BOGEN MODEL RP60 FM-AM MULTIPLEX RECEIVER

DESCRIPTION

The Bogen Model RP60 is a compactly designed high-fidelity stereophonic FM-AM Multiplex receiver combining a radiation-proof superheterodyne tuner, dual preamplifier, and two 30 watt power amplifiers on a single chassis. The versatile unit also provides for the amplification of stereophonic audio signals from a tape recorder, phonograph or one auxiliary high level signal source. The RP60 incorporates the following features:

Built-in Multiplex—to receive FM stereo programs via the Multiplex system approved by the FCC in April 1961. Completely self-contained. . .no extra chassis, interconnecting cables; wiring. Full band-width provides full frequency response, extremely low distortion and maximum separation between right and left channels.

Scratch and Rumble Filters—can be used for mono or stereo and regardless of whether one or two program sources are being used.

Loudness Compensator—preserves aural musical balance at low volume levels. Can be used for mono or stereo and regardless of whether one or two program sources are being used.

Mode Selector—to select the desired mode of operation . . . stereo, stereo with channels reversed, left channel or right channel input fed to both speaker systems.

Third Channel Output—for use with 3-speaker stereo arrangement or to operate an additional remote system.

The FM tuner circuitry features a fully tuned and amplified RF amplifier, wide-band tuned IF amplifier with dual limiting action, and ratio detector arranged to provide automatic interstation hush. AFC with "IN-OUT" switch is provided to maintain optimum fidelity as station transmission characteristics change. An AGC circuit maintains an FM audio output level of ±0.5 db with a range of signal varaition greater than 10 to 100,000 μv. This insures freedom from distortion blaring or fade-out due to station signal changes. A quick-acting electronic indicator provides visual assurance of tuning precision and convenience.

Tape Recorder operation RP60 has an input sensitivity sufficient to allow the connection of tape recorder heads (of a tape deck) directly to the tape inputs. Also tape outputs are provided which are of the cathode follower, low impedance type.

Pre-amplifier section features an input sensitivity for even the lowest output phono cartridges to be sufficient to drive the amplifier to a power output of 30 watts per channel, more than enough to drive even the lowest efficiency speakers. Frequency response is 18 to 30,000 cycles (±1db) with distortion held to 0.8% at full rated output. Pure DC current is used on all preamplifier tubes to guarantee absolute freedom from hum.

Extra-heavy duty, special "permafil" treated power transformer, oversized and conservatively employed parts and Bogen's traditionally strict quality control procedures insure trouble-free operation and life-long retention of original performance specifications.

SPECIFICATIONS

OUTPUT POWER: 30 watts, per channel
60 watts combined*

FREQUENCY RESPONSE: 20 to 20,000 cycles, ±1db.

DISTORTION: less than 0.6% at full output

HUM & NOISE LEVEL: —60 db Mag. and Tape
—75 db Aux. and Tuner

FM SENSITIVITY: 0.85 for 20 db quieting; IHFM 2.5μv

AM LOOP SENSITIVITY: 75 μv per meter
for 20 db quieting

ANTENNAS: FM-Built-in AC line and external connection for balanced 300Ω or 75Ω coaxial external antenna. AM-Built-in loopstick and external connection for high impedance outdoor antenna.

MULTIPLEX: Time division type with "Stereo-minder" indicator.

AUDIO SENSITIVITY:

Magnetic Cartridge	4.5mv
Tape Head	4.5mv
Crystal Cartridge	0.5v
Auxiliary	0.5v

SPEAKER OUTPUT: 4, 8 and 16 ohms

ACCESSORIES: Metal Enclosure—Model EN-7
Wood Cabinet —Model WE-7

CONTROLS: Programing Selector; Mode Selector; Volume; Balance; Separate coax Bass and Treble; LO Filter; HI Stereo-FM Filter; Loudness; Tape Monitor; Speaker Output switch; Power; Tuning; AFC.

TUBE COMPLEMENT: 20 tubes; 8 crystal diodes (including 3 matched pairs) and 7 rectifiers; total of 34 tube functions.

DIMENSIONS: 15-15/16"w. x 5-1/4"h. x 15"deep

SHIPPING WEIGHT: 35 lbs.

*Measured in accordance with I.H.F.M. Standards.

INSTALLATION

UNPACKING

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

CONNECTIONS BETWEEN COMPONENTS

Use single-conductor, low-capacity shielded wire for connecting the record player, tape recorder, and other components (except speakers) to the RP60. Keep leads under ten feet in length.

Speakers may be connected with standard flexible line cord ("zip cord") and up to 100 feet of cable may be used without appreciable loss.

Make certain that all audio cables are kept away from speaker cables, power cables, and power transformers, and that speaker cables are kept away from power cables.

GROUNDING THE UNIT

Ground the receiver by attaching a wire from a GND terminal on the chassis rear to a good ground such as the metal frame of the wall outlet or a water or steam pipe. Do not use the antenna ground terminal for this purpose.

POWER

Connect the line cord to a wall outlet supplying 117-volt AC, 60-cycle power.

AUXILIARY POWER RECEPTACLES

One AC receptacle has been included at the rear of the chassis (refer to figure 5) for the supply of power to a phonograph. The PHONO receptacle *is not* controlled by the power switch and phonographs connected to this receptacle must be turned on and off separately. *(This will prevent the phono idler wheel from developing flats which might occur if the amplifier controlled power to the phonograph and the amplifier was turned off before the phonograph was disengaged.)*

ANTENNA INPUTS

The RP60 is provided with built-in FM and AM antennas. Outdoor antennas are recommended in weak signal areas. If outdoor antennas are used, they should be mounted away from electrical devices and at a distance from large metallic objects to insure satisfactory reception.

FM ANTENNAS: The RP-60 is shipped from the factory with the FM line antenna connected to one of the 300-ohm lugs of the insulated antenna terminal strip (see figure 1).

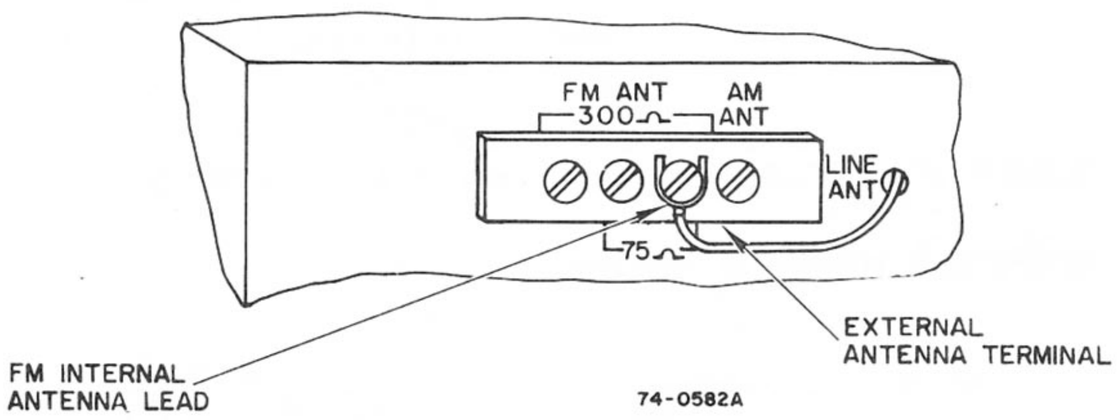


Figure 1 – Connection of FM line antenna.

This connection is adequate for normal or strong signal areas. For interference-free reception, the line cord should be completely unwound and left to hang freely as far as possible from metallic objects.

For weak signal areas, connect an external 300-ohm folded dipole antenna as shown in figure 2.

