones connectors provided. A shielded microphone cable is essential and may be fitted to the female cable connector supplied with the amplifier by the method described and illustrated.

**OUTPUT:** - The five prong sockets marked "Speaker" on the rear of the amplifier, are for connections to 2 speakers having their own P.M. fields or exciters. Only the 2 voice coil leads are used as shown in the diagram. Any combination of speakers or lines may be connected to the terminal strip marked "OUTPUT" as follows: - Terminal #1 is "common", #2 is two ohms, #3 is four ohms, #4 is nine ohms, #5 is fifteen ohms and #6 is 500 ohms.

**REMOTE CONTROL:** - An 8 prong octal socket is mounted on the rear of the amplifier. It is marked "Remote" and will accommodate any type of Bogen Remote Control Unit.

**NOTE:** - The four shielded tubes on the left of the amplifier are connected in series with the pilot lamp. This is a 6.3 volt .150 ampere bayonet base lamp and has a brown bead that can be seen welded to the stem. It is both a pilot light and a protective fuse for these tubes. If any of these tubes or pilot lamp should burn out, the others in this same group will fail to light. If ordinary .250 ampere pilot bulbs are used for replacement they will not act as protective fuses and they will not light brightly. On very loud signals the pilot light may flicker because of the extra current passed by the output tubes but this is normal.

**REMARKS:** - If any hum is noticed when using the microphone, reverse the line polarity by pulling out the A.C. line plug, giving it a half turn, and reinserting. Hum may be caused by faulty tubes. If hum is noticed with correct line polarity, check all tubes carefully. In some cases, an external ground may be necessary. Terminal #1 of input or #1 of output may be used to ground the system.

**FITTING MICROPHONE CABLE CONNECTOR**
1. Skin off about 1/2 inch of outer rubber covering, exposing shielding.
2. Cut shielding back so that only 1/4 inch is exposed.
3. Clinch sheet metal sleeve around whole cable so that small ends clinch upon shielding. Trim off any whiskers which might cause short.
4. Remove inner rubber insulation from wire, within 1/8 inch of metal sleeve.
5. Tin wire with solder and cut to about 1/8 inch.
6. Slip cable through connector body and solder wire into hollow end of center contact.
7. Draw cable back into connector body. Force bakelite washer into recessed seat. Tighten set screw into metal sleeve.
8. Never use soldering paste or acid on any microphone connection. Use Rosin core solder.

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The Model DX30 is an unusual 30 watt P.A. amplifier incorporating the new Electronic Tone Corrector. It has 4 input circuits for 2 microphones and 2 phonograph pickups and Universal output for speakers.

POWER RATING: - 105-125 volts AC 60 cycles, consumes 175 watts.

"g" type tubes are recommended thruout.

CONNECTIONS: Phonograph: - There are 2 low gain input channels for use with high impedance type of phono pickup or tuner. A shielded wire should be used to reduce hum pickup. Connect shields from both circuits to Terminal #1 which is grounded. Use Terminal #2 for wire from phono to 1st channel. Terminal #3 for wire from phono to second channel.
Microphone: - High impedance type microphones such as Velotron, Velocity or Crystal may be connected to the two screw type microphone connectors provided. A shielded microphone cable is essential and may be fitted to the female cable connector supplied with the amplifier.

OUTPUT: - Speakers having their own field supply or PM type should be used. The voice coil of one or two speakers may be connected to the "K" and "P" prongs of 5 prong plugs, which are then inserted into the 5 prong "speaker" socket. Speakers may also be connected to the output terminal strip in accordance with their impedance in ohms as indicated in the circuit diagram. Use wire size #16 between amplifier and speakers. If the distance is over 100', #14 or #16 wire should be used to prevent loss of volume and quality of tone. 110 volts for field exciter is provided on the 2 "F" prongs of the speaker sockets as shown in the diagram. Take care to keep this 110 volts out of the voice coil circuit.

FUSE: - A 2 ampere fuse is located under metal cover on rear panel. If fuse blows, examine wiring and equipment for possible short circuit or other trouble before attempting to operate system again.

REMOTE CONTROL: - An 8 prong octal socket is mounted on the rear of the amplifier adjacent to the input strip. This socket will accommodate any of the three types of Bogen Remote Control units.

LOW IMPEDANCE INPUT: - This amplifier has provision for mounting 2 Bogen special tri-alloy shielded input transformers. This is extremely desirable where long microphone lines are to be run. Long input lines should be low impedance to avoid hum and noise pick-up.

NOTE: - The two 6L6G tubes are connected in series with the pilot lamp. This is a 6.3 volt 150 ampere bayonet base lamp and has a Brown Bead that can be seen welded to the stem. It is both a pilot light and a protective fuse for these tubes. If any of these tubes or pilot lamp should burn out, the others in this same group will fail to light. If ordinary .250 ampere pilot bulbs are used for replacement they will not act as protective fuses and they will not light brightly. On very loud signals the pilot light may flicker because of the extra current passed by the output tubes, but this is normal.

REMARKS: - If any hum is noticed when using the microphone reverse the line polarity by pulling out the AC line plug, giving it a half turn and reinserting. Hum may be caused by faulty tubes. If hum is noticed with correct line polarity, check all tubes carefully. In some cases, an external ground may be necessary. Terminal #1 of input or #1 of output may be used to ground the system.

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The model DX-70 is a new type of P.A. amplifier incorporating Binaural Amplification and the Electronic Tone Corrector. It has 6 input channels for 4 high impedance type microphones and 2 phonograph pickups. There are two separate 35 watt output channels, tapped for both voice coil and 500 ohm lines.

Power Rating: 105-125 volts A.C., 60 cycles, consumes 290 watts.


Connections: Phonograph There are two low gain input channels for use with high impedance types of phono pickups. A shielded wire should be used between each phono pickup and the amplifier in order to prevent hum pickup, Connect the shield or negative wire from phono pickup #1 to input terminal #1 and the positive wire to terminal #2. The shield or negative wire from pickup #2 connects to terminal #3 and its positive wire goes to terminal #4.

Microphone: High impedance types of microphones, such as Velotron, Velocity, Crystal, Dynamic and others may be connected to each of the four screw type microphone connectors. A shielded microphone cable is essential between each microphone and the amplifier. Female connectors are supplied with the amplifier and should be fitted to the end of the microphone cable.

Output: Speakers having their own field supply or P.M. types should be used. Either speakers voice coils or 500 ohm lines may be connected to the output terminal strips in accordance with the impedance in ohms as shown in the diagram. Use wire size #18 between amplifier and speakers. If the distance is over 100 feet, #16 or #14 wire should be used to prevent loss of volume and quality of tone. Separate speakers or speaker lines are to be connected to the two output circuits.

The DX70 may be used as a single 70 watt amplifier by paralleling both output stages. This is done by connecting the corresponding output terminals on each channel. When paralleling any tap, the resulting impedance will be half, for example, if the two 500 ohm taps are connected, (#1 and #6) the resulting output impedance will be 250 ohms. When using the DX70 as a single amplifier, the "Power Channel" controls must be turned all the way up.

Caution: Never turn up the Binaural Control on an output channel unless suitable speakers are connected to that channel, to do so may permanently injure the output transformer.

Fuse: A 5 ampere fuse is located under a metal cover on the lower chassis. If the fuse blows, examine wiring and equipment for possible short circuit or other trouble before attempting to operate system again.

Electronic Tone Corrector: The Electronic Tone Corrector provides individual control of high and low frequencies. It operates on a new principle that is entirely different from that of the commonly known tone control which merely cuts off high frequencies to create an apparent bass increase. The Electronic Tone Corrector changes tone without introducing distortion or changing the overall frequency range. The control marked "Treble" increases the volume of the high frequencies when turned to the right. The control marked "Bass" increases the volume of the low frequencies when turned to the right and decreases their volume when turned to the left. Maximum volume is obtained with both controls turned all the way to the right. The tone volume decreases as the controls are turned to the left so that when both controls are turned all the way to

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the left the signal output will be zero. Tone can be blended to any degree desired by means of these control and the overall amplifier volume can then be regulated by means of the master volume control. On high volume levels, full bass accentuation may cause speaker rattle due to the fact that speaker overloading occurs that much sooner. In such cases, do not attempt to operate with the Bass control on full but reduce it to a pleasing level.

Binaural Control: The two controls on the Binaural Plate marked "Power Channel 1" and "Power Channel 2" vary the output of the separate output channels available in this amplifier. Unless they are actually being used as binaural controls they should be operated full on.

Remote Control: An 8 prong octal socket is mounted on the rear of the pre-amplifier chassis (top chassis). It is marked "Remote" and will accommodate any type of Bogen Remote Control Unit.

Warning: Do not turn up "Power Channel" controls unless a suitable speaker load is attached to the associated output terminals.

Note: The four 6G6G tubes are connected in series with the pilot lamp. This is a 6.3 volt .150 ampere bayonet base lamp and has a Brown Bead that can be seen welded to the stem. It is both a pilot light and a protective fuse for these tubes. If any of these tubes or pilot lamp should burn out, the others in this same group will fail to light. If ordinary .250 ampere pilot bulbs are used for replacement they will not act as protective fuses and they will not light brightly. On very loud signals the pilot light may flicker because of the extra current passed by the output tubes. This is normal.

Remarks: If any hum is noticed when using the microphone, reverse the line polarity by pulling out the A.C. line plug, giving it a half turn, and reinserting. Hum may be caused by faulty tubes. If hum is noticed with correct line polarity, check all tubes carefully. In some cases, an external ground may be necessary. Terminal #1 of input or #1 of output may be used to ground the system.
The Model D-10 is a 10 watt P.A. amplifier especially adaptable to portable use. It is provided with: 2 input channels, one for microphone and one for phonograph; Duo-stage electron mixing between channels; Tone Control; Outputs for two PM or self-excited speakers.

Power Rating: 105-125 volts AC, 60 cycles, Consumes 88 watts.

Tubes Used: Total 5; 2-6C8G; 2-6V6M; 1-5Y4G.

Output: Speakers having their own field supply or PM type should be used. The voice coil of 1 or 2 speakers may be connected to the five prong plugs provided. Use wire size #18 between amplifier and speakers. If the distance is over 100 feet, #16 or #14 should be used to prevent loss of volume and quality of tone.

Notes: Noise or hum may be caused by faulty tubes. It may be cleared at times by reversing the plug in the electrical outlet. The system may be grounded at terminal #1 of input.
The Model E8 is an 8 watt public address amplifier, designed to deliver its rated output with a minimum of distortion. There are two input channels for one microphone and one phonograph. Output impedances of 4, 8, 15 and 500 ohms are available at the 8 prong speaker socket.

POWER RATING: 105-125 volts AC; 60 cycles - consumption: 70 watts.

TUBES USED: Total 4; 1-7F7; 1-6AD7; 1-6F6G; 1-7Z4.

OUTPUT:

The type and number of loudspeakers used depends largely upon the installation requirements. In most cases, two speakers are preferred so that proper distribution of sound can be effected. The Model E8 is designed for use with either permanent magnet (PM) or electro-dynamic speakers. Field supply is provided for one electro-dynamic speaker, employing a 750 ohm field coil. The speakers should have a capacity of 8 to 10 watts, especially when only one is being used. Speaker voice coil connections are made to the 8 prong speaker socket in accordance with the schematic diagram. Correct impedance matching is important for good quality and volume. When using PM speakers, connect one speaker lead to the prong of the 8 contact speaker plug which corresponds to contact 1 of the speaker socket. Jump contacts 7 and 8, and solder the other speaker lead to the contact which corresponds to the impedance of the loudspeaker. For an electro-dynamic speaker, connect one speaker lead to contact 1, connect the field supply to contacts 6 and 8 and solder the other speaker lead to the contact which corresponds to the impedance of the speaker. If more than one speaker is connected be sure that they are correctly phased. Never turn on the amplifier unless the speaker has been connected.

MICROPHONES:

All high impedance microphones (Crystal, Dynamic, Velocity) couple to the amplifier in the same manner. Connection is made directly to the input microphone connector. A shielded microphone cable is essential.

PHONOGRAPH:

Either high impedance magnet or crystal type phonograph pick-up may be used. Make connections to the 2 screw terminals marked "PHONO", located beneath the microphone connector. Pickups must have a shielded connecting cable to prevent noise and hum from being picked up. It is important that the wire fastened to the outer shield be grounded to the left terminal marked "G".

NOTES: If the amplifier hums when first placed in operation, reverse the polarity of the line plug. Faulty tubes may also cause hum. When power line disturbances cause hum and noise, the amplifier should be grounded. Terminal #1 of the phonograph input may be used to ground the system.
POWER RATING: 105--125 volts, 60 cycles a.c.--power consumed--88 watts.

OUTPUT: Speakers having their own field supply or the PM type should be used. The voice coil of 1 or 2 speakers may be connected to the five prong plugs provided. Use wire size #18, or if distance is over 100 feet, use wire size #16 or #14. A variable impedance selector is provided for matching speakers of various impedances to the amplifier.
All connections are indicated on the rear view of the unit.

If the amplifier fails to operate when the switch is turned up, examine fuse. Fuse size is indicated on diagram.

INPUTS:

The amplifier is designed for any high impedance microphone or phonograph. Input impedances are 500,000 ohms.

OUTPUT CONNECTIONS:

Speakers may be connected by means of plugs to the speaker sockets, or they can be connected directly to the speaker output terminal strip. Variable impedances for speaker matching are provided at the speaker output terminal strip and also at the two speaker sockets. The pigtails lead with spade lug vary the impedance at the speaker sockets by connecting the spade lug under the terminal on the strip which provides the nearest impedance desired. Both speaker sockets and terminal strip may be used simultaneously but the pigtails spade lug must be connected to a terminal on the strip in order to operate from the speaker sockets. Connecting the pigtails spade lug will not interfere with the use of the terminal strip for connecting speakers.

When operating speakers on voice coil impedance (without transformers) use as heavy a wire as possible. Speaker cable runs of 100 feet or over, should be at least #16 wire.

REMOTE CONTROL:

Remote control is available as an optional feature in the Models E14, E20, and E30. As the standard Bogen Remote Control provides for only two channel control and the amplifier contains three input channels, a channel changeover strip is provided. The wiring of the amplifier is arranged so that Control #1 of the Remote Control operates Microphone #1 channel. Control #2 may be arranged to control Microphone #2 Channel or the phonograph channel. Inserting the spade lug of the pigtail lead under the terminal marked "1" makes Control #2 of the Remote Control effective on the Microphone #2 Channel and under the terminal marked "2" on the Phonograph channel.

HUM:

If the amplifier hums when first placed in operation, reverse the polarity of the line plug. Faulty tubes may also cause hum.
This circuit is used when the amplifier is wired for remote control.

For Notes, see Page 1-43
This circuit used when amplifier is wired for REMOTE CONTROL

#1 Remote Channel controls #1 microphone
#2 Remote Channel controls a choice of
#2 microphone, or phonograph.
This circuit is used when amplifier is wired for Remote Control

2-63FS

1.5 Ampere Fuse

17V-60V

125 Watts

Remote Channel controls #1 microphone

2nd Remote Channel controls choice of #2 microphone or phonograph

For Notes, see Page 1-43

10-10-39
This circuit is used when amplifier is wired for remote control.

1. Remote Channel controls #1 microphone.
2. Remote Channel controls a choice of #2 microphone or phonograph.

Speaker Sockets:
Connect Lug on Flexible Lead to Impedance Desired at Speaker Sockets.
POWER CONSUMPTION: 6.3 volt storage battery—7 amperes.
117 volts a.c.—50 watts.

OUTPUT: A speaker having its own field supply or the PM type should be used. Connect the voice coil to the five prong socket provided. Impedances of 4, 8, or 15 ohms may be selected according to the prongs used.
If a Bogen Model E75 amplifier is in use, and it is desired to increase the power of the system, a number of E80 booster amplifiers may be added up to a maximum of 6. The E80 should be connected directly across the power channel controls of the E75 (as shown in the Model E75 schematic) and the output of the booster amplifier is varied independently by its own controls.

