

BROADCAST AUDIO EQUIPMENT

Type BA-21A Preamplifier



RADIO CORPORATION OF AMERICA
ENGINEERING PRODUCTS DIVISION CAMDEN, N. J.

EQUIPMENT LOST OR DAMAGED IN TRANSIT

When delivering the equipment to you, the truck driver or carrier's agent will present a receipt for your signature. Do not sign it until you have (a) inspected the containers for visible signs of damage and (b) counted the containers and compared with the amount shown on the shipping papers. If a shortage or if evidence of damage is noted, insist that notation to that effect be made on the shipping papers before you sign them.

Further, after receiving the equipment, unpack it and inspect thoroughly for concealed damage. This should be done within 15 days, if possible. If concealed damage is discovered immediately notify the carrier, confirmed in writing and insist upon an inspection and report.

In addition to the above, the shortages or damages should also be reported to RCA, but do not return any damaged equipment unless we have furnished complete return shipping instructions.

Transportation companies are required to adjust for damage resulting from their negligence and RCA will assist you, if necessary, in obtaining settlement. Accordingly, you should save all shipping papers, letters or invoices concerning the shipment until it is certain that the equipment was delivered in good condition or until any damage has been adjusted.

REPLACEMENT PARTS

When ordering replacement parts, please give symbol, description, and stock number of each item ordered.

The part which will be supplied against an order for a replacement item may not be an exact duplicate of the original part. However, it will be a satisfactory replacement differing only in minor mechanical or electrical characteristics. Such differences will in no way impair the operation of the equipment.

The following tabulations list service parts and electron tube ordering instructions according to your geographical location.

SERVICE PARTS

LOCATION	ORDER SERVICE PARTS FROM:
Continental United States, Alaska and Hawaii	Service Parts Order Service, Bldg. 60, 19th & Federal Sts., Camden 5, New Jersey or through your nearest RCA Regional Office. Emergency orders may be telephoned, telegraphed, or teletyped to RCA Emergency Service, Bldg. 60, Camden, N. J. (Telephone: WO 3-8000).
Dominion of Canada	RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Quebec or through your local Sales Representative or his office.
Outside of Continental United States, Alaska, Hawaii and the Dominion of Canada	RCA International Division, Clark, N.J., U.S.A. or through your local Sales Representative.

ELECTRON TUBES

LOCATION	ORDER ELECTRON TUBES FROM:
Continental United States, Alaska and Hawaii	Local Tube Distributor
Dominion of Canada	RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Quebec or through your local Sales Representative or his office.
Outside of Continental United States, Alaska, Hawaii and the Dominion of Canada	Local Tube Distributor or from: Tube Department RCA International Division 30 Rockefeller Plaza New York 20, New York, U.S.A.

If for any reason, it is desired to return tubes, please return them to the place of purchase.

PLEASE DO NOT RETURN TUBES DIRECTLY TO RCA WITHOUT AUTHORIZATION AND SHIPPING INSTRUCTIONS.

It is important that complete information regarding each tube (including type, serial number, hours of service and reason for its return) be given.

When tubes are returned, they should be shipped to the address specified on the Return Authorization form. A copy of the Return Authorization and also a Service Report for each tube should be packed with the tubes.

LIST OF RCA REGIONAL OFFICES

Atlanta 3, Georgia 522 Forsyth Bldg. Lamar 7703	Boston 16, Mass. Room 2301, John Hancock Bldg. 200 Berkley St. Hubbard 2-1700	Chicago 54, Ill. 1180 Merchandise Mart Plaza Delaware 7-0700	Cleveland 15, Ohio 1600 Keith Bldg. Cherry 1-3450
Dallas 1, Texas 1907-11 McKinney Ave. Riverside 1371	Hollywood 28, Calif. RCA Bldg., 1560 N. Vine St. Hollywood 9-2154	Kansas City 6, Missouri 340 Dierks Bldg. Harrison 6480	New York 20, New York 36 W. 49th St. Judson 6-3800
	Branch—San Francisco 2, Calif. 420 Taylor St. Ordway 3-3027		