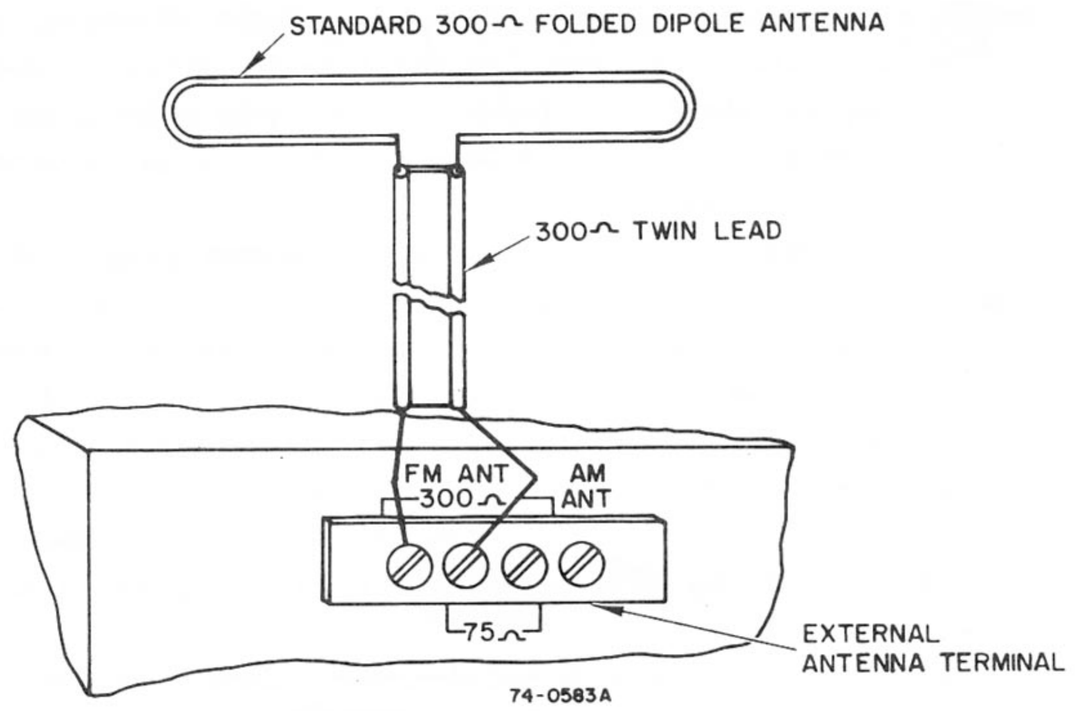


Figure 2 – Connection of external 300Ω FM antenna.

If, in addition to being in a weak signal area, there is considerable interference from man-made noises such as car ignition or electrical machinery, a coaxial 75-ohm cable RG-59/U may be used with a simple dipole or a more complex antenna. In such an installation, connect the outer shield of the cable to the ground lug of the antenna terminal post (figure 3) and the center conductor to either of the terminals marked 300 ohms.

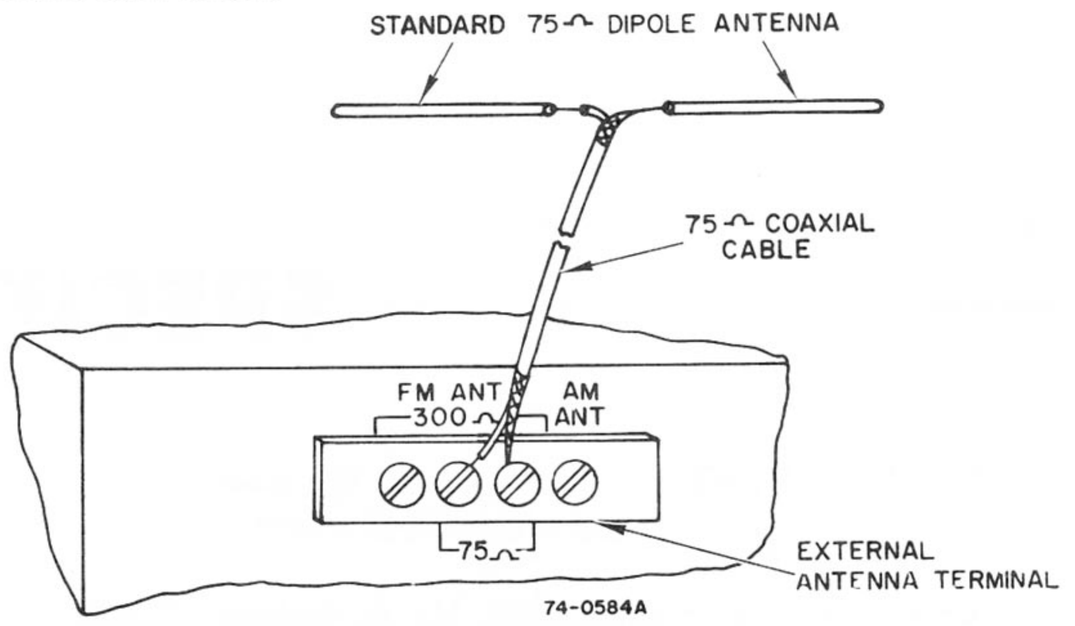


Figure 3 – Connection of external 75Ω FM antenna.

AM ANTENNAS: A high-Q ferrite loopstick antenna is located on the chassis for receiving normal or strong AM signals. No connections are necessary for AM reception, using this antenna.

For weak signal areas, use a standard "flat-top" outdoor antenna connected to the AM terminal as shown in figure 4.

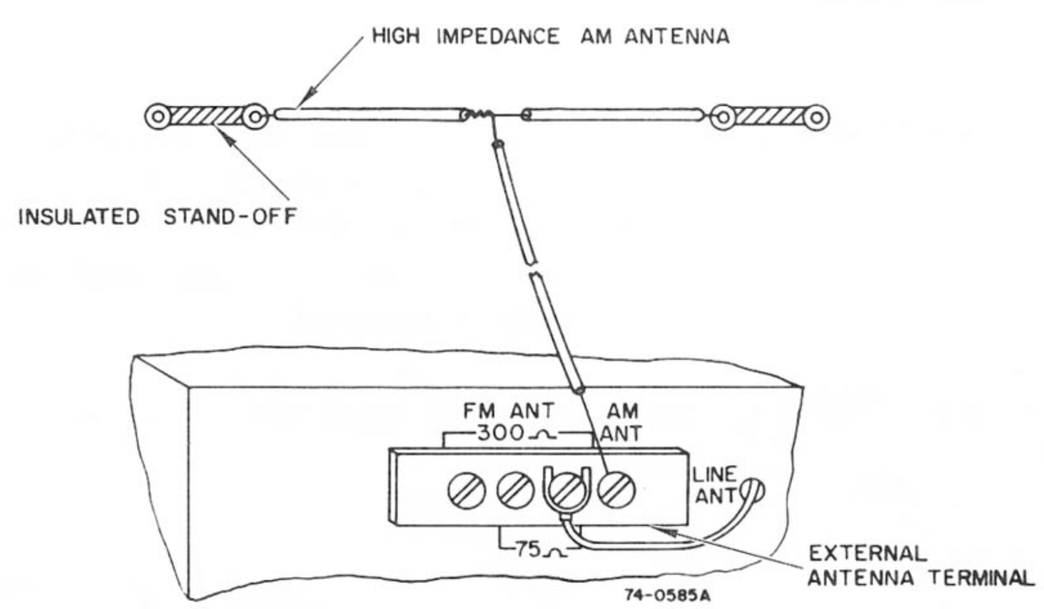


Figure 4 – Connection of external AM antenna.

