INSTRUCTION MANUAL

MODEL RPA-1

REMOTE PICKUP AMPLIFIER

MOSELEY ASSOCIATES, INC.
SANTA BARBARA RESEARCH PARK
GOLETA, CALIFORNIA 93017

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I. INTRODUCTION

The Moseley Associates, Inc. Model RPA-1 Remote Pickup Amplifier was designed specifically as a companion to the Model RPL-2 Remote Pickup Link. State-of-the-art features, such as a peak-reading output db meter and built-in AGC, make the device easy to use by untrained personnel. The RPA-1 will enable simplified operation of the RPL-2 Transmitter or it may be used as a conventional remote amplifier. Smoothness of operation in either mode, along with the high quality of the delivered signal, will be apparent upon installation.

All connections into and out of the Remote Pickup Amplifier are made by connectors on the rear of the unit. Here will be noted the individual microphone connectors, the line-level input connector, the telephone-line output connector, and the headphone jack. An AC power connector and the combination control-audio connector to the RPL-2 Transmitter, if used, are also on the rear. Gain controls for each microphone channel as well as the high-level input and headphone level controls are on the front panel. Along with these adjustments are the power switch and the peak-reading db meter and its associated switch for monitoring key points in the RPL-2 Transmitter.

II. SPECIFICATIONS

Number of mixing channels	Total of 3; 1 line and 2 microphone inputs
Input impedances	Line: 50 K Ω, unbalanced Microphones: 50-150 Ω, balanced, floating
Input levels	Line: -10 dbm to +10 dbm Microphones: -60 dbm to -40 dbm
Output level	+10 dbm normal after 3 db pad
Output impedance	600 Ω, balanced, floating
Frequency response	+0.4 db to -0.8 db, 30 Hz to 15 kHz
Distortion	Less than 0.5% at normal output level, 50 Hz to 15 kHz
Signal-to-noise ratio	Better than 60 db
Peak limiter	Control range approximately 20 db, attack time 1 millisecond
Metering	Peak-reading db meter on amplifier output; meter switch to read power supply and key transmitter parameters
Monitoring	Adjustable gain headphone power amplifier
Controls	Individual microphone gain controls; line level control, headphone level, meter switch, power and transmitter control switch
Input power	120 VAC, 50-60 Hz, 3 watts or ten "D" size batteries mounted internally. Power received from transmitter when operated with RPL-2 Remote Pickup Link.
Size	3-3/4" high, 12" wide, 11" deep
Weight	12 pounds, net, with batteries 15 pounds, shipping

III. UNPACKING

When unpacking the unit, keep all packing material until operation is confirmed. Immediately examine the unit for obvious shipping damage, and confirm its electrical performance as soon as possible. Report any shipping damage to the carrier.

IV. OPERATION & INSTALLATION

Operation in any of three modes is possible with this remote amplifier. It may be operated from internal batteries, or from the AC power line, or it may be used in conjunction with the companion RPL-2 Transmitter.

Because installation in a vehicle is never standard, no mounting bracket as such is supplied. Since the weight is rather low, and since shock and vibration should have a minimal effect on the device, mounting should present little problem. It is suggested that a strap of metal be cut and formed to mount the device to the underside of the dash of the car. Alternatively, it may be mounted on the floor.

In mobile service, a cable will have to be made up to connect the amplifier to the transmitter. This cable should be capable of handling the 100 milliamperes DC for power and control, and should complete a connection to the transmitter for control purposes. A shielded pair of wires is used to carry audio from the remote amplifier to the transmitter. Drawing 91A6370 in the rear of this manual gives the makeup of this cable. The pin connections for this cable are also shown on the schematic diagram for the audio package. This one cable is the only connection that is made between the amplifier and the RPL-2 system. All other connections for the RPA-1 will then consist of microphone, headphone, and line connections.

When the device is used as an ordinary remote amplifier with output attached to a telephone line, it is intended that 120 VAC at 50-60 Hz be applied to the 120 VAC connector. The telephone line or other terminating load is then connected to the OUTPUT terminals. The remaining connections, such as to the microphones and headphone, are self-explanatory.

Notice that the amplifier can be removed from the vehicle and used as a remote amplifier without any modification.