Pyramiding Model E80 booster amplifiers is made simple by the incorporation of a parallel input receptacle on each booster. Jump inputs of the E80 boosters as illustrated.
The Model EB0 is a dual channel booster. Each channel has an output of 40 watts at less than 2.5% distortion, and the two channels can be paralleled to deliver 80 watts of audio power. The EB0 requires a signal of only 0.5 volt to drive it to full output so that it can be fed by a zero level line, and a number of boosters can be added to an existing system without increasing the size of the driver. The dual channel construction of the Model EB0 provides maximum protection against breakdown, for should one channel break down, the other will continue to supply its own bank of speakers.

POWER CONSUMPTION: 250 watts at 117 v. AC 50-60 cycles.
TUBES USED: 1-7B4; 1-7F7; 2-6F6G; 4-6L6G; 2-7Z4; 2-5X4G.
INPUT: HIGH IMPEDANCE 1.0 Megohm.
OUTPUT: Each channel has its own output terminal strip, tapped 4, 8, 15, 500, 1,000 ohms.

Since 0.5 volt will drive the Model EB0 to maximum output, any zero level line or output, the high impedance output of a tuner or a high impedance crystal pickup can be fed directly into the input of the booster.

TO USE THE BOGEN "MODEL HH" PRE-AMPLIFIER AS A DRIVER, feed the output of the pre-amplifier directly into either one of the single prong connectors on the input of the EB0. A maximum of six EB0 boosters can be driven by the Model HH.

TO USE ANY BOGEN AMPLIFIER FROM THE EB TO THE EX35 AS A DRIVER, one of two methods may be employed: Both methods permit an almost limitless number of boosters to be used.

(1) Use 4 ohm winding on output of driver amplifier.

(2) Use 500 ohm winding on output of driver amplifier.
The Bogen Model E-100 amplifier is a booster supplying 100 watts of undistorted audio power. It requires a signal of only 3 watts to drive it, so that any existing small public address system may easily be converted into a super-power system.

**POWER RATING:** - 105-125 volts, AC, 60 cycles, consumption 300 watts.

**TUBES USED:** - Total 7: 4-616, 3-5X4 (G type).

**CONNECTIONS:** - **Input:** The input terminals are arranged as follows:-

- #1 - Common and Ground
- #2 - 15 ohms
- #3 - 50 ohms
- #4 - 250 ohms
- #5 - 500 ohms

All Bogen amplifiers that may be used for drivers for this booster are provided with tapped output terminals so that the proper match may be effected.

The following table indicates the connections for using any Bogen amplifier as driver for the E-100 Booster. As the booster does not require the entire output of the driving amplifier (except the SM6) the remaining driving power should be dissipated in a loading resistor or additional speaker load of the indicated impedance. This will insure proper matching and terminating impedance on the driving amplifier.

<table>
<thead>
<tr>
<th>DRIVER TERMINALS</th>
<th>TO DRIVER TERMINALS</th>
<th>ADDITIONAL LOAD (SPEAKER)</th>
<th>CONNECT ADDITIONAL LOAD TO DRIVER TERMINALS ON DRIVER</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM6</td>
<td>1-6</td>
<td>1-5</td>
<td></td>
</tr>
<tr>
<td>E10</td>
<td>1-3</td>
<td>1-2</td>
<td>1000 ohms</td>
</tr>
<tr>
<td>E14</td>
<td>1-3</td>
<td>1-2</td>
<td>750</td>
</tr>
<tr>
<td>E20</td>
<td>1-3</td>
<td>1-2</td>
<td>750</td>
</tr>
<tr>
<td>E30</td>
<td>1-2</td>
<td>1-2</td>
<td>650</td>
</tr>
<tr>
<td>EX25</td>
<td>1-4</td>
<td>1-3</td>
<td>650</td>
</tr>
<tr>
<td>EX35</td>
<td>1-2</td>
<td>1-2</td>
<td>650</td>
</tr>
<tr>
<td>EX70(1 channel)</td>
<td>1-2</td>
<td>1-2</td>
<td>650</td>
</tr>
</tbody>
</table>

**OUTPUT:** - The output terminals are arranged in two rows numbered as follows:

<table>
<thead>
<tr>
<th>UPPER ROW</th>
<th>LOWER ROW</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 - Common Gnd.</td>
<td>#1 - 84 ohms</td>
</tr>
<tr>
<td>2 - 2 ohms</td>
<td>2 - 100 ohms</td>
</tr>
<tr>
<td>3 - 4 ohms</td>
<td>3 - 125 ohms</td>
</tr>
<tr>
<td>4 - 9 ohms</td>
<td>4 - 166 ohms</td>
</tr>
<tr>
<td>5 - 15 ohms</td>
<td>5 - 250 ohms</td>
</tr>
<tr>
<td>6 - 72 ohms</td>
<td>6 - 500 ohms</td>
</tr>
</tbody>
</table>

**FUSE:** - A 5 ampere fuse is located on the rear of the chassis under the protective cover.
The Model E-620 is a public address amplifier which may be operated on either 117 volts AC or a 6 volt storage battery. It is provided with two input channels - one for microphone and one for phonograph; duo-stage noiseless mixing between channels; tone control; 60 cycle converter for phonograph motor on battery; universal output for various speakers.

**POWER CONSUMPTION:**
- 6.3 Volt storage battery
- 10.5 amperes for amplifier
- 3.25 amperes for phonograph
- 117 volts AC
- Amplifier - 75 watts
- Phonograph - 20 watts

**TUBES USED:** Total 5: 1-6SJ7; 2-6L6G; 1-6H5G; 1-6SC7.

**CONNECTIONS:**

On storage battery use the power cord with battery clips and insert its plug into the 20 prong socket. Fasten the clips to the terminals of the battery; red wire to the Hot side; white wire to Ground.

On AC use the power cord with the electric attachment plug. Insert its 20 prong plug into the 20 prong socket. Inserting the proper connecting cable automatically converts the amplifier for AC or DC operation.

**PHONOGRAPH:**

The phonograph motor is a standard 110 volt AC synchronous type. A 60 cycle converter contained within the amplifier is used for battery operation. If the phonograph channel is inoperative, check the pickup plug on top of the chassis. If the motor is inoperative, check the motor power plug. On DC, a defective or loose vibrator would prevent the motor from operating.

**MICROPHONE:**

A high impedance type of microphone, such as Velocity, Crystal or Dynamic may be connected directly to the input microphone connector. A shielded microphone cable is essential.

**OUTPUT:**

Speakers having their own field supply or PM type should be used. The voice coil of 1 or 2 speakers may be connected to the five prong plugs provided. Additional speakers may be connected to the output strip. Speakers must be connected to the amplifier before it is turned on.

**NOTES:** Noise or hum may be caused by faulty tubes. On 110 volts AC it may be cleared at times by reversing the plug in the electrical outlet. The system may be gound at #1 of the output.
For rear chassis view, see Page 1-59

INPUTS: The amplifier is designed for any high impedance microphone or phonograph. The input impedances are 500,000 ohms.

When operating speakers on voice coil impedance (without transformers) use as heavy a wire as possible. Speaker cable runs of 100 feet or over should be at least #16 wire.

HUM: If the amplifier hums when first placed in operation, reverse the polarity of the line plug. Faulty tubes may also cause hum.
FUSE: 2-3 ampere and 1-1 ampere fuses are located under metal covers.

The EX70 may be used as a single 70 watt amplifier by paralleling both output stages. This is done by connecting the corresponding output terminals on each channel. When paralleling any tap, the resulting impedance will be halved.
POWER RATING: 6 volt storage battery drain under load, 23.5 amperes. 
A.C. rating--120 watts.

NOTE: Regardless of the position of the standby switch, the shorting plug must be inserted to put amplifier into operation when operating from 6 volts D.C.
The Model EX632 is a PA amplifier which may be operated on 115 volts AC or 6 volts storage battery. It is provided with: 3 input channels - 2 for microphone and 1 for phonograph; duo-stage electron mixing between channels; Tone Corrector; Universal output for various speakers.
POWER RATING: - 6 volt storage battery drain under load 23.5 amperes.
   AC rating - 120 watts.

TUBES: -
   Total 8: - 2-7F7; 2-6L6G; 3-7B4; 1-5X4G.

CONNECTIONS:

On six volt storage battery use the power cord with battery clips and insert its plug into the 10 prong socket. Fasten the clips on the positive and negative poles of the battery according to cable color. If it is necessary to extend the battery cable wire should be heavy enough to prevent a drop in voltage due to high current.

On 115 volts AC use the power cord with 115 volt electric plug and insert its 10 prong plug into the 10 prong socket.

MICROPHONE:

High impedance type of microphone, such as Dynamic, Velocity or Crystal may be connected directly to input microphone connectors. Shielded microphone cable is essential.

OUTPUT:

Speakers may be connected by means of plugs to the speaker sockets, or they can be connected directly to the speaker output terminal strip. Variable impedances for speaker matching are provided at the speaker output terminal strip and also at the 2 speaker sockets. The pigtail lead with spade lug varies the impedance at the speaker sockets by connecting the spade lug under the terminal on the strip which provides the nearest impedance desired. Both speaker sockets and terminal strip may be used simultaneously but the pigtail spade lug must be connected to a terminal on the strip in order to operate from the speaker sockets. Connecting the pigtail spade lug will not interfere with the use of the terminal strip for connecting speakers. When operating speakers on voice coil impedances (without transformers) use as heavy a wire as possible. Speaker cable runs of 100' or over should be at least #16 wire.

STANDBY SWITCH: - In order to reduce the drain on the storage battery a separate switch for the vibrator is provided. The tubes may thus be kept hot ready for instant use without using the vibrator until actually needed.

REMOTE CONTROL:

An 8 prong socket marked "Remote" is mounted on the right side of the amplifier. As the standard Bogen Remote Control provides for only two channel control and the amplifier contains three channels (input), a channel changeover strip is located on lower right hand side of the amplifier base. The wiring of the amplifier is arranged so that Control #1 of the Remote Control operates Microphone #1 channel and Control #2 of the Remote Control may be arranged to control Microphone #2 channel, or Phonograph channel. Inserting the spade lug of the pigtail lead under the terminal marked "2" makes control #2 of the Remote Control effective on Microphone #2 channel, and under Terminal #1 the Phonograph channel.

NOTES: - Noise or hum may be caused by faulty tubes. On 115 volts AC it may be cleared at times by reversing the plug in the electrical outlet. The system may be grounded at #1 of output.
There are three variations of the F30 which are identical except for the type phonograph used: they are the F30A (with a built-in automatic record changer); the F30M (with a single-speed rim drive motor); and the F30V (with a dual speed motor and speed regulator).

NOTE: Before placing the amplifier in operation make sure all tubes are firmly seated in their sockets. Plug into a 110-125 volts, 60 cycle line only. The power consumption is 180 watts (165 watts for the amplifier, and 15 watts for the turntable motor). If the amplifier fails to operate when the switch is turned ON, examine the fuse (2 amp rating).

INPUTS:

The unit is designed for 2 high impedance microphone inputs and one high impedance external phono or tuner input which is isolated from the internal phono input (so that for external phono operation the internal phono input needn't be disconnected).

OUTPUT CONNECTIONS:

Speakers may be connected by means of plugs to the speaker sockets, or they can be connected directly to the speaker output terminal strip. Variable impedances for speaker matching are provided at the speaker output terminal strip and also at the two speaker sockets. The pigtail lead with spade lug varies the impedance at the speaker sockets by connecting the spade lug under the terminal on the strip which provides the nearest impedance desired. Both speaker sockets and terminal strip may be used simultaneously but the pigtail spade lug must be connected to a terminal on the strip in order to operate from the speaker sockets. Connecting the pigtail spade lug will not interfere with the use of the terminal strip for connecting speakers.

When operating speakers on voice coil impedance (without transformers) use as heavy a wire as possible. Speaker cable runs of 100 feet or over, should be at least #16 wire.

HUM:

If the amplifier hums when first placed in operation, reverse the polarity of the line plug. Faulty tubes may also cause hum.

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5-19-47

6SL7  6SN7  807

INPUT 5MEG

AMPHENOL (N-P05)

FOR LOW IMPEDANCE INPUT
(T6 SHOWN CONNECTED FOR 500 OHMS)

SAFETY INTERLOCK SWITCH

POWER CONSUMPTION:
210 WATTS AT RATED OUTPUT

NOTE - ALL VOLTAGE READINGS TAKEN WITH A 20,000 OHMS PER VOLT VOLTOMETER WITH CONTROLS SET AT ZERO. ALL D.C. VOLTAGES MEASURED BETWEEN POINTS INDICATED AND GROUND.
POWER RATING:  - 117 Volts, 60 cycles, 210 watts.

TUBES USED:  - Total 6: 2-307, 1-6SL7, 1-6SN7, 1-5Y3GT, 1-5R4GY.

INPUT REQUIRED:
- High Impedance (500,000 ohms) 2.5 volts.
- Low Impedance (500 ohms) 0 db level, i.e. 1.73V. at 500 ohms.
(see schematic for low impedance input wiring).

CONNECTIONS:
- INPUT: - Input connections are made to the high (or low) impedance microphone type connector on the right rear of the chassis.
- OUTPUT: - Connections are made as described in the section marked G-50, GX-50, GO-50 OUTPUT CONNECTIONS.
- POWER: - The AC plug connects to a standard AC power receptacle.

BOOSTER DRIVE:

The GO-50 can be driven by connection to a tap in the Bogen G-50 and GX-50 amplifiers, as shown on the schematics of these equipments. In addition the GO-50 can be driven by any amplifier which can develop a 2.5 volt signal with a low hum level across a 500,000 ohm load.

The recommended circuit to be used for amplifiers with a 500 ohm output is shown in Fig. 1. The 500 ohm resistor should have sufficient rating to dissipate the full output of the amplifier. An equivalent loudspeaker load may be used in place of the 500 ohm resistor.

![Diagram](image)

Fig. 1

The ratio of $R_a$ to $R_b$ is calculated to give approximately 2.5 volts across $R_b$ when the driver amplifier is delivering about two-thirds of its rated output across the 500 ohm load. The values of $R_a$ and $R_b$ should be great enough so that at the full rated output voltage of the driver the power dissipated in $R_a$ or $R_b$ is not greater than 1/4 watt. Standard 1/2 watt resistors may then be used.

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Recommended values of Ra and Rb for use with standard Bogen amplifiers to drive the G0-50 are given in the following table:

<table>
<thead>
<tr>
<th>DRIVER</th>
<th>Ra</th>
<th>Rb</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10</td>
<td>22K</td>
<td>1K</td>
</tr>
<tr>
<td>E14</td>
<td>27K</td>
<td>1K</td>
</tr>
<tr>
<td>E30</td>
<td>68K</td>
<td>1.5K</td>
</tr>
<tr>
<td>EX35</td>
<td>82K</td>
<td>2.3K</td>
</tr>
</tbody>
</table>

Similar tables may be devised for other amplifiers and other output impedances. The following formulae may be used:

Formula A: \[ E = \frac{2}{3} \frac{P}{Z} \]
Where \( P \) = full rated output
\( Z \) = output impedance

Solve for \( E \)

Then, substituting the correct value for \( E \) in Formula B, the correct ratio of \( \frac{Ra}{Rb} \) may be determined.

Formula B: \[ \frac{Ra}{Rb} = \frac{E - 2.5}{2.5} \]

Example: Using a 18 watt amplifier with a 250 ohm output.

Substituting in Formula A:
\[ E = \frac{2}{3} \frac{18}{250} = \frac{2}{3} \times 18 \times 250 = 3000 \]
approx. 55

Substituting in Formula B:
\[ \frac{Ra}{Rb} = \frac{55 - 2.5}{2.5} = \frac{52.5}{2.5} = 21/1 \]

For a 1/4 watt maximum dissipation at full output voltage, Ra should be at least 18K ohms. Using standard RMA values, and maintaining approximately the calculated ratio, Ra = 22K ohms, Rb = 1K ohms.

