

**BROADCAST AUDIO EQUIPMENT**

**Type BA-13A  
Program Amplifier**



**RADIO CORPORATION OF AMERICA  
ENGINEERING PRODUCTS DEPARTMENT CAMDEN, N. J.**

**BROADCAST AUDIO EQUIPMENT**

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**INSTRUCTIONS**

**Type BA-13A  
Program Amplifier**

**MI-11233, -A**

**RADIO CORPORATION OF AMERICA  
ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N. J.**

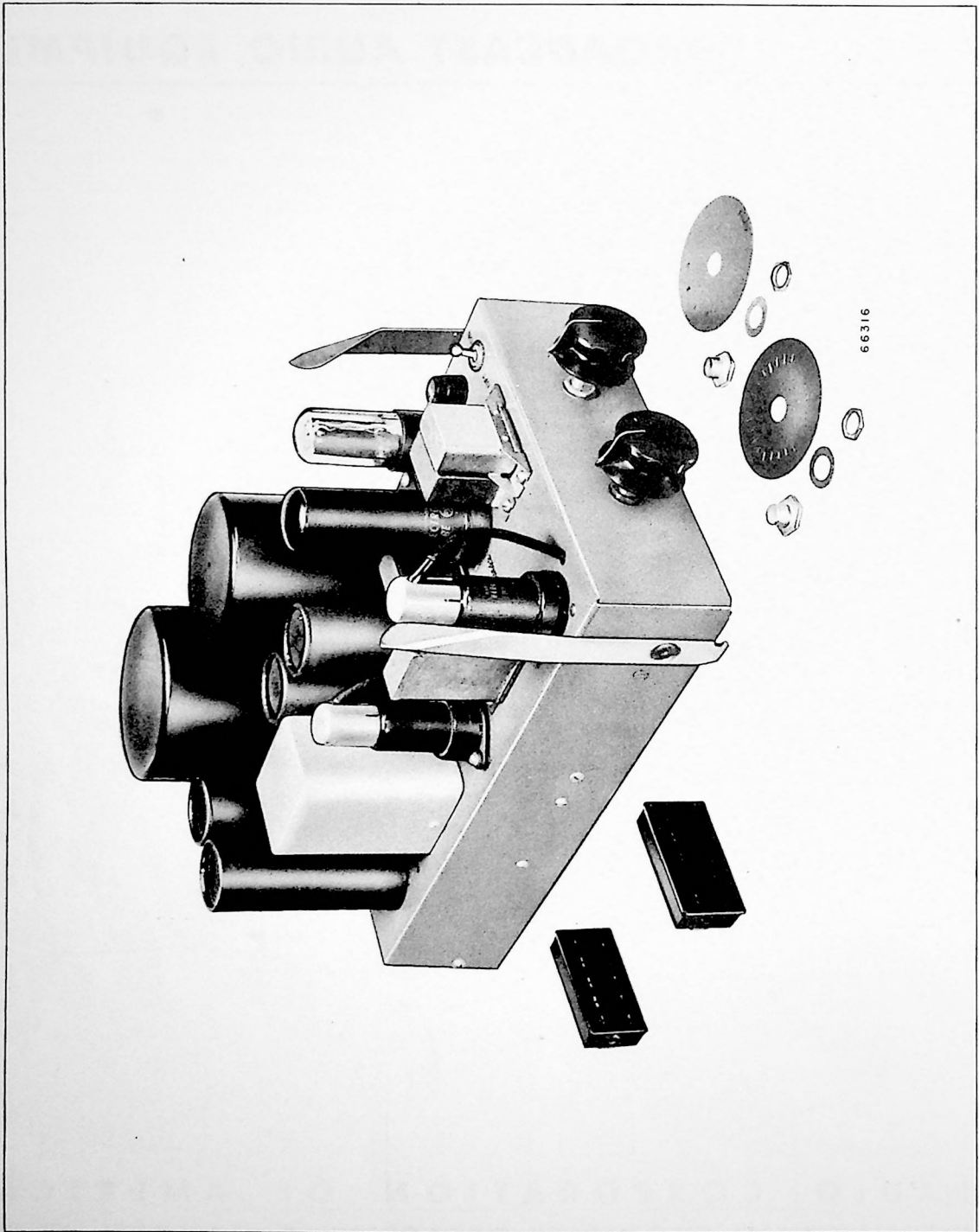


Figure 1—Front View of Type BA-13A Program Amplifier.

## DESCRIPTION

The Type BA-13A Program Amplifier, MI-11233-A, is a high-fidelity, high-gain, low-distortion amplifier designed to raise the output of pre-amplifiers or mixers to a level suitable for feeding broadcast telephone lines or radio transmitter inputs. It may be used as a bridging amplifier for isolation or other applications where a 20,000-ohm amplifier input is desirable. The Type BA-13A may also be used as an emergency monitoring amplifier

(2 watts output). The amplifier has a plug-in type chassis which allows easy removal from shelves or racks for servicing or interchanging units.