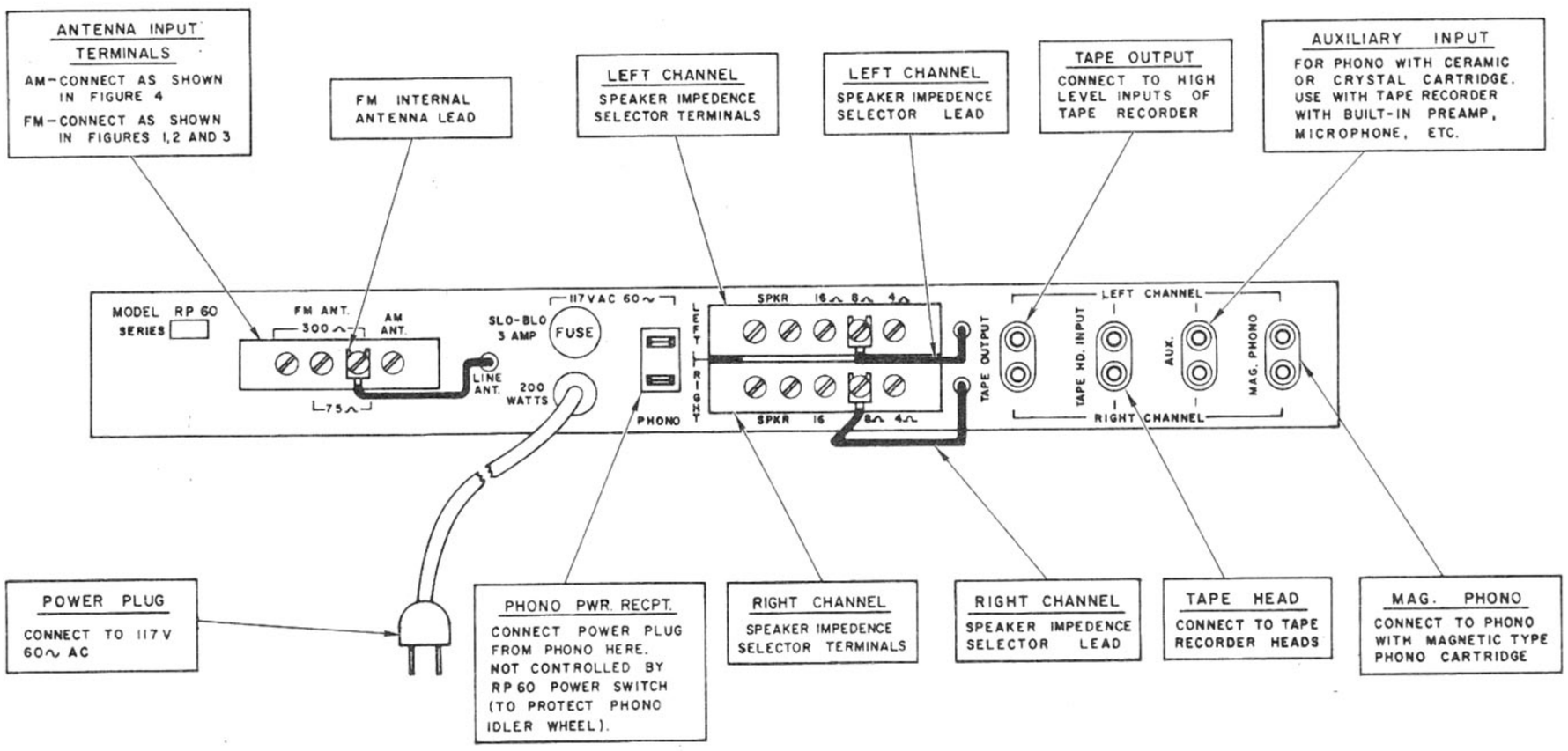


Figure 5 – Rear of chassis of RP60.

HOW TO CONNECT PROGRAM INPUTS

PHONOGRAPH: Facilities have been provided for stereo or monophonic inputs from phonographs having magnetic, ceramic, or crystal cartridges.

1. **MAGNETIC CARTRIDGE:** Connect the outputs of the phonograph to the two input jacks marked MAG. PHONO (Refer to figure 5)

2. **CERAMIC CARTRIDGE:** Connect the outputs of the phonograph to the two input jacks marked AUX. (Refer to figure 5)

3. **CRYSTAL CARTRIDGE:** Connect the outputs of the phonograph to the two input jacks marked AUX. (Refer to figure 5)

NOTE: *For monophonic listening (with a monophonic cartridge), select the left or right channel jack which corresponds to the type of cartridge being used in your player and and connect the phonograph output to that jack.*

For monophonic listening with a stereo cartridge, connect both phonograph outputs to the proper pair of jacks as explained above.

One of the most frequent causes of phonograph hum can be traced to the incorrect interconnection of the pickup cartridge, the phono turntable, and the amplifier. When hum is encountered in an installation and **disappears** when the phono plug is disconnected from the amplifier input receptacle, it is likely that the hum is due to 60-cycle AC current through the phono cable shield. This can be overcome by connecting the chassis of the phonograph to the amplifier's ground. Make certain that the phonograph cable shield is not connected electrically to the chassis of the phonograph.

TAPE RECORDER: When playing back prerecorded program material, plug the outputs of the stereo playback head of your tape deck into the two input jacks marked TAPE HD. on the rear of the amplifier's chassis (refer to figure 5) If your tape recorder is self-contained (that is, if it has its own playback amplifier), connect the playback head outputs to the two jacks marked AUX.

NOTE: *Use the left or right channel TAPE input jack for monophonic playback.*

AUXILIARY: The jacks marked AUX are for input connections from a tape recorder with a built-in preamplifier, from the sound section of a TV receiver, from a crystal microphone (high output, high impedance type) or other high-level sources.

NOTE: *For stereo, the program source must be connected to both AUX jacks; for monophonic programs, connect the program source to the left or right channel jack.*

HOW TO CONNECT OUTPUTS

SPEAKERS: Two separate speaker systems can be connected to the RP-60.

For best stereo reproduction, it is suggested that the two speaker systems be similar. Try placement of speakers in different locations for the most effective results. Recent experiments have indicated that when both speakers are placed against the same flat wall, the area of stereo coverage is greater than if they are placed in corners. Separate speakers by at least five feet. In most cases, the program will sound best if you are located about midway between the speakers at about twice the distance between the speakers (e.g., if the speakers are 6 feet apart, you should be approximately 12 feet away from them).

Connect the speaker leads of the left and right channel speakers to the respective pair of terminals marked SPKR. Check the speaker system impedance (4, 8 or 16 ohms). Connect the spade lugs of the pig tail leads, on the chassis rear, to the correct left and right channel terminals (refer to figure 5).

3RD CHANNEL: If you now own a monophonic high fidelity amplifier-speaker system, you may use it, together with your new stereo system, to provide a third channel and further enhance the effect of stereophonic sound. This third channel sound blends with the sound of the two regular stereo channels to add more body and presence to stereo. To set-up the third channel proceed as follows:

1. Insert input cable jack from your monophonic amplifier into jack, marked 3RD CHANNEL OUTPUT on top of RP 60 (refer to figure 7).
2. Place monophonic speaker between the stereo speakers.
3. Adjust volume control on monophonic amplifier to provide a balance between the three speaker outputs.

TAPE OUTPUT: For recording stereo programs, connect the input to the stereo tape recorder to the two jacks marked TAPE MONITOR. Do not connect a recording device that has an impedance of less than 100,000 ohms to these jacks.

OPERATION

HOW CONTROLS FUNCTION

POWER

Turn POWER switch on. Allow unit to warm up.

PROGRAMING SELECTOR

This control is used to select the desired program source. The control has the following positions:
AM-Used to select the AM program input from the AM tuner section.
FM ST-Used to select the multiplex program signal when a stereo FM-Multiplex program is being transmitted.
FM-Used to select the FM program input from the FM tuner section.
AUX-Used to select the program signal source connected to the AUX Input as described under Installation.
PHONO-Used to select the program signal source from a phonograph employing a magnetic type cartridge when connected as described under Installation.
TAPE HD-Used to select the program signal source from a tape recorder (direct from the tape recorder playback heads) when connected as described under Installation.

MODE

Used to select the desired mode of operation. . .stereo, stereo with channels reversed, left channel or right channel input fed to both speaker systems. The functions of the four positions are as follows:

STER NORM and STER REV – Used when listening to a stereo program source. In the **STER NORM** position the left channel signal will be heard from the left channel speaker system and the right channel signal will be heard from the right channel speaker system. In the **STER REV** position the amplifier outputs are reversed. The left channel signal will be heard from the right channel speaker system, while the right channel signal will be heard from the left channel speaker system. Therefore, if the sound directions appear to be wrong (e.g. if violins appear to be on the wrong side of orchestra) the directions of the sound may be reversed by switching between the **STER NORM** and **STER REV** positions.

MONO L-IN and MONO R-IN: In the **MONO L-IN** position the program source connected to the left channel input will be heard from both speaker systems. In the **MONO R-IN** position the program source connected to the right channel input will be heard from both speaker systems.

VOLUME AND BALANCE CONTROLS

The volume control of the RP60 controls the level of both channels. Clockwise rotation increases the volume level of both channels; counterclockwise rotation decreases the volume level. Rotate the VOLUME control until a satisfactory listening level is obtained.

The BALANCE control controls the level of each channel separately. By turning this control from its normal center position to the left, the volume from the left channel speaker will be decreased while the volume from the right channel speaker will remain constant. Rotation of this control to the right of center will decrease the volume of the right channel speaker, while volume from the left channel speaker will remain constant.

After adjusting the VOLUME control for an approximate listening level, adjust the BALANCE control for an exact balance between the two speakers. After the desired balance is obtained the volume may be increased without affecting the balance.

