The Model AD6 is a six watt P.A. amplifier for use on either AC or DC. It is provided with: 2 input channels (#1 for Microphone - Velocity or Crystal type, #2 for Phono-Pickup - High Impedance Type); Tone Control; Universal Output for Speakers.

Power Rating: - 105-125 volts, either AC or DC. Consumption 40 watts.


Connections: - Phonograph: - The low gain input terminals for high impedance type phonograph are located at the left on the front panel. A shielded lead is advisable to reduce noise and hum pickup. The shield should go to #1. #2 is the live or grid terminal.

Microphone: - A Velocity, Crystal, or Velotron Microphone may be used and should be connected by means of a single conductor shielded cable and the screw connector located below the input terminal strip. The female connector supplied with the amplifier should be fitted to the microphone cable as described and illustrated on back of sheet.

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.

Power Receptacle And Fuse: - An 110 volt power receptacle is located on the rear panel for use with speaker field exciters, phono motor, etc. It is controlled by the master switch on the front panel. A two ampere fuse is mounted on the rear, under a protective cover. If the fuse has blown, the wiring and tube should be examined for possible trouble before a new fuse is inserted.

NOTES: 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. On DC, if there is no response; or an AC, if there is a loud hum; reverse the polarity of the line cord by removing the plug, giving it a half turn and reinserting into power outlet.

Tubes: - The filaments of the tubes are connected in series as shown in the diagram. If one tube burns out the other tubes will not light.

CAUTION: - DO NOT UNDER ANY CIRCUMSTANCES CONNECT A "GROUND" TO THE CHASSIS OF THE AD6 AMPLIFIER. A "GROUND" CAUSES A LOUD HUM, SEE ALSO NOTES ABOVE.

FITTING MICROPHONE CABLE CONNECTOR

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 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 1/3 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.
Tubes: The filaments of the tubes are connected in series in two groups as shown in the diagram. The 6J7, 2-6C8 and 4-25L6 tubes are in one line. The 2-25Z6 tubes and the Bellast K67A form the other series. If one tube burns out the other tubes in the same line will not light. All tubes should be tested and only the defective ones need be replaced.

CAUTION: Do not under any circumstances, connect a "Ground" to the chassis of the AD-10 Amplifier.
The model AD-10 is a 10 watt P.A. Amplifier for use on either A.C. or D.C. It is provided with: 2 input channels (#1 for Microphone-Velocity or Crystal type, #2 for Phono-Pick-up - High Impedance type), Tone Control; Universal Output for Speakers.

Power Rating: 105-125 volts, either A.C. or D.C., Consumption 100 watts.

Tubes Used: Total 9, 1-6J7, 2-6C8G, 4-25L6, 2-2526, 1 Ballast K67A, 1-25 watt Indicator Bulb.

Connections: Phonograph The low gain input terminals for high Impedance type phonograph are located at the left on the rear panel. A shielded lead is advisable to reduce noise and hum pickup. The shield should go to #1. #2 is the live or grid terminal.

Microphone: A Velocity, Crystal or Velotron Microphone may be used and should be connected by means of a single conductor shielded cable and the screw connector located above the input terminal strip. The female connector supplied with the amplifier should be fitted to the male cable as follows:-

1. Skin outer rubber covering about 3/8 inch exposing the shield.
2. Remove all cotton sleeving which in some cable is present over the metal shield.
3. Remove the exposed shielding up to the sleeve making sure to bend back over the sleeve all metal wires from the end of the shielding.
4. Skin inside rubber covering about 1/8 inch from the sleeve exposing about 1/4 inch of the conductor.
5. Insert the cable thus prepared into one part of the connector, drop the spring washer into the recess, place bakelite washer over it, allowing the conductor to pass through the eyelet.
6. Clean and solder the conductor to the eyelet, cut off excessive wire and tighten the set screw over the sleeve.
7. Never use soldering paste or acid on any microphone connection. Use rosin-core.

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.