The Type BA-13A amplifier consists of three stages of amplification with a self-contained power supply. A power switch and an a-c line fuse are mounted on the chassis. Provision is made for controlling the gain of the amplifier, for adjusting the hum to a minimum, and for checking the operation of the individual tubes. The gain control

## TECHNICAL DATA

### Power Supply Required

100 to 130 volts, 50 to 60 cps, 55 watts

### Fuse Rating

1 ampere, Type MDL

### Tube Complement (MI-11266)

2 RCA 1620  
1 RCA 1622  
1 RCA 5Y3-GT

When increased hum distortion and microphonics can be tolerated, the following tube complement can be substituted:

2 RCA 6J7  
1 RCA 6L6  
1 RCA 5Y3-GT

### Source Impedance

600 or 150 ohms

### Input Impedance

#### Matching

600 or 150 ohms (approximate)

#### Bridging

20,000 ohms (approximate)

### Maximum Input Level

#### Matching Input:

+11 dbm for 1.0% total rms distortion from 30 to 15,000 cps (output +30 dbm)  
+10 dbm for 0.5% total rms distortion from 30 to 15,000 cps (output +18, dbm)

#### Bridging Input:

+30 dbm for 0.5% total rms distortion (output +18 dbm)

### Load Impedance (tapped transformer)

600 ohms balanced, taps for 150, 15, 7.5 and 5 ohms

### Rated Output Level

+30 dbm with 0.5% total rms distortion from 50 cps to 15,000 cps  
+30 dbm with less than 1.0% total rms distortion from 30 to 15,000 cps

### Gain

Measured at 1000 cps with gain control in maximum position

#### Matching Input:

65 db  $\pm$ 1 db, 600 or 150 ohm source to a 600 or 150 ohm load

#### Bridging Input:

28 db from a 600 ohm terminated line to a 600 or 150 ohm load

### Frequency Response

$\pm$ 1 db (referred to 1,000 cps) from 30 to 15,000 cps

Measured from either a 600-ohm or a 150-ohm source to a 600-ohm load with either bridging or matching inputs

### Noise Level

Less than -52 dbm with the gain control in the maximum position and the input and output circuits terminated in 600 ohms

### Isolation

90 db with matching input  
100 db with bridging input

### Connections

Two 10-prong plugs, mounted on the rear panel of the chassis, which engage with two receptacles provided with the amplifier

### Mounting

Shelf mounting in the Type BR-2A Panel and Shelf

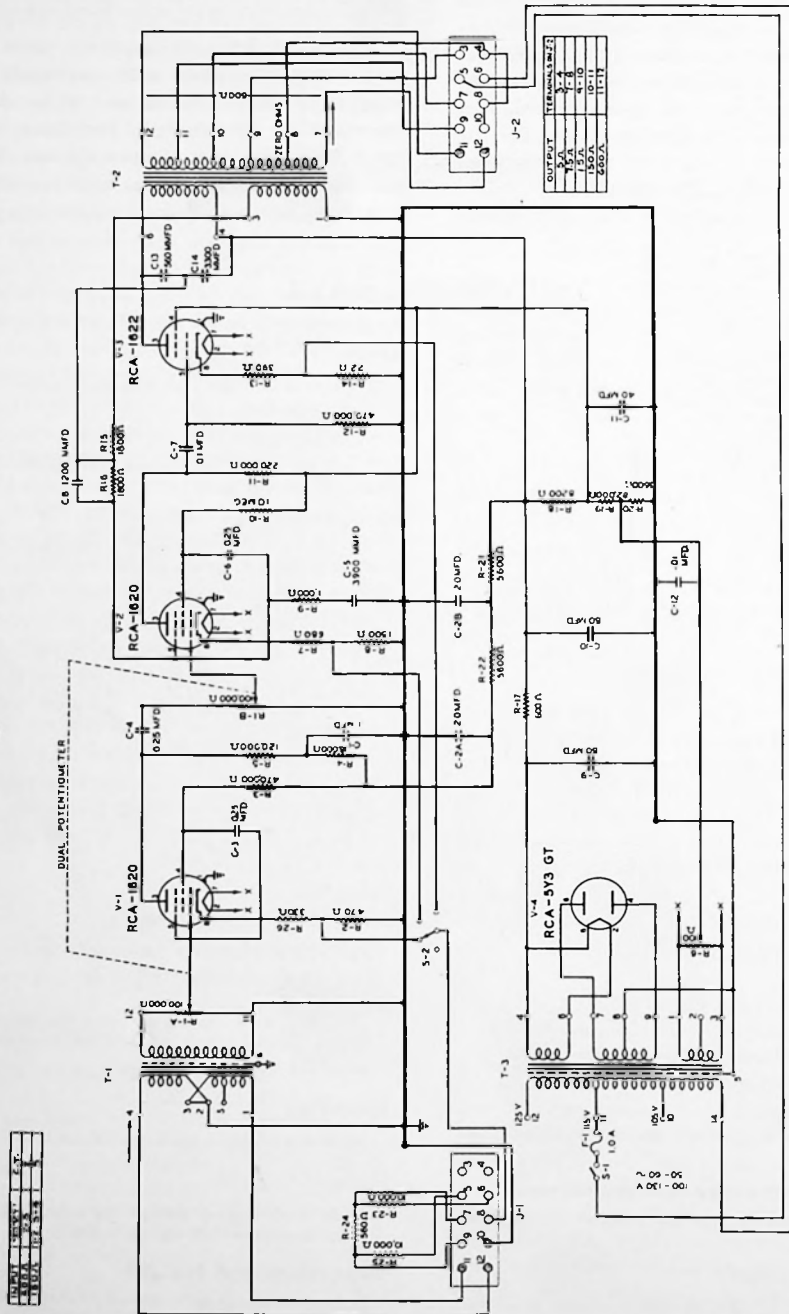
### Finish

Light umber gray except for output and power transformers which are satin black

### Dimensions and Weight

Length—14 inches  
Width—8 inches  
Height—7¼ inches  
Weight—17 pounds

See Back Page of Book.  
for Mod. for Addition Amp.