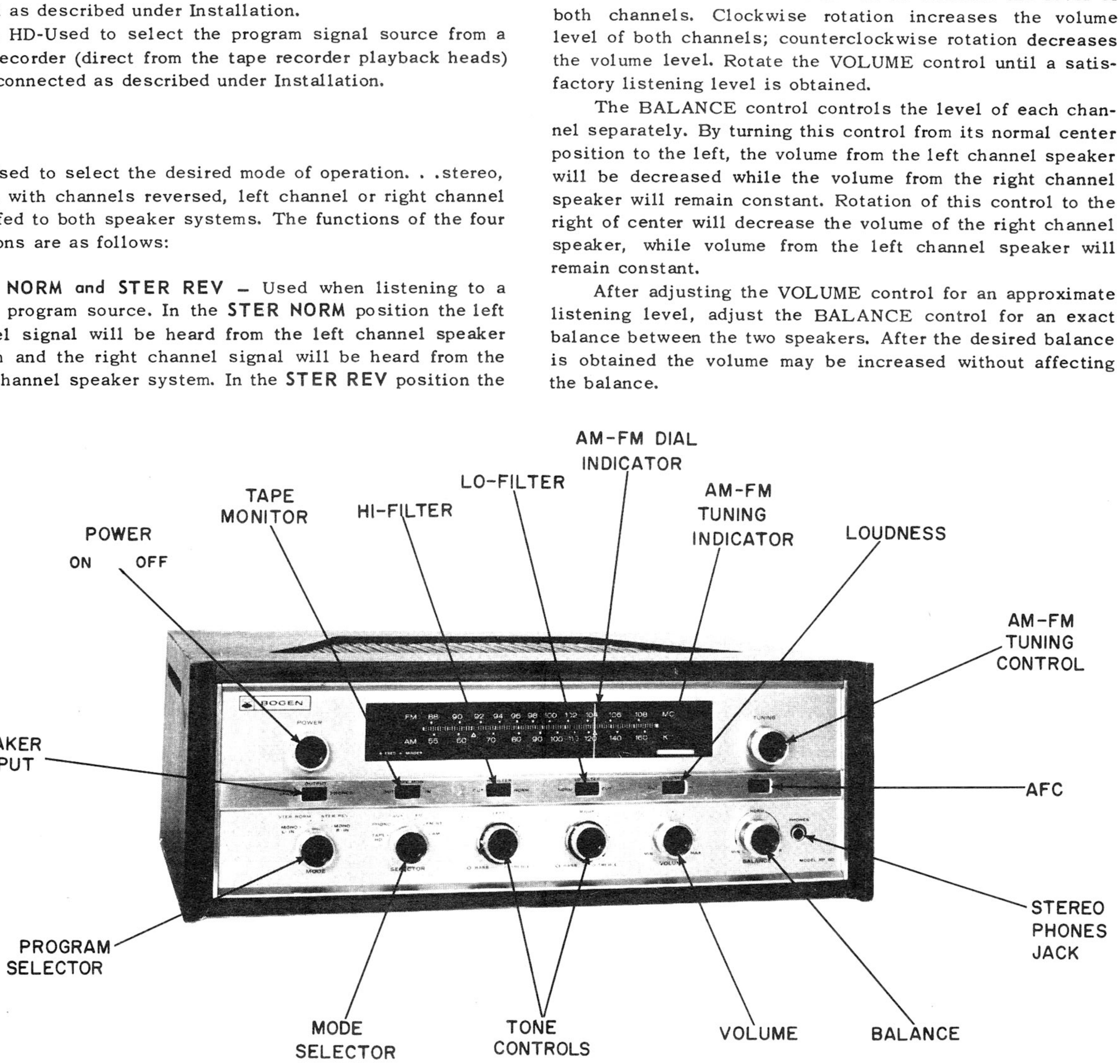


Figure 6 – Model RP60 Controls

BASS AND TREBLE

Four separate and independent controls have been provided for accurate setting of the tonal balance of each channel. The bass and treble controls for each channel are arranged coaxially. The front knob is used for treble adjustment while the rear knob is used for bass adjustment.

BASS: The mid-position of this control provides "flat" or normal low-frequency response. Clockwise rotation (↷) from the mid-position increases the bass response; counterclockwise rotation (↶) decreases the bass response.

TREBLE: The mid-position of this control provides "flat" or normal high frequency response. Clockwise rotation (↷) from the mid-position increases the treble response; counterclockwise rotation (↶) from the mid-position decreases the treble response.

SPEAKER OUTPUT SWITCH

This switch is used for listening to stereo phones only. When it is desired to listen to stereo phones, plug the phones into the phone jack, located on the right of the front panel, and place the OUTPUT switch in PHONES position.

TAPE MONITOR SWITCH

IMPORTANT: This switch must be in the OUT position when the RP60 is not used for tape monitoring.

This switch permits the RP60 to be used simultaneously as a signal source for your tape recorder and at the same time as a monitor power amplifier. When used with a tape recorder having a monitor feature (all high quality tape recorders are capable of monitoring directly from the tape while recording) the signal, which has been recorded on the tape, can be picked-up by the playback head and heard through the RP60 during the recording operation. This permits the user to adjust the controls affecting recording for optimum characteristics and correct his settings as the recording is being made. This is the system used by professional recording engineers.

HI and LO FILTER SWITCHES

HI FILTER: Used to reduce high frequency noise level (e.g. noise due to a scratched or worn phono record). For normal reproduction leave switch in NORM position. When it is desired to remove high frequency noise (frequencies above 4,000 cycles) move the HI FILTER switch to the CUT position.

LO FILTER: Used to reduce low frequency noise level (e.g. record changer rumble-motor vibration in phono mechanism). For normal reproduction leave switch in NORM position. When it is desired to remove low frequency noise (frequencies below 100 cycles) move the LO FILTER switch to the CUT position.

LOUDNESS SWITCH: When the volume control is used to reduce sound level, low frequencies seem to drop out. This apparent lack of bass at a low sound level is caused by a normal characteristic of the ear which makes it less sensitive to changes in loudness at low frequencies than at high frequencies. In a home system, however, you normally would not want to listen to music at "concert level." But you still would want to maintain tonal balance constant between high and low frequencies. The loudness switch does precisely that. Use this switch, then, when listening conditions change after you have achieved balance between your speakers with your volume controls. Therefore, when the VOLUME controls are set for low loudness level listening and the reproduction seems to lack bass response move the LOUNDESS switch to the IN position. At all other times, when the VOLUME controls are increased to provide a loudness level at or near concert level, move the LOUDNESS switch to the OUT position.

AFC SWITCH

AFC (Automatic Frequency Control) is incorporated in the RP60 to provide optimum Bandwidth as the program and station characteristics change. Maximum fidelity and positive drift free performance are insured when the switch is in the IN position. The use of this control is discussed under "Tuner Operation".

TUNING CONTROL

The TUNING control is used to select the desired AM or FM station. The operation of this control is discussed under "Tuner Operation".

TUNER OPERATION

AM MONOPHONIC RECEPTION

1. Place the PROGRAM SELECTOR control in AM position.
2. Rotate the TUNING control until the dial pointer is in the vicinity of the station's frequency. Continue to rotate control slowly back and forth until the TUNING INDICATOR is at maximum closing (narrows to a thin band). Station is now precisely tuned.

FM MONOPHONIC RECEPTION

1. Place the PROGRAM SELECTOR control in the FM position. Place the MODE selector switch in the MONO L-IN position (or MONO R-IN position).
2. Move the AFC switch to the OUT position.
3. Rotate the TUNING control until the dial pointer is in the vicinity of the station's frequency. Continue to rotate the TUNING control back and forth until the TUNING INDICATOR is at maximum closing (narrows to a thin band). Station is now precisely tuned.
4. Move AFC Switch to IN position to "lock" station on proper frequency.

FM STEREO MULTIPLEX RECEPTION

1. Rotate the PROGRAM SELECTOR switch to the FM ST position. Place the MODE Selector switch in the STER NORM position.
2. Move the AFC switch to the OUT position.
3. Rotate the TUNING control until the dial pointer is in the vicinity of the station's frequency. Continue to rotate the TUNING control back and forth until the TUNING INDICATOR is at maximum closing (narrows to a thin band). Station is now precisely tuned.
4. Move AFC switch to IN position to "lock" station on frequency.
5. When the STEREO MINDER indicator is lit, the selected station is transmitting in stereo.

   While tuning across the FM dial scale, the STEREO MINDER indicator may flash on and off. This is due to inter-station noise and is not a malfunction. Once a station is correctly tuned, and the tuning indicator is at maximum closing, the STEREO MINDER will stay on only if the station is broadcasting stereo.

PHONOGRAPH OPERATION

MONOPHONIC REPRODUCTION

1. Select the PHONO (for magnetic cartridge) or AUX (for ceramic or crystal type cartridges) position with the PROGRAM SELECTOR control.

2. Set MODE control to MONO L-IN (or MONO R-IN) position.
3. Set VOLUME, BASS, TREBLE controls and FILTER switches to provide the desired loudness and tonal balance.

STEREOPHONIC REPRODUCTION

(when using stereo cartridge)

1. Select the PHONO position (for magnetic cartridge), or AUX position (for ceramic crystal type cartridges), with the PROGRAM SELECTOR control.
2. Set the MODE control to STEREO NORM position.
3. Adjust VOLUME, BALANCE, BASS, TREBLE controls and filter switches to provide balanced output at desired loudness level and tonal balance.
4. If it is desired to reverse sound direction place the MODE control in the STER REV position.