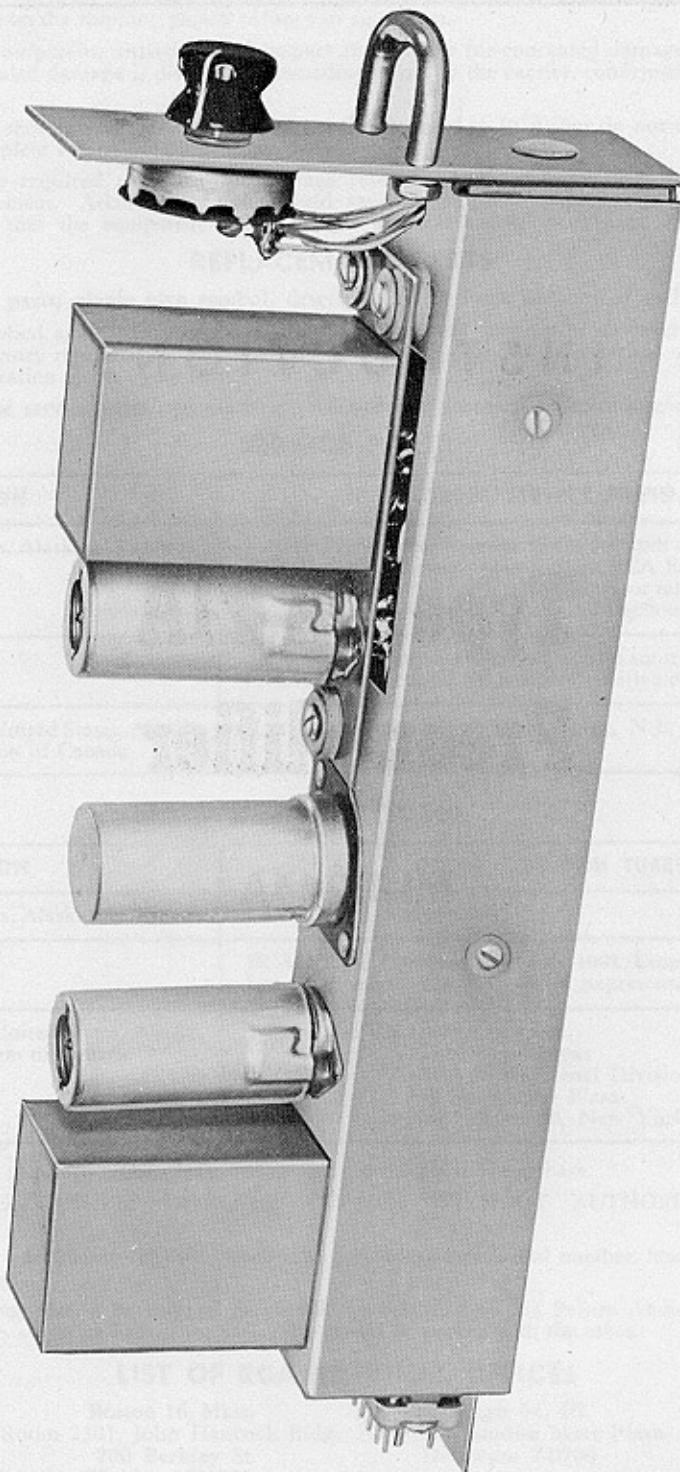
BROADCAST AUDIO EQUIPMENT

INSTRUCTIONS

**Type BA-21A
Preamplifier**

MI-11244A

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



80274

Figure 1—Type BA-21-A Preamplifier MI-11244A

TECHNICAL DATA

Power Required

Plate: 285 volts, 10 ma dc
0.3 mv ripple voltage
Heater: 6.3 volt, 0.6 amp. ac

Power Supply

MI-11317 Preamplifier Power Supply will furnish power to 10 preamplifiers

MI-11305-D Power Supply will furnish power to 4 preamplifiers

Source Impedance

150-ohm balanced source when shipped; may be reconnected to operate from a 600-ohm balanced or unbalanced or a 37.5-ohm unbalanced source.

Input Impedance

Matching: Input transformer unloaded; primary winding center-tap grounded, input impedance higher than source impedance for all frequencies from 30 cps to 15000 cps.

Bridging: MI-11278-C/-E for panel mounting.
MI-11278-D/-F for chassis mounting
10,000 ohms approximately

Output Impedance

25 or 100 ohms approximately

Load Impedance

150 or 600 ohms balanced or unbalanced

Maximum Input Level

Matching: -22 dbm ± 1 db

Bridging: 30 dbm

Rated Output Level and Distortion

Total rms harmonic distortion at 18 dbm output:

0.75% rms at 30 cycles

0.50% rms at 50 to 15,000 cycles

Matching Gain

Insertion gain at 1000 cps, operating from 600/150/-37.5-ohm source into a 600/150-ohm load is 40 db ± 1 db.

Bridging Gain

4 db maximum with MI-11278-E/F Bridging Gain Control bridging a 600-ohm line.

Feedback

20 db at 1000 cps

Frequency Response

± 1 db from 30 cps to 15000 cps
(See figure 2)

Hum and Noise Level

-82 dbm maximum at output

Tube Metering Voltage

1.0 volt ± 0.1 v

Mounting

Plug-in unit on MI-11597 Mounting Shelf, accommodating up to 10 amplifiers on one shelf

Mechanical Dimensions

Length—chassis 10 $\frac{3}{8}$ inches, overall, 12 $\frac{1}{2}$ inches

Height—4 $\frac{1}{2}$ $\frac{1}{2}$ inches

Width—1 $\frac{1}{8}$ inches

Weight—2 $\frac{1}{2}$ lbs.

Finish—Light umber gray lacquer

Tube Complement MI-11482 (not supplied)

1—MI-11299 RCA selected 12AY7

1—RCA 12AY7

DESCRIPTION

The Type BA-21A Preamplifier, MI-11244A, is designed to amplify the output of low impedance microphones and phonograph pickups. This plug-in unit requires an external power supply such as the Preamplifier Power Supply MI-11317.

The preamplifier may be plug-in mounted on an MI-11597 Mounting Shelf which may be installed in a standard Type BR-84 rack. As many as 10 units may be mounted on a single shelf.

Type BA-21A Preamplifier may be used as a bridging or isolation amplifier with the addition of the Bridging Gain Control MI-11278-C/-E for panel mounting, or MI-11278-D/-F for chassis mounting.

A switch for the selective metering of the tube currents is provided on the front panel. A U-shaped

handle on the preamplifier front panel makes the unit easily installed or withdrawn.