When installed in the vehicle and operating in conjunction with the RPL-2 Transmitter, the meter switch can be used to measure the battery voltage, the anntenna or transmission line voltage, and the final transistor amplifier RF voltage. For these positions, the meter should deflect into the black region. In normal operation, as during an actual broadcast, the meter switch should be in the

PEAK AUDIO position. The meter should delflect occasionally to the 0 db mark.

In a vehicular installation, the POWER switch will remove all power from the amplifier in the OFF position. In the AUDIO position, the amplifier is turned on and the microphone or line-input controls can be tested or preset. The transmitter will not be turned on until the switch is moved to the RADIATE position.

In AC-powered remote amplifier service, the POWER switch is inoperative and the device is powered and operable as long as the power cord is installed. The METER switch, however, will enable measurement of the power line voltage and the peak audio output level.

As regards the meter reading in the PEAK AUDIO position, it is suggested that the meter not be run beyond the 0 db mark excessively. It is at this point that the AGC system starts its gain reduction, and consequent compression of the dynamic range may result in an unnatural sound. Below the 0 db mark, the AGC is inoperative and no dynamic range reduction will occur. For this reason, the system, whether using a telephone line or a transmitter, is eminently suited for transmission of all types of program material including music. The AGC system will prevent overmodulation without audible distortion, thus making the system very smooth in operation.

V. PRINCIPLES OF OPERATION

Rugged construction, all silicon semiconductors, and inherent circuit stability are all part of the design of the RPA-1 Remote Pickup Amplifier. Should servicing be required, however, a background will prove helpful in pinpointing a failure quickly. It is the intent of this section to give such information.

The RPA-1 is shown in block diagram form in drawing 92A1035. The complete schematic is shown in drawing 91C6369.

At the lower left corner of the schematic will be seen the power rectifiers, filtering and noise-bypassing capacitors, and the electronic regulator. This regulator is vital to the operation of the system; it is used not only to hold the supply at a constant voltage (+10 volts DC) but also to greatly reduce noise from the battery system or hum from the power line. The method of battery-pack connection is also shown.

The power supply is arranged in a manner such that the car battery, the internal battery pack, or standard commercial power will supply the input voltage to the regulator. This primary power is then regulated down to a value of 10 volts by the regulator. Should the

output rise above 10 volts, the 10 volt Zener diode will conduct, allowing base current to flow into transistor Q1. This will drop the voltage at the collector of Q1, reducing the base voltage of Q2 and so reducing the output voltage back to 10 volts. A small capacitor is connected across the output of the regulator as a precautionary measure to insure that short transients will not enter the electronics. This regulator has both line and load regulation; it will remove variations in the output voltage if either the incoming DC voltage or the output load current varies.

At the upper left corner of the schematic will be seen the RF-bypassed microphone connection. The microphone is terminated in an unloaded microphone transformer, T1. (Should the microphone involved be a ribbon or velocity type, it may be necessary to terminate the microphone with a resistor. This is covered under "Field Changes"). Operation in this mode (unterminated) is always desired from the viewpoint of best signal-to-noise ratio. The microphone preamplifier has been designed to give the most efficient possible usage of the limited supply voltage. Hence the second stage employs a PNP transistor in an inverted configuration. More than 20 db of negative feedback reduces the already-low distortion to negligible proportions. The Field Changes section of this manual will cover adjustment of the otherwise fixed gain of the preamplifier. The output of the preamplifier is routed to a gain control located off of the printed circuit board.

A second preamplifier, located schematically below the first, operates in an identical manner.

Each of these microphone preamplifiers as well as the external line-level input, drives a gain control. The outputs of these gain controls are summed and fed to the base of Q8, a buffer. The purpose of this stage is to present a high impedance to the mixing point (bus) and at the same time enable the interstage transformer T3 to be driven.

T3 provides balanced push-pull drive to the integrated circuit variable gain stage. This amplifier has a gain proportional to its collector current. Normally operating at maximum gain, IC-1 can have its gain reduced by lowering the voltage applied to pin 7. The output of IC-1 is applied to another interstage transformer T4. This transformer drives the program amplifier using transistors Q15 through Q19. It also drives the AGC section using transistors Q9 though Q14.

