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27 November 01

RST-504
DOCUMENT SUMMARY

504-001 -- Chassis Schematic (with intercom)

504-002 -- Aircraft Electrical Installation

504-003 -- Theory of Operation

504-004 -- PCB Parts Values

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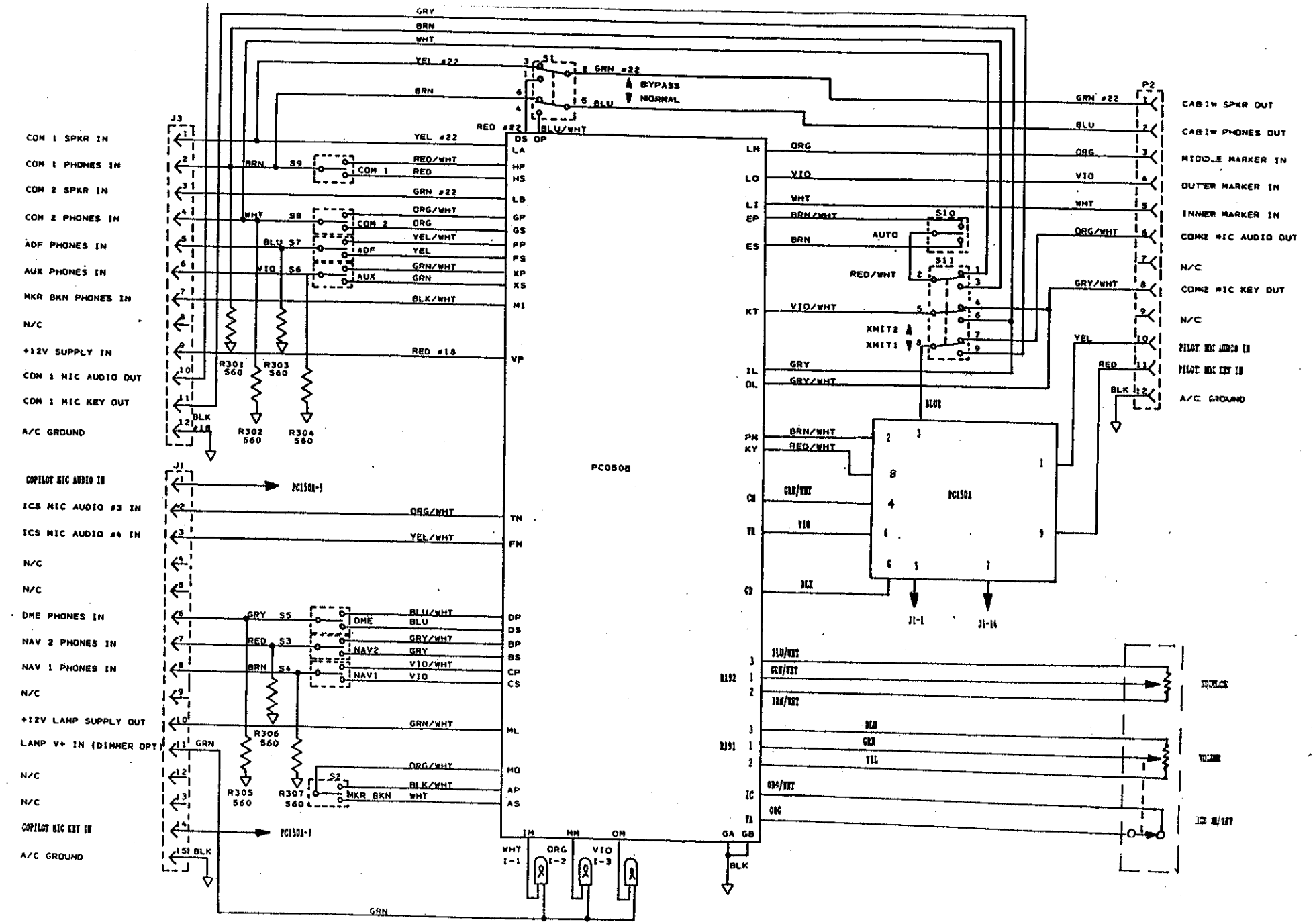
504-008 -- Chassis Parts View

504-009 -- Chassis Schematic (without intercom)

504-010 -- PCB Schematic (without intercom)

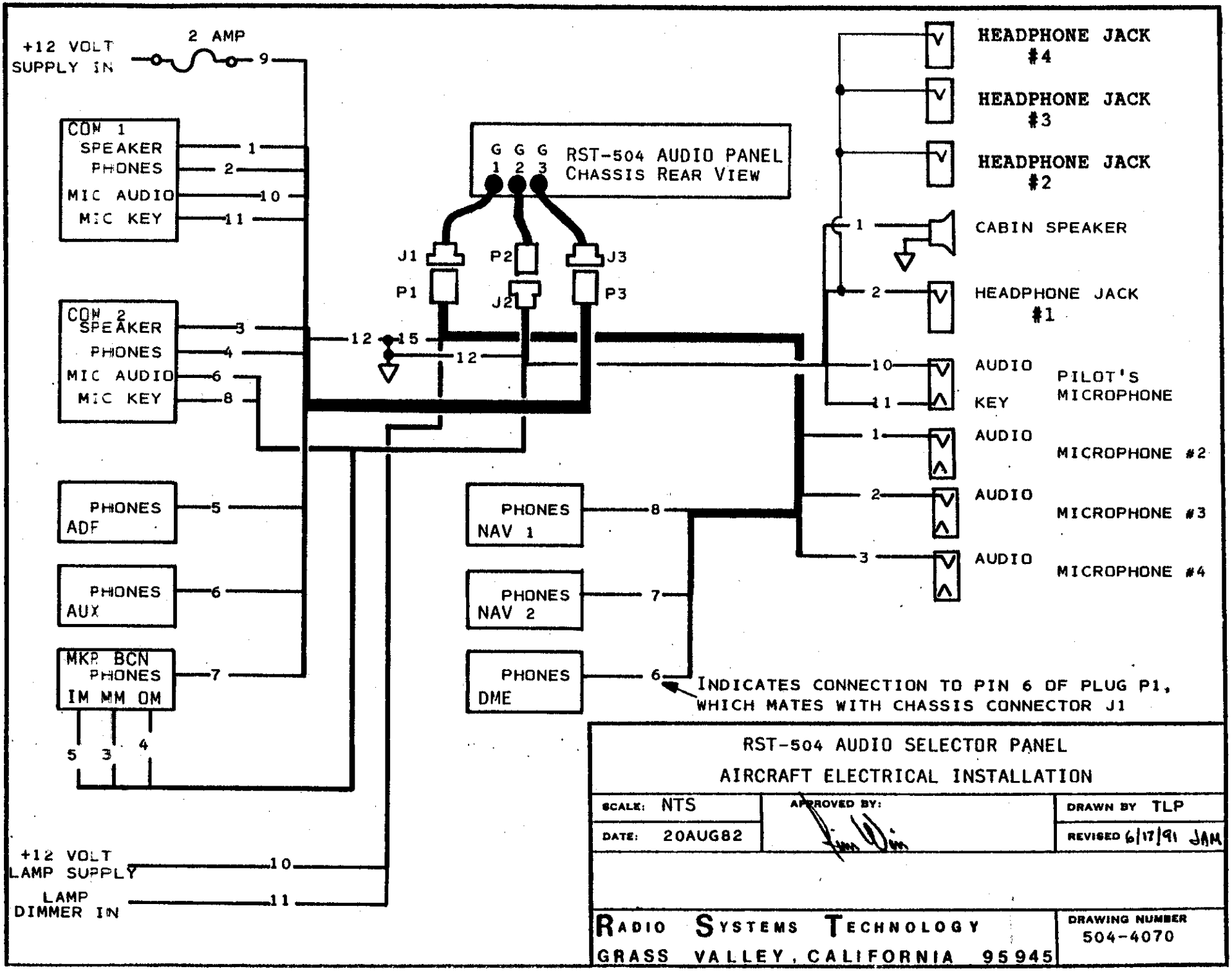
504-011 -- PCB Schematic (with intercom)