TAPE OPERATION

MONOPHONIC REPRODUCTION

1. Select the TAPE HD position with the PROGRAM SELECTOR control.
2. Set MODE control to MONO L-IN (or MONO R-IN) position.

Set VOLUME, BASS, TREBLE controls and filter switches to provide the desired loudness and tonal balance.

STEREOPHONIC REPRODUCTION

1. Select the TAPE HD position with the PROGRAM SELECTOR control.
2. Set the MODE control to STEREO NORM position.
3. Set remaining controls as described above in steps 3 and 4 of Phono Stereophonic Reproduction.

SERVICE

TUBE REPLACEMENT

Tubes should be tested at least once every six months insure optimum high-fidelity performance. To avoid possibility of shock, do not remove bottom plate when replacing tubes. Handle tubes by their bases only when removing or inserting them.

DIAL LIGHT

The dial lights are 50,000-hour GE Number 12 lamps and should not require replacement during life or receiver.

FUSE REPLACEMENT

A three-ampere slow-blow fuse is located on rear of chassis (refer to figure 5). To replace, press spring-loaded cap inward, rotate counterclockwise and withdraw cap and fuse. Use only 3 amp. slow-blow fuse for replacement. If second fuse blows, do not attempt to further operate equipment. Consult an experienced technician or Bogen representative for inspection of unit.

REPLACEMENT OF AM FERRITE LOOP ANTENNA

In event AM ferrite loop antenna is replaced for any reason, check alignment as follows:

1. Connect DC VTVM at "B" (see schematic) and check alignment of AM RF oscillator in accordance with chart.
2. Set signal generator to 600 KC and tune receiver to signal. Adjust loopstick by sliding coil in bracket to point where maximum DC voltage is obtained.
3. Seal loopstick in position by applying drop of Duco or other suitable cement to bind coil with respect to bracket.
4. Adjust AM RF trimmer at 1500 KC in accordance with chart.

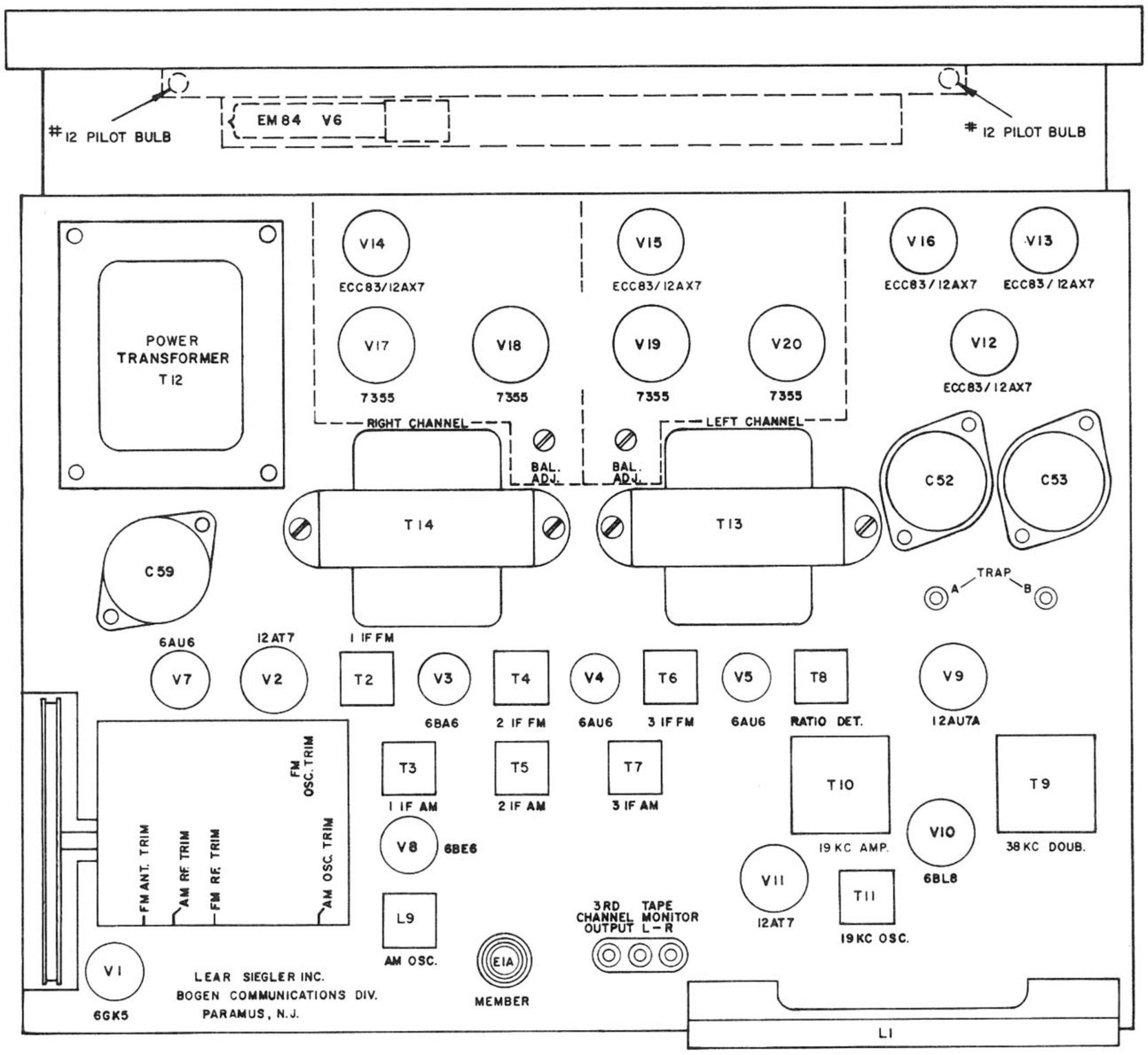


Figure 7 – Top View of Chassis

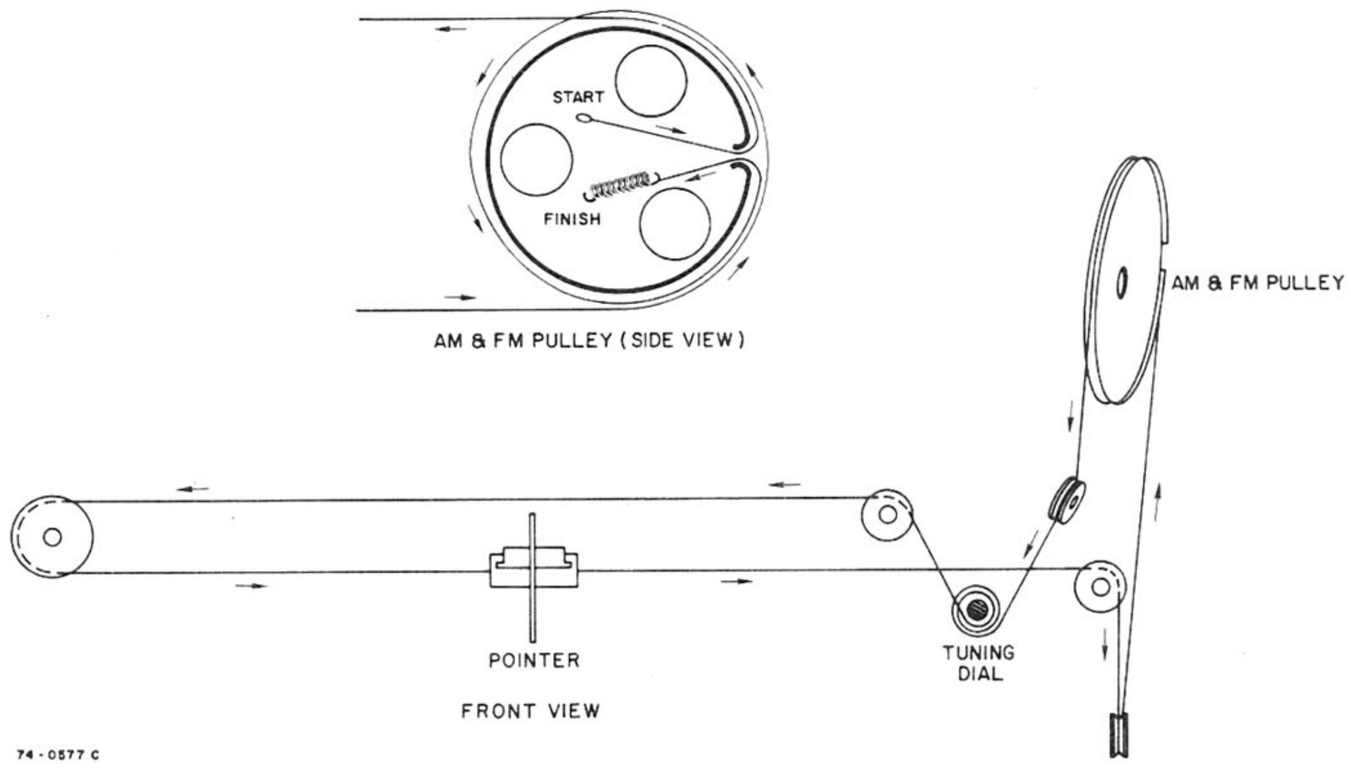


Figure 8 – Dial Stringing Procedure

BALANCING OUTPUT TUBES

If any of the audio power output tubes are replaced, the BAL ADJ controls (refer to figure 7) should be reset as described in the following procedures. Procedure #1, requiring a distortion analyzer provides the most precise adjustment for minimum distortion. Procedure #2, should be used if only a VTVM is available. If no test instruments are available then set controls to their center positions.