A sample of the voltage at the secondary of T4 is applied to the base of Q9. Here it is amplified and applied to a phase splitter, Q10. This transistor provides push-pull drive to the rectifier driver Q11 and Q12. A balance control is provided here to insure precise symmetry of the positive and negative half-cycles into the

rectifier. The Field Adjustments section discusses adjustment of this control.

The signal present at the combined collector connection of Q11 and Q12 is applied to the AGC rectifier diode and used to charge a capacitor. The only way this capacitor can discharge (excluding base current into buffer Q13) is through the associated 1 megohm resistor. This sets the AGC recovery time.

Buffer Q13 drives the voltage amplifier Q14. This transistor is held at cutoff by the resistors in its emitter circuit and is driven into conduction with increasing audio levels by application of base drive.

Notice that the collector of Q14 normally idles at a high value of voltage. This drives pin 7 of IC-1 and allows the remote amplifier to have maximum gain. When audio levels become excessive, Q14 conducts, its collector voltage drops, and the voltage at IC-1 pin 7 drops. This restores the gain to the proper value.

The signal level at which this action occurs has been set by design and is not adjustable. It is approximately 50 millivolts peak-to-peak into the base of Q15. Q15 is a current amplifier with a relatively high output impedance. Its gain is adjustable by means of the drive adjust potentiometer. Adjustment of this control is covered under Field Adjustments.

The output of Q15 (an adjustable-gain driver) is used to provide excitation to the program amplifier using transistors Q16 through Q19. This is a direct-coupled three-stage amplifier. The first stage (involving Q16) provides all the voltage gain needed. Q17 is a buffer to drive the output stage whose prime component is Q18. Q19 acts solely as a current sink (an electronic inductor) and enables all of the output signal to flow into the load. Otherwise Q18 acts as an ordinary emitter-follower. The output stage operates in a pure Class A mode. The 47 Ω resistor in series with the output forms a pad going from the near-zero output impedance of this amplifier into the 50 Ω primary of the output transformer.

The program amplifier recovers without audible or measurable ill effects from transients of up to 20 db above normal level. These transients will be cleanly and symmetrically clipped. However, the only time the program amplifier is called upon to do this is during the time that the AGC system is reducing the system gain. Since this time is only about 1 millisecond, the program amplifier very seldom actually clips the signal, and then only for an entirely inaudible period of time.

The end result of this combination of AGC followed by instantaneous clipping is a system that is smooth acting and guarantees a

ceiling on the modulation or output level.

A sample of the program amplifier output, prior to the output pad, is taken to drive the peak-reading db meter. This stage, using transistor Q20, functions basically as an emitter-follower. The 15 μfd capacitor in the emitter of Q20 charges very quickly (in less than 100 μseconds) to substantially the full value of the waveform sample. The resultant voltage across the capacitor is used to drive the front-panel meter movement. To speed up this meter movement, a selected capacitor has been placed across the meter multiplier. The resistor across the meter controls damping and overshoot.

The output side of the pad (or the primary of the output transformer) is sampled by the headphone gain control. This control selects the amount of signal applied to the headphone-monitoring amplifier using transistors Q21 and Q22. The gain of this amplifier is sufficient to hear the studio calling in a cueing system over a telephone line. The amplifier will provide maximum power into a 200 Ω load, but loads up to 2000 Ω and down to 20 Ω will prove satisfactory.

VI. FIELD CHANGES

It should be apparent that not every system will be identical in installation or operation. Even a given remote amplifier may be used under several varying conditions. This section will suggest certain modifications which can be made to the equipment for applications which are to be considered unusual or specialized.

The first change which might possibly be made is the termination of velocity microphones. This is a type of microphone which should be terminated. A resistor of the proper value should be connected across the microphone connector inside of the RPA-1 Remote Pickup Amplifier. This will typically be 220 Ω, ½ watt.

The internal gain of the preamplifiers has been set at the factory by design to a nominally acceptable value. If it becomes apparent in the field that either the gain is too low for the intended application or that the preamplifiers tend to overload because of excessive input level, then the preamplifier gain may easily be changed. Examination of the schematic will reveal a 220 Ω resistor common to the emitter circuit of the first stage (Q4) and the collector of the second stage (Q5). If more gain is desired, lower the value of this resistor. Do not go below 47 Ω. If less gain is desired, raise the value. Do not go above 2200 Ω. The resistor can easily be located on the printed circuit board by noting that the mounting "pads" are rectangular instead of round as for the other components.

