DC LINE ADAPTER
RLA-54A
Sub-Assembly No.14.1040

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RLA-54A D.C. LINE ADAPTER, SUB-ASSEMBLY 14.1040

1 SPECIFICATIONS

POWER REQUIREMENTS	+13 VDC at 27 mA.typ.
LINE IN SENSITIVITY	-20 dBm, 3.5 kHz.dev.
LINE OUT LEVEL	+7 dBm at 3% THD or less
RESPONSE LINE IN/OUT	+1-3 dB, 300 to 3000 Hz.
IMPEDANCE LINE IN/OUT	600 ohms nominal
PTT TIME-OUT TIMER	6 minutes nominal
TRANS. F1	+3 mA.
TRANS. F2	+8 mA.or more pos.
REC. F2, CTCSS MONITOR	-3 mA.or more neg.
D.C. TERMINATION	10 kohms
P.C. EDGE CONNECTOR	22 pin, 3.96 mm spacing
SIZE LxWxH	154 mm x 30 mm x 107 mm

2 DESCRIPTION

The 14.1040 D.C. Line Adapter contains the interface to allow the operation of a radio transmitter and receiver from a remote position, using a two-wire line having D.C.continuity. The circuit board plugs into a 22 pin P.C.edge connector. A labelled front panel allows easy access to the adjustment controls. A folded metal card-holder allows quick removal of the plug-in assembly for service or testing.

The Line Adapter has provision for two-wire or four-wire (duplex) operation, transmit channel selection F1 or F2, and receive channel selection F1 or F2. CTCSS monitor function can be used in lieu of receive channel selection. Three jumpers program the above functions. A time-out timer circuit disables the transmitter line-keying after 6 minutes of continuous line-keying. The timer resets immediately after line-keying stops.

The line-receiver has a pre-emphasis circuit to allow connection to the transmitter modulator. An on-board front-panel switch is provided for service convenience for disabling the line-keying function during adjustment or test periods.

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3 FUNCTIONAL CONNECTIONS (BY PIN NUMBER)

1	GND	Common ground.
2	RX AF IN LO	Receiver low-level audio input.
3	RX AF IN HI	Receiver high-level audio input. Used for WR-494 receiver.
4	LINE OUT	Line out for 4-wire duplex.
5	LINE OUT	Line out for 4-wire duplex.
6	+13V IN	+13 volt supply input.
7	LINE DRIVER IN	Auxilliary input to line driver.
8	$\overline{\text{TOS}}$ IN	Application of ground to this pin will switch the line driver from tone-operated squelch to carrier operated.
9	$\overline{\text{TRANSMIT}}$ IN	Application of ground to this pin will key the transmitter in the same manner as the transmit line current detector.
10	MOD	Leveled output of the line receiver for voice modulation input to the radio transmitter.
11	SW +9.5V	+9.5V switched by the LINE/LOCAL channel selector to the radio receiver.
12	RX OSC 1	Switched supply to the receiver channel 1 oscillator.
13	RX OSC 2	Switched supply to the receiver channel 2 oscillator.
14	COS IN	Carrier-operated switch input. This circuit is connected to the receiver squelch circuit and will detect a carrier as being present for more than about 3 volts input. The line driver is switched by this signal (and "$\overline{\text{TOS}}$ IN" for CTCSS).
15	SW TX +9.5V	TX +9.5V switched by the LINE LOCAL channel selector in the radio transmitter.

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FUNCTIONAL CONNECTIONS (BY PIN NUMBER)

16	TX OSC 1	Switched supply to the transmitter channel 1 oscillator.
17	TX OSC 2	Switched supply to the transmitter channel 2 oscillator.
18	PTT	An internal open-collector NPN switch grounds this pin to key the transmitter. It will connect to the PTT input of the transmitter.
19	LINE IN +	Positive line input.
20	LINE IN -	Negative line input.
21	LINE REC OUT	Line-receiver output, directly from the line-transformer.

4 CIRCUIT OPERATION

Transformer T1 has a split-winding to allow line-current sensing through R6, 10 kohms. Three current detectors (U1,U2 and U3) are provided. They are used to sense +3 mA., +8 mA.and -3 mA.of line-current respectively. The control R8 (labelled PTT CH2) is adjusted so that U2 does not respond to +3 mA.but does respond to +8 mA. U6 and U7 are quad Schmitt-NAND gates used to produce a decisive logic level from the line-current detector outputs, the COS inverter Q2 and the time-out delay capacitor C6.