Procedure #1 – Remove the speaker connections for the channel to be balanced and connect a 4 ohm, 30 Watt resistor from terminal #2 to ground. Connect a distortion analyzer in parallel with resistor. Connect an audio generator to the AUX input and set the PROGRAM SELECTOR control to connect the signal to the channel being balanced. Adjust the VOLUME control (for channel) and generator output to provide approximately 15 watts amplifier output. Rotate the MODE control to STEREO NORM position. Adjust the BAL ADJ control (for channel) to provide a minimum distortion reading on the distortion analyzer.

Procedure #2 – Remove the speaker connections for channel to be balanced and connect a VTVM, capable of reading 0.001 Volt AC, from terminal #4 to ground. Set VOLUME control (for channel) to minimum and rotate MODE control to STEREO NORM position. Adjust BAL ADJ control (for channel) to provide a minimum reading on the VTVM.

FM ALIGNMENT PROCEDURE

When using the FM Alignment Procedure below, it is recommended that either Measurements Model 78FM or Boonton Type 202 or equivalent signal generators be employed. Adjustment points are labelled on chassis as FM RF TRIMM, AM RF TRIMM, AM OSC TRIMM, etc. Use an insulated screwdriver for all adjustments.

DIAL CORD RESTRINGING

Connect dial cords at points START as shown in figure 8. Restringing as indicated; be sure that sufficient pressure from spring at FINISH is maintained in order to prevent slipping.

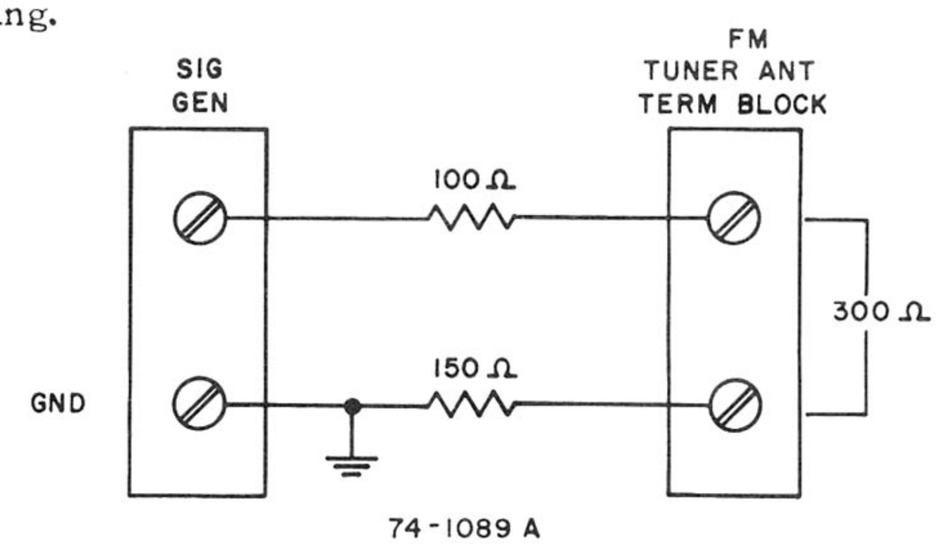


Figure 9 – FM alignment generator connections.

	STEP	BAND & DIAL SETTING	GENERATOR FREQUENCY	SIGNAL INPUT POINT	INDICATOR & CONNECTION POINT	ADJUSTMENT
AM ALIGNMENT	1	AM 1400KC	455KC 30% Mod	6BE6 pin #7 thru .01mf	VTVM Point "C" (see schem)	AM IF transformers for max output
	2	AM 600KC	600KC 30% Mod	AM ant term	Same	AM osc coil, loopstick and RF transformer for max output
	3	AM 1400KC	1400KC 30% Mod	AM ant term	Same	AM osc, AM ant. and RF trimmers for max output; check tracking by repeating steps 2 and 3.
FM ALIGNMENT	1	FM	10.7MC ±300KC deviation	12AT7 pin #2 thru .01mf	Oscilloscope Point "B" (see schem)	FM IF transformers for max gain and symmetry
	2	FM 104MC	104MC ±300KC deviation	FM ant term (see fig 9)	Same	FM osc and RF amp trimmers for max output (set AFC Control to "AFC OUT" position).
	3	FM 90MC	90MC ±300KC deviation	Same	Oscilloscope Point "B" (see schem)	Check tracking (AFC shorted, see step 2) and adjust FM osc and RF coils if necessary.
	4	FM 90MC	90MC ±300KC deviation	Same	Oscilloscope Point "A" (see schem)	Check discriminator for balanced "S" pattern and max ampl (AFC shorted, see step 2).

NOTE: *In step 1 above, top slug of 3rd AM IF can should be set at extreme counterclockwise position.*