RELAY OPERATION:

Remote relay control of the high voltage may be obtained by use of a Bogen R6 standby controller. Refer to the schematic diagram. For relay operation, remove the shorting plug from the Relay Socket, insert the R6 plug, and connect the remote switch leads to the terminals on the R6 box.
The Bogen Model G0-125 is a booster amplifier supplying 125 watts of undistorted audio power.

POWER RATING: 117 volts, 60 cycles, 400 watts

TUBES USED: Total 8 - 2-807, 3-6SN7, 1-6SL7, 1-5Y3, 1-5R4GY

INPUT REQUIRED: High impedance (100,000 ohms), 5 volts.
Low impedance (500 ohms), "0" level, i.e. 1.73v at 500 ohms (see schematic for low impedance input wiring).

CONNECTIONS:

INPUT: Input connections are made to the two terminal barrier strip at the right rear of the chassis.

OUTPUT: Three output terminals and a ground terminal are provided on a barrier strip at the left rear of the chassis. Constant voltage output taps of 140v and 70v are provided for normal speaker output connections. A third tap of 90 ohms impedance is also provided, for high power installations using multi-driver type loudspeakers.

Speakers may be connected in parallel to either of the constant voltage taps. Matching transformer impedances may be readily calculated by means of the following formula:

\[ Z = \frac{E^2}{P} \]

For the 140 volt tap

Required Impedance = \frac{20,000}{\text{Desired Power}} \text{ Example: To obtain a 2 watt output, } Z = \frac{20,000}{2} = 10,000 \text{ ohms} 

For the 70 volt tap

Required Impedance = \frac{5,000}{\text{Desired power}} \text{ Example: For a 2 watt output } Z = \frac{5,000}{2} = 2,500 \text{ ohms} 

SPEAKER INSTALLATION: To assure correct power distribution, it is essential that the correct line matching transformer be used in conjunction with each speaker. The recommended transformer and proper impedance tap for the most commonly used powers are tabulated below. The impedances listed are based on a nominal 8 ohm voice coil impedance. If a 15 ohm voice coil speaker is employed, use a transformer incorporating a tap marked at \( \frac{1}{3} \) the value shown on the table. For example, to obtain
SPEAKER INSTALLATION: 1 watt on a 70 volt line with an 8 ohm voice coil speaker, the table indicates use of a transformer tapped at 5,000 ohms. If a 15 ohm voice coil speaker is used, a tap marked 2,500 ohms should be employed.

<table>
<thead>
<tr>
<th>Required Power</th>
<th>For 70V Tap</th>
<th>Transformer</th>
<th>For 140V Tap</th>
<th>Transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ watt</td>
<td>10,000 ohms</td>
<td>T45C</td>
<td>10,000 ohms</td>
<td>T45C</td>
</tr>
<tr>
<td>1 &quot;</td>
<td>5,000 &quot;</td>
<td>T45C</td>
<td>4,000 &quot;</td>
<td>T25B</td>
</tr>
<tr>
<td>2 &quot;</td>
<td>2,500 &quot;</td>
<td>T25C</td>
<td>2,000 &quot;</td>
<td>T5B</td>
</tr>
<tr>
<td>5 &quot;</td>
<td>1,000 &quot;</td>
<td>T5B</td>
<td>1,000 &quot;</td>
<td>T5A</td>
</tr>
<tr>
<td>10 &quot;</td>
<td>500 &quot;</td>
<td>T5B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 &quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PARALLEL OPERATION: A number of boosters may be connected in parallel for an installation requiring more than 125 watts. Parallel the inputs of all the boosters by bridging across each pair of input terminals. The outputs are also paralleled by connecting all the ground or common terminals of each output strip together and either all the 70 or 140 volt terminals together, depending on whether a 70 or 140 volt line is desired. In computing the impedances of matching transformers when a number of boosters are connected in parallel, the impedance formula is the same as for single amplifiers.

RELAY OPERATION: Provision is made for optional remote relay control of high voltage. Reference to the schematic diagram will indicate that a 6 volt relay may be connected to the six volt filament winding and be operated by a remote SPST switch. Remove the shorting plug, disconnect the wire between plug terminals 4 and 5 and connect remote switch leads to plug terminals 2 and 3.

SERVICE: The 6SN7 connected across the screen supply of the 807 tubes acts as a regulator of the screen supply voltage to maintain proper screen voltage for correct plate dissipation of the output tubes under all signal conditions. The screen voltage supply is adjusted for optimum value under full signal conditions. Under zero and low signal conditions, the screen current decreases. The regulator tube plate current variation is opposite to that of the 807 screen current variation thus keeping the drain and therefore the voltage of the screen supply constant. Action of the 6SN7 tube is controlled by the changes in 807 control grid voltage resulting from changes in grid current with signal.

The Bogen Model G0125 booster amplifier can be driven by any amplifier which can develop a 5 volt signal with a low hum level, across a 100,000 ohm load.
The recommended circuit to be used for amplifiers with a 500 ohm output is shown in Fig. 1. The 500 ohm resistor should have sufficient rating to dissipate the full output of the amplifier. An equivalent loudspeaker load may be used in place of the 500 ohm resistor.

The ratio of $R_a$ to $R_b$ is calculated to give approximately 5 volts across $R_b$ when the driver amplifier is delivering about two-thirds of its rated output across the 500 ohm load. The values of $R_a$ and $R_b$ should be great enough so that at the full rated output voltage of the amplifier, the power dissipated in $R_a$ or $R_b$ is not greater than 1/4 watt. Standard 1/2 watt resistors may then be used.

Recommended values of $R_a$ and $R_b$ for use with standard Bogen amplifiers to drive the G0125 are given in the following table.

<table>
<thead>
<tr>
<th>DRIVER</th>
<th>$R_a$</th>
<th>$R_b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10</td>
<td>12K</td>
<td>1K</td>
</tr>
<tr>
<td>E14</td>
<td>15K</td>
<td>1K</td>
</tr>
<tr>
<td>E30</td>
<td>30K</td>
<td>1.5K</td>
</tr>
<tr>
<td>EX35</td>
<td>30K</td>
<td>1.5K</td>
</tr>
<tr>
<td>LL0 &amp; HLO</td>
<td>$R_a$ and $R_b$ built-in.</td>
<td></td>
</tr>
<tr>
<td>Any amplifier with RMA standard 70 volt</td>
<td>12K</td>
<td>1K</td>
</tr>
<tr>
<td>Output</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Similar tables may be devised for other amplifiers and other output impedances. The following formulae may be used.

Formula A: $E = \sqrt{\frac{2}{3}ZP}$

Where $P =$ full rated output

$Z =$ Output impedance

Solve for $E$

Then, substituting the correct value for $E$ in Formula B, the correct ratio of $R_a$ may be determined.

Formula B: $\frac{R_a}{R_b} = \frac{E - 5}{5}$

Example: To solve for $R_a$ and $R_b$, using a 15 watt amplifier with a 250 ohm output.

Substituting in Formula A: $E = \sqrt{\frac{2}{3} \times 250 \times 15} = \sqrt{2500} = 50$

Substituting in Formula B: $\frac{R_a}{R_b} = \frac{50 - 5}{5} = \frac{45}{5} = 9$

For optimum performance, it has been determined that $R_b$ should be between 1K and 3K ohms. Therefore, the value of $R_b$ would be between 9 and 27K. Use the nearest standard equivalent, maintaining approximately the calculated ratio.
POWER RATING: 117 Volts, 60 cycles, 200 watts.

TUBES: Total 11: 2-807, 4-6SC7, 1-6SJ7, 1-6SL7, 1-6SN7, 1-5Y3, 1-5R4GY

INPUTS: The amplifier is designed for three high impedance microphones inputs and one high impedance phonograph input. Input impedances are approximately 500,000 ohms. Low impedance microphone inputs may be provided by addition of tapped input transformers giving a choice of input impedances of 50, 200 or 500 ohms.

The Bogen amplifiers Models G-50, GX50 and G650 have their output connections terminated at strips marked OUTPUT. Standard speaker voice coil impedances of 4, 8 and 15 ohms are provided. In addition, two constant voltage taps of 70 and 140 volts, respectively, are provided. Speaker lines may be connected directly to the output strip, connections being made to Common, or #1 terminal, and to the taps required. These amplifiers are also provided with two built-in speaker sockets. Connections are made to these sockets by standard 5 prong connector plugs. The impedance or voltage at the sockets may be selected by connecting the lug on the flexible lead to the desired terminal on the output strip.

IMPEDANCE TAP:

For speaker line lengths of 25 to 30 feet, use the most convenient output tap, depending on number and type speakers used and power to be delivered to each speaker. For longer distances between amplifier and speakers, the following figures may be used as a guide. Using standard #18 speaker wire, the maximum lengths of line for use of the voice coil impedances are as follows:

4 ohms - 45 feet, 8 ohms - 90 feet, 15 ohms - 180 feet

These lengths of line give a loss of approximately 15% of the output power. For longer lines the constant voltage outputs should be used.

Correct speaker matching transformer taps, to give desired speaker power when connected to one of the constant voltage outputs, may be calculated by means of the formula:

\[ Z = \frac{E}{P} \]

For the 140 volt tap

Required Impedance = \( \frac{20,000}{\text{Desired power}} \)

Example: To obtain a 2 watt output

\[ Z = \frac{20,000}{2} = 10,000 \text{ ohms} \]

For the 70 volt tap

Required Impedance = \( \frac{5,000}{\text{Desired power}} \)

Example: To obtain a 5 watt output

\[ Z = \frac{5,000}{5} = 1,000 \text{ ohms} \]

The recommended Bogen transformer and proper impedance tap for commonly used speaker input powers are tabulated below.

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Impedances listed are based on a nominal 8 ohm voice coil impedance. If a 15 ohm voice coil speaker is employed, use a transformer incorporating a tap marked at 1/2 the value shown on the table. For example, to obtain 1 watt on a 70 volt line with an 8 ohm voice coil speaker, the table indicates use of a transformer tapped at 5,000 ohms. If a 15 ohm voice coil speaker is used, a tap marked 2,500 ohms should be employed. If a 4 ohm voice coil speaker is employed, use a transformer incorporating a tap marked at 2 times the value shown on the table. In the example above, the tap for a 4 ohm speaker will be 10,000 ohms.

<table>
<thead>
<tr>
<th>Nominal Power</th>
<th>For 70 V. Tap</th>
<th>Transformer</th>
<th>For 140 V. Tap</th>
<th>Transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 watt</td>
<td>10,000 ohms</td>
<td>T45C</td>
<td>10,000 ohms</td>
<td>T45C</td>
</tr>
<tr>
<td>1 watt</td>
<td>5,000 ohms</td>
<td>T45C</td>
<td>4,000 ohms</td>
<td>T25B</td>
</tr>
<tr>
<td>2 watts</td>
<td>2,500 ohms</td>
<td>T25C</td>
<td>2,000 ohms</td>
<td>T5B</td>
</tr>
<tr>
<td>5 watts</td>
<td>1,000 ohms</td>
<td>T5B</td>
<td>1,000 ohms</td>
<td>T5A</td>
</tr>
<tr>
<td>10 watts</td>
<td>500 ohms</td>
<td>T5B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 watts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ADDITIONAL POWER:**

For additional power, several Bogen Model G0-50 booster amplifiers may be driven by the G-50 or GX50. Input to the G0-50 is taken from a tap in the G-50, or GX-50, amplifier circuit as shown on the schematics. The outputs of the amplifiers are paralleled by connecting similar taps together. In computing output impedances available when paralleling similar voice coil impedances, divide the value of the impedance by the total number of paralleled amplifiers. If the constant voltage taps are paralleled the output voltages do not change, and the method of computing matching transformer input impedances is the same as given for a single amplifier.

**NOTE:**

The sum of the wattages drawn by all speakers connected to one G-50 or GX-50 shall not exceed 50 watts, the rated output of the amplifier. Either FM speakers or speakers having their own field supply should be used.
POWER RATING: - 117 volts, 60 cycles, 210 watts

TUBES: - Total 9: 1-5Y3GT, 1-5R4GY; 3-6SC7GT, 1-6SN7GT, 2-807

INPUTS:

The H50 is designed for two high impedance microphone inputs and one high impedance phonograph input. Input impedances are approximately 500,000 ohms. Where low impedance microphone circuits are needed the HL50 or H2L50 provide respectively one or two low impedance inputs of 50, 200 or 500 ohms.

CONTROLS:

Two microphone and one phonograph volume controls are provided for control of the different input channels. A tone control, a power switch and a pilot light are also provided.

INSTALLATION:

The output leads of the H50 amplifier terminate in two 5 prong sockets connected in parallel. Standard speaker voice coil impedances of 4 and 8 ohms are provided as well as two voltage taps of 70 and 140 volts. In addition, a 15 ohm tap is provided at the output transformer. Connections are made to these sockets by standard 5 prong connector plugs - either or both sockets may be used. The impedance or voltage at the plugs may be selected by wiring the output cable between the pin giving the desired output matching condition (see schematic) and pin 4 (ground). If a 15 ohm output is desired at the output plug it will be necessary to eliminate one of the other output impedances (or voltage taps) available at the plug. This can be accomplished by disconnecting the lead (giving the output condition to be eliminated) from the output transformer and reconnecting it to lug 2 (15 ohm output). As an example, if the 9 ohm output is to be eliminated, clip the lead connected to lug 4 of the output transformer and reconnect it to lug 2.

CAUTION: - SHUT THE POWER OFF BEFOREREWIRING.

IMPEdance TAP:

For speaker line lengths of 25 to 30 feet, use the most convenient output tap, depending on number and type speakers used and power to be delivered to each speaker. For longer distances between amplifier and speakers, the following figures may be used as a guide. Using standard #18 speaker wire, the maximum lengths of line for use of the voice coil impedances are as follows: 4 ohms - 45 feet, 8 ohms - 90 feet, 15 ohms - 180 feet.

These lengths of line give a loss of approximately 15% of the output power. For longer lines the voltage outputs should be used.
Correct speaker matching transformer taps, to give desired speaker power when connected to one of the voltage outputs, may be calculated by means of the formula:

\[ Z = \frac{E^2}{P} \]

For the 140 volt tap
Required Impedance = \( \frac{20,000}{\text{Desired Power}} \)
Example: To obtain a 2 watt output
\[ Z = \frac{20,000}{2} = 10,000 \text{ ohms} \]

For the 70 volt tap
Required Impedance = \( \frac{5,000}{\text{Desired Power}} \)
Example: To obtain a 5 watt output
\[ Z = \frac{5,000}{5} = 1,000 \text{ ohms} \]

The recommended BOGEN transformer and proper impedance tap for commonly used speaker input powers are tabulated below. Impedances listed are based on a nominal 8 ohm voice coil impedance. If a 15 ohm voice coil speaker is employed, use a transformer incorporating a tap marked at 1/2 the value shown on the table. For example, to obtain 1 watt on a 70 volt line with an 8 ohm voice coil speaker, the table indicates use of a transformer tapped at 5,000 ohms. If a 15 ohm voice coil speaker is used, a tap marked 2,500 ohms should be employed. If a 4 ohm voice coil speaker is employed, use a transformer incorporating a tap marked at 2 times the value shown on the table. In the example above, the tap for a 4 ohm speaker will be 10,000 ohms.

<table>
<thead>
<tr>
<th>Nominal Power</th>
<th>For 70 V. Tap Transformer</th>
<th>For 140 V. Tap Transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 watt</td>
<td>10,000 ohms T45C</td>
<td>10,000 ohms T45C</td>
</tr>
<tr>
<td>1 watt</td>
<td>5,000 ohms T45C</td>
<td>4,000 ohms T25B</td>
</tr>
<tr>
<td>2 watts</td>
<td>2,500 ohms T25C</td>
<td>2,000 ohms T5B</td>
</tr>
<tr>
<td>5 watts</td>
<td>1,000 ohms T5B</td>
<td>1,000 ohms T5A</td>
</tr>
<tr>
<td>10 watts</td>
<td>500 ohms T5B</td>
<td></td>
</tr>
<tr>
<td>20 watts</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: The sum of the wattages drawn by all speakers connected to one H50 shall not exceed 50 watts, the rated output of the amplifier. Either FM speakers or speakers having their own field supply should be used.