504-012 -- Aircraft Mechanical Installation



NOTES: 1. A REV: ECO #92 9/27/93
2. B REV: DSL. 28V OPT. 6/11/96
3. C REV: ECO #87 6/10/97
4. D REV: ADD PC150A & EXT. VOL/SQ. CONT. CHG. DOC. # TO 504-7800-2 11/17/92

RST-504 CHASSIS SCHEMATIC
FOR UNITS WITH INTERCOM OPTION
504-7800-2
NOVEMBER 17, 1992



RST-504 AUDIO SELECTOR PANEL
AIRCRAFT ELECTRICAL INSTALLATION

SCALE: NTS	APPROVED BY:	DRAWN BY TLP
DATE: 20AUG82		REVISED 6/17/91 JAM

RADIO SYSTEMS TECHNOLOGY
GRASS VALLEY, CALIFORNIA 95945

DRAWING NUMBER
504-4070

D. THEORY OF OPERATION

[Information pertaining to audio panels equipped with the RST-506 Intercom package is shown in brackets].

The basic function of the RST-504 is to condition and mix the various audio signals in the aircraft and amplify them for detection in the aircraft speaker and headphones. Also included in the circuitry are a marker beacon audio attenuation circuit [a voice-activated (VOX) intercommunication system], and automatic routing of microphone audio and key signals.

In normal operation, one or more of the eight possible inputs will be amplified and routed to either speaker or headphones, selected by switches S2 through S9. The RST-504 also has a NORMAL / BYPASS switch, S1, which acts as a fail-safe should the panel ever malfunction. In the bypass position, the COM 1 speaker and phones outputs are hardwired to the speaker and phones, providing COM 1 radio operation.

The audio panel operation will be explained in six sections -- General, Speaker Amplifier, Phones Amplifier, Intercom, Marker Attenuation Circuit, and Power Supply. Refer to the chassis Schematic (Drawing #504-7800) and PC050 schematic (Drawing #504-7000) for clarification during circuit descriptions.

1. General

a. Low level (headphone) audio from COM 1, COM 2, ADF, AUX, DME, NAV 1, and NAV 2 enters the audio panel at J1 and J3 and is routed to switches S3 through S9 where it is loaded to ground with a 560 ohm resistor. These switches determine whether the audio is terminated (off), or routed to the speaker or phones amplifier. The MKR BCN audio goes through conditioning circuitry before it is switched to the speaker of phones amplifier.

b. The AUTO switch routes the COM audio from the radio selected by the transmit switch (XMIT 1/XMIT 2) to either the speaker or phones amplifier as selected. For example, with the AUTO switch in the “speaker” position and XMIT 1 selected, COM 1 audio would be present in the speaker. If the XMIT switch is flipped to the XMIT 2 position, COM 2’s audio is provided to the speaker (regardless of the position of either COM 1 or COM 2 switches). The xmit switch, S11 switches the key and audio lines for COM 1 and COM 2 and the COM 1 and COM 2 audio for the AUTO switch.

c. COM 1 and COM 2 speaker audio signals are terminated to ground through the 10 ohm resistors (R100 and R201).

2. Speaker Amplifier

(see Drawing #504-7000.)

a. Selected low level audio from S2 through S9 enters PC050 at points AS through HS and is summed together at R109 (with the exception of AUX audio from S6, which is introduced later). Operational amplifier U102D attenuates this signal 3 dB with the output appearing at U102-14. Under normal operation, this attenuated audio is applied to the main amplifier input (U101-8) through R111 and C104. R123 sets the input impedance of U101.

b. A portion of the audio from U102-14 is fed through C103 and R112 to the AUX input muting circuit. The audio is amplified by U102C (10X) and rectified to a dc level by CR101 and C106. This dc level is applied to comparator U102B at the inverting input, pin 6. R117 sets the dc level at the non-inverting input, U102-5. The voltage at C106 is around 0 volts and there is little or no audio at U102-14. This potential rises as the audio level increases. When the level at U102-5 exceeds that at U102-6, the output at U102-7 rises to around 10 volts. This provides the bias voltage required to turn on Q101. Audio from the AUX input (XS) is amplified by Q101 and applied to the amplifier (at U101-8) through C110. When the level at U102-6 exceeds that at U102-5, U102's output drops to around 0 volts turning off Q101 and preventing any AUX audio from being passed to the main amplifier (U101).

c. The speaker must be muted during both transmit [and ICS functions] to prevent feedback. Q102 and Q103 provide this muting. IN transmit, point KY is pulled low by the key line. This provides the bias required to turn on Q102, bringing its collector voltage up to about 10 volts. This, in turn, provides the bias voltage required to turn on Q103 and shunt any audio present at U101-8 (the main amplifier input) to ground, thus muting all speaker audio. [In the ICS position, 10 volts is applied to point IC which turns on Q107, thus bringing its collector voltage to ground and muting the speaker as described above.] The main speaker amplifier, U101, is a TBA 810 power integrated circuit. Its gain is set at approximately 60 with R128 and C112. The output at U101-12 passes through dc blocking capacitor C117 to OS, the speaker output.