Power Receptacle and Fuse: An 110 volt power receptacle is located on the rear panel for use with speaker field exciter, phono motor etc. It is controlled by the master switch on the front panel. A 2 amper fuse is mounted on the rear, under a protective cover. If the fuse has blown, the wiring and tubes should be examined for possible trouble before a new fuse is inserted.

NOTES: 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. On D.C. if there is no response or on A.C. if there is a loud hum, reverse the polarity of the line cord by removing the plug, giving it a half turn and re-inserting into power outlet.
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.

6-Prong Socket Supplies Field of 5000 Speaker
7-Prong Socket Supplies Field of 10,000 Speaker
The model C15 is a P.A. amplifier which delivers 15 watts of output power. It supplies field excitation for two speakers and has 4 input circuits for 2 microphones and 2 phonograph pickups.

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

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

**Connections:**

There are 2 low gain input channels for use with high impedance type of phono pick-up. A shielded wire should be used between each phono and the input terminals in order to reduce noise pick-up. 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:**

Field supply for one 500 ohm and one 10,000 ohm speaker is supplied by the amplifier. These two speaker fields are essential to complete the amplifier circuit and are connected to the six and seven prong plugs as shown in the diagrams on the back of this sheet. As a safety precaution, a jumper wire is used to connect the two "F" prongs of each plug. Therefore, if either speaker becomes disconnected the 110 volt circuit will be opened. Additional speakers having their own field supply or P.M. types may be connected to the output terminal strip in accordance with the impedance values shown in diagram. Use wire size #18 between speakers and amplifier. If the distance is over 100 ft., use #16 or #14 wire to prevent loss of volume and quality of tone.

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

TUBES USED: - Total 7, 4-6L6, 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 proper match may be affected.

If the Bogen SM6 is used to drive the C100 Booster, the 500 ohm output of the SM6 may be connected directly to the 500 ohm input of the C100.

If any driver other than the SM6 is used, such as the CX15, C30 or CX30, the following procedure is observed:

Connect the 15 ohm output of the driver (#1 and #5) to the 500 ohm input of the booster (#1 and #5). Connect #1 to #1, and #5 to #5.

Connect a 1000 ohm 10 watt resistor across the 500 ohm output terminals (#1 and #6) of the driver amplifier.

This procedure is necessary because the larger amplifiers, when used as drivers, have considerably more power than is needed to drive the C100 booster.

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 &quot;</td>
</tr>
<tr>
<td>3 = 4 &quot;</td>
<td>3 = 125 &quot;</td>
</tr>
<tr>
<td>4 = 9 &quot;</td>
<td>4 = 166 &quot;</td>
</tr>
<tr>
<td>5 = 15 &quot;</td>
<td>5 = 250 &quot;</td>
</tr>
<tr>
<td>6 = 72 &quot;</td>
<td>6 = 500 &quot;</td>
</tr>
</tbody>
</table>

FUSE:

A 10 ampere fuse is located on the rear of the chassis under the protective cover.
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 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 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 re-instating. 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 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 AC 60 cycles, consumes 290 watts.

TUBES USED: - Total 17, 4-6T7G, 2-6CG8, 2-6F5, 2-6F6G, 4-615G and 3-5X4G. Close fitting tube shields are supplied for the 4-6T7G and 2-6CG8 tubes and top shields are provided for the 2-6F5 tubes.

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 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 PM 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 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.

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 fall 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:- 2-6C8G; 1-616; 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 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 re-inserting. 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 1/3 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 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; 2-6G8G, 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 input or #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., generator 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 PM 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 1/3 inch of metal sleeve.
5. Tin wire with solder and cut to about 1/3 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 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, 1-6C8G, 1-5F6G, 2-6L6G and 1-5X4G.