Equipment Supplied (See figures 1 and 3)

Quantity	Unit	MI-Number
1	Preamplifier (Type BA-21A)	MI-11244A
1	Guide Assembly for Mtg. on shelf	
1	Receptacle Container, for necessary mtg. hardware	
1	Instruction Book	IB-24767-3

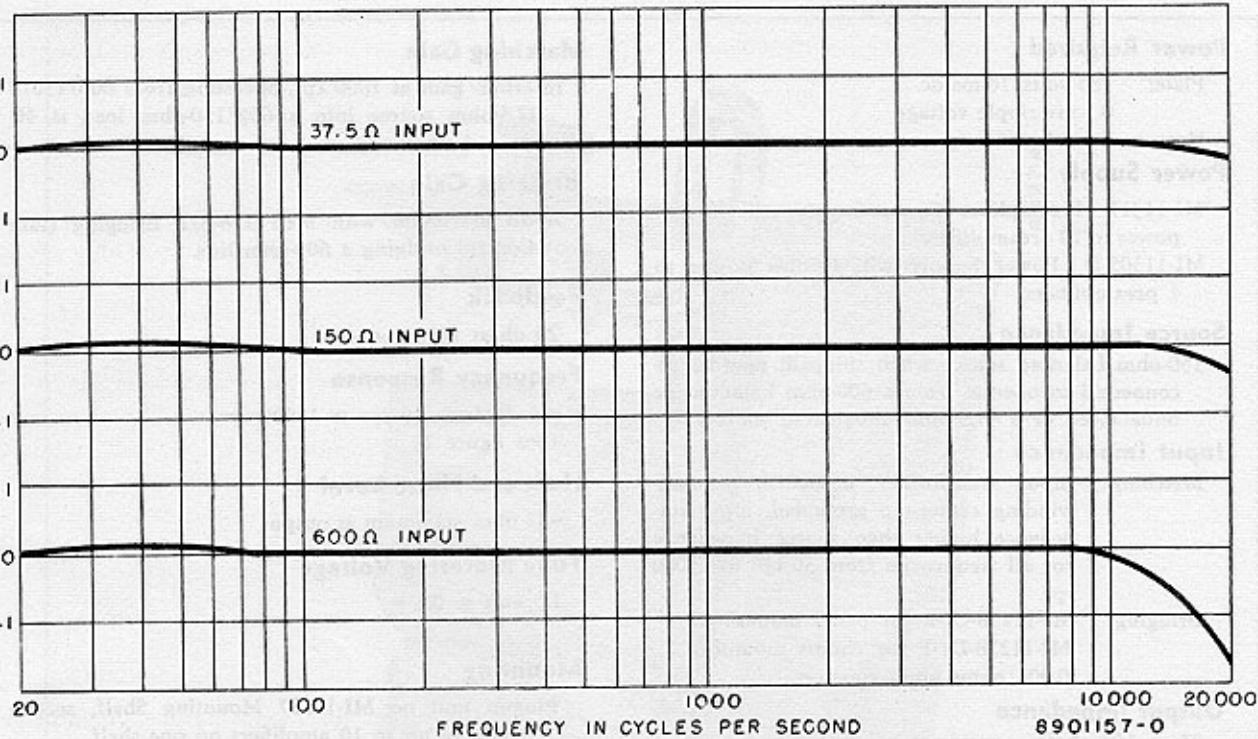


Figure 2—Frequency Response Curves

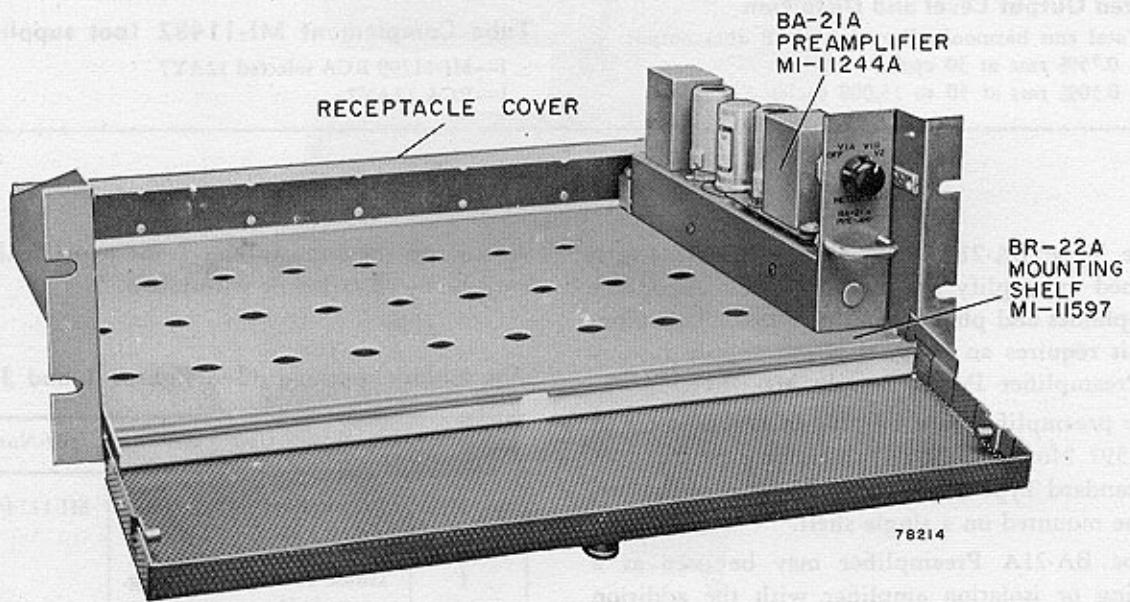


Figure 3—Type BA-21A Preamplifier and Guide Assembly on Mounting Shelf MI-11597

Accessories (Not supplied, only tubes required)