T-164620

Figure 2—Schematic Diagram of Type BA-13A Program Amplifier.

is mounted on the left side of the amplifier front panel and the meter switch on the right, see figure 1. The hum-adjustment potentiometer is mounted on top of the chassis, in front of the output transformer, see figure 3. The MI-11233 and MI-11233-A units are similar, except that the former uses a dual step-type attenuator gain control, and the latter uses a dual continuous-type attenuator.

## INSTALLATION

### Tubes

With the power switch in the OFF position, install the tubes in the correct sockets. The tube type for each socket is stenciled on the chassis near the socket. Mount the two grid caps and two grid-cap shields on the 1620 tubes. Each shield must make a good electrical connection to the shell of the tube to insure noise-free operation.

### Electrolytic Capacitors

Plug the four electrolytic capacitors into the red sockets provided for them on the amplifier chassis. Carefully check each capacitor as it is installed to ascertain that the ratings marked on the capacitor cover correspond to the values stenciled on the chassis, adjacent to the sockets.

### Power Transformer Connections

The power transformer T-3 is connected for operation from a 115-volt a-c power line. If the line voltage is normally 120-130 volts, disconnect the red-and-black wire from terminal number 11 on T-3 and connect it to terminal number 12. If the line voltage is normally 100-110 volts, disconnect this same red-and-black wire and connect it to terminal number 10 on T-3. Refer to figures 2 and 8.

### Mounting

The Type BA-13A Program Amplifier is designed for mounting on a Type BR-2A (MI-11598,-A and MI-11599,-A) Panel and Shelf.

The gain-control shaft is on the left side of the amplifier (front view) and the meter-switch shaft is on the right side. Mount the dial plates furnished with the amplifier on the panel, in positions corresponding to the respective shaft positions (GAIN dial to the left of the METER dial), securing them in place with the bushings, washers and nuts also supplied. Assemble the parts with the heads of the bushings on the inside of the panel to insure clearance.

Assemble the receptacles furnished with the amplifier to two of the U-shaped brackets supplied

with the shelf assembly (MI-11599,-A) by means of four of the No. 6-32 fillister-head machine screws furnished with the shelf. Mount the receptacles and brackets in the correct spaces on the shelf with six of the No. 8-32 round-head machine screws and lockwashers supplied with the shelf. Install the receptacle cover or shield, according to instructions for the Type BR-2A Panel and Shelf, contained in IB-24411 after the receptacles have been wired according to the following information:

Attach one of the guide bars, furnished with the shelf, to the shelf on each side of the space which is to be occupied by the amplifier. Use two No. 4 self-tapping screws also supplied with the shelf, to mount each guide bar. Holes are provided in the guide bars and in the shelf for this purpose. The square ends of the bars should be towards the front.

Slide the amplifier chassis onto the shelf so that the plugs fit into the receptacles and the hooks of the ejector handles fit into the square holes in the shelf. Push back on the ejector handles to obtain good contact in the receptacles. Install the panel by slipping it over the control shafts of the amplifier and attaching it to the shelf, by engaging the panel latches on the rear at each side of the panel.

Adjust the spring catches on the top section of the panel, for minimum and equal snap action. This adjustment may be made by loosening the No. 6-32 hex nuts holding the catches and moving the catches up or down. Close the top section of the panel and place the knobs on the control shafts.

Should it become necessary at any time to remove the amplifier for servicing, first remove the knobs and panel. Then, pull forward on the handles and slide the amplifier out.

### Receptacle Connections

The connections to the two 10-prong receptacles which mate with the amplifier plugs are shown in the following tabulations:

**INPUT RECEPTACLE J-1**

<i>Terminal No.</i>	<i>Connection</i>
3	No connection
4	No connection
5	Bridging input
6	Bridging input
7	Output of bridging pad
8	Test meter (+)
9	Output of bridging pad
10	Amplifier ground
11	Matching input
12	Matching input

### OUTPUT RECEPTACLE J-2

Terminal No.	Connection
3	Output transformer—5-ohm tap
4	Output transformer—center tap
5	A-C input to power transformer
6	A-C input to power transformer
7	Output transformer—7.5-ohm tap
8	Output transformer—center tap
9	Output transformer—15-ohm tap
10	Output transformer—Center tap
11	Output transformer—600 ohms
12	Output transformer—600 ohms

#### Input Shielding

All audio leads should be shielded twisted pair copper wire, insulated for 200 volts, and need not be larger than No. 19 A.W.G. All joints should be securely soldered, and of low resistance. If the circuits run in conduit or duct which may be subject to moisture, a type of wiring having a natural or synthetic rubber covering over the shield or lead should be used. To minimize undesirable noise pickup and cross talk on long input circuits, the shielding of the lines to the input terminals of the amplifier or rack should be covered with a cotton braid or other suitable insulation and the shielding should be grounded only at the amplifier (point of lowest level). Make sure that the shields are electrically continuous and that the ground connections are perfect. Do not run the audio-input leads adjacent to, or laced in with, a-c or high-level audio lines.

#### Matching Input Connections

Connect the incoming line to terminals number 11 and 12 of the input receptacle for input plug J-1. Refer to figures 3 and 8. Make impedance matching connections as follows:

- 600-OHM BALANCED INPUT.**—The amplifier is wired at the factory for this type of operation. Terminals number 2 and 3 on input transformer T-1 are connected together, terminals number 2 and 11 are connected together. Refer to figures 2 and 3.
- 600-OHM UNBALANCED INPUT.**—Disconnect from terminal number 2 on T-1 the wire which is connected to terminal number 11, and connect it to terminal number 1. Connect the grounded side of the incoming line to terminal number 11 on the receptacle for plug J-1.
- 150-OHM BALANCED INPUT.**—Remove the wire connecting terminals number 2 and 3

on input transformer T-1. At terminal number 2, disconnect the wire to terminal number 11 and connect it to terminal number 5. Connect terminals number 1 and 2 together, and connect terminals number 3 and 4 together. Refer to figures 2 and 8.