ADDITIONAL POWER:

For additional power, several Bogen Model H050 booster amplifiers may be driven by the H50. Input to the H050 is taken from a tap in the H50 amplifier circuit as shown on the schematic. The outputs of the amplifiers are paralleled by connecting similar taps together. In computing output impedances, divide the value of the impedance by the total number of parallel amplifiers. If the voltage taps are paralleled the output voltages do not change, and the method of computing matching transformer input impedances is the same as given for a single amplifier.
The Bogen Model HA system provides selective communication between a master control unit and any one or more of a number of remote stations, can function as a public address or page system, and can function as a program distribution system for radio and phonograph.

POWER RATING: 117 volts AC, 50-60 cycles; consumption of master unit 75 watts; remote stations - no power connection.

TUBES USED:
Total 4; 2-GSJ7; 1-6L6GA; 1-5Y3

SPEAKER INSTALLATION:
Speakers used with the Model HA system are provided with line matching transformers. The proper impedance to use for any desired power is indicated in the following table:

<table>
<thead>
<tr>
<th>POWER</th>
<th>IMPEDANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 watt</td>
<td>2000 ohm</td>
</tr>
<tr>
<td>1/2 &quot;</td>
<td>1500 &quot;</td>
</tr>
<tr>
<td>3/4 &quot;</td>
<td>1000 &quot;</td>
</tr>
<tr>
<td>1-1/2 &quot;</td>
<td>500 &quot;</td>
</tr>
<tr>
<td>3 &quot;</td>
<td>250 &quot;</td>
</tr>
<tr>
<td>6 &quot;</td>
<td>125 &quot;</td>
</tr>
<tr>
<td>10 &quot;</td>
<td>75 &quot;</td>
</tr>
<tr>
<td>Full Output</td>
<td>50 &quot;</td>
</tr>
</tbody>
</table>

NOTE: The sum of the power drawn by all speakers must not exceed the full output rating of the amplifier.
Total power output of the master unit is 15 watts.

PRIVACY:
Provision is made for converting this unit into a private system; i.e. a system wherein it is impossible for the control unit to eavesdrop on any remote station. To accomplish this, it is required that every remote unit be equipped with a break-in switch. In addition, the twisted orange leads on the under side of the chassis must be clipped and the ends taped to prevent them from touching other leads. These leads are shown as dotted lines at the upper left hand corner of the SCHEMATIC diagram. Under this condition of operation, calls can be initiated from any remote area to the master unit, however, the TALK-LISTEN switch (break-in switch) MUST be used at the remote area when communicating with the master station; i.e. it must be pressed down to talk and released to listen.
POWER RATING: 105-125 Volts A.C., 30 watts.

TUBES: Model HH: 4-6SJ7; 1-6S5P; 1-5W4.

Models HLO and LLO: 4-6SJ7; 1-6S5P; 1-6C5; 1-5W4.

The Model HH is a self-powered, four channel mixer and pre-amplifier. It will mix any four high impedance microphones into any high impedance input amplifier. Each input channel has its individual gain control. A master gain control is provided to adjust the level of the mixed program.

The Model HLO is the same as the Model HH except for the addition of the following features: A headphone jack (for monitoring), provision for zero level output terminating in multiple low impedance lines, which, unless otherwise specified, is connected for 500-ohm output, and a built-in DB meter on the control panel, used to indicate output level. The DB meter is calibrated for zero DB. The output impedance may be changed without changing the calibration of the meter.

The Model LLO is the same as the Model HLO except for the addition of low impedance input transformers. Unless otherwise specified, they will be connected for 200 ohm input.

Input and output transformers may be reconnected for other line impedances as follows:

50 ohms - connect to 2 and 5, join 2 to 3, and 4 to 5.
125 ohms - connect to 1 and 6, join 1 to 3, and 4 to 6.
200 ohms - connect to 2 and 5, join 3 to 4.
250 ohms - connect to 1 and 6, join 2 to 3.
333 ohms - connect to 1 and 5, join 3 to 4.
500 ohms - connect to 1 and 6, join 3 to 4.

CONNECTIONS: Shielded microphone connectors are located on the rear of the chassis and correspond in position to the controls on the front of the chassis. The connector at the extreme left rear of the chassis facing the rear is the output to the main amplifier. Shielded cable is required for both the microphone and output lines to prevent hum pickup.

If radio or phonograph is to be used instead of a microphone, the volume control on the radio or phonograph must be turned down so that its output is the same level as that of a microphone, in order to prevent overloading the input of the pre-amplifier.

The Model HH is designed to operate into the phonograph input of the main amplifier, and the Models HLO and LLO into a zero level line.

NOTE: In the Models HLO and LLO, which are equipped with level indicating meters, the needle should not exceed 0 DB if zero level is required for output to a line. This reading on the 500-ohm line indicates 0.006 watts or zero level.
POWER RATING: 117 volts, 60 cycles, 325 watts

TUBES USED: Total 8 - 2-807, 3-6SN7, 1-6SL7, 1-5Y3, 1-5R4GY

INPUT REQUIRED: High Impedance (100,000 ohms), 3 volts Low Impedance (500 ohms), "0" level, i.e. 1.75v at 500 ohms see schematic for low impedance input wiring.

CONNECTIONS:

INPUT: Input connections are made to the two terminal barrier strip at the right rear of the chassis.

OUTPUT: The output of the amplifier terminates in a standard 5 prong plug. "Constant voltage" output taps of 140v and 70v are provided for normal speaker output connections. A third tap of 90 ohms impedance is also provided for high power installations using multi-driver type loudspeakers. See schematic for correct pin connections. To connect the output cable to this socket use a standard 5 prong plug. Proper output matching is obtained by wiring the output cable between the pin giving the desired matching condition and pin 4 (ground).

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Speakers may be connected in parallel to either of the constant voltage taps. Matching transformer impedances may be readily calculated by means of the following formula: 

\[ Z = \frac{E^2}{P} \]

For the 140 volt tap
\[ \text{Required Impedance} = \frac{20,000}{\text{Desired Power}} \]

Example: To obtain a 2 watt output
\[ z = \frac{20,000}{2} = 10,000 \text{ ohms} \]

For the 70 volt tap
\[ \text{Required Impedance} = \frac{5,000}{\text{Desired Power}} \]

Example: For a 2 watt output
\[ z = \frac{5,000}{2} = 2,500 \text{ ohms} \]

**SPEAKER INSTALLATION:**

To assure correct power distribution, it is essential that the correct line matching transformer be used in conjunction with each speaker. The recommended BOGEN transformer and proper impedance tap for the most commonly used powers are tabulated below. The impedances listed are based on a nominal 8 ohm voice coil impedance. If a 15 ohm voice coil speaker is employed, use a transformer incorporating a tap marked at \( \frac{1}{2} \) the value shown on the table.

For example, to obtain 1 watt on a 70 volt line with an 8 ohm voice coil speaker, the table indicates use of a transformer tapped at 5,000 ohms. If a 15 ohm voice coil speaker is used, a tap marked 2,500 ohms should be employed.

<table>
<thead>
<tr>
<th>Required Power</th>
<th>For 70V Tap</th>
<th>Transformer</th>
<th>For 140V Tap</th>
<th>Transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8 watt</td>
<td>10,000 ohms</td>
<td>T45C</td>
<td>10,000 ohms</td>
<td>T45C</td>
</tr>
<tr>
<td>1 watt</td>
<td>5,000 &quot;</td>
<td>T45C</td>
<td>4,000 ohms</td>
<td>T25B</td>
</tr>
<tr>
<td>2 &quot;</td>
<td>2,500 &quot;</td>
<td>T25C</td>
<td>2,000 ohms</td>
<td>T5B</td>
</tr>
<tr>
<td>5 &quot;</td>
<td>1,000 &quot;</td>
<td>T5B</td>
<td>1,000 ohms</td>
<td>T5A</td>
</tr>
<tr>
<td>10 &quot;</td>
<td>500 &quot;</td>
<td>T5B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 &quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**INPUT:**

The Bogen Model H0125 booster amplifier can be driven by any amplifier which can develop a 5 volt signal with a low hum level, across a 100,000 ohm load.

The recommended circuit to be used for amplifiers with a 500 ohm output is shown in Fig. 1. The 500 ohm resistor should have sufficient rating to dissipate the full output of the amplifier. An equivalent loudspeaker load may be used in place of the 500 ohm resistor.
The ratio of $R_a$ to $R_b$ is calculated to give approximately 5 volts across $R_b$ when the driver amplifier is delivering about two-thirds of its rated output across the 500 ohm load. The values of $R_a$ and $R_b$ should be great enough so that at the full rated output voltage of the amplifier, the power dissipated in $R_a$ or $R_b$ is not greater than 1/4 watt. Standard 1/2 watt resistors may then be used.

Recommended values of $R_a$ and $R_b$ for use with standard Bogen amplifiers to drive the H0125 are given in the following table:

<table>
<thead>
<tr>
<th>DRIVER</th>
<th>$R_a$</th>
<th>$R_b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10</td>
<td>12K</td>
<td>1K</td>
</tr>
<tr>
<td>E14</td>
<td>15K</td>
<td>1K</td>
</tr>
<tr>
<td>E30</td>
<td>30K</td>
<td>1.5K</td>
</tr>
<tr>
<td>EX35</td>
<td>30K</td>
<td>1.5K</td>
</tr>
<tr>
<td>LLO &amp; HLQ</td>
<td>$R_a$ &amp; $R_b$ built-in</td>
<td></td>
</tr>
<tr>
<td>RMA standard 70 volt output</td>
<td>12K</td>
<td>1K</td>
</tr>
</tbody>
</table>

Similar tables may be devised for other amplifiers and other output impedances. The following formulae may be used:

Formula A: $E = \sqrt{\frac{2}{3}} \cdot 2P$

Where $P =$ full rated output  
$Z =$ Output impedance

Solve for $E$

Then, substituting the correct value for $E$ in Formula B, the correct ratio of $R_a$ may be determined.

$\frac{R_a}{R_b} = \frac{E-5}{5}$

Example: To solve for $R_a$ and $R_b$, using a 15 watt amplifier with a 250 ohm output.

Substituting in Formula A:

$E = \sqrt{\frac{2}{3}} \cdot 2P = \sqrt{\frac{2}{3}} \cdot 250 \cdot 15 = \sqrt{2500} = 50$

Substituting in Formula B:

$\frac{R_a}{R_b} = \frac{50 - 5}{5} = \frac{45}{5} = \frac{9}{1}$
For optimum performance, it has been determined that $R_b$ should be between 1K and 3K ohms. Therefore, the value of $R_b$ would be between 9 and 27K. Use the nearest standard equivalent, maintaining approximately the calculated ratio.

PARALLEL OPERATION:

A number of boosters may be connected in parallel for an installation requiring more than 125 watts. Parallel the inputs of all the boosters by bridging across each pair of input terminals. The outputs are also paralleled by connecting all the ground or common terminals of each output strip together and either all the 70 or 140 volt terminals together, depending on whether a 70 or 140 volt line is desired. In computing the impedances of matching transformers when a number of boosters are connected in parallel, the impedance formula is the same as for single amplifiers.

RELAY OPERATION:

Provision is made for optional remote relay control of high voltage (see schematic). To make use of this operation remove the cage from the chassis. An 8 prong socket is mounted on the top side of the chassis with a matched shorting plug normally inserted. Remove this plug and insert the 8 prong plug, mounted on the standby box, into the socket. NOTE: Be careful of the aligning element on the plug and socket - there is only one correct mounting position. The box is held securely to the chassis by screwing the two self tapping screws (supplied) through the brackets on the box into the two holes provided on the chassis. Run control leads from the terminal box through the back of the chassis to any desired point. Be sure when replacing the cage that these leads run through the notch in the cage provided for them. By shorting these leads, by means of a control switch, the amplifier is placed in a ready-to-operate condition. With the leads unconnected (switch open) the amplifier is in a standby condition; i.e. the filaments are heated but plate voltage is removed, thereby reducing the standby power consumption.

SERVICE:

The 6SN7 connected across the screen supply of the 807 tubes acts as a regulator of the screen supply voltage to maintain proper screen voltage for correct plate dissipation of the output tubes under all signal conditions. Under zero and low signal conditions, the screen current decreases. The regulator tube plate current variation is opposite to that of the 807 screen current variation thus keeping the drain and therefore the voltage of the screen supply constant. Action of the 6SN7 tube is controlled by the changes in 807 control grid voltage resulting from changes in grid current with signal.
The Bogen Model JR112 recorder is designed to operate on alternating current only (110-120 volts, 60 cycles). Before inserting the plug which is supplied with each recorder into the wall socket, make sure that the current supply is not D.C. (Direct Current).

The amplifier is turned "on" or "off" by means of the toggle switch located on the amplifier panel on the sloping front of the case. When the switch is turned "on" the meter face will become illuminated and after a few minutes the tubes in the amplifier will be sufficiently warmed up to operate.

The amplifier switch does not actuate the turntable motor. To turn the motor "on" lift the knob located on the left of the turntable and turn it to the right to its stop, then push the knob down to lock it in place. This action performs two functions: first, it turns the motor switch "on"; second, it engages the idler wheel with turntable and motor shaft. To turn "off" the motor, lift the knob and turn it to the left to its stop, then push down to lock.

It is very important that this knob be in the "off" position when recorder is not in use. Failure to abide by this suggestion will cause the rubber idler to remain in contact with the motor shaft, thus developing a "flat" spot which, in turn, will cause noisy operation of the recorder or variation of speed.

The Model JR112 Recorder is designed to operate as a:-

a. Public Address System
b. Recorder
c. Phonograph

GENERAL:-

To lift motor board assembly, first remove the turntable by spinning it counter clockwise. The turntable will then lift easily from its bearing.

Unscrew the four large screws at the edge of the motor board and with the aid of the two fingers inserted in the ventilation holes, lift the board assembly.

All working parts and tubes are thus accessible.

Do not tamper with the adjustments. Use oil occasionally, but sparingly.

To remove amplifier unscrew front sloping panel from case and remove two screws holding chassis to bottom of case.

When replacing the motor board assembly into the case, make sure that the locating screw projecting from the center and at the bottom of the motor, slides into the rubber shock absorber located at the bottom of the case. Failure to do so will seriously injure the motor mountings if the recorder is transported from one place to another.
The "C" type DeLuxe Bogen Communophone series is available in 4 models: MC307, providing selective communication between seven master stations; MC313, for thirteen master stations; MC319 for 19 master stations and MC325 for twenty-five master stations.

POWER RATING: - 117 Volts, 60 cycles A.C.
Power Consumption: - 45 watts.

TUBES USED: - Total 3: 1-7F7; 1-7G5; 1-7Z4.

OUTPUT: - - 3 watts.

CONNECTIONS: - All wiring in this system should be done with two conductor, twisted, UNSHIELDED cable. The mast cable consists of a number of twisted pairs (MC307 has 7 pairs, MC313 has 13 pairs, etc.). Reference to the cable color code table will show color coding employed.