OUTPUT:

Speakers having their own field supply or F.M. type should be used. The voice coil of one or two speakers may be connected to the "K" 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 #16 wire should be used to prevent loss of volume and quality of tone. 110 volts for field exciter is provided on the 2 "P" 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: - 4-616; 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 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>CONNECT DRIVER TERMINALS</th>
<th>TO</th>
<th>ADDITIONAL LOAD (SPEAKER OR RESISTOR)</th>
<th>CONNECT ADDITIONAL LOAD TO DRIVER 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>
</tr>
<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>1-3</td>
<td>1-2</td>
<td>750</td>
<td>1-6</td>
</tr>
<tr>
<td>E30</td>
<td>1-3</td>
<td>1-2</td>
<td>650</td>
<td>1-6</td>
</tr>
<tr>
<td>EX25</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**
  - #1 - Common Gnd.
  - 2 - 2 ohms
  - 3 - 4 ohms
  - 4 - 9 ohms
  - 5 - 15 ohms
  - 6 - 72 ohms

- **LOWER ROW**
  - #1 - 34 ohms
  - 2 - 100 ohms
  - 3 - 125 ohms
  - 4 - 165 ohms
  - 5 - 250 ohms
  - 6 - 500 ohms

**FUSE:** - A 5 ampere fuse is located on the rear of the chassis under the protective cover.
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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.

**POWER RATING:**
- 6 Volt Storage Battery - Consumption 9 amps., Output 12 Watts.
- 110 Volts A.C. - Consumption 85 watts, Output 15 watts.

**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 D515-2 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 - 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 86 watts for amplifier, 20 watts for phonograph.

**Tubes Used:**
- Total 7, 1-G77; 2-G68; 2-G6V6; 2-6X5. "G" type recommended.

**Connections:**
- On six volt storage battery use the power cord with battery clips and insert plug into the "B" prong socket. See that the vibrator is in the "VIB" socket. If the U15 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 3-prong plug into the 3-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 case.

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 replace vibration, it 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 on lines may be connected to the terminal strip labeled "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 200 ohms.

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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; 1-6P6G; 1-6C8G; 2-6N6G; 1-5X4G. A close fitting tube shield is supplied for the 6P6G 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-10 is a unique 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: 2-5T7, 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 phonograph 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 phonograph to first channel. Terminal #3 for wire from phonograph 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 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.

TUBES USED: Total 10: 2-6G6G, 4-6J7G, 1-5FU6, 2-6L6G, 1-5X4G.
"G" type tubes are recommended thruout.

CONNECTIONS: Phonograph: There are 2 low gain input channels for use with high impedance type of phone 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 phone to 1st channel. Terminal #3 for wire from phone 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 #18 between amplifier and speakers. If the distance is over 100', #14 or #12 wire should be used to prevent loss of volume and quality of tone, 110 volts AC field exciter is provided on the 2 "P" 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 fuse 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.

John F. Rider
The model DX-70 is a new type of P.A. amplifier incorporating
Binaural Amplification and the Electronic Tone Corrector. It has
600 ohm input terminals for 4 high impedance type A.G. line
microphones or phonograph pickups. There are two separate 35 watt output channels, tapped for both voice coils and 500 ohm lines.

Power Rating: 105-125 volts A.C., 50 cycles, consumes 200 watts.

Impedance Used: Total 17, 4-650B, 1-656B, 1-650B, 2-650B, 4-616D, 1-540D.

Connections: There are two low gain input channels for use with high impedance types of phone pickup or phonograph pickups. They should be used between the phone pickup and the amplifier in order to prevent hum pickup. Connect the shielded or non-shielded wire to the input terminal #1 and the positive wire to terminal #2. The shield or non-shielded wire to the pickup #2 connects to terminal #3 and its positive wire goes to terminal #4.

Microphone: High impedance types of microphones, such as Velocron, Beauty, Crystal, Dynamic and others may be used 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 the wire size #18 between amplifier and speakers. If the distance is over 100 feet, #16 or #14 wires are used to prevent loss of volume and quality of tone.