- 150-OHM UNBALANCED INPUT.**—Remove the wire connecting terminals number 2 and 3 on T-1. At terminal number 2, disconnect the wire to terminal number 11 and connect it to terminal number 1. Connect terminals number 1 and 2 together and connect terminals number 3 and 4 together. Connect the grounded side of the incoming line to terminal 11 on the receptacle for plug J-1.

#### Balanced Bridging Input Connections

Connect the incoming line to terminals number 5 and 6 on the input receptacle for plug J-1, figures 3 and 8. Connect terminals number 7 and 12 together, and connect terminals number 9 and 11 together, on the same receptacle. The input transformer is connected as in (a) under *Matching Input Connections*.

#### Output Connections

The amplifier is wired for operation into a variety of load impedances. The secondary winding of the output transformer T-2 is provided with a number of taps which are brought out to the terminals of the connection plug J-2 mounted on the rear of the amplifier chassis (directly behind the power transformer). The center tap of the output-transformer-secondary winding (terminal number 8 on the output transformer) is connected to terminals number 4, 8 and 10 of the connection plug J-2. Refer to figures 2 and 8.

Connection to the plug J-2 is made by means of one of the receptacles supplied with each amplifier. The following table shows line connections for loads of various impedance:

#### AMPLIFIER OUTPUT CONNECTIONS

Load Impedance	Receptacle Terminals
*600 ohms	11 and 12
150 ohms	10 and 11
15 ohms	9 and 10
7.5 ohms	7 and 8
5 ohms	3 and 4

\*600-ohm winding has a center tap (terminals number 4, 8 and 10 on J-2).

#### A-C Power Supply

Connect the a-c line for the amplifier to terminals number 5 and 6 of the output receptacle (for output

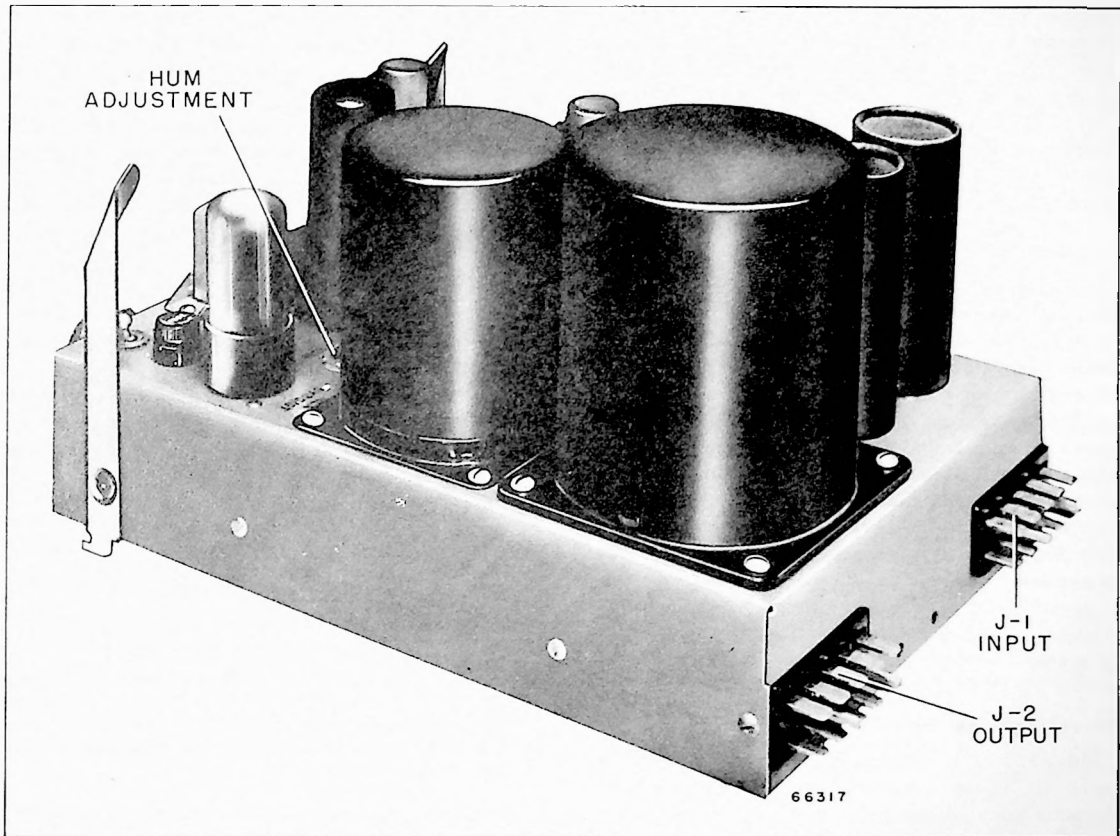


Figure 3—Rear View of Type BA-13A Program Amplifier.

plug J-2, figures 3 and 8). To insure a low hum level the a-c supply circuit should be shielded and the shield grounded.