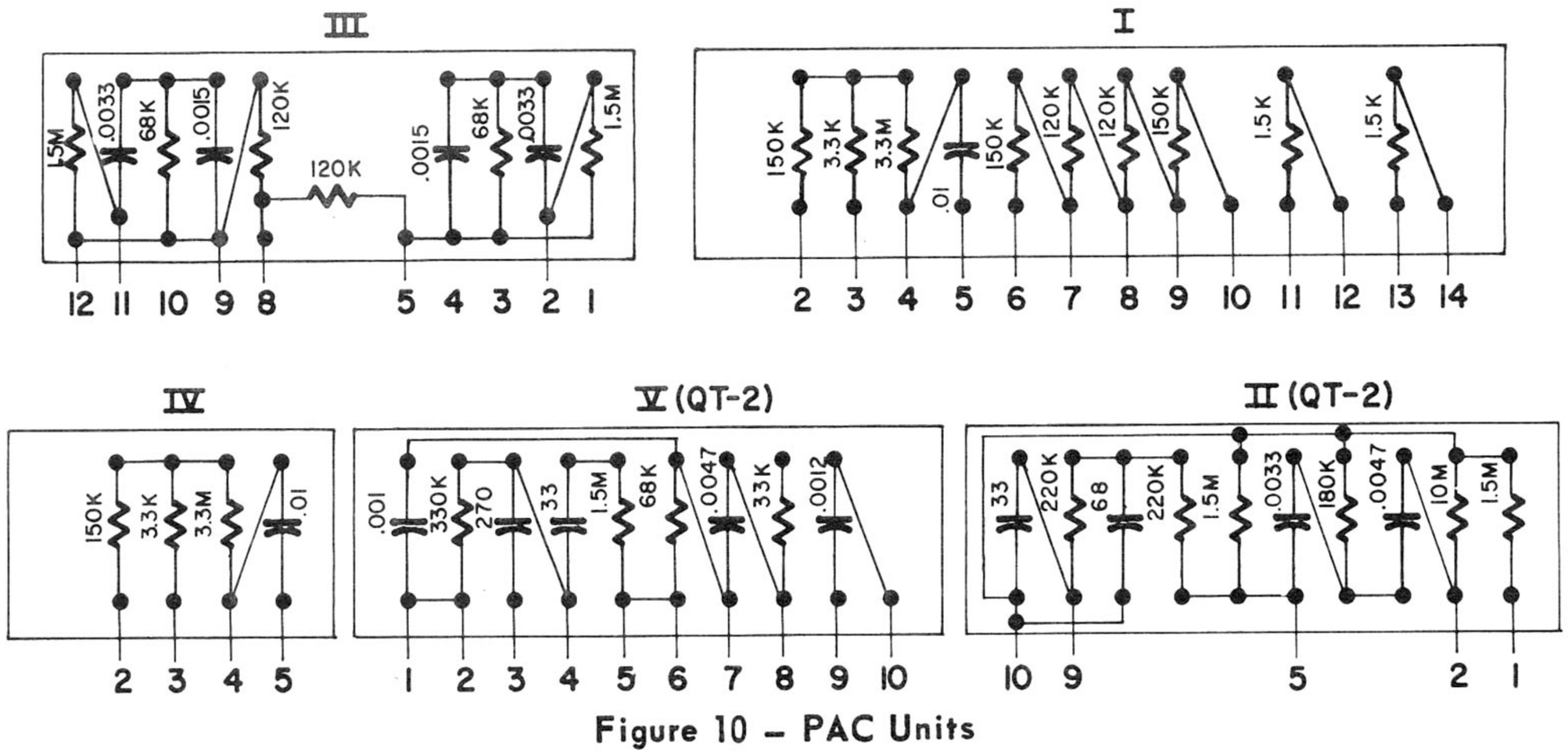


Figure 10 – PAC Units

MULTIPLEX SECTION ADJUSTMENT

Your receiver was precisely aligned at the factory with the best available test equipment (no service shop can attain the same exacting standards). Bogen therefore does not recommend alignment by anyone other than a factory authorized service station. However, in some instances it may be necessary to "touch-up" the multiplex section to meet differences between stations or slight misadjustment due to extreme shock incurred in shipment.

If a whistling or tweet type interference occurs, perform the adjustments given in steps 1 and 2 below to eliminate the disturbance. This disturbance is due to station transmitting background music over second multiplex sub-carrier. If this adjustment does not eliminate the interference, check that the station is precisely tuned-in, that the FM antenna is correctly oriented (try re-positioning), that a mismatch does not exist between antenna and receiver (try reversing leads), or if a better and more directional antenna is required.

If distortion occurs during FM multiplex transmission and is not present during monaural transmission it is due to trouble at the transmitter or in the antenna system (reflections, etc.)

It is considered very unlikely that a complete alignment will ever be required. This should be attempted only by a thoroughly experienced serviceman possessing good equipment. The following equipment, or its equivalent is recommended:

Scott Model 830 Multiplex Generator
Boonton Model 202E RF Signal Generator
Hewlett–Packard Model 202C Audio Oscillator

Before attempting the complete alignment procedure, be sure to carefully read and thoroughly understand the multiplex generator instruction manual. Interconnect equipment as described in manual. Be sure generator is properly calibrated and all equipment is matched in regard to levels and impedances (and that signals are free from distortion). Be sure that alignment area is **free** from interference.

MULTIPLEX ALIGNMENT CHART

STEP	ALIGN	GENERATOR	SIGNAL INPUT POINT	INDICATOR, TEST POINT	ADJUSTMENT
1	67KC TRAP	67KC-Audio Oscillator	V9 12AV7 Pin 2 Approx. 0.5V Level	VTVM at junction of Trap "A" and "B"	Trap "A" min.
2	76KC TRAP	76KC-Audio Oscillator	Same as Step 1	Same as Step 1	Trap "B" min.
3	19KC AMP	98MC FM signal modulated 10% by Stereo Gen. with Pilot Signal	Ant. Terminals 1000 μv Level	VTVM at Pin 8 of V10 6BL8	Tune T10 for max. Top of T11 for min.
4	38KC Doubler	Same as Step 3	Same as Step 3	VTVM at junction of IN542 diodes and T9	Tune T9 for max.
5	19KC Oscillator Phase	98MC FM signal modulated 45% with 1KC "LEFT ONLY" signal and 10% Pilot	Same as Step 3	Scope at left TAPE output	Tune bottom of T11 for max. undistorted 1KC output signal

VOLTAGE CHART

NO.	TYPE	PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V1†	6GK5	0.14	9	6.3AC	0	113	0	0.74	–	–
V2†	12AX7	129	-1.6	0	6.3AC	81		-0.9	0	0
V3†	6BA6	-1.2	0	6.3AC	0	90	90	0	–	–
V4†	6AU6	0	0	6.3AC	0	118	118	0.9	–	–
V5†	6AU6	-0.58	0	6.3AC	0	52	52	0	–	–
V6†	EM84	-0.76	155	0	0	6.3AC	155	33	155	33
V7†	6AU6	0	1.8	6.3AC	0	127	127	1.8	–	–
V8*	6BE6	-12.5	0	6.3AC	0	107	107	-0.65	–	–
V9†	12AU7	129	-2	45	0	0	72	0	2.75	6.3AC
V10†	6BL8	76	-3.4	113	6.3AC	0	129	0.01	1.18	0
V11†	12AT7	140	-4.9	-0.02	0	0	37.5	-0.45	0	6.3AC
V12▲	12AX7	127	0	1	12.3	12.3	130	0	1	–
V13▲	12AX7	180	0	1.3	12.3	12.3	190	6.8	55	0
V14▲	12AX7	250	4	60	12.3	12.3	49	-0.05	0.57	–
V15▲	12AX7	250	4	60	12.3	12.3	46	-0.05	0.57	–
V16▲	12AX7	175	0	1.3	12.3	12.3	185	7.5	55	0
V17▲	7355	-28	0	335	NC	0	-28	6.3AC	345	–
V18▲	7355	-28	0	335	NC	0	-28	6.3AC	345	–
V19▲	7355	-28	0	335	NC	0	-28	6.3AC	345	–
V20▲	7355	-28	0	335	NC	0	-28	6.3AC	345	–

NOTES:

1. VTVM measurements with respect to chassis ground. All grid voltages measured with a 1 megohm resistor in series with a DC probe.
† 2. SELECTOR switch in FM position.
* 3. SELECTOR switch in AM position.
▲ 4. SELECTOR switch in AUX position.
5. 12AX7 DC filament voltage measured between pin 4 and pin 5.

REPLACEMENT PARTS

The components used in BOGEN equipment, with exception of items listed below, are standard parts available through all reputable parts jobbers. However several parts are custom-made to strict BOGEN specifications and should be replaced only with genuine BOGEN parts. These custom-made parts are listed here and are available through BOGEN distributors, service agencies or direct from the factory.

When ordering parts specify part number, description of part and model number.

Part No.	Description
70-9132-01	Carriage and Pointer Assy.
12-4061-02	Dial Window
12-4007-01	Antenna Holder
03-0559-04	Knob, Tuning
03-0572-01	Knob
03-0568-04	Knob, Front Coax
03-0557-02	Knob, Rear Coax
94-0193-01	Lamp, NE2-E
94-0175-01	Pilot Light, #12

Ref. No.	Part No.	Description
C1	80-0129-01	Capacitor, Variable AM/FM Tuning
C2	80-2004-01	Capacitor, FM Osc Trimmer (less screw)
C61, C62	79-003-055	Capacitor, Electrolytic, 4mf. 50V.
C54, C55, C56	79-001-116	Capacitor, Electrolytic, 20mf, 350V.
C57, C58	79-001-078	Capacitor, Electrolytic, 30mf, 150V.
C38, C11	79-001-026	Capacitor, Electrolytic, 100mf, 6V.
C52, C53	79-010-031	Capacitor, Electrolytic, 4x20mf, 450V.
C59	79-010-022	Capacitor, Electrolytic, 2000mf, 15V.

REPLACEMENT PARTS (Continued)