<table>
<thead>
<tr>
<th>No.</th>
<th>Colors</th>
<th>No.</th>
<th>Colors</th>
<th>No.</th>
<th>Colors</th>
<th>No.</th>
<th>Colors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Red</td>
<td>7</td>
<td>Yellow - Red</td>
<td>13</td>
<td>Green - White</td>
<td>19</td>
<td>Yellow - Red</td>
</tr>
<tr>
<td></td>
<td>Black</td>
<td></td>
<td>Maroon</td>
<td></td>
<td>Yellow</td>
<td></td>
<td>Maroon</td>
</tr>
<tr>
<td>2</td>
<td>Green - White</td>
<td>8</td>
<td>Orange - Red</td>
<td>14</td>
<td>Orange - White</td>
<td>20</td>
<td>Orange - Red</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td></td>
<td>Orange</td>
<td></td>
<td>Blue</td>
<td></td>
<td>Orange</td>
</tr>
<tr>
<td>3</td>
<td>Orange - White</td>
<td>9</td>
<td>Yellow - Brown</td>
<td>15</td>
<td>Brown - White</td>
<td>21</td>
<td>Yellow - Brown</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td></td>
<td>Blue - Red</td>
<td></td>
<td>Grey</td>
<td></td>
<td>Blue - Red</td>
</tr>
<tr>
<td>4</td>
<td>Brown - White</td>
<td>10</td>
<td>Blue - White</td>
<td>16</td>
<td>Red - Black</td>
<td>22</td>
<td>Blue - White</td>
</tr>
<tr>
<td></td>
<td>Grey</td>
<td></td>
<td>Blue</td>
<td></td>
<td>Green</td>
<td></td>
<td>Black</td>
</tr>
<tr>
<td>5</td>
<td>Red - Black</td>
<td>11</td>
<td>Blue - Orange</td>
<td>17</td>
<td>Red - White</td>
<td>23</td>
<td>Blue - Orange</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td></td>
<td>Green - Yellow</td>
<td></td>
<td>Brown</td>
<td></td>
<td>Green - Yellow</td>
</tr>
<tr>
<td>6</td>
<td>Red - White</td>
<td>12</td>
<td>Black - White</td>
<td>18</td>
<td>Black - Yellow</td>
<td>24</td>
<td>Black - White</td>
</tr>
<tr>
<td></td>
<td>Brown</td>
<td></td>
<td>Green</td>
<td></td>
<td>Green</td>
<td></td>
<td>Green</td>
</tr>
</tbody>
</table>

MC307

MC313

MC319

MC325

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MODEL MS Deluxe
Communophone

Bottom View of Chassis

Front

"ON" Bus
Cut pair according to Installation Notes.

Rear

Note: Cut bus on both rows of lug terminals.

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The "S" type Deluxe Bogen Communophone series is available in 4 master models: MS307, providing push-buttons to call any combination of master and remote stations, totaling 6; MS313 for a total of 12; MS319 for a total of 18; MS325 for a total of 24.

POWER RATING: 117 volts, 60 cycles A.C. power consumption, 45 Watts - Remote units use no power.

TUBES USED: Total 3: - 1-7F7; 1-7C5; 1-7Z4.

OUTPUT: 3 Watts.

CONNECTIONS:

All wiring in this system must be done with two conductor, twisted UNSHIELDED cable. The master cable consists of a number of twisted pairs (MS307 has 7 pairs; MS313 has 13 pairs, etc.).

IMPORTANT INSTALLATION NOTE:

In installing the system, the master stations must be inter-wired to the lowest number switch positions. For example, if there are 5 masters, each master will have the other four masters wired to its number, 1, 2, 3 and 4 positions.

To prevent interference between stations, after the system is completely installed, the "ON BUS" must be cut to separate the Master portion of the "ON-BUS" from the Remote portion of the "ON BUS".

The "ON BUS" consists of two bare wires connecting together all contacts of the upper and lower wafers of the push-button selector switch. The bus is located on the underside of the chassis as shown in the drawing.

Both wires should be cut between the last switch position used for a master and the first position used for a remote. In the example above, they should be cut between the fourth and fifth contacts.

If there is only one master in the system, it is not necessary to cut any wires. If master stations only are being used, the bus should be cut after the last position employed.
SPECIFICATIONS

GAIN: 120 db. at 400 cycles.
INPUT IMPEDANCE: 500 C.T.; 200 C.T., or 50 ohms.
OUTPUT IMPEDANCE: 500 ohms C.T.
OUTPUT RATING: 15 watts at 2\% total harmonic
distortion. 20 watts at 4\% total harmonic distortion.
TUBES: 2-6K5G; 1-6G5G; 1-6F6G; 2-5B4G;
1-5X4G; 1-5Y4G.
POWER CONSUMPTION: 150 watts.
VOLTAGE: 105-125 Volts, 50/60 cycles
DIMENSIONS: 15"L x 9"D x 8"H.
SHIPPING WEIGHT: 35 Lbs.
FINISH: Cadmium plated chassis.

The power output section is provided with facilities for
connecting from one to three additional model P015 power amplifiers
similar in design to the power section embodied in the PA-15
amplifier.

THE EQUALIZING OR COMPENSATING CIRCUIT is inserted in the final
stage of the voltage amplifier section and consists of specially
designed non-resonant circuits. This compensating network has
been arranged to give five positions of frequency equalization as
follows: Two steps of attenuation at 30 cycles of 10 db. per
step and two steps of attenuation at 10,000 cycles of 15 db. per
step. This attenuation curve does not affect the response at
400 cycles in any of the four positions and will give a gradual
attenuation both sides of this point to the selected equalization.

THE POWER OUTPUT amplifier section of this unit contains the
power supply for all filament, bias and plate voltages of both
the voltage and power amplifiers. Provisions have been made in
this section for supplying filament and plate voltages, when
required, through a receptacle on the rear of the chassis.

THE INPUT to the power amplifier is connected to a receptacle
located on the rear of the chassis for paralleling one to three
additional model P015 power amplifiers when increased power output
is desired. This input circuit is connected to a driver stage
of amplification transformer coupled to a push-pull stage of
amplification which employs two triode power tubes operating at
fixed bias.

The care in design of circuit components and layout of the
PA-15 amplifier results in an output having a flat frequency
response, but of more importance an output in which all of the
harmonics arithmetically added result in a distortion factor
not greater than 2.5\% under any load condition up to the rated
output.

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CONNECTIONS: A shielded input cable fitted with lock type connector at one end should be used between control box and amplifier. Connect microphone plug of this input cable to #1 microphone connector on amplifier and other end of input cable to input strip of control box. See diagram. Connect shield of input cable to correct terminal on control box. Connect terminals 1 and 6 of amplifier to output terminal strips of control box. #1 terminal of amplifier connects to bottom terminal on control box and #6 to top terminal. Connect each speaker to terminals on control box as shown—speaker #1 to terminals #1, speaker #2 to terminals #2, etc. Ground side of speaker is bottom terminal. Shielded wire must be used for all speakers. Single wire shielded is satisfactory in which case shield is ground. If two wire shielded is used, the shield and ground wire must be tied together.

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The Bogen Model PH10 is a 10 watt amplifier for radio and phonograph reproduction. It is provided with a special multi-range tone control switch. Four tone control positions are provided, corresponding to four different frequency response curves for different types of operation.

**POWER RATING:** 117 V - 60 Cycles: Power consumption - 60 Watts

**TUBES:** Total 4:2-6V6, 1-6SL7, 1-5Y3.

**CONNECTIONS:**

Input: The amplifier has a high impedance input. Connection is made from the radio output or phonograph pickup to the INPUT terminal by a single shielded wire using the single prong connector provided. For full output of the amplifier the input device must be capable of delivering approximately one volt across 500,000 ohms. Most crystal pickups, high output type magnetic pickups and most radio tuners can provide this voltage.

Output: Two voice coil output impedances, of 3.2 ohms and 8 ohms, respectively, are provided. Connections are made from COM and the proper impedance tap directly to the speaker voice coil. Either FM speakers or speakers having their own field supply should be used. An A.C. power receptacle is provided for power supply to the accompanying radio or phono turntable.

**TONE CONTROL:**

Position 1 provides an accentuated bass response with a lowered treble response. It is best for phonographic reproduction of popular type recordings and is designed to accentuate the orchestral rhythm effects. Position 2 provides the same bass response as in position 1, but the treble response does not drop off as fast. This type response is best for phonographic reproduction of symphonic and other classical type recordings. Position 3 provides a level response of the bass and mellow ranges and a gradually decreasing response in the treble range. This response is good for reproduction of standard AM broadcast programs. Position 4 provides equal response at all frequencies and is ideal for reproduction of FM broadcast programs.
There are 2 basic kits as follows:

Kit PK-1 consists of a PH10 Amplifier, reproducer combination (a 12" speaker and a tweeter with cross-over network), and an automatic record changer with (built-in switch to automatically disconnect the phonograph during the change cycle).

Kit PK-2 is the same as the PK-1 except that a PH10C amplifier is substituted for the PH10: (the PH10C is identical to the PH10 except that the controls are brought out on extended leads for external mounting).

INTERCONNECTION OF UNITS:

The reproducer unit, which is common to both kits is connected to the output of the PH10 or PH10C amplifier. The reproducer unit terminates in a three conductor cable which is connected to the output strip of the amplifier. (See interconnection diagram). This strip is marked "COM-3.2-8" to which are connected respectively the blue, white and red leads of the reproducer cable.

The output of the automatic record changer is connected to the input of the amplifier by plugging the single conductor shielded lead (terminated in a single prong plug) into the corresponding input receptacle on the amplifier. Phonograph turntable power is obtained by plugging the power cord into the power receptacle on the amplifier (which, in turn, has its power cord plugged into any convenient 117V, 60 cycle outlet).

RECORD CHANGER: Webster Model 148
The Model PM4-AC-2 is identical to the PM4-AC except that there is no longer provision for voltage type velotron microphone.

The Model PM4-AC-2 is a four position Mixer and Pre-amplifier, self powered. It can be attached to the input of any amplifier so that any combination up to four high impedance microphones, phonographs or a radio may be blended by the operator.

**Power Rating:** 105-125 volts A.C., Consumption 35 watts.

**Tubes Used:** Total 5: 4-6P5G; 1-25Z6, Balast type BK-67-B.

**Connections:** Shielded microphone receptacles are available on the chassis to connect any high impedance microphone such as velotron (no voltage, velocity dynamic or crystal). A shielded wire cable is necessary for each of the 4 circuits to minimize hum. The female cable connectors supplied with each of the 4 input connectors should be fitted to the cables from microphones or other source of sound by the following method.

1. Skin off about 1 inch of outer rubber covering, exposing shielding.
2. Cut shielding back so that only 3/8 inch is exposed.
3. Clinch sheet metal sleeve around shielding and trim off any whiskers, clinch small ends around inner rubber insulation only.
4. Remove inner rubber insulation from wire, within 1/8 inch of metal sleeve.
5. Tin wire with solder and cut to about 1/8 inch.
6. Slip cable through connector body and solder wire into hollow end of center contact.
7. Draw cable back into connector body. Force bakelite washer into recessed seat. Tighten set screw into metal sleeve.
8. Never use soldering paste on any microphone connection. Use Rosin core solder.

The Input circuits are all of high impedance and are, therefore, suitable for high impedance microphones, phono-pick-ups, etc. If a low impedance device is used, it is necessary to use a matching transformer, designed for use with that device and having a high impedance secondary (to tube grid). This transformer should be kept one or two feet away from all power transformers to prevent hum pick-up. The strength of signal from radios and phonographs should be kept down by their own volume control so as to prevent overloading the tubes in the pre-amplifier.

**Output:** The output circuit of this pre-amplifier is of high impedance and therefore matches the input to other Bogen amplifiers. A shielded cable is necessary in connecting to the input of the power amplifier. It should be kept short to reduce the chance of picking up noise and loss of high tones. A shielded output connector is on the left end of the chassis. Because of the "Gain" obtained in this pre-amplifier it is generally advisable to connect it to the "phono input" terminals of the power amplifier rather than to the "microphone input" terminals.

**NOTES:** The PM4-AC-2 or any associated amplifier or device should not be grounded excepting through a paper condenser of not over .25 mfd. Hum may be caused by faulty tubes or by a ground. In some locations hum may be reduced by reversing the 110 volt power plug in the electrical outlet.

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The Model SLX is a Volume Expander unit, self-powered, for use with any public address system or amplifier. It restores the full dynamic range of volume an originally played at the radio or recording studio.

POWER RATING: - 117 volts AC, power consumption 28 watts.

TUBES: - Total 3: 1-C6A7; 1-6C3G; 1-5W4.

CONNECTIONS:

Input: The phono pickup is connected to the terminals on the left side of the Volume Expander. "GND" or "1" is for the grounded or shielded side, "M" or "2" is for the live wire of a magnetic pickup. "L.C." or "3" is for the live wire of a low output crystal pickup. "H.C." or "4" is for the live wire of a high output crystal pickup. If a low impedance pickup is to be used, a matching transformer should be connected between the phono-head and the input terminals.

Output: The two output terminals on the right side of the Volume Expander should be connected to the "Phono-Input" terminal of the amplifier. Using a shielded wire, connect #1 on the Expander to the grounded input terminal on the amplifier by means of the shield itself. Then connect the wire from #2 on the Expander to the live or grid terminal on the phonograph input on the amplifier.

Plug the power cord into a 117 volt AC output and turn on the switch mounted on the front panel. If there is a noticeable hum, remove the power plug, rotate it one-half turn to reverse the polarity and re-insert it in the power outlet.

Volume Expansion: - The knob marked "Expansion" controls the amount of expansion. It is not a volume control. Zero on the dial indicates normal reproduction and as the knob is turned towards 10, expansion is increased.

To Set Expander: - Set the expander control to zero. Turn up the amplifier volume control to a point near the desired volume. On a loud passage of the record, turn the expansion control to the right until the volume level of these passages reach the desired expanded point. Now regulate amplifier volume control to obtain the overall volume required. The expander does not affect the softer portions of the record but only increases the volume of loud passages. With the expander in operation, needle scratch will be reduced, as the expanded loud passages will now constitute loudest listening volume and the soft passages will consequently be lower.

The Volume Expander may be used with a radio or tuner. Connect voice coil or detector output leads to the "Phono Input" lugs, varying the live lead between Terminals "M" or "2", "L.C." or "3", and "H.C." or "4", for best results.

To use the Volume Expander with a complete radio, break the grid lead in the first audio stage and connect the grid lead to the input terminals according to best results. Connect the grid of the audio tube to #2 on the output strip. Use shielded wire, connecting the shield to "GND" or "1" of Expander input #1 of expander output, and to radio chassis. Operate as outlined above.

The Volume Expander should be used only for music. Set the Expander control to zero to cut out all expansion.

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The Bogen Model PV-10 is a 10 watt phonograph amplifier. It is provided with a Volume Expander which restores the full dynamic range of volume as originally played at the recording studio.

**POWER RATING:** 117 volts, AC, 60 cycles, power consumption 75 Watts.

**TUBES:**
Total 6; 2-6SL7, 1-6SA7, 2-6V6G, 1-5Y4G.

**CONNECTIONS:**

**Input:** The pickup is connected to the terminals marked "PHONO INPUT" on the rear of the chassis. "GND" is for the grounded or shield side of the pickup. Connect the live wire of a magnetic pickup to "M". Crystal pickups may be connected to either "LC" (Low Output Crystal) or HC (High Output Crystal). A radio tuner may be connected to the Model PV-10. The radio output can be taken from the detector output or voice coil leads. Connect the radio ground to the terminal marked "GND". If both radio and phonograph are to be used, connect a single pole double throw switch to the amplifier to select between radio and phonograph.

**Output:** The amplifier output is terminated in various impedances on the strip marked "Output". Either PM speakers or speakers having their own field supply should be used. Plug the power cord into a 117 volt AC outlet and lift power switch up to the "ON" position. If there is a noticeable hum, remove the power plug, rotate it one-half turn to reverse the polarity and re-insert it in the power outlet.

**TONE CONTROL:** is adjusted to obtain the most satisfactory quality and pitch.

**VOLUME EXPANSION:**

The knob marked "Expansion" controls the amount of expansion. IT IS NOT A VOLUME CONTROL. Zero on the dial indicates normal reproduction, and as the knob is turned towards 10, expansion is increased.

**TO SET EXPANDER:**

Set the expander control to zero. Turn up the amplifier volume control to a point near the desired volume. On a loud passage of the record, turn the expansion control to the right until the volume level of this passage reaches the desired expanded point. Now regulate amplifier volume control to obtain the overall volume required. The expander does not affect the softer portions of the record, but only increases the volume of loud passages. With the expander in operation, needle scratch will be reduced, as the expanded loud passages will now constitute loudest listening volume and the soft passages will consequently be lower.

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DAVID BOGEN CO., INC. MODELS PV-15, PV-15M

NOTES - ALL CAPACITANCE VALUES IN MFD.
ALL VOLTAGE READINGS ARE VAC.
WITH CONTROLS SET AT ZERO.