#### Metering

The four-position rotary switch mounted on the front panel of the amplifier chassis (right side) is designed to be used in conjunction with the Type BI-1A (MI-4388-B or MI-4388-C) or the Type BI-2A (MI-11275 or MI-11275-A) Metering Panel to conveniently check the operation of the individual tubes. The numbers on the METER dial plate indicate the tube which is being checked. Circuit arrangement is such that, with the tubes operating normally, the meter will read approximately 1 volt. When a Type BI metering panel is not available any suitable voltmeter having an internal resistance of 20,000 ohms-per-volt or greater can be used. Connect the positive terminal of the meter to terminal number 8 and the negative terminal of

the meter to terminal number 10 on the input receptacle (for input plug J-1, figures 3 and 8).

#### Hum Adjustment

A hum-adjustment potentiometer marked HUM is located on top of the chassis, in front of the output transformer and in line with the meter switch, see figure 3. A screwdriver slot is provided in the potentiometer shaft, which is accessible from the top of the chassis, for adjusting the hum level to a minimum.

## CIRCUIT MODIFICATIONS

#### Gain Controls

In applications where extreme quietness or extended periods of operation without servicing are prime considerations the dual continuous-type attenuator or gain control furnished in MI-11223-A



amplifier can be replaced with the dual step-type attenuator furnished in the MI-11233 amplifier. Order from *RCA Replacement Parts Department, Camden, New Jersey*, specifying stock number 57121. This attenuator is similar electrically to the continuous type of attenuator and must be wired into the circuit as shown on the wiring diagram, figure 8.

### Frequency Compensation

The normal frequency response of the Type BA-13A Program Amplifier, shown by the curve in figure 5, is flat throughout the audio range. Under certain conditions it may be desirable to increase the response at either the high-frequency or the low-frequency end of the range. The curves in figures 6 and 7 show the increase in response which may be obtained by making compensation adjustments within the amplifier, according to the instructions in the following paragraphs. If desired, both high and low frequency compensation may be applied.

NOTE: Because of slight differences in wiring and tolerances of component parts, it may be necessary to use capacitors differing in value from those given in the following tables in order to secure the desired response.

#### Increasing High-Frequency Response

Three curves, numbered 1, 2 and 3, are shown in figure 6. These curves illustrate the frequency characteristics of the amplifier after changes are made, in the circuit constants, to increase the high-frequency response of the amplifier, by approximately one, two and three decibels at 10,000 cps. To obtain a frequency response corresponding to one of the three curves, replace the 3900 mmfd capacitor designated C-5 in figures 2 and 4 with a capacitor having the value given, opposite the curve number, in the following table.

#### CAPACITOR VALUES

<i>Response Curve Number</i>	<i>C-5 (200 vdc) Capacity in mmfd</i>
1	5,600
2	8,200
3	10,000

#### Increasing Low-Frequency Response

The curves numbered 1, 2 and 3 in figure 7 show the frequency response of the amplifier, after alterations have been made in the circuit to obtain greater low-frequency response. An increase of 2, 3 and 4 decibels at 30 cps can be obtained by making suitable modifications in the circuit. To

obtain a frequency response corresponding to one of the three curves make the following changes:

a. Disconnect the yellow lead from R-15 (on terminal No. 1 of terminal board 1) and connect this lead to a compensator composed of a 5600-ohm resistor and a 1-mfd capacitor (in parallel). Connect the other side of the compensator to R-15 on terminal No. 1 on terminal board 1. The compensator may be supported by a small terminal board mounted on the side wall of the chassis. The position in the circuit of the resistor and capacitor, identified as R-27A and C-15A is shown in figure 4 (they should have ratings of 1 watt and 200 vdc respectively).

b. Replace the 0.25 mfd capacitor, designated C-4 in figures 2 and 4, with a capacitor having the value given opposite the curve number in the following table.

#### CAPACITOR VALUES

<i>Response Curve Number</i>	<i>C-4 (400 vdc) Capacity in mfd</i>
1	0.03
2	0.05
3	0.1

NOTE: Check the high-frequency response. If it is found to be too high, substitute for C-5 a capacitor of the next lower standard value as required.

In applications where system losses or other deficiencies require an increase in the response at both ends of the audio spectrum, some suitable combination of high-frequency and low-frequency compensation can be selected and applied as described in the two preceding paragraphs.

## MAINTENANCE

### Cleaning

The care of the Type BA-13A Program Amplifier should include the usual precautions observed in the maintenance of high-quality audio components. Do not allow dust or dirt to accumulate on the amplifier. Perform the following operations at regular intervals:

- Clean the tube prongs and the contacts in the tube sockets.
- Clean the prongs of the plug-in capacitors and the contacts of the capacitor sockets.
- Keep the prongs of the amplifier connection plugs clean using clean dry cloth. Do not use abrasive. Clean the connection-plug receptacles approximately every two months by

removing the amplifier from the receptacles. This action automatically cleans the receptacle contacts by the wiping action of the springs. Plug the amplifier in and pull it out several times to secure sufficient cleaning action.

- d. Clean the step type attenuator in the MI-11233 amplifier. Press the catch nearest the rear end of the attenuator, turn the rear-end cover sufficiently to release it, and pull the cover off of the attenuator. Apply Davenoil to the exposed rear-section contacts, rotate the shaft, and if any dark streaks appear wipe off the contacts. Repeat this procedure until the contacts are clean, then apply a thin film of Davenoil. Press the catch nearest the front of the attenuator and remove the rear section of the attenuator, exposing the front-section contacts. Clean these contacts in the same manner. Replace the rear section and the end cover and lock each in place.