3. Phones Amplifier

a. The phones amplifier circuitry is very similar to that of the speaker amplifier. Low level audio is input at points AP through FP and [R191 with panels equipped with intercom option]. The audio is attenuated by U105C and applied to the phones amplifier at U106-2. The AUX muting circuit involving U105B, U105A and Q104 is similar to that described in the speaker amplifier section, above.

b. The COM 1 and COM 2 inputs are conditioned so that when one COM is transmitting, the other one is muted (i.e. COM 2 is muted when transmitting on COM 1). This prevents possible bleedover between radios. COM 1 audio is input at point HP and applied to U104-2 through R158 and C131. As long as point OL (COM 2 key line) is at around 12 volts (unkeyed state), audio will be amplified by U104A (unity gain) and summed with the rest of the phones inputs at U105-9. If OL is near 0 volts (COM 2 keyed), then biasing is removed from U104-3 and little or no audio will be present at

U104-1. The above description also applies to the COM 2 circuit incorporating GP, IL, and U104B.

c. The main phones amplifier is a LM386 low voltage audio power amplifier. The gain is set at approximately 60 by R162 and C134. The output at pin 5 is set internally at V+/2 (5 volts for a 10 volt supply) to provide maximum output swing. After passing through dc blocking capacitor C137, headphone audio is output at point OP.

4. [Intercommunications System]

a. [Built into the RST-504 audio panel is an optional voice-activated intercom system. The system is activated when S12 is rotated to the "ICS ON" position by providing a 10 volt dc signal to point IC which activates the ICS circuitry. The 10 volt signal at point IC turns on Q106 and Q107. The collector of Q107 is pulled to ground muting the speaker amplifier through R126 and turns on the MM marker lamp through CR111 and R175) one-half brilliance to indicate that the ICS is activated.

b. The emitter voltage of Q106 rises to approximately 9.3 volts to bias "ON" the four microphones through R176 (PM), R177 (CM), R178 (TM), and R179 (FM). These four microphones' signals are then summed at C143 and amplified (3X) by U103B. Audio from U103-7 passes through R187 and C148 to ICS volume control R191. A percentage (0-100%) of this audio is selected from the wiper of R191 for presentation to the phones amplifier, U106, via the summing amp U105C.

c. To provide voice activation, a squelch circuit is needed. A portion of the audio from U103-7 is rectified by CR112 and C146 to a dc level, and applied to comparator U103A, pin 2. When the level set by R192 (ICS SQUELCH) is greater than that at pin 2, the output of the comparator goes to near 10 volts and turns on Q108 through CR113 and R190. This shunts any audio present at C148 to ground. When there is sufficient audio to "break" the squelch, Q108 is turned off and audio is routed to the headphone summing amplifier, U105C.]

5. Marker Attenuation Circuit

a. Once a preset marker audio level has been achieved, the marker attenuation circuit will attenuate the marker audio to a comfortable listening level. After the aircraft has passed over the marker beacon, the circuit resets itself to maximum sensitivity.

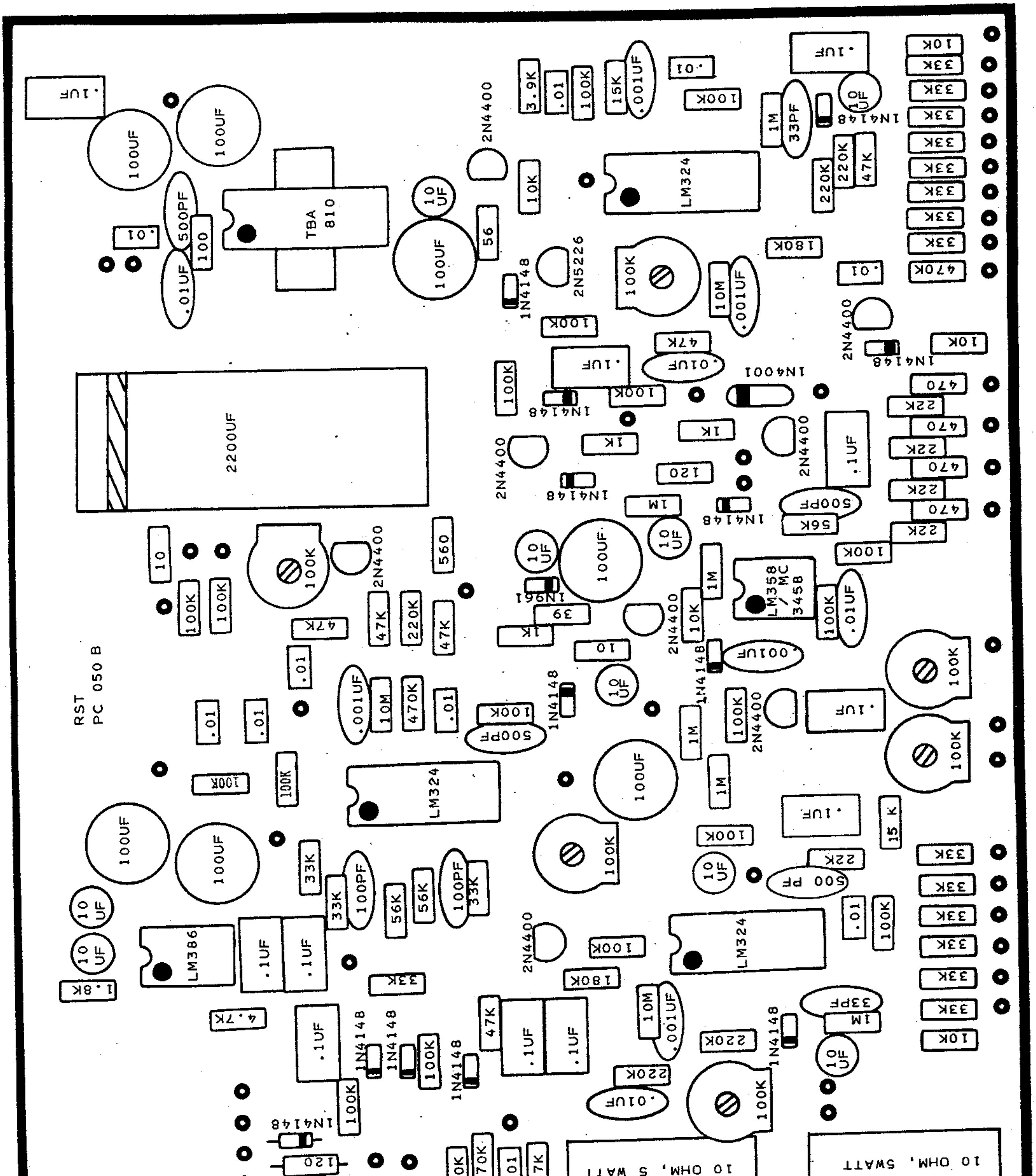
b. Marker beacon audio is fed into point MI on PC050 and loaded to ground with R163. The signal is amplified (2X) by U104C and output at pin 8. In normal, low level operation, this audio will be present at the marker beacon audio output (MO) and applied to S2 (MKR BCN) for selection to the speaker or phones amplifier.