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The Bogen Model PV15 is a 15 watt phonograph amplifier. The distortion is under 2% for its 15 watts rated output, with a peak output of 25 watts. It is provided with separate Bass and Treble controls and input facilities for any type of phonograph pickup. A Volume Expander is incorporated which restores the full dynamic range of volume as originally plated at the recording studio.

POWER RATING: - 117 Volts AC, 60 cycles; Power Consumption: 130 watts.

TUBES: - Total 9: 2-6SJ7; 1-6SK7; 2-6SL7GT; 1-6SF5; 2-6L6G; 1-5Y3G.

CONNECTIONS: Input:

The pickup is connected to the terminals marked "Phono Input" on the rear of the chassis. "GND" is for the ground or shield side of the pickup. Connect the live wire of a magnetic pickup to "M". Crystal pickups may be connected to either "LC" (Low Output Crystal) or "HC" (High Output Crystal). If in doubt as to type of crystal pickup used, try both terminals for best results. Additional input receptacles are provided for low output pickups such as the GE variable reluctance (REL) and for the dynamic type cartridge made by American Microphone Co. (DYN) in conjunction with the matching transformer supplied with it. The DYN input terminal is also used for connection of the Pickering Model 120M cartridge. A radio tuner may be connected to the Model PV15. The radio output can be taken from the detector output or voice coil leads. Connect the radio ground to the terminal marked "GND". Connect the live lead to the HC terminal. If both radio and phonograph are to be used, connect a single pole double throw switch to the amplifier to select between radio and phonograph.

OUTPUT:

The amplifier output is terminated in various impedances on the strip marked "Output". Either FM speakers or speakers having their own field supply should be used. Plug the power cord into a 117 volt AC outlet and lift power switch up to the "ON" position. If there is a noticeable hum, reverse the polarity of the power plug.

VOLUME EXPANSION:

The knob marked "Expansion" controls the amount of expansion. It is not a volume control. Zero on the dial indicates normal reproduction and as the knob is turned towards 100, expansion is increased.

TO SET EXPANDER:

Set the expander control to zero. Turn up the amplifier volume control to a point near the desired volume. On a loud passage of the record, turn the expander control to the right until the volume level of this passage reaches the desired expanded point. Now regulate the amplifier volume control to obtain the overall volume required. The expander does not affect the softer portions of the record but only increases the volume of the loud passages. With the expander in operation, needle scratch will be reduced, as the expanded loud passages will not constitute the loudest listening volume and the soft passages will consequently be lower.

PV15M:

The model PV15M incorporates a separate input for microphone use. The volume for this channel is controlled independently by the control marked "MIC". TUBES: Add 1 - 6SJ7 to above.
The Bogen Model PV20A is a 20 watt phonograph amplifier. Rated output of 20 watts is attained with less than 2% distortion. Peak output is 30 watts. Separate Bass and Treble controls, constituting a Triple Range Electronic Tone Corrector, are provided. A volume expander is incorporated which restores the full dynamic range of volume as originally played at the recording studio. A 70 volt constant voltage output tap is provided for ease in selecting speaker matching transformers.

POWER RATING: - 117 volts, AC, 60 cycles, 120 watts.
TUBES: - Total 8: 2-77F7, 2-6L6G, 1-6S7J7, 1-6SN7, 1-6SA7, 1-5U4G.

CONNECTIONS: Input: The pickup is connected to the terminals marked "Phono Input" on the rear of the chassis. "GND" is for the grounded or shield side of the pickup. Connect the live wire of a magnetic pickup to "M". Crystal pickups may be connected to either "Lc" (Low Output Crystal) or "Hc" (High Output Crystal). If in doubt as to type of crystal pickup used, try both terminals for best results. A radio tuner may be connected to the Model PV20A. The radio output can be taken from the detector output or voice coil leads. Connect the radio ground to the terminal marked "GND". Connect the live lead to the terminal which gives best results. If both radio and phonograph are to be used, connect a single pole double throw switch to the amplifier to select between radio and phonograph.

OUTPUT: - The amplifier output is terminated at a strip marked OUTPUT, in standard output impedances of 4, 8, 15 and 500 ohms. In addition, a 70 volt constant voltage tap is provided. Speakers may also be connected to the two built-in speaker sockets. The impedance, or voltage at the sockets may be selected by connecting the lug on the flexible lead to the desired terminal on the output strip. Speaker lines may also be connected directly to the output strip. Connect the lines to common, or terminal #1, and to the tap required. Speakers may be readily connected in parallel to the constant voltage tap, calculating the matching transformer impedances by means of the following formula:

\[
Z = \frac{E_2}{P}
\]

Required Impedance = \frac{5000}{\text{Desired Power}}

Example: For a 2 watt output,

\[
Z = \frac{5000}{2} = 2,500 \text{ ohms.}
\]

SPEAKER INSTALLATION: - To assure correct power distribution, it is essential that the correct line matching transformer be used in conjunction with each speaker. The recommended Bogen transformer and proper impedance tap for the most commonly used powers are tabulated below. The impedances listed are based on a nominal 8 ohm voice coil impedance. If a 15 ohm voice coil speaker is employed, use a transformer incorporating a tap marked at 1/2 the value shown on the table. For example, to obtain 1 watt on a 70 volt line with an 8 ohm voice coil speaker, the table indicates use of a transformer tapped at 5000 ohms. If a 15 ohm voice coil speaker is used, a tap marked 2,500 ohms should be employed.

<table>
<thead>
<tr>
<th>Wattage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>T45C</td>
</tr>
<tr>
<td>T25C</td>
</tr>
<tr>
<td>T5B</td>
</tr>
</tbody>
</table>

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NOTE: - The sum of the wattages drawn by all speakers must not exceed 20 watts, the rated output of the amplifier.

Either PM speakers or speakers having their own field supply should be used. Plug the power cord into a 117 volt AC outlet and lift power switch up to the ON position. If there is a noticeable hum, remove the power plug, rotate it one-half turn to reverse the polarity and re-insert it into the power outlet. When operating speakers on voice coil impedance (without transformers) use as heavy a wire as possible. Speaker cable runs of 100 feet or over should be at least #16 wire.

VOLUME EXPANSION: - The knob marked "EXPANSION" controls the amount of expansion. It is not a volume control. Zero on the dial indicates normal reproduction and as the knob is turned towards 100, expansion is increased.

EXPANDER CIRCUIT: - The expander circuit consists of a 6SA7 control tube, a 7F7 expander amplifier and rectifier tube, with associated components. Simplified, the action of the expander is as follows:

Output of the first triode section of the 7F7 input tube is applied to the grid of the second triode through a voltage divider network. The upper leg of the divider is a fixed .22 megohm resistor. The other leg consists of the expander circuit proper. This leg can act as a constant or variable resistor, depending on the position of the EXPANSION control. With this control in the 0 or extreme counter clockwise position, the expander is off, the lower leg of the divider is fixed, and a fixed percentage of the signal is fed to the second triode grid. With the EXPANSION control on, the lower leg of the voltage divider varies, increasing in value as the signal increases, decreasing in value as the signal decreases, with a resultant increase or decrease of the percentage of the signal fed to the second grid. Rotation of the control in a clockwise direction - contact moves away from the ground end of the expansion control - increases the amount of expansion for a given increase in signal.
DESIGNED TO PROVIDE MULTI-BAND RECEPTION WITH ANY BOGEN SOUND OR SCHOOL SYSTEM

SPECIFICATIONS

Input Voltage: 117 Volts  Power Consumption: 40 W.

Range:
- Broadcast Band: 550 to 1700 K.C.
- Intermediate Band: 1.5 to 5.5 M.C.
- Short Wave Band: 5.5 M.C. to 18.5 M.C.

Tubes Used:
- 7H7 - R.F. Amplifying stage (pentode)
- 7Q7 - Converter Stage (pentagrid converter)
- 7H7 - I.F. Amplifying stage (pentode)
- 7A6 - Second Detector and A.V.C. (twin diode)
- 5Y4 - Rectifier (full wave, high vacuum)
- 6U5 - Tuning Indicator (Electron ray triode)

The output matches a 200 Ohm microphone line or High impedance phonograph line.

ALIGNING INSTRUCTIONS

1. I.F. Alignment
   a. Connect the test oscillator output to center section of variable condenser.
   b. Tune oscillator to 456 K.C. and adjust its output so that the tuning indicator tube is half closed.
   c. Adjust the I.F. trimmers for the narrowest shadow in the tuning eye, readjusting the oscillator output as necessary.

2. Broadcast Band
   a. Connect the test oscillator to the antenna terminal of the tuner and set both to 550 K.C.
   b. Set the tuner bandswitch to "Broadcast" and adjust the broadcast padder for the narrowest shadow in the tuning eye.
   c. Set both the oscillator and tuner to 1600 K.C. and adjust the broadcast oscillator trimmer, R.F. trimmer and antenna trimmer for narrowest shadow.
   d. Re-check the 550 K.C. Calibration.

3. Intermediate Band
   a. Connect the test oscillator to the antenna terminal of the tuner and set both the oscillator and tuner to 1.6 M.C.
   b. Set the tuner bandswitch to "Intermediate" and adjust the intermediate padder for the narrowest shadow in the tuning eye.
   c. Set both the oscillator and tuner to 3.4 M.C. and adjust the intermediate oscillator trimmer, R.F. trimmer and antenna trimmer for narrowest shadow.
   d. Re-check the 1.6 K.C. calibration

4. Short Wave Band
   a. Connect the test oscillator to the antenna terminal of the tuner and set both the oscillator and tuner to 5.5 M.C.
   b. Set the tuner bandswitch to "Short Wave" and adjust the short wave padder for the narrowest shadow in the tuning eye.
   c. Set both the oscillator and tuner to 1.8 and adjust the short wave oscillator trimmer, R.F. trimmer, and antenna trimmer for narrowest shadow in the tuning eye.
   d. Re-check the 5.5 M.C. calibration.
The Bogen Model S-32 Centralized Sound System operates from 110 - 125 volts. 50 - 60 cycles.

POWER CONSUMPTION: 175 Watts.

TUBES USED: Tuner - 1-6A7, 1-6D6, 1-6Q7, 1-6Y5, 1-6X5, 1-6V5. Amplifier - 2-6J7, 1-6C8, 1-6F8, 2-6N6, 1-5X4.

It is recommended that a noise reducing antenna system be installed for use with the S-32 tuner to assure best reception. Connect the antenna to the red wire on the radio tuner and a ground wire to the black wire of the tuner.

For connecting speakers two wire shielded cable should be used. The speaker connection terminals are mounted in the inside rear of the cabinet. These terminals are mounted in sections, each containing ten pair of terminals, but only eight pair on each section are used. These correspond to the number of switches in each row on the speaker switching panels. Each speaker should have a separate two conductor shielded cable connected to the pair of terminals corresponding to a given speaker switch.

Starting with switch #1 on the first row, its terminals will be 1 and 2. Switch #2 will have terminals 3 and 4, and so on to switch #8, with terminals 15 and 16. If the cabinet contains more than one row of switches, #1 switch of the second row will again control terminals 1 and 2 of the second terminal section. Switch 1 of the second row may also be designed as Switch #9.

In connecting the speakers, one wire of the two wire shielded cable should be connected to the inside or odd numbered terminal. The other wire and shield should be connected to the outside or even numbered terminals. A convenient method of connecting wire and shield together is to strip the wire back, wrap it around the shield several times, then fasten the wire under the even numbered screw terminal.

The two wires of the cable should be connected to the two black wires of the transformer mounted on each speaker. The shield should not be connected to either wire at the speaker end, but should be secured to the speaker chassis under the clamp provided.

All speakers provided with Bogen Centralized Systems are equipped with variable line transformers. Normally, these speakers leave the factory connected for 15,000 ohms impedance. This means that the speakers will draw one-half watt of power, which has been proven by experience to be sufficient power for classroom speakers. If a variation of this power is desired, Table #1 is provided which gives the impedance and power the speaker will draw. The "Connect V.C." column shows the numbered lugs of the transformer to which the voice coil of the speaker must be connected in order to give the desired impedance.

<table>
<thead>
<tr>
<th>OHMS IMPEDANCE</th>
<th>CONNECT V.C. POWER TO SPKR LUGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>15,000</td>
<td>1-3</td>
</tr>
<tr>
<td>10,000</td>
<td>2-5</td>
</tr>
<tr>
<td>7,000</td>
<td>1-4</td>
</tr>
<tr>
<td>4,000</td>
<td>1-5</td>
</tr>
<tr>
<td>2,000</td>
<td>2-5</td>
</tr>
<tr>
<td>1,500</td>
<td>1-4</td>
</tr>
<tr>
<td>1,000</td>
<td>1-5</td>
</tr>
<tr>
<td>500</td>
<td>2-5</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>SPEAKER</th>
<th>POWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>7,000 ohms</td>
<td>1 watt</td>
</tr>
<tr>
<td>4,000 &quot;</td>
<td>2 &quot;</td>
</tr>
<tr>
<td>2,000 &quot;</td>
<td>4 &quot;</td>
</tr>
<tr>
<td>1,500 &quot;</td>
<td>5 &quot;</td>
</tr>
<tr>
<td>1,000 &quot;</td>
<td>15 &quot;</td>
</tr>
<tr>
<td>500 &quot;</td>
<td>15 &quot;</td>
</tr>
</tbody>
</table>
When speakers are required in auditoriums or gymnasiums, they must supply considerably more power. This power may range anywhere from 1 to 15 watts, therefore, speakers for auditoriums must be larger in size than is ordinarily supplied for classrooms. These larger speakers must be equipped with special adjustable line transformers to permit the proper power adjustment. The impedance of the transformer will determine the power that any speaker will draw from the system. Table #2 shows the relationship between impedance and power.

MICROPHONE:

An external high impedance microphone may be connected to the connector provided on the rear of the amplifier chassis. Provision is made for connecting two external phonographs. A three point terminal strip is mounted on the rear of the amplifier chassis adjacent to the microphone connector. Terminal 1 is ground or common for both phonographs. Connect first phono between terminals 1 and 2. Connect second phono or other input device between terminals 1 and 3.

EXPANSION:

The Model S-32 has provision for from 8 to 32 speaker control switches. If the S-32 is originally purchased with any number less than 32, control switches may be added at any time until the maximum number is reached. As figure #1 shows, the switches are arranged in rows of 8 each. Each row is connected to its own terminal section. The rows of switches, as well as the terminal sections, are numbered from the bottom up.

Row 1 is supplied with the Standard S-32-8, rows 1 and 2 with the S-32-16, rows 1, 2, and 3 with the S-32-24 and rows 1, 2, 3, and 4 with the S-32-32.

Standard panels completely wired at the factory, are available for expansion of any Model S-32 originally purchased with less than 32 switches. When ordering switching panels for expansion, the number of switches already present should be specified. Expansion should be done with additional panels as follows:

S-32-8 to S-32-16 - Order PS8 and insert in place of upper blank switching panel.
S-32-16 to S-32-24 - Order PS8 and insert in place of upper blank switching panel.
S-32-24 to S-32-32 - Order PS16, remove upper panel with Row #3 and insert.
S-32-32 to S-32-24 - Order PS16 and insert in place of upper blank switching panel.

When adding switch panels, mount terminal strips in mounting holes on side of cabinet, using screws and bushings provided. The cable should be placed as shown on figure #1.

The extreme right hand switch, looking at rear of panel, is then wired to the switch mounted on panel directly below it as shown on figure #2.
REMOTE STATIONS SCHEMATIC

CONNECTIONS AT SPEAKER

IMPEDEANCE | POWER
--- | ---
500 | 15 WATTS
1000 | 7.5
1500 | 50
2000 | 37.5

HOOK-UP DIAGRAM

See Schematic Diagram for color code of wires in Master Station Cable. See instruction sheet for hook-up of any combination of Master and Remote Stations. Each split line = represents a two wire shielded cable. The Inter-connecting Cable should not be grounded at any point. Use covered cable throughout. See Remote Station Schematic for color code of wires in Break-in Boxes.
The Bogen Model S115 Industrial Paging and Communicating System provides selective communication between various master stations and various remote stations. The combined total of master and remote stations are 11, 21, 31 and 41, for Models S115, S215, S316 and S416, respectively.