Quantity	Description	MI-Number
1	Tube kit, one MI-11299, selected 12AY7, and one 12AY7	MI-11482
1	Bridging gain control kit Panel Mtg. (with Knob)	MI-11278-C/-E
	Chassis Mtg. (Screw Driver Adj.)	MI-11278-D/-F
1	Preamplifier Power Supply, Type BX-21A (Supplies plate and heater power to 10 MI-11244A Preamplifiers)	MI-11317
1	Meter Panel Type BI-1B (Tube metering for 17 amplifiers)	MI-11388
1	Mounting Shelf, for rack mounting (For 10 MI-11244A Preamplifiers) (Requires 5 1/4 inches vertical rack space)	MI-11597

Circuit

The Type BA-21A Preamplifier consists of three stages, resistance-capacitance coupled, including a phase inverter and pushpull output stage. Refer to figure 4.

An unloaded input transformer T1, having windings for source impedances of 600, 150 and 37.5 ohms, supplies the input signal to the grid of the

first stage. The output of the first stage is resistance-capacitance coupled to the grid of the phase splitter which applies equal voltages of opposite polarity by means of resistance-capacitance coupling to the grids of the pushpull output stage. An output transformer T2 matches the output stage to a 600-ohm or 150-ohm load.

The split windings of the input and output transformers are connected in series with 600-ohm and in parallel for 150-ohm impedance.

A tertiary winding on the output transformer supplies negative feedback through a resistance-capacitance network to the cathode of the input stage. The feedback corrects the frequency response, reduces harmonic distortion and stabilizes the gain of the amplifier.

A tap in the cathode circuit of each amplifier stage provides a metering voltage of one volt selected by means of metering switch S1.

Guide Assembly

As shown in figure 3, a guide assembly is supplied with each amplifier for mounting the preamplifier on the MI-11597 shelf. The guide assembly bolts on to the mounting shelf and holds the plug receptacle. Refer to Installation for assembly procedure.

Power Supply

The MI-11317 Preamplifier Power Supply will furnish power to ten MI-11244A Preamplifiers and is designed specifically for this purpose.

Other power supply units may be used if the ripple voltage is less than 0.5 mv. The MI-11305-D Power Supply will furnish power to four MI-11244A Preamplifiers.

INSTALLATION

Mounting Guide Assembly and Shelf (refer to figure 3)

1. Place the guide assembly on the shelf so that the bracket is at the far or rear end and extends upwards.

2. Install the socket (Item 3) on the near side of the bracket with terminal #1 in the upper left hand corner. Fasten the socket to the bracket on the guide assembly by means of the two #6-32 x 1/2 machine screws (Item 4A), two #6 internal teeth lockwashers (Item 4D) and the two #6 hex nuts (Item 4C).

3. Secure the guide assembly to the mounting shelf with the two #6-32 x 1/4 binder head machine

screws (Item 4B) and two #6 internal teeth lockwashers (Item 4D).

4. Mount the shelf on the rack by means of the hardware supplied with the rack.

Tubes (not supplied)

Plug the tubes into the sockets and push the tube shields (Item 5) over the tubes, locking the shields in place by twisting.

To obtain a minimum noise level, the MI-11299 RCA selected 12AY7 should be inserted in the input tube socket XVI which is the socket nearest the front panel. The commercial 12AY7 is inserted in the output tube socket which is the one located nearest to the plug end of the amplifier.