### Tubes and Plug-in Capacitors

Check the tubes for normal characteristics. Label each tube, indicating condition and length of service. Check the plug-in capacitors for leakage and capacity.

### Fuse Replacement

When replacing a fuse, make certain that the replacement fuse is of the same type and rating

(1 ampere, Type MDL, stock number 53447) as the one furnished with the amplifier. In emergencies when this fuse is not available, a 1 ampere, Type 3-AG fuse can be used as a temporary substitute. Do not use a fuse of higher rating for replacement purposes since this will needlessly endanger the windings of the power transformer.

### Voltage and Current Values

Voltage and current values for a typical amplifier operating under normal conditions are given in the following table:

#### VOLTAGE AND CURRENT VALUES

A-C supply to amplifier—117 volts, 60 cps  
(A-C supply connected to the 115-volt tap on the power transformer)

	First stage RCA 1620	Second stage RCA 1620	Third stage RCA 1622
Plate to ground	65 volts dc	90 volts dc	310 volts dc
Screen to ground	72 volts dc	48 volts dc	270 volts dc
Cathode to ground	1.8 volts dc	1.5 volts dc	21 volts dc
Filaments to ground	18 volts dc	18 volts dc	18 volts dc
Meter Indication	1 volt dc	1 volt dc	1 volt dc
Filaments	6.3 volts ac	6.3 volts ac	6.3 volts ac
Plate Current	1.7 ma	0.84 ma	45 ma
Screen Current	0.5 ma	0.22 ma	2.2 ma

Plate Supply Voltage—360 volts

Total rectified current—56 milliamperes

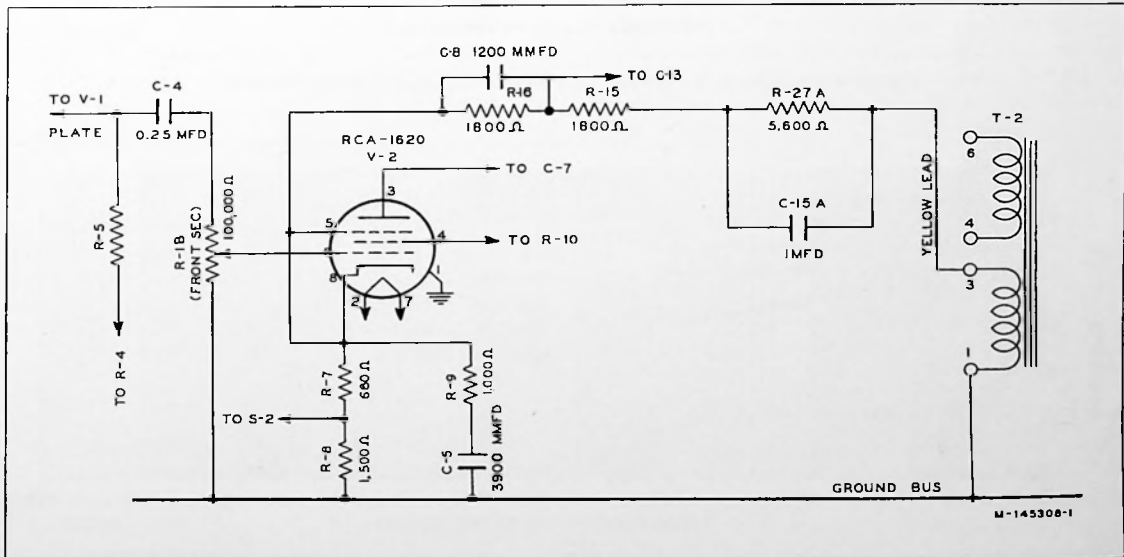


Figure 4—Partial Schematic Diagram Showing Changes for Compensation.

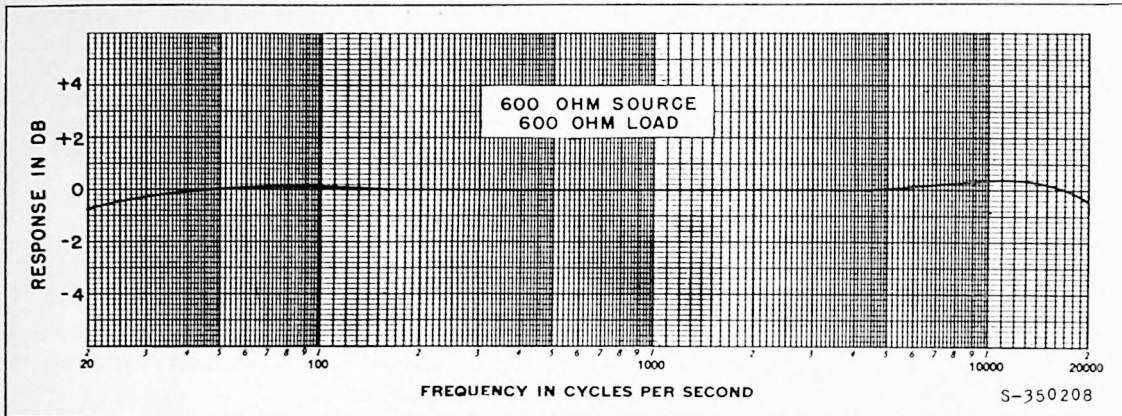


Figure 5—Normal Frequency Response of Type BA-13A Program Amplifier.