POWER RATING:  
- Master Units - 117 volts AC—Power Consumption—88 watts  
- Remote Units — No power required.

TUBES USED:  
- Total 5—2-7F7; 2-7C5; 1-7Z4

CONNECTIONS:  
- All wiring in this system must be done with two conductor shielded cable. Either a multiple cable with the required number of pairs of wires may be used, or the entire installation wired with two conductor shielded.

NO BREAK-IN REMOTE —

Connect Pair R of remote to the next available master cable pair, as explained above. Interconnect to every master, using the same "Pair Number" on each master. It is obvious that should it be necessary that the remote communicate with a particular master, the connections to that pair on the master cable is omitted. Ground the shield of the cable to the lug provided at the transformer mounting.

REMOTE WITH BREAK-IN —

Connect pair R of cable on break-in box to the next available master cable pair, as explained above, and interconnect to each master the BR-1 of remote to Pair Br of master, for Model CS break-in box where break-in to one master is possible. For Model CS3 where break-in to three masters is possible, connect Pair S and R as above. Connect Pair BR-1 of remote to Pair Br of first master. Pair Br-2 of remote to Pair Br of second master, and Pair Br-3 of remote to Pair Br of third master. If break-in to more than three masters is desired, use CS12 break-in box. Hookup as above, connecting Br-4 of remote to Pair Br on fourth master, etc. Any unused pairs on the CS12 should be cut off at the serving. For cable colors of the pairs, see the schematic diagram. Names of stations can be placed on push-buttons on the paper and celluloid inserts provided.

SERVICE:

If the device, when first connected to the power line, hums, the power plug should be reversed - this is done to correct the polarity.

To prevent interference between stations, after the system is completely installed, the "On Bus" must be cut to separate the Master portion of the "On Bus" from the Remote portion of the "On Bus". The "On Bus" consists of two bare wires running the length of the pushbutton switches. These wires should be cut between the last button being used to control a master and the first button being used to control a remote. If there is only one master in the system the red and black shielded pair connected to the "On Bus" must be cut. The "On Bus" is shown in the schematic diagram labeled "On" and is also shown in the pictorial diagram. In the example of a system consisting of five masters, the bus is cut between buttons numbered four and five.
There are two types of busy signals, one being a steady tone, or whistle, and the other a buzz, depending upon whether a master or remote station is being called.

In calling several master stations at once, after pressing the buttons of the stations to be called, place the "Talk-Listen" switch in the "Listen" position. If a whistle is heard, it means that the station is in use and the master stations are conducting a conversation which would be interrupted if they were called. In conducting a conference, any number of master stations may listen, but only one may talk at any time. If more than one station talk at once, the whistle will interfere with the conversation.

In calling a remote station, after pressing the button of the station to be called, place the "Talk-Listen" switch in the "Listen" position. If a buzz is heard, it means that the station is in use and would be interrupted if called.

Each horizontal row represents a station cable; a vertical row the interconnected pairs. Numbers correspond to cable colors.
The Bogen Model SA system provides selective communication between the master station and any one of a number of remote stations, acts as a public address or call system, and, when connected to radio and/or phonograph pickup, provides a program distribution system.

**POWER SOURCE:** 117 volts AC, 50-60 cycles

**POWER RATING:** Master Unit-75 watts at 117 volts AC. Remote Stations - No power required.

**POWER OUTPUT:** 15 watts

**TUBES USED:** Total 4 - 2-6SJ7; 1-6L6GA; 1-5Y3

**SPEAKER INSTALLATION:**

Speakers used with the Model SA system are equipped with line matching transformers. The proper impedance to use for any desired power is indicated in the following table:

<table>
<thead>
<tr>
<th>Impedance</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>3/8 watt</td>
</tr>
<tr>
<td>1500</td>
<td>1/2 watt</td>
</tr>
<tr>
<td>1000</td>
<td>3/4 watt</td>
</tr>
<tr>
<td>500</td>
<td>1-1/2 watt</td>
</tr>
<tr>
<td>250</td>
<td>3 watt</td>
</tr>
<tr>
<td>125</td>
<td>6 watt</td>
</tr>
<tr>
<td>75</td>
<td>10 watt</td>
</tr>
<tr>
<td>50</td>
<td>Full Output</td>
</tr>
</tbody>
</table>

**NOTE:** The sum of the wattages drawn by all speakers must not exceed the full output of the amplifier.

The speakers are connected to the master cable by means of two-wire cable. Each speaker is connected to a numbered pair on the master cable, to correspond with the number of a pushbutton. See Schematic Diagram. The break-in leads from the remote stations shall be connected to the master station by means of two-wire shielded cable. It is recommended that a junction box be used for making connections. Connect the ground lead in the master cable to the shield of the break-in leads and to a good external ground.

![Connections at Speaker Diagram](image-url)
The Model SM6 is a 6 watt AC operated amplifier useful especially for small installations and as a driver for the 100 watt booster amplifier or speech amplifier and modulator for transmitters.

POWER RATING: 105-125 Volts, AC 60 cycles, consumption 50 watts.

TUBES USED: Total 4: 2-6C8G; 1-6L6, and 1-5Y4G. The tube shields provided should be used on the two 6C8G tubes on the extreme left.

CONNECTIONS: Phonograph: The two post terminal strip on the upper left corner of the front panel is for high impedance type of phonograph pick-up. A shielded wire should be used to reduce hum pickup. Connect the shield to terminal #1 which is grounded. Connect the wire itself to terminal #3 which is the grid lead.

Microphone: High impedance type of microphones, such as Velotron, Velocity or Crystal may be connected to the connector on the front panel. Be sure to use shielded microphone cable and ground the shield to the metal cap of plug.

OUTPUT:

Speakers may be connected to the terminal strip marked "output". Terminal 1 is common, terminal 2 is 2 ohms, terminal 3 is 4 ohms, terminal 4 is 9 ohms, terminal 5 is 15 ohms, terminal 6 is 500 ohms. Use the 500 ohm tap as a modulator or driver.

REMARKS: If any hum is noticed when using the microphone, reverse the line polarity by pulling out the AC line plug, giving it a half turn, and reinserting. Hum may be caused by faulty tubes. If hum is noticed, with correct line polarity, check all tubes carefully. In some cases, an external ground may be necessary. Terminal #1 of phono input may be used to ground the system.

FITTING MICROPHONE CABLE CONNECTOR:
1. Skin off about 1/2 inch of outer rubber covering, exposing shielding.
2. Cut shielding back so that only 1/4 inch is exposed.
3. Clinch sheet metal sleeve around whole cable so that small ends clinch upon shielding. Trim off any whiskers which might cause short.
4. Remove inner rubber insulation from wire, within 1/8 inch of metal sleeve.
5. Tin wire with solder and cut to about 1/8 inch.
6. Slip cable through connector body and solder wire into hollow end of center contact.
7. Draw cable back into connector body. Force bakelite washer into re-cessed seat. Tighten set screw into metal sleeve.
8. Never use soldering paste or acid on any microphone connection. Use Rosin core solder.
The model "VE6-AD" is a Volume Expander Unit, self powered for use with any public address system or amplifier. It restores the full range of volume as originally played at the radio or recording studio. It also reduces needle scratch to a minimum as explained in paragraphs below.

**Power Rating:** 105-125 volts, A.C. or D.C., Consumption 32 watts.

**Tubes:** Total 5, 1-6F5, 1-6L7, 1-6H6, 1-25Z6, 1-BK76B ballast, 1-25 watt indicator bulb. Note that metal tubes are recommended in place of "G" tubes.

**Connections:** Input The high impedance phono-pickup is connected to the "Input" terminals mounted on the left side of the Volume Expander. #1 is for the grounded or shielded side. #2 is for the live wire. If a low impedance pickup is to be used, a matching transformer should be connected between the phono-head and the input terminals.

**Output:** The two output terminals on the rear of the Expander should be connected to the "Phono-Input" terminals of the amplifier. (Do not use the "Microphone-Input" terminals for this purpose as there would be too much amplification and quality would suffer). Using a shielded wire, connect #1 on the Expander to the grounded input terminal on the amplifier by means of the shield itself. Then connect the wire from #2 on the Expander to the live or grid terminal on the phonograph input on amplifier.

**Protective Lamp:** If the lamp mounted with the tubes lights up, it is a warning, indicating that some part of the equipment is "Grounded". This should be corrected before attempting to operate further.

**Volume Expansion:** The knob marked "Volume" controls the amount of expansion, it is not a volume control. 100 on the dial indicates normal reproduction and as knob is turned towards zero, expansion is increased. In practical use the setting is likely to vary between 20 and 70. As a trial start with the control at 100 and using a phonograph record, place the pickup at the finish end of the record so that the needle rides in the blank groove. The needle scratch should be observed as this is the normal scratch without expansion. Slowly rotate the control toward zero until a marked decrease in needle scratch is noticed. There is an abrupt change at this point which is easily distinguished. A place just beyond this point will generally be found to be the best adjustment.

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Models WP and WM are wireless phonographs which can be used with any radio. Model WP consists of a phonograph only, while Model WM includes provision for microphone input.

Tubes Used: - Model WP - 1-6C8G
               Model WM - 1-6C8G, 1-6J7


The signal from the phonograph will be found at approximately 550 kilocycles, or the upper end of the dial. If the signal cannot be found, or there is too much static, the short wire protruding from the line and near the plug should be wrapped around the aerial wire near the set. In extremely noisy locations, this wire may be connected directly to the aerial connection of the radio.

If interference between the phono and a radio station is encountered, phono reception may be shifted to a different part of the dial, as follows: - Near the tone arm rest will be found a small hole, insert a screw driver thru this hole into the adjustment screw. Rotating clockwise will shift the phono toward the upper end of the dial, and rotating counter-clockwise will shift it toward the lower end.

Once adjusted, the phono will always be found at the same point on the dial.

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The WR Remote Control is made up of a transmitter and receiver. The transmitter only uses power from the supply line.

Tubes Used: Transmitter - 1-6C8
Receiver - 2-6B8, 1-6X5
Power Consumption: Transmitter - 35 watts
110 volts AC-DC.

The transmitter may be operated from any point in the same building. It is only necessary to plug into a 110 volt AC or DC receptacle and connect the ground wire to a good ground. This may be done by inserting the ground lug under the screw that holds the outlet plate. If the outlet being used has a bakelite plate, then it must be removed and the ground lug fastened to the wall box. This ground connection is extremely important. A good ground may also be obtained by using the water, gas or steam pipes in the building.

With the receiver connected to the amplifier, the amplifier is inoperative unless the remote unit is turned on by means of its toggle switch. When this switch has been turned on and the unit allowed to heat up the Remote Control is ready for operation.

If units fail to operate check tubes first. The transmitter and receiver are aligned perfectly at the factory, but if unit becomes weak or there is interference between channels, they may be re-aligned. Equipment needed is an R.F. oscillator and a 10 volt D.C. 1000 ohm per volt meter.

On the side of the receiver are three terminals which are normally connected together. Remove the jumper from terminal 2, leaving 1 and 3 connected. Place meter across 1 and 2. Connect oscillator to the ground wire of the receiver and the oscillator chassis to receiver chassis. Set oscillator to 100 K.C. and adjust trimmer A shown in Fig. 1 for maximum reading on the meter. After trimmer A is adjusted, connect jumper wire to terminals 1 and 2, and place meter across 1 and 3. Set oscillator to 150 K.C. and adjust trimmer B shown on Fig. 1 to maximum reading on the meter.

Disconnect the oscillator and connect the ground wire of the receiver to the BX or ground in the manner normally used. Connect the remote unit to the ground normally used and turn the switch on. Turn Volume Control #1 off and #2 full on. Adjust trimmer B of the transmitter shown in Fig. 2 until meter connected to terminals 1 and 3 indicates maximum. Do not touch receiver trimmers. Again reconnect jumper wire to terminals 1 and 3, and meter to 1 and 2. Turn Volume Control #2 off and #1 full on. Adjust trimmer A shown in Fig. 2 for maximum meter reading.

When receiver and transmitter have been aligned as described, reconnect the jumper on the three terminals of the receiver.
on. Turn Volume Control #1 off and #2 full on. Adjust trimmer B of the transmitter shown in Fig. 2 until meter connected to terminals 1 and 3 indicate maximum. Do not touch receiver trimmers. Again reconnect jumper wire to terminals 1 and 3, and meter to 1 and 2. Turn volume Control #2 off and #1 full on. Adjust trimmer A shown in Fig. 2 for maximum meter reading. When receiver and transmitter have been aligned as described, reconnect the jumper on the three terminals of the receiver.
The Model WR is a wireless remote control which may be used on any Bogen amplifier provided with remote control facilities. This is standard equipment on some Bogen models but may be had on any Bogen amplifier. The WR Remote Control makes it possible to control the two inputs of the amplifier at any remote point in the building.

The WR Remote Control is made up of a transmitter and receiver. The transmitter only uses power from the supply line.

Tubes Used:  - Transmitter - 1-6G8G  
Receiver  - 2-6P7G - 1-6B8G  
Power Consumption:  - Transmitter - 35 watts - 110 volts AC-DC.

With the receiver connected to the amplifier, the amplifier is inoperative unless the remote unit is turned on by means of its toggle switch. When this switch has been turned on and the unit allowed to heat up the Remote Control is ready for operation.

When the remote control is used for mixing or fading between the two channels, a slight cancellation effect may be noticed. This may be evidenced by a slight variation in volume between the two channel controls. This condition is perfectly normal and can easily be compensated by merely advancing either control, until the volume level is equalized. For example, Control #1 is at 70 and it is necessary to increase the volume on control #2. When control #2 is advanced it seems to effect a variation in the volume of control #1, then merely advance control #1 a little further to bring up its volume thereby compensating for the cancellation effect created by control #2. A slight time lag may also be noticed when operating the remote control. This condition is also normal and is due to the fraction of a second difference in time between the rotation of the control and the result at the amplifier. It is recommended that the remote control be moved slowly, not abruptly, to increase or decrease volume, then there will be no noticeable time lag.

If units fail to operate check tubes first. The transmitter and receiver are aligned perfectly at the factory, but if unit becomes weak or there is interference between channels, they may be re-aligned. Equipment needed is an R.F. oscillator and a 10 volt D.C. 1000 ohm per volt meter.

On the side of the receiver are three terminals which are normally connected together. Remove the jumper from terminal 2, leaving 1 and 3 connected. Place meter across 1 and 2. Connect oscillator to the ground wire of the receiver and the oscillator chassis to receiver chassis. Set oscillator to 100 K.C. and adjust trimmers A shown in Fig. 1 for maximum reading on the meter. After trimmers A are adjusted, connect jumper wire to terminals 1 and 2, and place meter across 1 and 3. Set oscillator to 70 K.C. and adjust trimmer B shown on Fig. 1 to maximum reading on the meter.

Disconnect the oscillator and connect the ground wire of the receiver to the BX or ground in the manner normally used. Connect the remote unit to the ground normally used and turn the switch

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The models 2AR and 2RS Communo-Phones consist of 1 master and 1 remote station to provide intercommunication between two points only. In the 2AR system, any conversation originating at or near the remote will be heard automatically at the master. In the 2RS system, both stations incorporate press-to-talk switches.

POWER RATING: - Master unit only: 25 watts, 117 volts AC or DC. Remote Units: no power connection.

CONNECTIONS:

Model 2AR:

A 50 ft roll of two conductor cable is supplied with each system. Remove approximately 1/2" of insulation from the wires at one end of the roll and connect to terminal "G" and the center terminal of the master unit. Cut the roll of wire to the required length, remove insulation, and observing cable colors, connect to similar terminals of the AR remote station. Make certain that the link between the center and "B" terminal of the master unit is firmly screwed in place. Refer to drawing A.