Separate speakers or speaker lines are to be connected to the 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 terminals on each channel. When paralleling any tap, the resulting impedance will be half, for example, if the two 500 ohm taps are connected, 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 selector dials on each channel. When paralleling any tap, there is a resulting bass increase. The Electronic Tone Corrector changes tone without introducing distortion or changing the overall frequency range. The control marked "Preset" controls 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 the right, the left the output will be zero. Tone can be blended to any degree desired by means of these controls and the overall amplification 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. 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 650B tubes are connected in series with the pilot lamp. This is a 6.3 volt 150 ampere bayonet base lamp and has a Brown Base 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. If very loud signals the pilot light may flicker because of the extra current passed by the output tubes. This is normal.

Remember: If any hum is noticed when using the microphone, reverse the line polarity by pulling out the A.G. 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; 2-6G8G; 2-6V6; 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.

PHONOGRAPHER:

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 #10 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 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.

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.
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 E80 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 E80 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 E80 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; 2-724; 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 E80 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 E80. A maximum of six E80 boosters can be driven by the Model HH.

TO USE ANY BOGEN AMPLIFIER FROM THE E8 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: 4-6L6, 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</th>
<th>CONNECT TO</th>
<th>ADDITIONAL CONNECT ADDITIONAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRIVER</td>
<td>OUTPUT TERMINALS</td>
<td>E-100 INPUT TERMINALS</td>
</tr>
<tr>
<td>SM6</td>
<td>1-6</td>
<td>1-5</td>
</tr>
<tr>
<td>E10</td>
<td>8 ohms</td>
<td>1-2</td>
</tr>
<tr>
<td>E14</td>
<td>1-3</td>
<td>1-2</td>
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<tr>
<td>E20</td>
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<td>E30</td>
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<td>EX25</td>
<td>1-4</td>
<td>1-3</td>
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<tr>
<td>EX35</td>
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<td>1-2</td>
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<tr>
<td>EX70(1 channel)</td>
<td>1-2</td>
<td>1-2</td>
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</tbody>
</table>

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

**Upper Row**
- #1 - Common Gnd.
- 2 - 2 ohms
- 3 - 4 ohms
- 4 - 9 ohms
- 5 - 15 ohms
- 6 - 72 ohms

**Lower Row**
- #1 - 84 ohms
- 2 - 100 ohms
- 3 - 125 ohms
- 4 - 166 ohms
- 5 - 250 ohms
- 6 - 500 ohms

**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; duoch phase 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 grounded 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.
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.
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.
POWER RATING: 117 Volts, 60 cycles, 210 watts.

TUBES USED: Total 6: 2-507, 1-6SL7, 1-6SN7, 1-5X3GT, 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.

The ratio of Ra to Rb is calculated to give approximately 2.5 volts across Rb when the driver amplifier is delivering about two-thirds of its rated output across the 500 ohm load. The values of Ra and Rb should be great enough so that at the full rated output voltage of the driver the power dissipated in Ra or Rb 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 GO-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>2.2K</td>
</tr>
</tbody>
</table>

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

Formula A: \[ E = \frac{2}{3} \cdot \frac{Z}{P} \]

Where \( P \) = full rated output  
\( Z \) = output impedance

Solve for \( E \)

Then, substituting the correct value for \( E \) in Formula B, the correct ration of \( Ra/Rb \) 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: \[ E = \frac{2}{3} \cdot \frac{2}{3} \times 18 \times 250 = 3000 \approx 55 \]

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 120v 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 120 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 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

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SPEAKER INSTALLATION: (continued) 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>1/2 watt</td>
<td>10,000 ohms</td>
<td>T45C</td>
<td>2,000 ohms</td>
<td>T5B</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>10,000 ohms</td>
<td>T45C</td>
</tr>
<tr>
<td>5 &quot;</td>
<td>1,000 &quot;</td>
<td>T5B</td>
<td>2,000 &quot;</td>
<td>T5B</td>
</tr>
<tr>
<td>10 &quot;</td>
<td>500 &quot;</td>
<td>T5B</td>
<td>1,000 &quot;</td>
<td>T5A</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 GO125 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>E114</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; HLO</td>
<td>$R_a$ and $R_b$ built-in.</td>
<td></td>
</tr>
<tr>
<td>Any amplifier with 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: $E = \sqrt{\frac{2}{3}ZP}$

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 $\frac{R_a}{R_b}$ 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: $E = \sqrt{\frac{2}{3} \times 15 \times 250} = \sqrt{2500} = 50$

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.