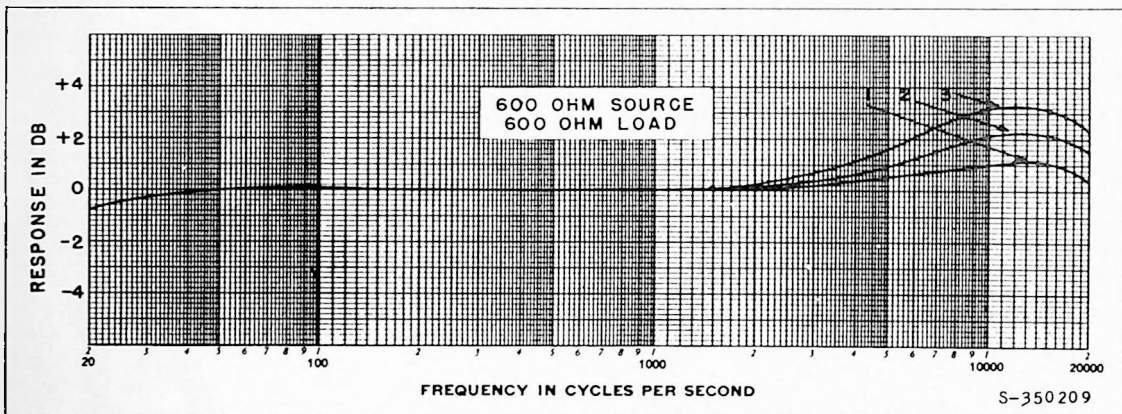


Figure 6—Frequency Response with High-Frequency Compensation.

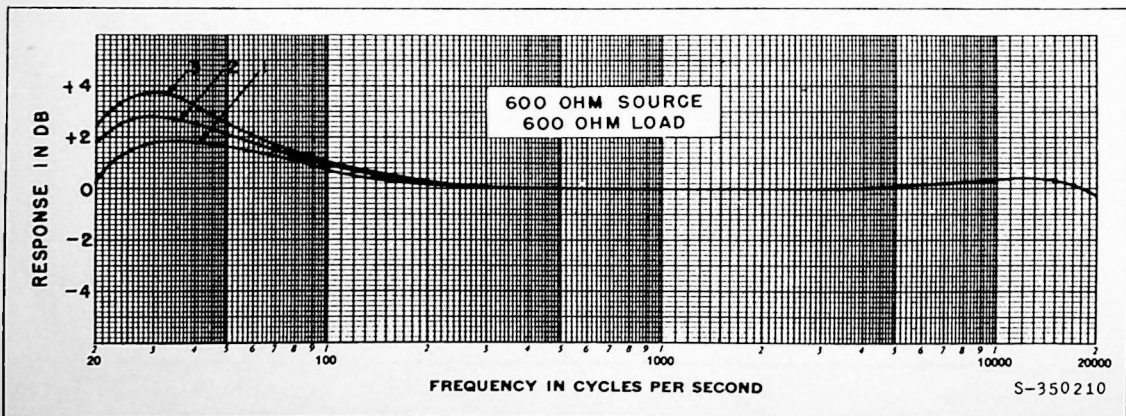


Figure 7—Frequency Response with Low-Frequency Compensation.