Both microphone preamplifiers are identical, so a change made on one is similarly effective for the other.

It is distinctly NOT recommended that the AGC time constant be changed. If it is lengthened, the front panel db meter will tend to read low in the PEAK AUDIO position. If shortened, the sound will become unnatural. Dual recovery timing was deliberately avoided.

VII. FIELD ADJUSTMENTS

There are two internal adjustments which are possible in the RPA-1. One is the AGC bias generator balance, R-53, and the other is the program amplifier drive adjustment, R-24. To correctly set these adjustments, should the occasion arise, proceed as follows:

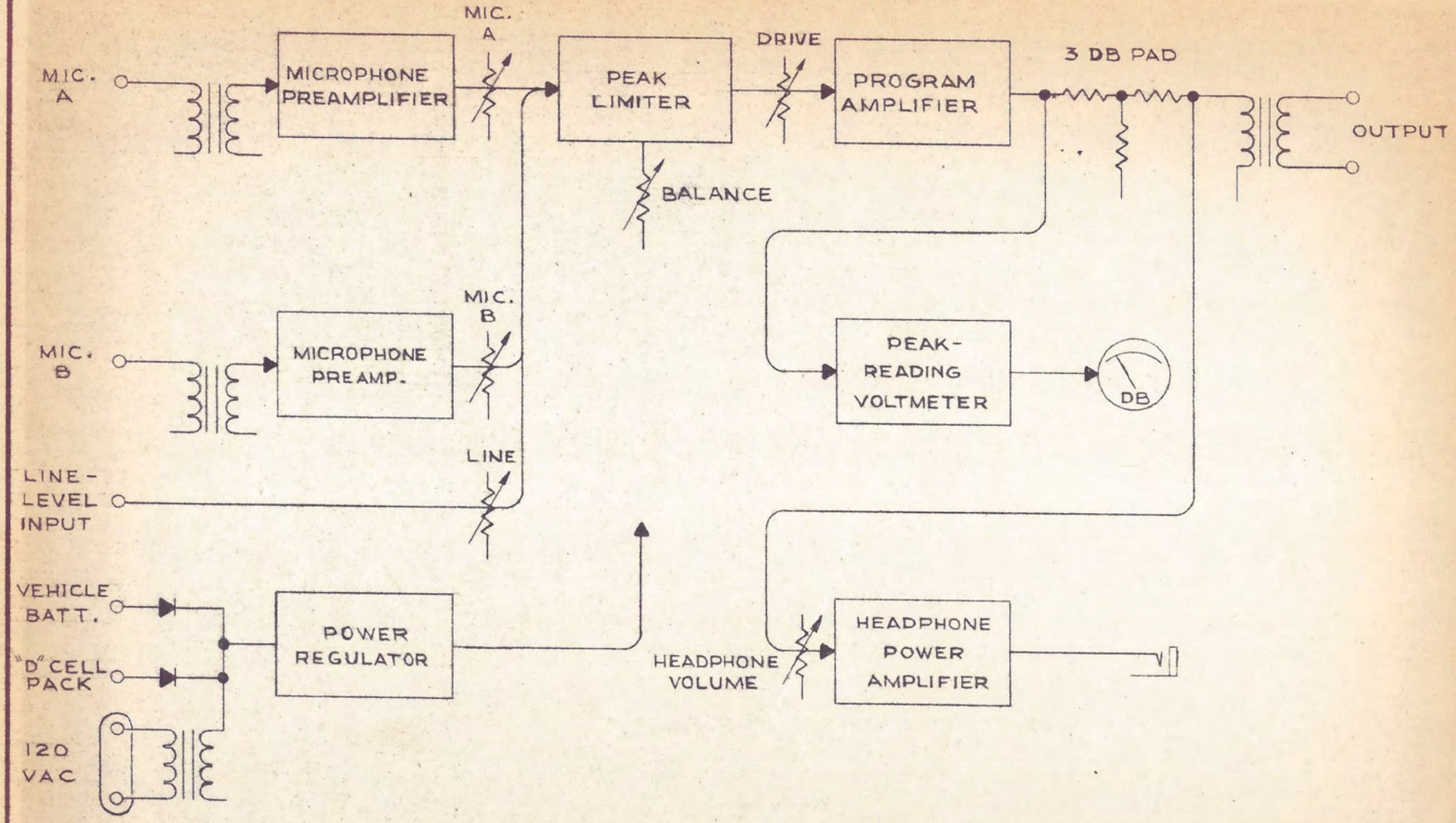
1. Terminate the RPA-1 with a resistor of 560 Ω.
2. Remove the top cover and measure the voltage between the chassis and the violet test point, TP-4, with a DC voltmeter. With power applied this point should measure about 8 volts DC.
3. Apply an audio tone of 1 kHz at a level of 0 dbm to the line input.
4. Advance the LINE level control until the DC meter kicks downward to +4.5 volts DC.
5. Confirm that the front panel db meter shows a deflection and that the unit has an output as measured at the line output terminals.
6. Adjust the AGC Bal., R-53, control for a maximum meter reading on the DC voltmeter; this should correspond to a maximum meter reading on the db meter.
7. Adjust the drive control, R-24, for an output level of +10 dbm. The front-panel meter should read between +0.5 db and +2.5 db. No further adjustments are necessary.