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POWER RATING: 117 Volts, 60 cycles, 200 watts.

TUBES: Total 11: 2-207, 4-6SC7, 1-6SJ7, 1-6SL7, 1-6SN7, 1-5Y3, 1-574GY

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 G050 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.

IMPEDEANCE 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:

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

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</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 GO-50 booster amplifiers may be driven by the G-50 or GX50. Input to the GO-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 PM 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 BEFORE REWIRING.

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:

\[ Z = \frac{\text{E}^2}{\text{F}} \]

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: 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>½ watt</td>
<td>10,000 ohms</td>
<td>T45C</td>
</tr>
<tr>
<td>1 watt</td>
<td>5,000 ohms</td>
<td>T45C</td>
</tr>
<tr>
<td>2 watts</td>
<td>2,500 ohms</td>
<td>T25C</td>
</tr>
<tr>
<td>5 watts</td>
<td>1,000 ohms</td>
<td>T5B</td>
</tr>
<tr>
<td>10 watts</td>
<td>500 ohms</td>
<td>T5B</td>
</tr>
<tr>
<td>20 watts</td>
<td>1,000 ohms</td>
<td>T5A</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 PM 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.

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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; 1-6SF5; 1-5W4.
Models HLO and LLO: 4-6SJ7; 1-6SF5; 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. 1.73v 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: - 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
\[
\frac{\text{Required Impedance}}{\text{Desired Power}} = \frac{20,000}{1} = 20,000 \text{ ohms}
\]

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

For the 70 volt tap
\[
\frac{\text{Required Impedance}}{\text{Desired Power}} = \frac{5,000}{1} = 5,000 \text{ ohms}
\]

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

**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>½ 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>T2SB</td>
</tr>
<tr>
<td>2 &quot;</td>
<td>2,500 ohms</td>
<td>T2SB</td>
<td>2,000 ohms</td>
<td>T5B</td>
</tr>
<tr>
<td>5 &quot;</td>
<td>1,000 ohms</td>
<td>T5B</td>
<td>1,000 ohms</td>
<td>T5A</td>
</tr>
<tr>
<td>10 &quot;</td>
<td>500 ohms</td>
<td></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 HO125 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.

\[ V_a \]

AMPLIFIER
OUTPUT STRIP

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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 HO125 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>EL0</td>
<td>12K</td>
<td>1K</td>
</tr>
<tr>
<td>EL4</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; HLO</td>
<td>$R_a$ &amp; $R_b$ built-in</td>
<td></td>
</tr>
<tr>
<td>Any amplifier with 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 formulas 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:

$$E = \sqrt{\frac{2}{3} ZP} = \sqrt{\frac{2}{3} \times 250 \times 15} = \sqrt{2500} = 50$$

Substituting in Formula B:

$$\frac{R_a}{R_b} = \frac{50 - 5}{5} = \frac{45}{5} = 9$$

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For optimum performance, it has been determined that $R_p$ should be between 1k and 3k ohms. Therefore, the value of $R_p$ 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>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>2</td>
<td>Orange-white</td>
<td>9</td>
<td>Orange - Blue</td>
<td>15</td>
<td>Brown-white</td>
<td>21</td>
<td>Yellow-Brown</td>
</tr>
<tr>
<td>3</td>
<td>Brown-white</td>
<td>10</td>
<td>Black</td>
<td>16</td>
<td>Red-black</td>
<td>22</td>
<td>Blue-white</td>
</tr>
<tr>
<td>4</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>5</td>
<td>Red - White</td>
<td>12</td>
<td>Green - Yellow</td>
<td>18</td>
<td>Black-white</td>
<td>24</td>
<td>Black - White</td>
</tr>
<tr>
<td>6</td>
<td>Black-yellow</td>
<td>13</td>
<td>White</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC307

MC313

MC319

MC325
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.