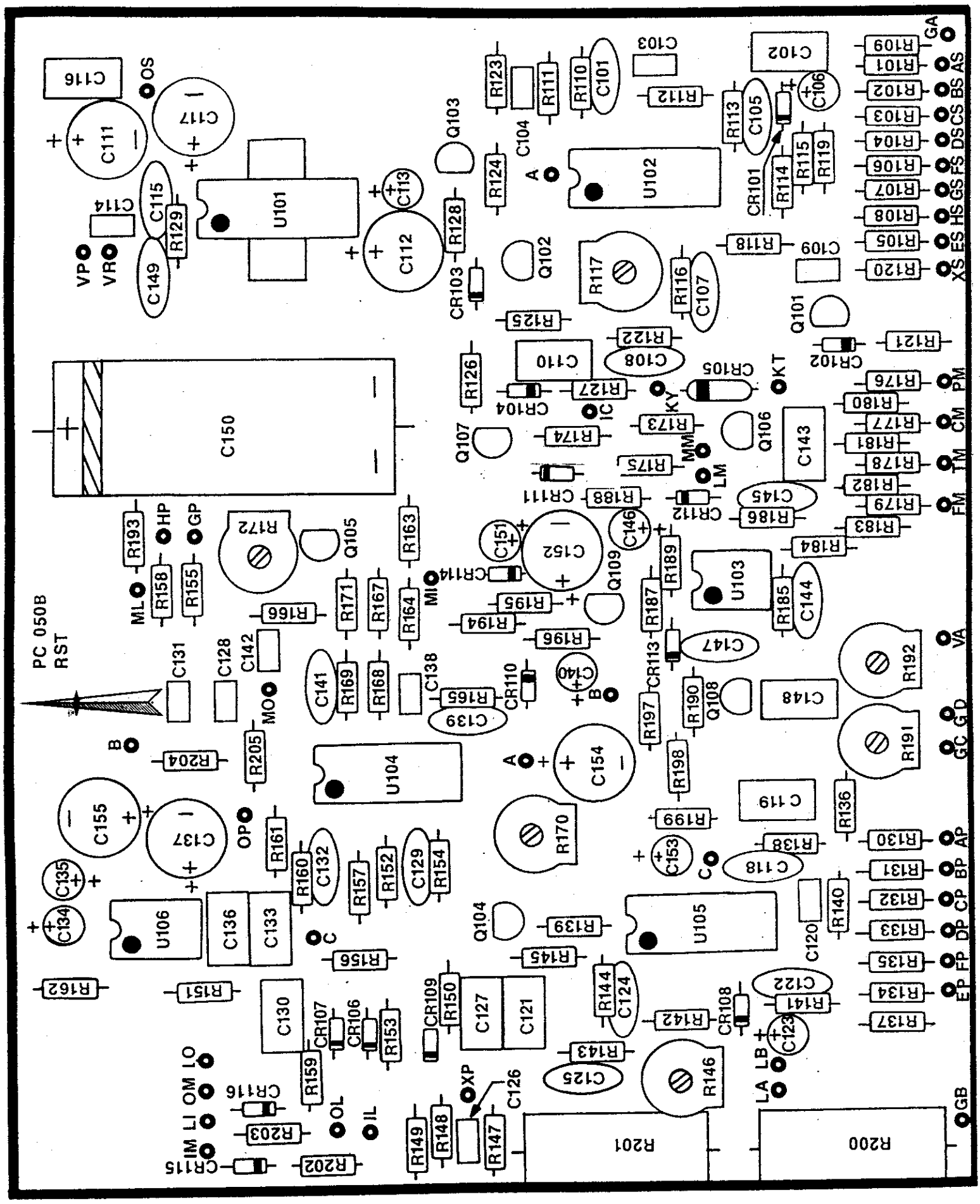
c. To activate the attenuation circuit, a portion of the audio from U104-8 is rectified by CR110 and C140 to a dc level and applied to comparator input U104-12. R170 (MKR TRIG ADJUST) sets the level at U104-13. As the audio level at U104-8 increases and the level at U104-12 exceeds that at U104-13, the output of U104-D rises to about 10 volts and turns on Q105, bringing its collector voltage to ground. A portion of the audio passing through R166 is then shunted to ground through R172. The degree of attenuation is adjustable from about 3 dB to over 60 dB by R172.

6. Power Supply

a. Power for the RST-504 comes in to PC050 at point VP. The 12-15 volt input is filtered by C149 and C150. The positive supply for the marker/indicator lamps is fused with R193 (a 10 ohm, 1/4 watt resistor) and output at point ML.

b. CR114, C151, and R194 provide the stable 10 volt reference for Q109, the series pass element. The fairly high current 9.3 volt supply is filtered by C152. To obtain the V+/2 supply, R197 and R198 form a voltage divider to produce the V+/2 signal at U105-12. U105D is hooked up in a follower configuration to provide the required current drive for the V+/2 (5 volt) supply.


RST
PC 050 B
TBA 810
2200UF
LM324
LM324
LM324
LM358 / MC 3458
LM386
2N4400
2N5226
1N4148
1N4001
1N961
10 OHM, 5 WATT
10 OHM, 5WATT