VIII. STORAGE

When the RPA-1 is not in service for a period of a month or more, the internal batteries should be removed. This will prevent possible damage to the unit should the batteries corrode or leak.

Additionally, the batteries should be removed if the device is installed in an automobile. The battery holder has not been designed to support the batteries under conditions of shock and vibration, and damage to the RPA-1 may result if the batteries become loose.

No other precautions need be observed as regards storage of the RPA-1.



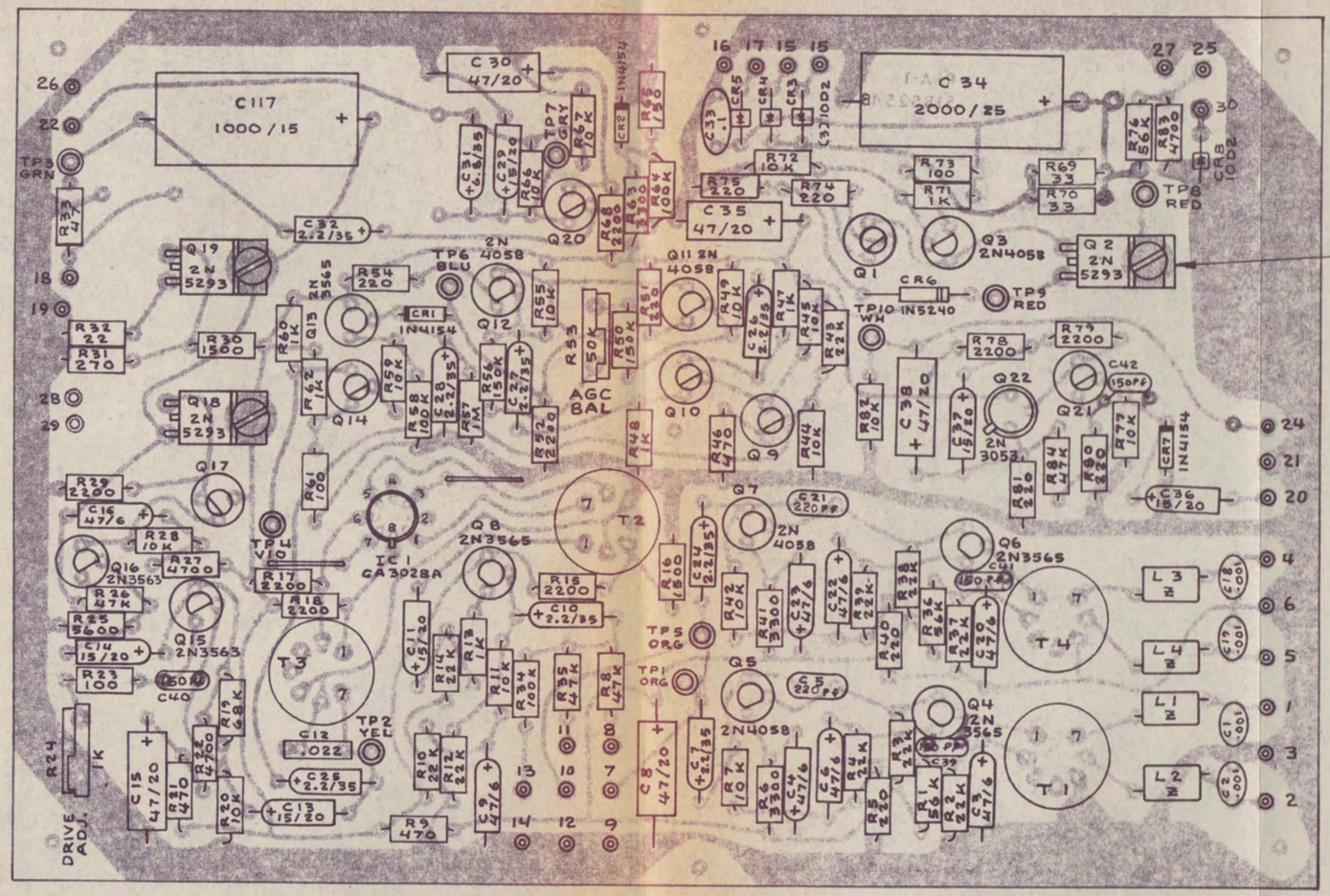
REVISIONS | DATE

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

BLOCK DIAGRAM
MODEL RPA-1

TOL. FRACT ± 1/32. .XX ± .030. .XXX ± .010

DWN	JAG	2-70	SCALE:
CHK	FXY	2/70	
ENG	J(?	2-70	92A1035



NOTES :

1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%
   CAPACITOR " " " MICROFARADS.
   TRANSISTORS ARE 2N2924
2. T1 ~ T4 ARE 3-1041
3. P.C. BOARD 5185254
4. SCHEMATIC 91C6369

REVISIONS	DATE
C	C5 & C21 WERE 100PF ECO 347. 5-70
B	ADD C39-C42 PER ECO 318. 2-70
A	ADD TERM. 30, CR8. CIRCUIT MODIF. 2-70

MOSELEY ASSOCIATES, INC.