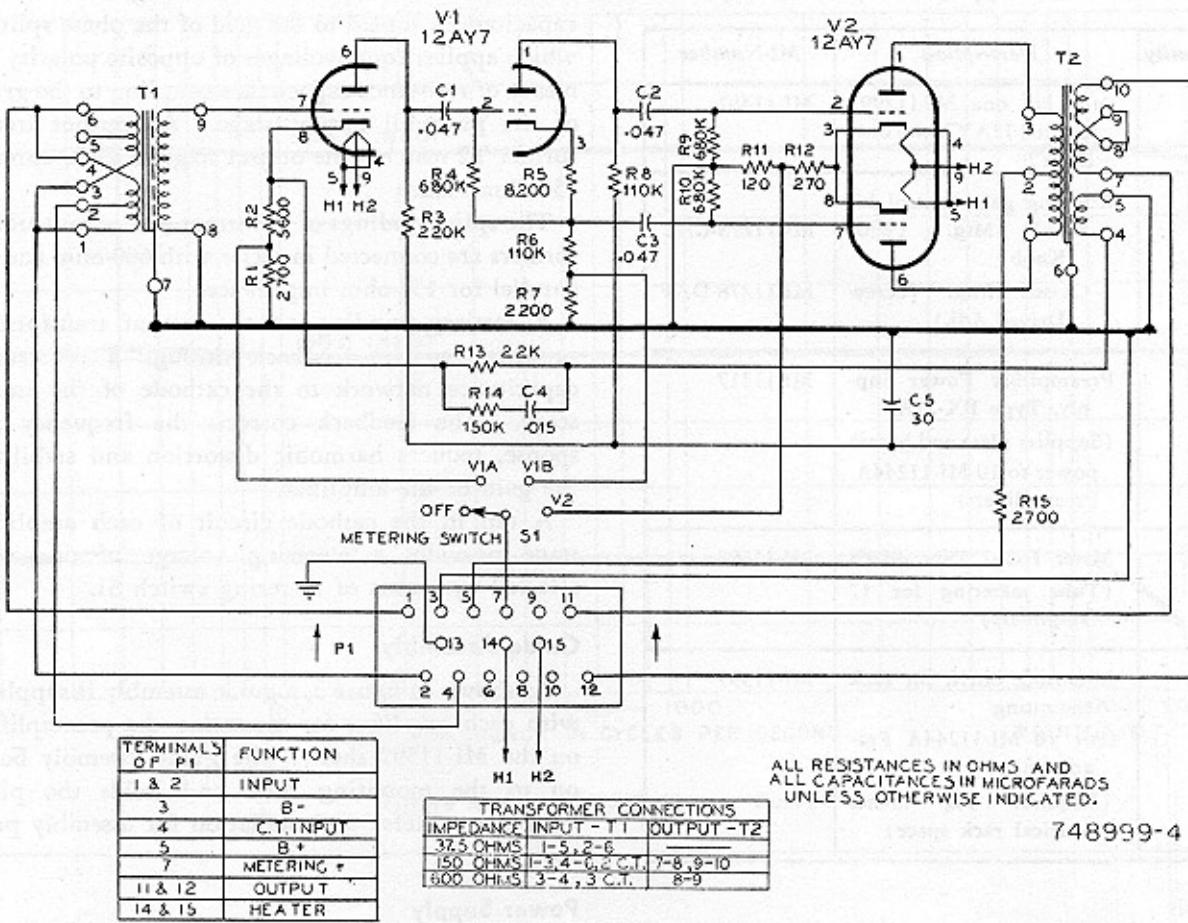


Figure 4—Schematic Diagram

CAUTION

Before mounting preamplifier on the rack, check the transformer connections. If correct as described under Internal Connections, plug the unit into the receptacle mounted on the guide assembly.

Internal Connections

The Type BA-21A Preamplifier is shipped from the factory with the input transformer connected for operation from a balanced 150-ohm source and the output transformer is connected for matching a 600-ohm load. See figure 5.

The preamplifier may also be reconnected to operate from a 600-ohm or 37.5-ohm balanced or unbalanced source.

1. 600-ohm Input

To operate from a 600-ohm input, remove jumpers between terminals 1-3 and 4-6 of input transformer T1. Install a jumper between terminals 3 and 4.

For balanced operation, connect white wire #50 to terminal 3 of T1; for unbalanced operation, con-

nect white wire #50 to terminal 1 of T1.

2. 37.5-ohm Input

To operate from a 37.5-ohm input, remove jumpers between terminals 1-3 and 4-6 of input transformer T1. Install jumpers between terminals 1-5 and 2-6 of T1. No center tap is available for balanced operation at this impedance.

3. 150-ohm Output

Remove the jumpers between terminals 8-9 of the output transformer T2 and jumper terminals 7-8 and 9-10.

Impedance Adjusting Networks

The Type BA-21A Preamplifier is designed with an unloaded input transformer. This type of input circuit is for operation directly from microphones or low-impedance turntable pickups. When it is desired to use the amplifier as a line booster, it will be necessary to connect a resistive network ahead of the input transformer to provide a constant-impedance input. Figure 6 illustrates networks for

WIRE TABLE		DESCRIPTION	PS. OF D.W.C. T. M. NO. 555 A. 84698-503
WIRE NO. 2 INC. 1/2" SUE		WIRES TINNED COPPER 0.02 DIA.	105
20	27	WIRES TINNED COPPER 0.02 DIA.	105
30	34	TUBING INS. BLACK 0.210	76
40	46	TUBING INS. BLACK 0.270	77
50	50	WIRES WH. 7/10	805 E
60	63	WIRES BLACK	78
70	63	WIRES BLACK	79
80	72	WIRES RED	80
80	83	WIRES YEL./GRN.	81
90	90	WIRES ORANGE	82
100	100	WIRES YEL./RED	82
110	111	WIRES BROWN	84
120	121	WIRES BRN./BLK.	85
130	132	WIRES YEL.	86
140	151	WIRES WH.-BLK.	87
150	151	WIRES WH.-BLK.	87
160	160	SHIELDED CABLE	805-6
170	173	TUBING INS. TRANS. 1061D.	47229-2
			7229-9
			90