PC 050B
RST
C116
C111
C117
C114
C115
C149
R129
U101
C113
C112
Q103
R123
R111
R110
C101
C103
R112
C102
R109
R101
R102
R103
R104
R106
R107
R108
R105
R120
C106
R113
C105
R114
R115
R119
CR101
C104
R124
U102
R128
CR103
Q102
R117
R116
C107
R118
C109
Q101
R121
CR102
R125
R122
C108
C110
R126
CR104
R127
CR105
C150
Q107
R174
R173
R175
Q106
C143
C145
R186
CR112
R188
CR111
C146
R193
R158
R155
R172
Q105
R163
R171
R167
R164
R166
C151
C152
CR114
R195
R194
R196
Q109
R189
R187
U103
R185
C144
R184
R183
R182
R179
R178
R181
R177
R180
R176
C147
CR113
R197
R190
Q108
C148
R192
R191
R136
C119
R138
C118
R130
R131
R132
R133
R135
R134
R137
C120
R140
C122
R141
C123
R142
CR108
R143
C125
R146
R200
R201
R139
R145
C124
R144
U105
Q104
C153
R198
R199
C154
R170
C139
R165
CR110
C140
C138
C141
R169
R168
C142
C128
C131
R204
R205
U104
C155
C137
C135
C134
U106
C136
C133
R161
R160
C132
R157
R152
C129
R154
R156
R162
R151
C130
CR107
CR106
R153
R159
CR109
R150
C127
C121
R149
R148
R147
C126
R203
R202
CR115
CR116
VP
VR
OS
HP
GP
ML
MO
OP
MI
MM
LM
KT
KY
IC
PM
CM
TM
FM
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GA
AS
BS
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DS
FS
GS
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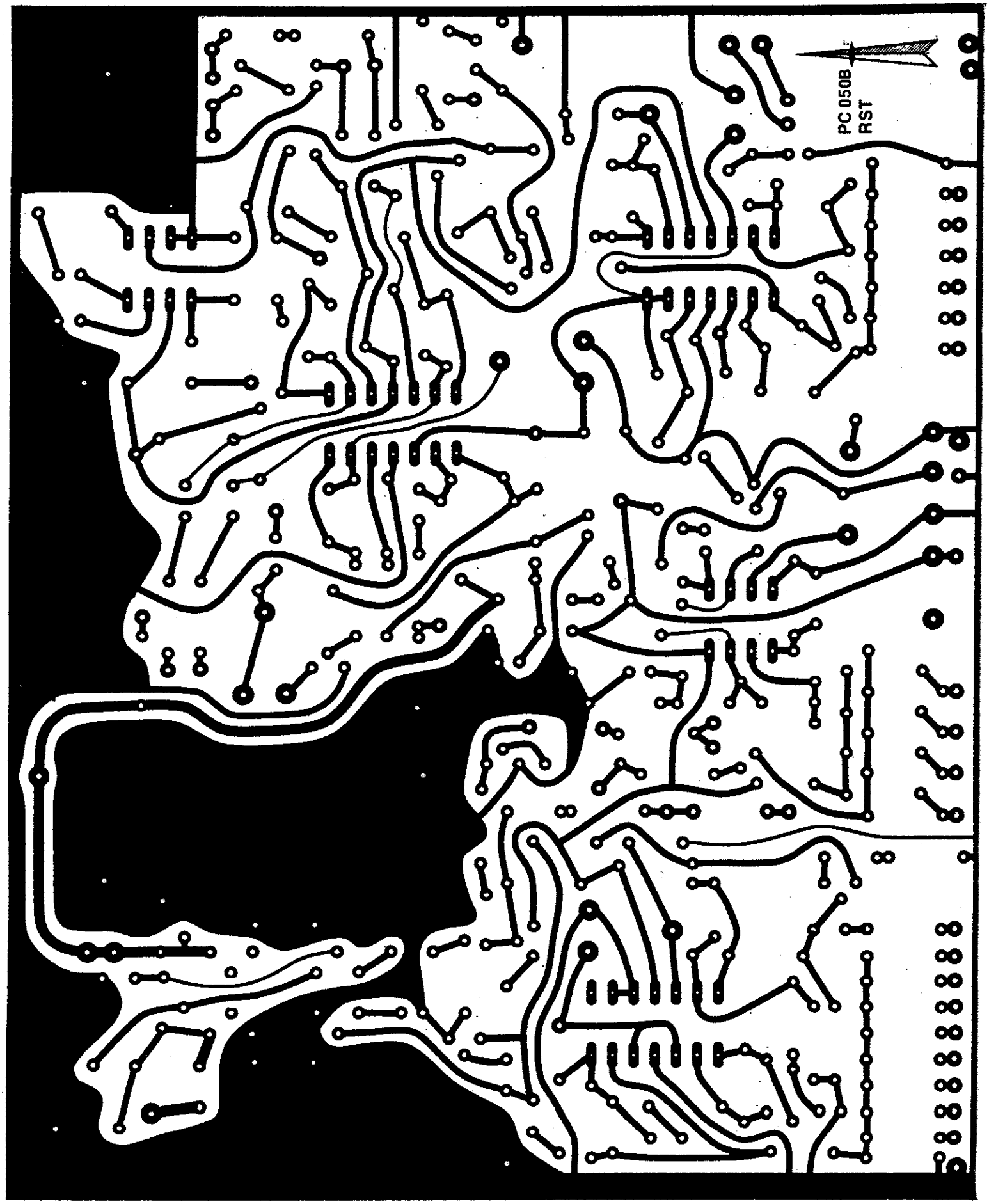
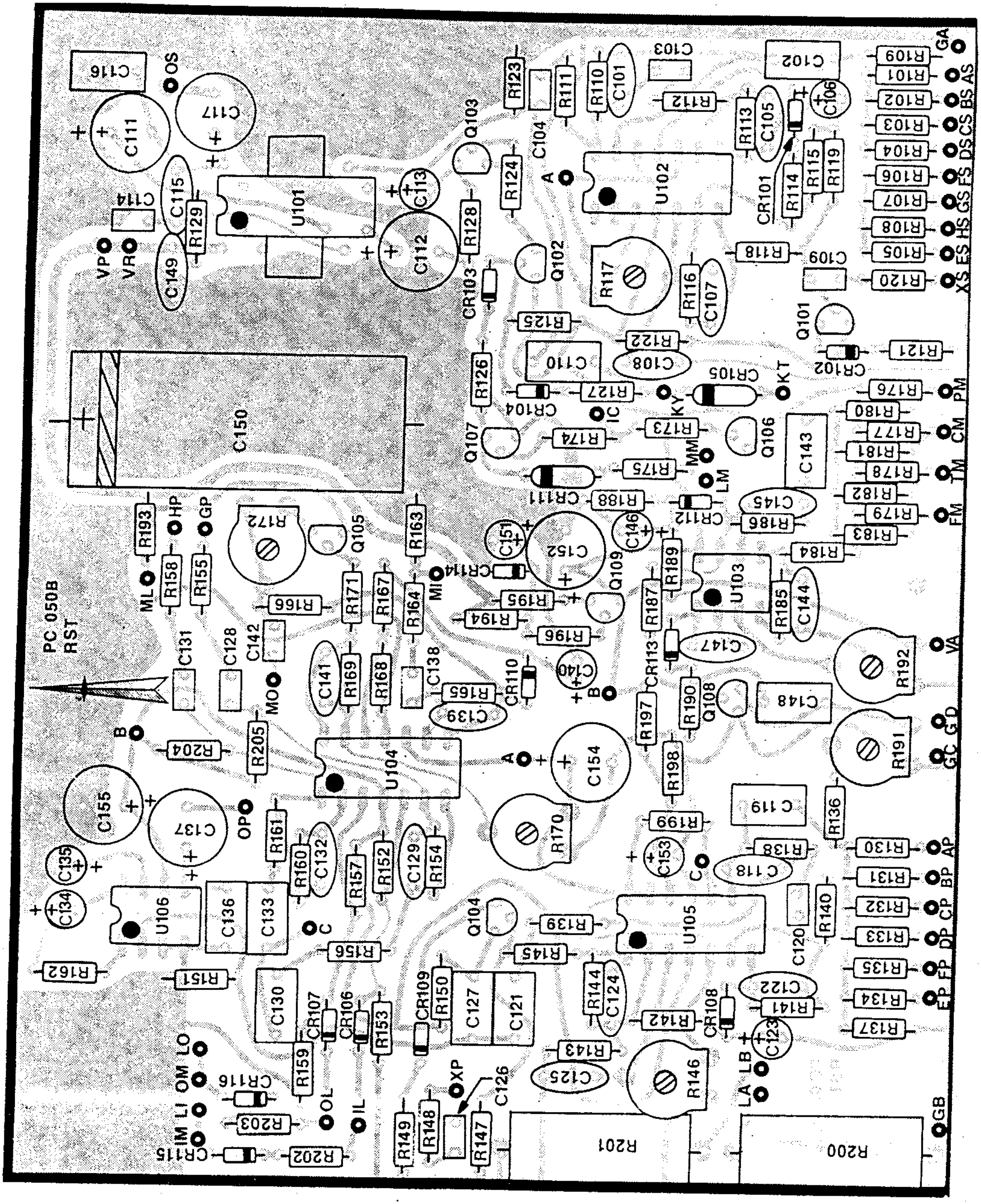
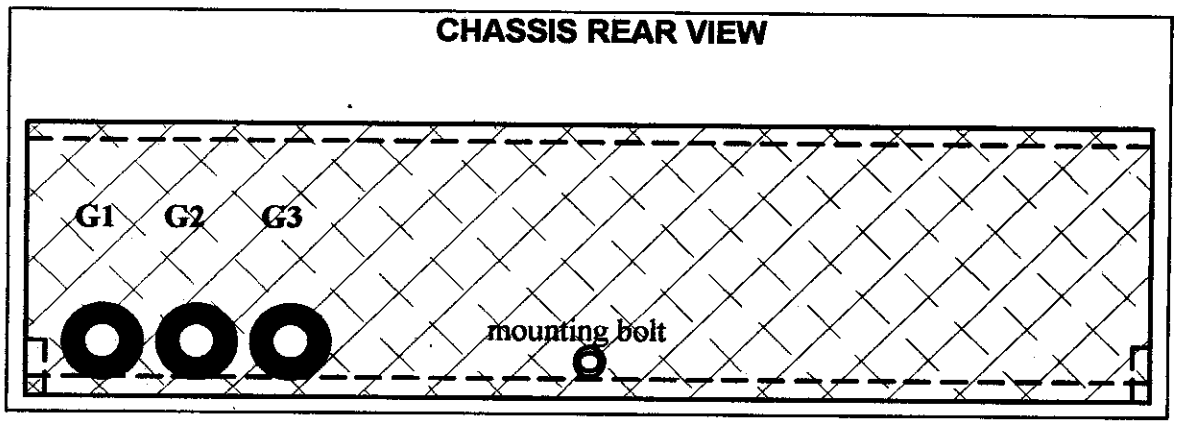
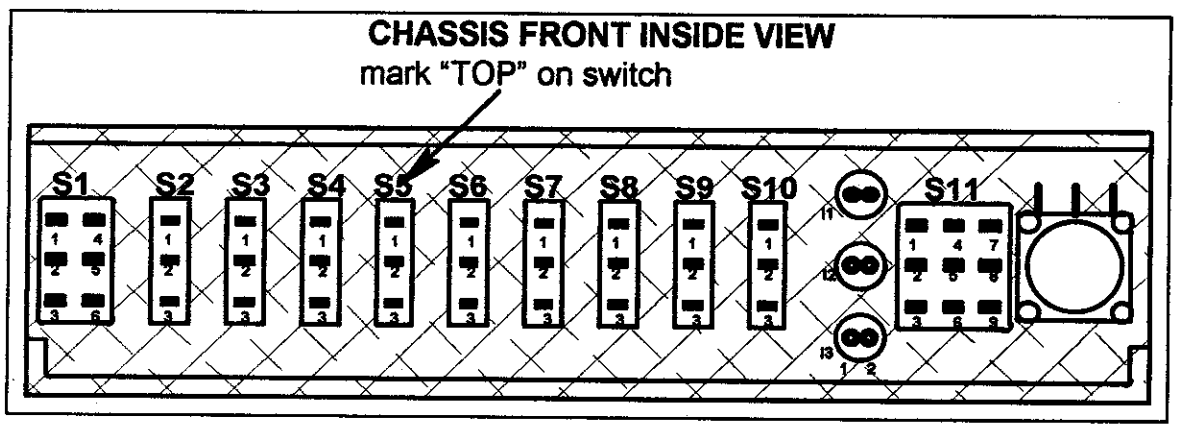
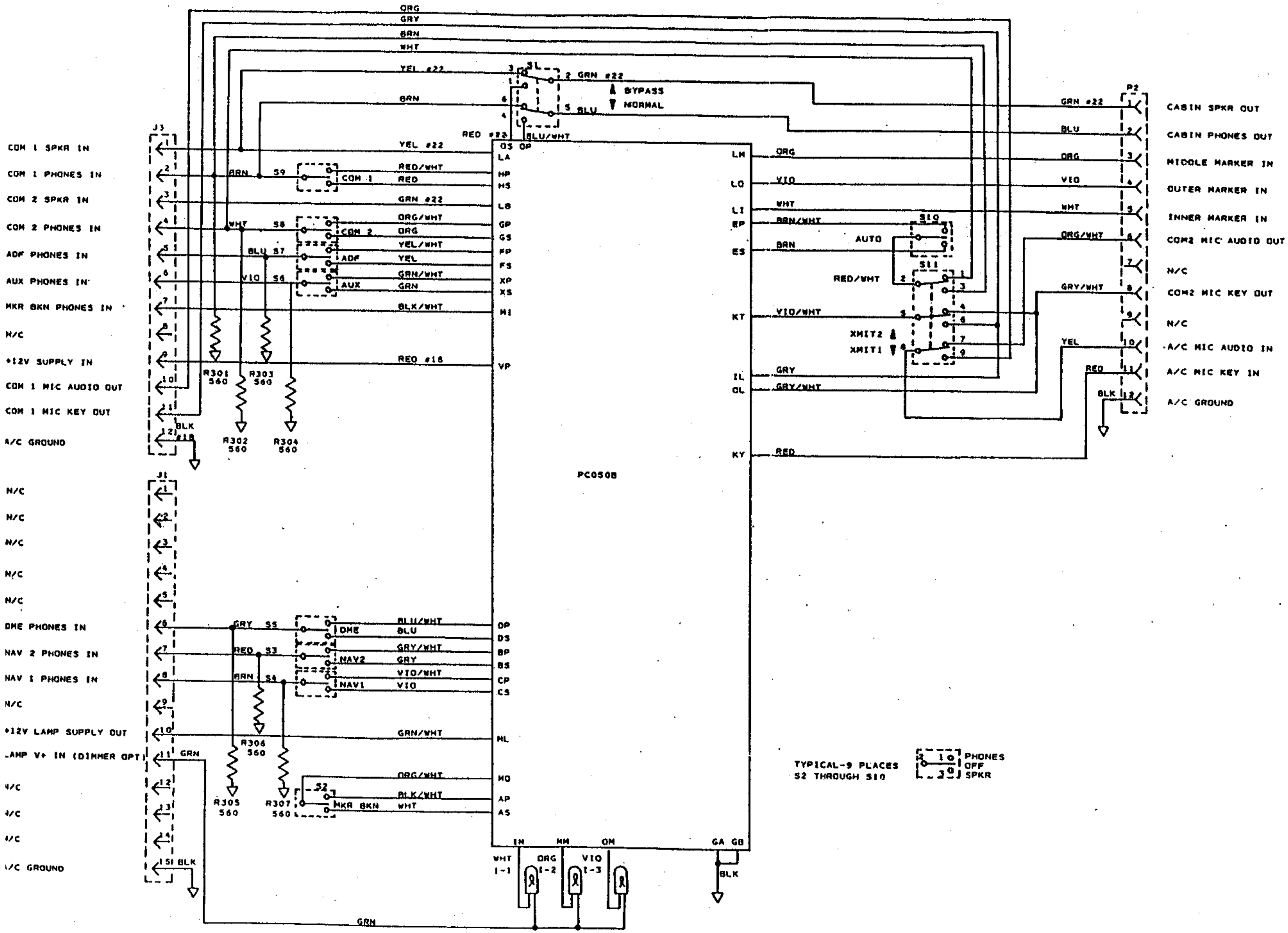