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COMPONENT LAYOUT
MODEL RPA-1

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	JAG	1-70	SCALE: FULL
CHK	FXY	1/70	
ENG	JCJ	1-70	20B2160 C

Q22 CR9 TP10 R85 C42 R104 C108

P.C. BOARD
51B5254

R103
MIC. A LEVEL
100K LOG

J102
MICROPHONE
INPUT
A

J103
MICROPHONE
INPUT
B

J106
INPUT
HIGH Z LINE
"LINE"
R101
100K LOG
J107
GND

R102
MIC. B
LEVEL
100 K LOG

T1 3-1041
T2 3-1041
T3 3-1041
T4 3-1041

IC 1
CA3028A

Q1 2N2924
Q2 2N5293
Q3 2N4058
Q4 2N3565
Q5 2N4058
Q6 2N 3565
Q7 2N 4058
Q8 2N3565
Q9 2N 2924
Q10 2N 2924
Q11
Q12
Q13 2N3565
Q14 2N 2924
Q15 2N 3565
Q16 2N3565
Q17 2N 2924
Q18 2N 5293
Q19 2N5293
Q20 2N 2924
Q21 2N2924
Q22 2N3053

TP1 ORG 1VP-PTYP 6VP-P CLIP
TP2 YEL
TP3 GRN 3.6V P-P
TP4 V10
TP5 OR6 .06V P-P
TP6 BLU 2V P-P
TP7 GRY
TP8 RED .15V P-P RIPPLE
TP9 RED
TP10 WH 7V P-P

+8.5 NO SIGNAL, +2.6 @ 20 DB OF LIMITING
.02 V P-P
.06VP-P
.17VP-P
.17VP-P
5V P-P @ +10 DBM
1.8V P-P
3.6V P-P
.7 NO SIGNAL, +2@ 20 DB OF LIMITING
0V NO SIGNAL +1.5 @ LIMITING THRESHOLD, 2.5 @ 20 DB OF LIMITING
+.9V NO SIG., +1.5V@ 20DB OF LIMITING
.05 NO SIG., +2.3 @ +10 DBM
.75 V P-P
AGC BAL.
DRIVE ADJ.
PEAK AUDIO