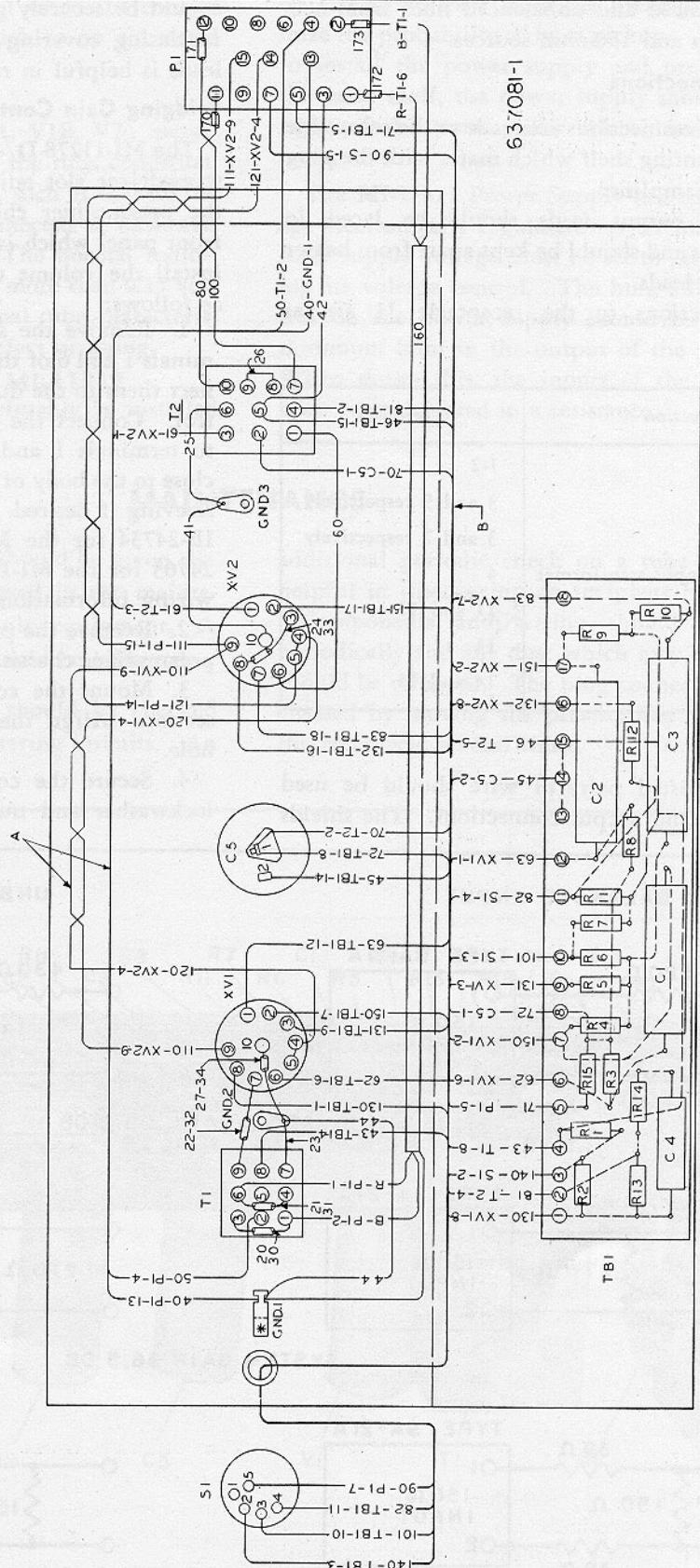


Figure 5—Connection Diagram

use with balanced and unbalanced lines from 600-ohm, 250-ohm and 150-ohm sources.

External Connections

All external connections are made to the receptacle J1 on the mounting shelf which mates with the plug P1 on the preamplifier.

Input and output leads should be laced in separate cables and should be kept apart from heater and other a-c leads.

The connections to the receptacle J1 are as follows:

Function	Terminal
Input	1-2
B- and B+	3 and 5 respectively
Metering	3 and 7 respectively
Center Tap, input transformer	4
Output	11 and 12
Ground	13
Heater	14 and 15

Shielding

Shielded twisted pairs of wire should be used for the input and output connections. The shields

should be securely grounded at one end only. An insulating covering over the shields of the input leads is helpful in reducing noise and crosstalk.

Bridging Gain Control

The MI-11278-D/-F Bridging Gain Control (with screwdriver slot adjustment) may be mounted on the preamplifier chassis through the hole on the front panel which is covered by a plug-button. To install the volume control on the chassis, proceed as follows:

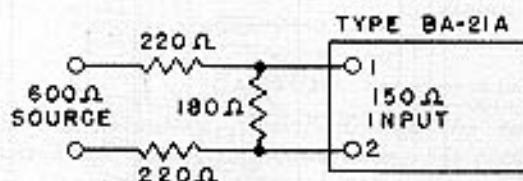
1. Remove the shielded pair of wires from terminals 1 and 6 of the input transformer T1 and connect them to the dummy terminals of the gain control. Connect the output terminals of the control to terminals 1 and 6 of T1. Bend the terminals close to the body of the gain control. Insulate with sleeving if desired. Refer to the instruction books IB-24734 for the MI-11278-C/-D controls and IB-24763 for the MI-11278-E/-F controls if additional wiring information is desired.

2. Remove the plug-button from the front of the preamplifier chassis. See figure 1.

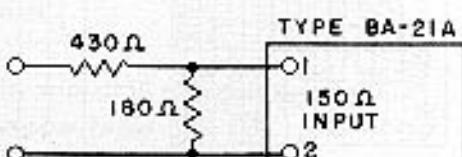
3. Mount the control behind the chassis front section. Align the control shaft with the center hole.

4. Secure the control on the outside with the lockwasher and nut supplied with the control.

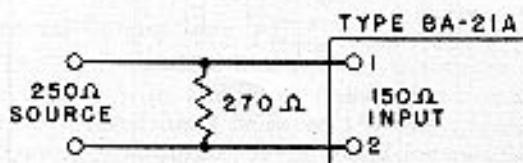
BALANCED INPUT



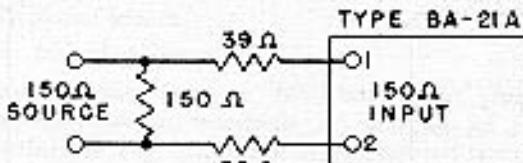
UNBALANCED INPUT



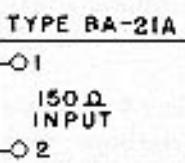
SYSTEM GAIN 29.5 DB



SYSTEM GAIN 36.5 DB



SYSTEM GAIN 34 DB



B-474073-0

Figure 6—Type BA-21A Preamplifier Input Networks

Use the MI-11278C/-E control when the control is to be mounted externally, such as on a control panel.