PC 050B
RST
C150
U101
U102
U103
U104
U105
U106
C111
C112
C116
C117
C152
C154
C155
C137
R117
R146
R170
R172
R191
R192
R200
R201

e. Chassis component identification



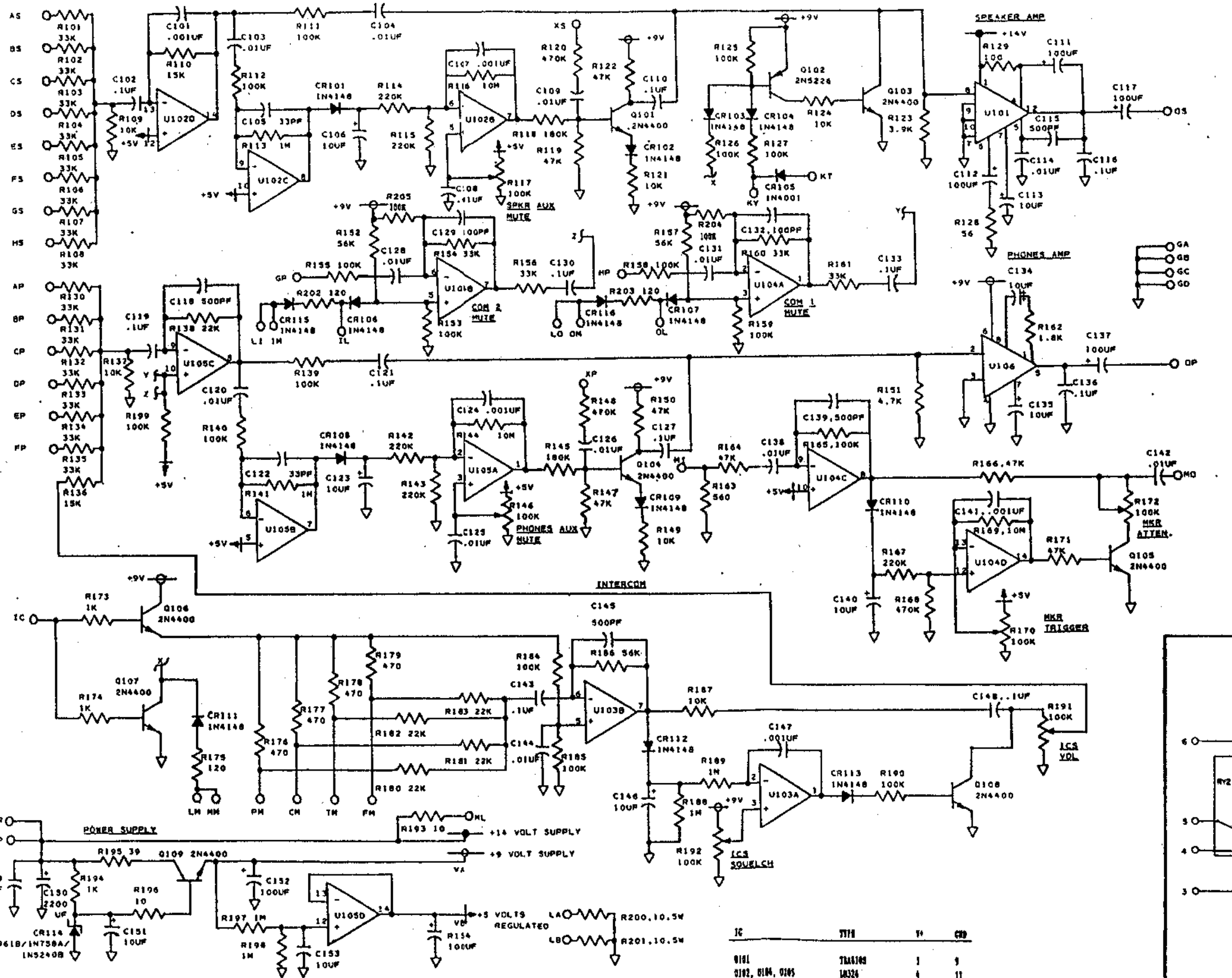


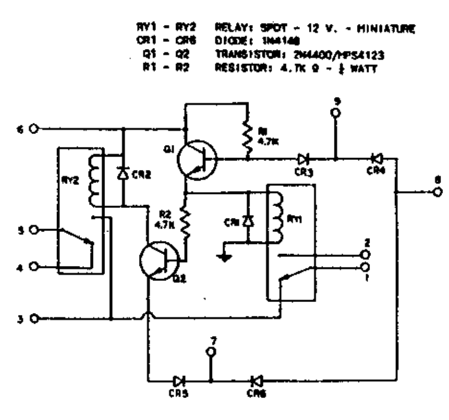


NOTES:
1. A REV: ECO 602 9/27/83
2. B REV: DEL. 20V OPT. 6/11/86
3. C REV: ECO 607 4/10/87
4. D REV: DEL. ICS WIRING & CHG. DWG. # TO 504-7800-1 11/17/92

RST-504 CHASSIS SCHEMATIC
FOR UNITS WITHOUT INTERCOM OPTION
504-7800-1
NOVEMBER 17, 1992

SPEAKER AMP
PHONES AMP
MKR TRIGGER
SPKR AUX MUTE
COM 2 MUTE
COM 1 MUTE
PHONES AUX MUTE
LO OM
HI OM
LO IM
HI IM
LM MM
+14 VOLT SUPPLY
+9 VOLT SUPPLY
+5 VOLTS REGULATED