Ref. No.	Part No.	Description
C51, C57, C58, C25, C63, C64, C65	78-200-127	Capacitor, Ceramic, Disc., 1500mmf, 1400V.
L1	95-5008-01	Loopstick, AM Antenna
L2	95-5001-01	Choke Assy, RF
L3	95-5005-02	Choke, RF
L4	95-0003-32	Coil, RF
L5	95-0003-33	Coil, FM Mixer Input
L6	95-0003-34	Coil, FM Oscillator
L7	95-5018-01	Choke, RF
L8	95-5019-02	Choke, RF
L9	95-5009-01	Coil, AM Oscillator
L11, L12, L13, L14	95-5015-01	Choke, RF
L15	95-5016-01	Choke, RF
L16	95-5043-01	Coil, RF Bypass Filter
L17	95-5042-01	Coil, RF Bypass Filter
R2, R42	75-233-124	Resistor, Deposited, Carbon, 120K ohms
R92	76-107-097	Resistor, Wirewound, 1 ohm, 2w
R100	75-742-102	Resistor, Wirewound, 1000 ohm, 7w
R101	76-124-001	Resistor, Wirewound, 2,500 ohm, 20w
R12-R15	77-001-532	Control, Tone, Dual 2Meg ohm Pot.
R51-R55	77-001-532	Control, Tone, Dual 2Meg ohm Pot.
R17-R57	77-001-530	Control, Volume, Dual 500K ohm Pot.
R103-R104	77-001-531	Control, Balance, Dual 1.5 Meg ohm Pot.
R27	77-001-392	Control, Bal. Adjust, 100K ohm Pot.
R66	77-001-392	Control, Bal. Adjust, 100K ohm Pot.
SW1	81-001-560	Switch, Program SELECTOR
SW2	81-001-559	Switch, MODE
SW3	81-003-010	Switch, Tape Monitor
SW4	81-003-010	Switch, LO Filter
SW5	81-003-010	Switch, HI Filter
SW6	81-003-010	Switch, LOUDNESS
SW8	81-003-010	Switch, Speaker OUTPUT
SW9	81-003-010	Switch, AFC
SW7	81-006-012	Switch, ON-OFF
T1	95-5017-01	Transformer, FM Antenna Input
T2	95-5011-01	Transformer, FM IF
T3	95-5013-01	Transformer, AM IF
T5	95-5013-01	Transformer, AM IF
T7	95-5013-01	Transformer, AM IF
T4	95-5010-01	Transformer, FM IF
T6	95-5010-01	Transformer, FM IF
T8	95-5036-01	Transformer, FM Detector
T9	95-5041-01	Transformer, Doubler 38KC
T10	95-5044-01	Transformer, 19KC
T11	95-5035-02	Transformer, FM Multiplex Osc.
T12	83-658-000	Transformer, Power
T13	83-324-010	Transformer, Output
T14	83-324-010	Transformer, Output
X1	96-5022-01	Diode, Silicon
X2	96-5022-01	Diode, Silicon
X3	86-0016-01	Rectifier, Selenium
X4, X5, X6, X7	96-5023-01	Diode, Silicon, Power Supply
X8, X9, X10	96-5007-02	Diode, Germanium, 1N541
X11, X12	96-5007-01	Diode (2), Matched Pair, 1N542
X13, X14	96-5007-01	Diode (2), Matched Pair, 1N542
X15, X16	96-5007-01	Diode (2), Matched Pair, 1N542
Z1	78-907-001	Printed Circuit
	78-909-001	Packaged Circuit, I
	78-917-001	Packaged Circuit, II
	78-916-001	Packaged Circuit, III
	78-911-001	Packaged Circuit, IV
	78-910-001	Packaged Circuit, V

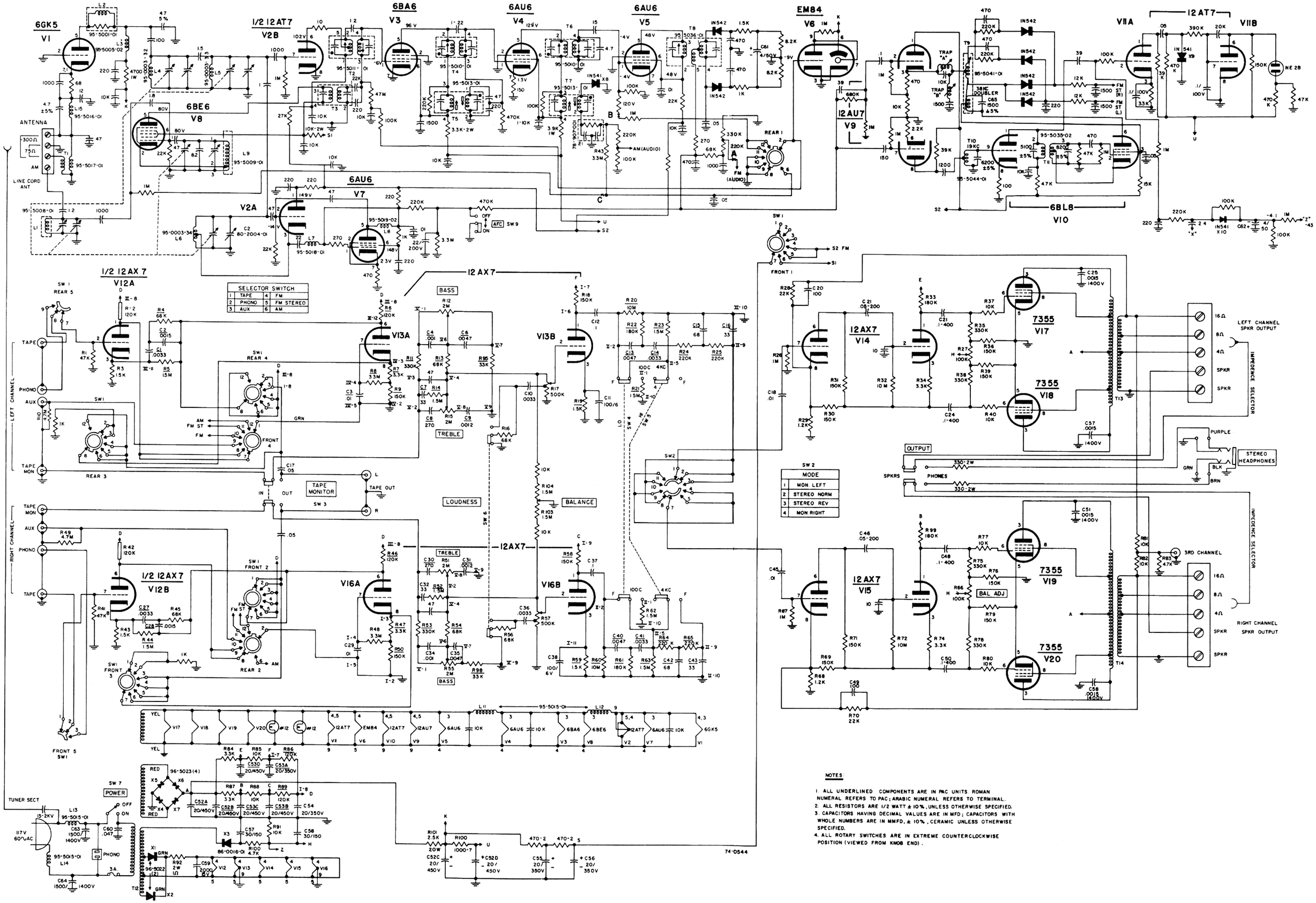
WARRANTY

The Bogen-Communications equipment which you have just purchased has been carefully tested and inspected before leaving our factory. When properly installed and operated in accordance with instructions furnished, it should give excellent performance and reliable operation.

Bogen-Communications equipment is guaranteed against all defects in material and workmanship for one year from date of sale to the original purchaser. Any part of the equipment which, under normal installation and use, becomes defective will be repaired or replaced by us, provided it is returned for our examination. Transportation prepaid, to our factory (or authorized service station). This warranty does not apply to equipment which has been subjected to abuse or accident, or which has been altered in any way; nor does this warranty extend to tubes, vibrators, or accessories, etc., not of our own manufacture and which are separately covered by the producing manufacturer's warranty.

The registration card enclosed with the equipment must be filled out and mailed to us within 5 days of purchase to place the warranty in effect.

Figure 11 – Schematic of Model RP60



NOTES:

1. ALL UNDERLINED COMPONENTS ARE IN PAC UNITS. ROMAN NUMERAL REFERS TO PAC; ARABIC NUMERAL REFERS TO TERMINAL.
2. ALL RESISTORS ARE 1/2 WATT ± 10%, UNLESS OTHERWISE SPECIFIED.
3. CAPACITORS HAVING DECIMAL VALUES ARE IN MFD; CAPACITORS WITH WHOLE NUMBERS ARE IN MMFD, ± 10%, CERAMIC UNLESS OTHERWISE SPECIFIED.
4. ALL ROTARY SWITCHES ARE IN EXTREME COUNTERCLOCKWISE POSITION (VIEWED FROM KNOB END).

IF TROUBLE OCCURS

If trouble ever develops with your unit, please do not hesitate to ask our advice or assistance. We are interested in your Bogen unit for as long as you have it. Information can be obtained by writing to: Service Department, Bogen-Communications, P.O. Box 500, Paramus, New Jersey.

When communicating with us give the model number and serial number of your unit. Completely describe the difficulty encountered. Describe the effects each operating control has upon the symptoms of trouble. Include details on electrical connections to associated equipment and list such equipment.

When we receive this information we will send you service information if the trouble appears to be simple (e.g. bad vacuum tube, incorrect connections). If trouble requires servicing, we shall send you the name and address of the nearest Bogen authorized service agency to which you can send your unit for repair.

When shipping your unit, pack instrument well using the original shipping carton and filler material to prevent damage in transit. Send unit, fully insured and prepaid, via railway express. Do not ship via parcel post unless so instructed. The unit will be promptly repaired and returned to you via express collect.

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