Metering

The four-position (OFF, V1A, V1B, V2) metering switch permits checking of the tube condition. A 20,000-ohm-per-volt dc meter, such as that on the Type BI-1A meter panel, is connected to terminals 3 and 7 of the connector P1. The normal indication is one volt. A variation of more than 0.15 volt indicates a departure from normal tube characteristics which may be caused by defect or aging.

Installation of Power Supply MI-11317

The power supply should preferably be installed

on a separate shelf from the preamplifier to minimize the probability of hum pickup. If it is desired to install the power supply and preamplifiers on the same shelf, the power supply should be on the right of the preamplifier when viewed from the front.

The MI-11317 Power Supply has its output voltage electronically regulated. After installation, the plate supply voltage must be set to 285 v by adjusting its voltage control. The hum adjustment control on the power supply should be adjusted for minimum hum in the output of the preamplifiers. When doing this, the inputs of the preamplifiers must be terminated in a resistance.

MAINTENANCE

The MI-11244A Preamplifier should be given the care and checkup usually observed in the maintenance of high quality electronic equipment. A system of periodic inspection should be followed.

The condition of the tubes should be checked frequently by means of the metering circuits. An

additional periodic check on a tube tester is also helpful in discovering an incipient failure.

Components and wiring should be inspected periodically and any dust which may have collected should be removed. The plug connectors should be cleaned by moving the preamplifier in and out of the receptacle several times.

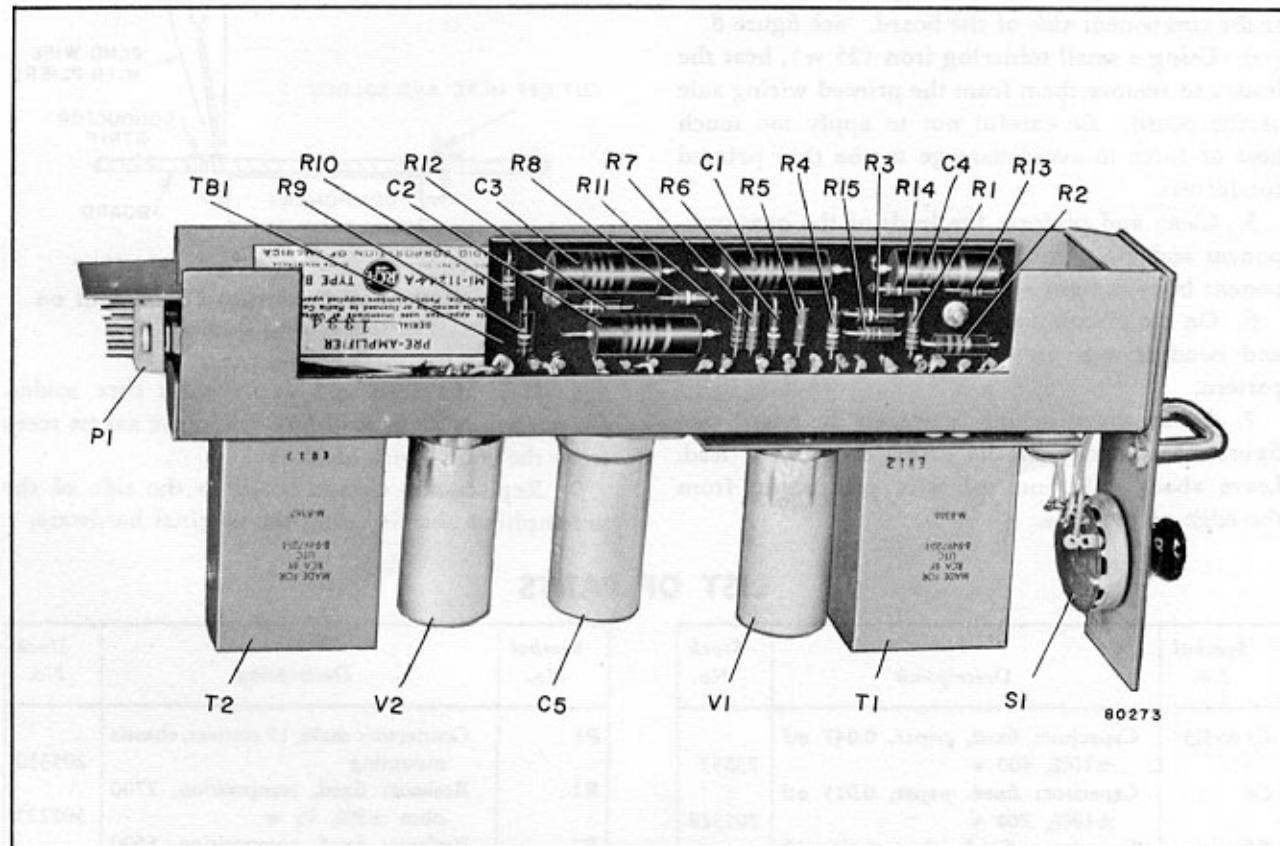


Figure 7—Type BA-21A Preamplifier, Bottom View Showing Printed Circuit

Voltage Readings

The following table shows the typical voltage to ground readings at the tube socket terminals.