POWER SUPPLY
PCB508 SCHEMATIC
FOR UNITS WITHOUT INTERCOM OPTION
NOVEMBER 16, 1992
504-7000-1



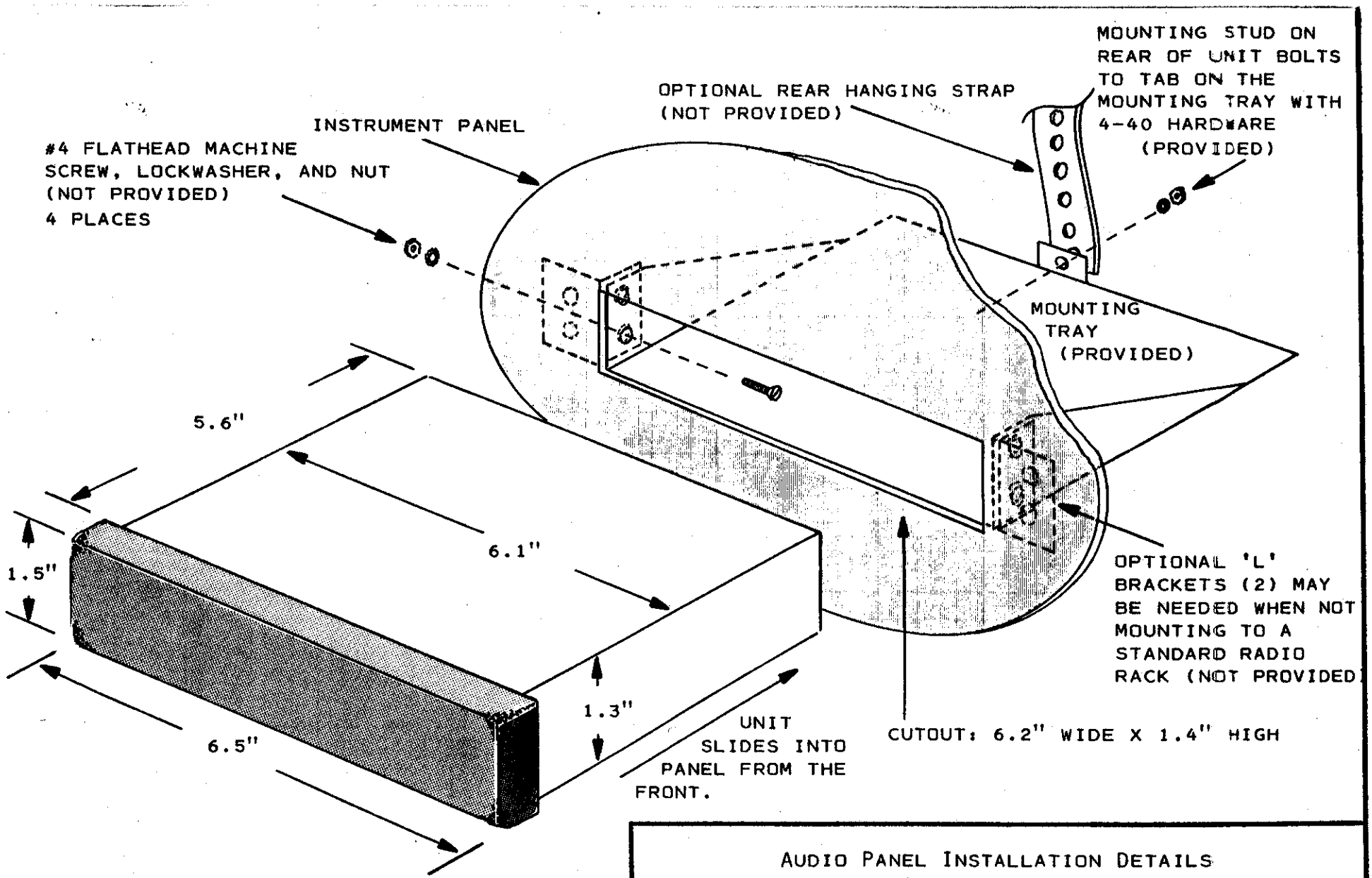


PC150A SCHEMATIC

IC	TYPE	V+	GND
U101	[illegible]	1	9
U102, U104, U105	LM324	4	11
U103	LM358/MC3458	8	4
U106	LM386	6	4

PC050B SCHEMATIC
FOR UNITS WITH INTERCOM OPTION
NOVEMBER 16, 1992
504-7000-2

NOTES: 1. B REV: REF. ECO #87 9/4/86
2. C REV: CHG VALUE OF R204 & R205 FROM 220K TO 100K
3. D REV: ADDED PC150A & CHG DWG # TO 504-7000-2 9/16/92



AUDIO PANEL INSTALLATION DETAILS

SCALE: NTS	APPROVED BY:	DRAWN BY TLP
DATE: 19AUG82		REVISED

RADIO SYSTEMS TECHNOLOGY
GRASS VALLEY, CALIFORNIA 95945

DRAWING NUMBER
504-3900