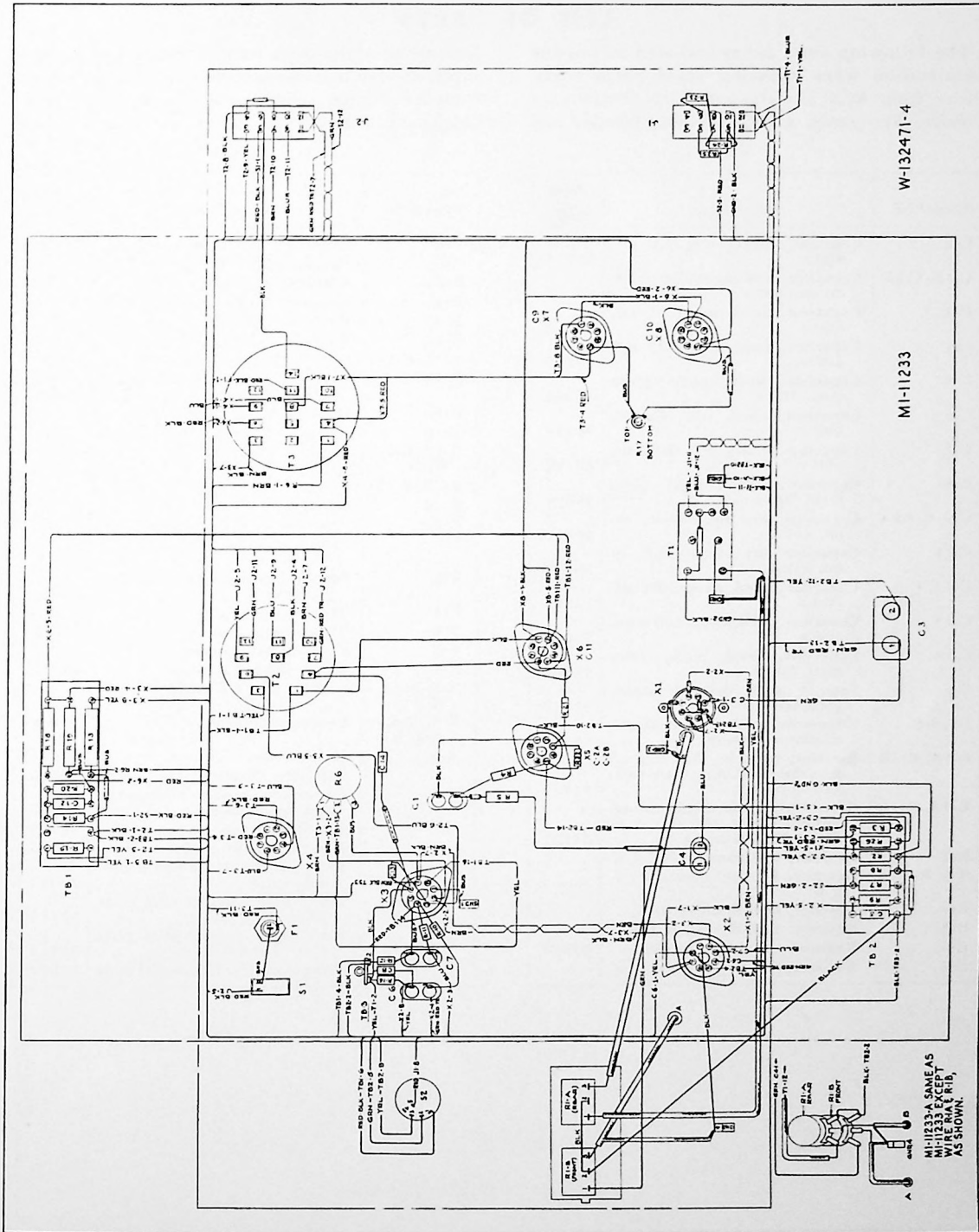


Figure 8—Wiring Diagram for Type BA-13A (MI-11233 and MI-11233-A)

## LIST OF PARTS

The following parts list is included to provide identification when ordering replacement parts. Order from *RCA Replacement Parts Department, Camden, New Jersey*, giving the *Stock Number* and

*Description* of the parts wanted. Replacement parts supplied may be slightly different in form or size from the original parts but will be completely interchangeable with them.

Symbol No.	Description	Stock No.
C-1	Capacitor, fixed, oil, 0.1 mf, 400 v	56115
C-2A, C-2B	Capacitor, dry electrolytic, 20-20 mf, 450 v	57117
C-3	Capacitor, fixed, oil, 0.25 mf, 400 v	57118
C-4	Capacitor, fixed, oil, 0.25 mf, 400 v	57119
C-5	Capacitor, fixed, mica, 3900 mmf, 500 v	39666
C-6	Capacitor, fixed, oil, .25 mf, 400 v	56118
C-7	Capacitor, fixed, oil, 0.1 mf, 400 v	57120
C-8	Capacitor, fixed, mica, 1200 mmf, 500 v	39654
C-9, C-10	Capacitor, dry electrolytic, 80 mf, 450 v	56411
C-11	Capacitor, dry electrolytic, 40 mf, 450 v	56410
C-12	Capacitor, fixed, paper, .01 mf, 200 v	71585
C-13	Capacitor, fixed, mica, 560 mmf, 500 v	39646
C-14	Capacitor, fixed, mica, 3300 mmf, 500 v	39664
F-1	Fuse, 1 amp, delayed action, glass body	53447
J-1, J-2	Connector, male, 10 contacts, chassis mounting	48788
R-1A, R-1B	Resistor, variable, dual step attenuator, 100,000 ohms (MI-11233 only)	57121
R-1A, R-1B	Resistor, variable, dual, continuous attenuator, 100,000 ohms (MI-11233-A only)	57122
R-2	Resistor, 470 ohms, $\pm 5\%$ , 1 w	
R-3, R-12	Resistor, 470,000 ohms, $\pm 5\%$ , 1 w	
R-4	Resistor, 18,000 ohms, 1 w	
R-5	Resistor, 120,000 ohms, 1 w	
R-6	Resistor, variable, 100 ohms	43498
R-7	Resistor, 680 ohms, 1 w	

Symbol No.	Description	Stock No.
R-8	Resistor, 1500 ohms, $\pm 5\%$ , 1 w	
R-9	Resistor, 1000 ohms, 1 w	
R-10	Resistor, 1 megohm, 1 w	
R-11	Resistor, 220,000 ohms, 1 w	
R-13	Resistor, 390 ohms, $\pm 5\%$ , 2 w	
R-14	Resistor, 22 ohms, $\pm 5\%$ , 1 w	
R-15, R-16	Resistor, 1800 ohms, $\pm 5\%$ , 1 w	
R-17	Resistor, wire wound, 600 ohms, 10 w	18952
R-18	Resistor, 8200 ohms, 2 w	
R-19	Resistor, 82,000 ohms, 2 w	
R-20, R-21, R-22	Resistor, 5600 ohms, 1 w	
R-23, R-25	Resistor, 10,000 ohms, 1 w	
R-24	Resistor, 560 ohms, 1 w	
R-26	Resistor, 330 ohms, 1 w	
S-1	Switch, toggle, SPST, 3 amp, 250 v, Off-On	48791
S-2	Switch, rotary, single pole, 4 position	53426
T-1	Transformer, audio input	57123
T-2	Transformer, output	46098
T-3	Transformer, power	50793
X-1	Socket, tube, 8 contact	28413
X-2, X-3, X-4	Socket, tube, 8 contact	31319
X-5, X-6, X-7, X-8	Socket, capacitor	45368
X-9	Holder, fuse	48894
	Cap, tube shield	12110
	Connector, female, 10 contact, chassis mounting	49032
	Handle, ejector, left	52403
	Handle, ejector, right	52404
	Knob, gain control and metering switch	27990
	Plate, gain control dial plate (MI-11233 only)	57115
	Plate, gain control dial plate (MI-11233-A only)	57116
	Plate, metering switch dial plate	52922



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