Model 2RS: - A 50 ft. roll of three conductor cable is supplied with each system. Follow same procedure as outlined above, but connect the three wires as indicated in drawing B. Remove the link between the center and "B" terminal of the master unit. In the event that operation similar to the 2AR system is required with a 2RS system, connect as indicated in drawing A.
TEST DATA
LINE - 115 V. AC
METER - 20 MA. / V
VC SET AT 0
SWITCH SET AT LISTEN

11-19-41
POWER RATING: Master Unit only, 110 volts AC or DC, consumption 32 watts. Remote Units, no power connection.
The 5SC Communo-Phone is a self-powered combination microphone loud speaker system. It operates on either AC or DC current, 105-125 volts. Each unit draws 35 watts and is designed for continuous service. The tubes used are:- 1-25Z6; 1-637; 1-6C5; 1-25A6; 1-25 watt, 120 volt bulb and 1-Ballast BK55B.

Connections:-

These units are connected together by means of the 5SC communicator connector box. Cables are supplied in any length to meet requirements and come equipped with a six prong male plug on each end. The connector box is supplied with a five foot length of cable and a six prong male plug. The cable from the connector box is plugged into the socket marked "Fwr". ("A" Fig. #1) located on the rear of the first station. To connect the other stations insert one plug of the cable into the socket on the rear of the station, and insert the other plug into a socket on the connector box (see-Fig. #2). When less than five stations are used the cables should be plugged into consecutive sockets on the connector box.

Insert the plugs of the line cords into any source of 110 volt AC or DC. Snap the line switches on and observe the 25 watt lamp. If the lamp is brilliant, reverse the line plug which will give the correct operating polarity. With each unit at correct polarity, the system should be operating. If you desire to connect your own connector box and cables, refer to figure #3.

When Using These Units on DC:

When all units are plugged in as outlined above, inter-communication may be started among the various stations, making sure that the volume control is turned up. If no sound is heard, the polarity of the units is incorrect and all the plugs must be reversed at the same time. This applies to DC only.

NOTE: CAUTION !!!!!! Do not under any circumstances connect a ground to this chassis.
The Model 6C Communo-Phone is an intercommunicating loud-speaking system, in which all stations are masters and each can call any other station.

**POWER RATING:** 105 to 125 volts, either AC or DC
**Consumption:** 32 watts per unit.

**CONNECTIONS:**

All stations are joined into a single system with a cable having an number of wires. This number is one greater than the total number of stations in use (i.e., for six stations a cable of seven conductors is needed). To connect system, first assign a number to each station for identification and follow indicated wiring chart. Plug line cord into the usual power outlet. If the device is silent when first connected to Direct Current, the power line plug should be removed and rotated so that its prongs are reversed - this is done to correct the polarity. If the unit hums on AC, reverse line plug.

**OPERATION:**

To call a station turn the selector switch to the position marked for the station you wish to call. Then press the right hand knob down which is the "talk-listen" switch and talk.

**CABLE LENGTH:**

For best results use heavy wire for long distances between units. For distances not over 100 feet, use copper wire size #20 or larger, for greater distances #18 or heavier should be used.
NOTES - ALL CAPACITANCE VALUES IN MFD.
ALL VOLTAGE READINGS TAKEN WITH A 20,000 OHMS PER VOLT VOLTMETER.
Important: - It is essential to the best operation of the 7W system that a good common ground be obtained at each unit. If the electrical ground at the wall socket does not give satisfactory operation, try several other grounds until best results are obtained. A steam pipe, gas pipe, cold water pipe, radiator or ventilator system can be used to establish good common grounds. It is possible, in some cases, that dissimilar grounds give better transmission than similar grounds. If trouble is experienced in transmission of any unit with another, try other grounding media, one at a time, at each unit, until best transmission is obtained. Thus the same grounding medium is not essential for all units, if dissimilar grounds give best and most efficient transmission.

If it is impossible to obtain efficient transmission because of utter lack of a good grounding system, the ground leads of the units may be interconnected by a single wire to act as the transmitting ground.
The Bogen Model 7W is a wireless communicating system that may be operated from any electric outlet supplying 105 to 125 volts, either AC or DC. Each station draws 40 watts and is designed for continuous service. Tubes used in each station are: 2-6K7, 1-6Q7, 1-6J7G, 1-25A7G, 1-25A6G, 1-BK40B.

Each station must be connected to a good ground.

Silent Watchman: The Silent Watchman is an adjustable control device for the automatic suppression of line noises. This adjustment should be set to the correct value when the system is first put into operation. However, before making Silent Watchman adjustments, all stations should be installed and the frequency communication established.

To adjust the Silent Watchman turn the station "ON" and advance the volume control at least half way. Turn the adjuster shaft with a small screwdriver slowly to the right until the point is reached where the line noise becomes inaudible. Do not turn adjustment beyond the point where line noise becomes inaudible. Make this adjustment carefully. The Silent Watchman is then left in this position, no further adjustments being necessary.

NOTE: The other 7W stations should not be in the "talk" position when this adjusting is being done.

FREQUENCY SELECTOR: The 7W Wireless System consists of 7 units; 7WA, 7WB, 7WC, 7WD, 7WE, 7WF, 7WG. The letter after 7W denotes the receiving frequency of each master unit. The units are tuned and set at the factory to the following frequencies: - 7WA-100Kc., 7WB-120Kc., 7WC-140Kc., 7WD-160Kc., 7WE-180Kc., 7WF-220Kc., 7WG-260Kc. Each unit has six push buttons, one for each transmitting frequency except its own. If a unit is marked 7WA, its receiver is tuned to 100Kc., and the 100 Kc. transmitting frequency is omitted in this unit. Obviously, as a station cannot call itself, number one selector button is set to the next transmitting frequency, which would be the following letter in the alphabet. For example 7WA, Push button number one would transmit to 7WB, etc. In order to communicate between 7WA and 7WB, 7WA would press #1 button to talk to 7WB and 7WB would press #1 to talk to 7WA.

Addition of stations: When a complete 7W system is installed there should be no two units with the same last letter. System should comprise seven units with letters A to G. If less than seven stations are installed, start with letter A and when ordering additional stations for an existing system of less than seven units specify the letters of the units already installed, or order units with letters not already in the existing system. For example, if a system has been installed using three units marked 7WA, 7WB, and 7WC, and two stations are to be added, order the next two consecutive letters, namely 7WD and 7WE.
CABLE LENGTH: For best results use heavy wire for long distances between units. For distances up to 100 feet, use #20 wire. For greater distances, use #18 or heavier.

POWER: 32 watts for master only. Remote requires no power.

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VOLTAGES MEASURED ON A.C.
VOLTAGE: 105--125 volts, a.c. or d.c. POWER: 32 watts per unit.
POWER RATING: - 117 Volts AC or DC; consumption - 25 watts per unit

TUBES USED: - 1-14F7; 1-50L6GT    Pilot Lamp - NE51 Neon

CONNECTIONS: -

All stations are connected to form a single system with a multi-wire cable. The number of wires in the cable is one more than the number of stations in use, (that is, for five stations a cable of six conductors is needed).

CABLE LENGTHS: - For best results use heavy wire for long distances between units. For distances not over 100 feet, use copper wire size 20 or larger. For greater distances, number 20 or heavier should be used.
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The Models 12N and 219N Communo-Phones are intercommunicating loudspeaking systems, in which all stations are master units and can call any other station.

**POWER RATING:** - 105-125 Volts, AC-DC, 32 watts power per unit.

**TUBES:** - 1-14P7; 1-50L6GT; 1-35Z5GT; -Pilot light 117 volts, 6 watts.

**CONNECTIONS:**

All stations are joined into a single system with a cable having a number of wires. This number is one greater than the total number of stations in use (i.e., for 5 stations a cable of 6 conductors is needed). Larger cable may be used, with spare conductors for possible future expansion of number of stations. For small systems of 5 stations or less, a 6 conductor cable will be found convenient. Then, when necessary, an additional station may be installed.

**EARPHONE:**

On units having an earphone and hookswitch, either the loudspeaker or the earphone may be used for listening. When the phone is removed from the hook, it automatically cuts off the loudspeaker. The phone is then used for listening, but the loudspeaker is still used as a microphone. This is used principally to prevent others in the same room from hearing replies which may be confidential.

**CABLE LENGTHS:**

For best results use heavy wire for long distances between units. For distances not over 100 feet, use copper wire size #20 or larger, for greater distances #18 or heavier should be used.

**selector switch table**

<table>
<thead>
<tr>
<th>STATIONS NO. NAME</th>
<th>SELECTOR SWITCH POSITION</th>
<th>STATION 1 SMITH</th>
<th>STATION 2 HENRY</th>
<th>STATION 3 JONES</th>
<th>STATION 4 SHIPPING</th>
<th>STATION 5 STENO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Smith</td>
<td>1</td>
<td>Henry</td>
<td>Smith</td>
<td>Smith</td>
<td>Smith</td>
<td>Smith</td>
</tr>
<tr>
<td>2 Henry</td>
<td>2</td>
<td>Jones</td>
<td>Jones</td>
<td>Henry</td>
<td>Henry</td>
<td>Henry</td>
</tr>
<tr>
<td>4 Ship.</td>
<td>4</td>
<td>Steno</td>
<td>Steno</td>
<td>Steno</td>
<td>Steno</td>
<td>Steno</td>
</tr>
<tr>
<td>5 Steno</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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The Model 12S Communo-Phone provides selective communication between various master stations and various remote stations; up to a combined total of 12 master and remote stations. 

POWER RATING: Master units - 117 volts, AC or DC, power consumption 32 watts. Remote units - no power required.

TUBES USED: Total 3: 1-14P7; 1-50L6GT; 1-35Z5GT. Pilot light 117 volts, 6 watts.

CONNECTIONS:
All wiring in this system must be done with two conductor shielded cable. Either a multiple cable with the required number of pairs of wires may be used, or the entire installation wired with two conductor shielded.

Bond all shields at every junction.
NOTE: Rear wafer only shown. To cut pair, corresponding wire on identical wafer behind rear wafer must be cut.
See Schematic Diagram for color code of wires in Master Station Cable. Hook-up above shows connections for various Master and Remote Stations. For different combinations, see instruction sheet. Each split line — — represents a two conductor twisted pair. For color code of wires in Remote Station Cable, see Schematics of Remote Stations. A Junction Box is available for connecting Master and Remote Stations to the Interconnecting Cable. See Schematic Diagram for connections at Junction Box. The Interconnecting Cable should not be grounded at any point.

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SPECIFICATIONS:

Master Units: 117 volts, AC or DC. Power Consumption 25 watts.
Remote Units: No power required.
Tubes Used: Total 2: 1-14F7, 1-50L6GT
Pilot Light: NE51 Neon

REMOTE MODELS: - There are four types of remotes which may be used in this system:

Model 1SARH (no break-in)
Model 1SRSH (one master break-in)
Model 1R3SH (three master break-in)
Model 1R512H (eleven master break-in)

All wiring in this system must be done with two conductor twisted pairs of wire. Either a multiple cable with the required number of pairs of wires may be used, or the entire installation may be done with two conductor twisted wire.

IMPORTANT:

To prevent interference between stations in the 112SH system after the system is completely installed, the "ON BUS" must be cut to separate the master portion of the "ON BUS" from the remote portion of the "ON BUS". The "ON BUS" consists of two bare wires connecting all contacts of the two rear wafers of the selector switch. (See Figure below). These wires should be cut between the last switch position being used for a master and the first position being used for a remote; i.e., for a system of 5 masters they should be cut between the 4th and 5th contacts on the two rear wafers. If there is only one master in the system, it is unnecessary to cut these wires.

If the system, when first connected to the power line is silent on D.C. or hums on A.C., the power plug should be reversed in the outlet to correct polarity.
ALIGNMENT
Alignment is made to any frequency between 160Kc and 196Kc, selected to insure operation with a minimum of interference. Connect a signal generator between the common negative terminal and the external ground lead. Set the generator to the chosen frequency (between 160Kc and 196Kc), modulated 30%. Adjust the slug, AL, for maximum output. Repeat above procedure for each unit in the system.

SQUELCH ADJUSTMENT
To adjust the squelch circuit, proceed as follows:
1. Pry the large plug button on the front of the cabinet with a screwdriver.
2. Have someone count slowly into one unit while the following adjustment are made at the other unit.
3. With a screwdriver, rotate the control in a clockwise direction until the sound just ceases. Now slowly rotate the control in the reverse direction until the received signal is crisp and undistorted.
4. Replace plug button.
5. Repeat steps 1, 2, 3 and 4 for the other unit.

TWO WIRE-THREE WIRE SWITCH
The switch located at the rear of each unit of the “Twin” is used to select either a two-wire or a three-wire method of connection to the power line. The three-wire connection will provide stronger signals with less noise over a given distance and should be used whenever possible, particularly if the stations are located at some distance from each other.
The two-wire connection provides sufficient output when the stations are fairly close, for example, in different rooms of a home. Since the grounding lug previously mentioned is not required for the two-wire system, the units can be moved from room to room and placed in operation simply by plugging into the wall outlet. The increased line noise and hum which may result in some cases from the use of the two-wire connection can be reduced by reversing the power cord in the outlet. In some localities where the power lines are not grounded the two-wire system must be used. In cases of doubt, the local power company can supply information about their lines. Regardless of which type of connection is used, it is important that the switch of each unit of the “Twin” be placed in the same position.

OPERATION
To call the other station, depress the push-to-talk button and speak in a normal tone of voice. To receive, release the button.

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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## PARTS LIST AND DESCRIPTIONS

### TUBES (SYLVANIA or Equivalent)

<table>
<thead>
<tr>
<th>ITEM No.</th>
<th>USE</th>
<th>REPLACEMENT DATA</th>
<th>INSTALLATION NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>David-Bogen PART No.</td>
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<td>70B</td>
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<td>Detector</td>
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<tr>
<td>V2</td>
<td>AF Amplifier</td>
<td>12AX7</td>
<td>9A</td>
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<tr>
<td>V3</td>
<td>Audio Output</td>
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### CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mfd. for Mica and Ceramic Capacitors.

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<th>ITEM No.</th>
<th>RATING</th>
<th>CAP.</th>
<th>VOLT</th>
<th>David-Bogen PART No.</th>
<th>AEROVOX PART No.</th>
<th>CENTRALAB PART No.</th>
<th>CORWELL- DUBILIER PART No.</th>
<th>ERIE PART No.</th>
<th>MALLORY PART No.</th>
<th>SPRAQUE PART No.</th>
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Note 1. Some Models combine C4, C5 and R8 in one unit.

### CONTROLS

<table>
<thead>
<tr>
<th>ITEM No.</th>
<th>RATING</th>
<th>RESISTANCE</th>
<th>WATTS</th>
<th>David-Bogen PART No.</th>
<th>IRC PART No.</th>
<th>CLAROSTAT PART No.</th>
<th>CENTRALAB PART No.</th>
<th>MALLORY PART No.</th>
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### RESISTORS

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Note 1. Some models may use a 20K1 resistor in this application.
Note 2. Some models combine R3, C4 and C5 in one unit.
## PARTS LIST AND DESCRIPTIONS (Continued)

### TRANSFORMER (AUDIO OUTPUT)

<table>
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<th>ITEM No.</th>
<th>IMPEDANCE</th>
<th>DC RES.</th>
<th>RATING</th>
<th>STANCOR PART No.</th>
<th>MERRIL PART No.</th>
<th>CHICAGO PART No.</th>
<th>TRIAD PART No.</th>
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### COILS (RF-IF)

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<td>U-305, Coupling winding, 300</td>
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### SELENIUM RECTIFIER

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<td>M3</td>
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### MISCELLANEOUS

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<th>ITEM No.</th>
<th>PART NAME</th>
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<tr>
<td>M2</td>
<td>Crystal Diode</td>
<td>Squelch Rectifier (465)</td>
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<tr>
<td>M3</td>
<td>Switch</td>
<td>Talk-Listen, Line (Transmission) Selector</td>
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<tr>
<td>M4</td>
<td>Switch</td>
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</tr>
</tbody>
</table>
A PHOTOPACT STANDARD NOTATION SCHEMATIC
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1. DC Voltage measurements are at 20,000 ohms per volt; AC Voltages measured at 1000 per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.