These readings were obtained with a 20,000-ohm-per-volt meter. The values are approximate and may vary $\pm 10\%$ because of normal component tolerances.

Voltage Chart

Pin	1	2	3	4	5	6	7	8	9
Tube V1	200	—	55	*	*	130	0	3.1	*
Tube V2	255	0	3.0	*	*	255	0	3.0	*

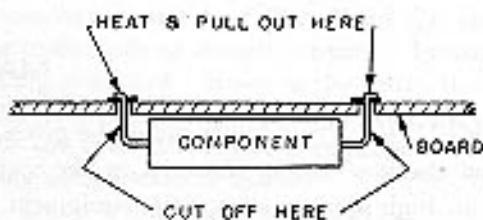
*6.3 v ac between terminals 4, 5 and 9.

Replacement of Components on Printed Wiring Board

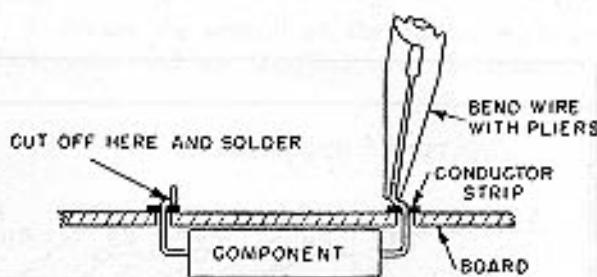
As shown in figure 7 the MI-11244A Preamplifier has a removable printed wiring board on one side of which numerous components are mounted and on the other, a printed circuitry. Should it be necessary to replace the circuit components for failure, proceed as follows:

1. Remove the board TB-1 from the side of the chassis by removing the two screws and associated washers and nuts.
2. Isolate the defective component.
3. To remove the component, snip the lead off at the component side of the board. See figure 8.
4. Using a small soldering iron (25 w), heat the leads and remove them from the printed wiring side of the board. Be careful not to apply too much heat or force to avoid damage to the thin printed conductors.
5. Clean and preform the leads of the new component and insert through the holes until the component body is tight against the board.
6. On the circuit side, grasp the component lead and bend it over in the direction of the circuit pattern.
7. Crimp the wire tightly against the board (see figure 8), and cut off the excess component lead. Leave about 1/16 inch of wire protruding from the edge of the hole.

TO REMOVE DEFECTIVE COMPONENT



TO INSTALL NEW COMPONENT



A-8301150-0

Figure 8—Method of Replacing Component on Printed Wiring Board

8. Heat the lead and apply rosin core solder. *Do not use paste or acid flux.* Remove excess rosin from the joints with alcohol.

9. Replace the circuit board to the side of the preamplifier chassis, using the original hardware.

LIST OF PARTS

Symbol No.	Description	Stock No.
C1 to C3	Capacitor: fixed, paper, 0.047 mf $\pm 10\%$, 400 v	73553
C4	Capacitor: fixed, paper, 0.015 mf $\pm 10\%$, 200 v	205328
C5	Capacitor: fixed, electrolytic, 30 mf, 350 v	97480

Symbol No.	Description	Stock No.
P1	Connectors: male, 15 contact, chassis mounting	205330
R1	Resistor: fixed, composition, 2700 ohm $\pm 5\%$, 1/2 w	502227
R2	Resistor: fixed, composition, 5600 ohm $\pm 5\%$, 1 w	512256

Symbol No.	Description	Stock No.
R3	Resistor: fixed, composition, 220,000 ohm $\pm 5\%$, $1/2$ w	502422
R4	Resistor: fixed, composition, 680,000 ohm $\pm 10\%$, $1/2$ w	502468
R5	Resistor: fixed, composition, 8200 ohm $\pm 5\%$, $1/2$ w	502282
R6	Resistor: fixed, composition, 110,000 ohm $\pm 5\%$, $1/2$ w	2732
R7	Resistor: fixed, composition, 2200 ohm $\pm 5\%$, $1/2$ w	502222
R8	Resistor: same as R6	2732
R9, R10	Resistor: same as R4	502468
R11	Resistor: fixed, composition, 120 ohm $\pm 5\%$, $1/2$ w	502112
R12	Resistor: fixed, composition, 270 ohm $\pm 5\%$, $1/2$ w	502127
R13	Resistor: fixed, composition, 22,000 ohm $\pm 5\%$, $1/2$ w	502322

Symbol No.	Description	Stock No.
R14	Resistor: fixed, composition, 150,000 ohm $\pm 5\%$, $1/2$ w	502415
R15	Resistor: same as R1	502227
S1	Switch: metering	30155
T1	Transformer: audio input	205326
T2	Transformer: audio output	205325
XV1, XV2	Socket: tube, 9 pin miniature	94880
TB1	Circuit Board Assembly: etched circuit board complete, including C1 to C4, R1 to R15	206512
	Button: plug	205327
	Connector: female, 15 contact, chassis mounting	205331
	Grommet: rubber, $9/16$ " O.D. x $17/64$ " I.D. x $23/64$ " thk.	37396
	Knob: black, pointer type (for S1)	205329
	Shield: tube	56359
	Screw: shouldered, for P1	209283
	Plate: mounting, for C5	28452



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