T102 3-1043 50:600 8A4
RED
YEL
GRN
BLU
GRY

SW101 OFF AUDIO RADIATE
SW102 SUPPLY VOLTAGE / COLLECTOR RF

J104 AUX. POWER 120 VAC
F101 .25A S.B.
T101 3-1042 8P32
15V RMS
15V RMS (3) 200 PIV 500 MA 10D2
+11.5V MIN, +14V NOM.
+10 REGULATED
CR1 CR2 CR3 CR4 CR5 CR6 10V.5W IN5240 CR7 CR8 CR9 10D2

J105
WIRING SIDE
1-2 AUDIO
3 COMMON (MTRG)
4 CONTROL
5 ANT MTRG.
6 COLL MTRG.
7 ⅓ -10V
8 +10V

J108
AUDIO 2
6 COLL.
5 ANT.
3 COMMON

J109
J110
BLK
B 1-10
10 "D" CELLS

J101 HEADPHONE JACK

R104 "PHONES" HEADPHONE VOLUME 10K LOG

NOTES:
1 UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%
CAPACITOR " " " MICROFARADS
DIODES ARE IN4154
2 ◯ DENOTES TERMINAL ON P.C. BOARD
3 P.C. BOARD 51B5254
4 COMPONENT LAYOUT 20B2160
5 → DENOTES PIN ON J105

REVISIONS	DATE	
D	1-70	ADD CR9 & R85. R76 WAS 68K C6 & C21 WERE 100PF Q6 WAS 2N3563. ECO 347.
C	2-70	ADD C39-C42 & C104-C108 PER ECO 318.
B	2-70	ADD J109 & J110.
A	1-70	ADD B1-10, CR8, PIN 30.

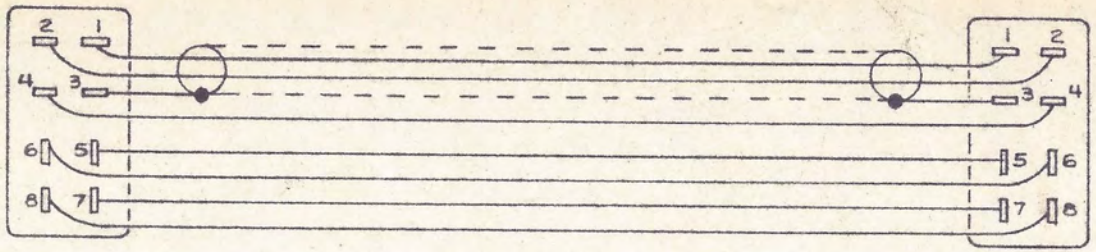
MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC
MODEL RPA-1

TOL. FRACT ± 1/32. XX ± .030. XXX ± .010

DWN	JAG	10-69	SCALE:
CHK	FXY	1-70	
ENG	JCA	1-70	91C6369 D

LENGTH AS REQUIRED



PLUG
CINCH JONES-P-308-CCT

SOCKET
CINCH JONES-S-308-CCT

PIN NO.	FUNCTION
1 & 2	AUDIO
3	AUDIO SHIELD & METERING GROUND
4	CONTROL TO TRANSMITTER
5	ANTENNA RF METERING
6	COLLECTOR RF METERING
7	CONTROL & POWER GROUND
8	POWER FROM TRANSMITTER

NOTES:

1 SUGGESTED WIRE;
PINS 1, 2 & 3 - 2 CONDUCTOR SHIELDED.
BELDEN 8451 OR EQUIVALENT.
PINS 4 THRU 8 - AWG #22 STRANDED
PVC HOOK-UP WIRE

REVISIONS | DATE

MOSELEY ASSOCIATES, INC.
SANTA BARBARA, CALIFORNIA

SCHEMATIC
INTERCONNECTING CABLE RPL-2, RPA-1

TOL. FRACT ± 1/32, .XX ± .030, .XXX ± .010

DWN	F XY	2/70	SCALE: NONE
CHK	[illegible]	2/70	91A6370
ENG	JO	2-70	