If U1 is activated by +3 mA.(or more) then U1 pin 5 will go low, making U6 pin 6 low. If pin 5 or pin 6 of U6 goes low, pin 4 will go high. "$\overline{\text{TRANSMIT}}$ IN" can set U6 pin 4 high in the same manner as U1 pin 5. The high at U6 pin 4 causes U6 pin 10 to go low. This turns on Q8 and Q7, keying the transmitter. However, if S1 is in the "DISABLE" position, Q7 will never turn on and the transmit keying function will be disabled. CR4 becomes reverse-biased when U6 pin 4 goes high. This causes C6 (the time-out timing capacitor) to charge. After about 6 minutes of continuous keying, U6 pin 3 will go low. This forces U6 pin 10 high, disabling the transmitter keying capability of the Line Adapter. The timer is reset whenever U6 pin 4 goes low, that is, when keying control signals stop.

The high-level current detector U2 will have a low at pin 5 (when properly set up) with +8 mA. or more of line-current. The PTT CH 2 control will set the sensitivity. This value of line-current is used to transmit on channel 2. Since more than +3 mA. is flowing, detector U1 will key the transmitter in the manner previously described.

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Half of U7 is used to provide switching signals to the transmit oscillator switching transistors, Q3, Q4, Q9 and Q10. Normally, Q3 and Q9 are on. When detector U2 is activated, it sets U7 pins 5 and 6 low, making pin 4 high. This makes U7 pin 3 go low, turning Q3 and Q9 off and Q4 and Q10 on. This selects the channel 2 transmit oscillator. The oscillators will, however, only be supplied when TX +9.5V is applied to the Line Adapter input pin 15. This would be the case if the channel selector switch in the radio transmitter was in the "LINE" position.

Pin 5 of current detector U3 will go low for negative line currents (-3 mA. sensitivity). This can be used to change either to receive channel 2 or monitor for CTCSS. Jumper JU-3 must be connected for CTCSS monitor and must be removed for two-channel receive applications. The low at U3 pin 5 appears at U7 pin 8. U7 pin 9 is connected to "$\overline{\text{TOS}}$ IN" from the Line Adapter input pin 8. If either pin 8 or 9 of U7 goes low, U7 pin 10 will go high. This selects monitor for CTCSS or receive channel 2 for two-channel receive applications. U7 pins 10 and 11 drive transistors Q5, Q6, Q11 and Q12 to select the receive channel. The Line Adapter input pin 11 is connected to +9.5V when the channel selector switch in the radio receiver is in the "LINE" position. For CTCSS, jumper JU-3 allows muting of the line driver when the proper CTCSS tone is absent.

The COS (carrier-operated switch) will detect the presence of a received carrier with an input of 3 volts or greater. It is made up of Q2 as a threshold detector and a Schmitt-NAND gate to produce a suitable logic level. U6 pin 11 will be high when a carrier is detected in the radio receiver. The diode AND gate CR6, CR7 allows only the presence of carrier (COS) and CTCSS tone (TOS) to gate the receiver audio to the line driver (if JU-3 is in place). If JU-3 is not placed, only COS will gate the audio. The half of U5 with output at pin 7, amplifies the receive audio to be leveled at the LINE OUT control R37. Separate audio inputs are used for high level (Line Adapter pin 3) and low level (Line Adapter pin 2) receiver audio. The leveled output from U5 is combined with the signal from LINE DRIVER IN at Line Adapter pin 7, to be applied to the line driver Q1. Jumper JU-1 is used to connect Q1 to T1 for two-wire operation and jumper JU-2 is used to connect Q1 to T2 for four-wire operation. Only one of these jumpers can be placed on the board for a given application. The line driver has the capability of more than +7 dBm of output power into a terminated line. Capacitors C2 and C8 prevent radio-frequency signals on the lines from causing audible interference such as would be heard from AM broadcast stations.

The LINE IN control, R2, levels the line input signal going to the line-receiver amplifier. C4 and R3 provide 6 dB/octave pre-emphasis in the frequency range from 300 to 3000 Hz. CR5 will mute this amplifier when there is no transmit control signal (logic high) at U6 pin 10. The amplifier output at U5 pin 1 has its output impedance increased to 4.7 kohms by R5. This allows

the parallel connection of more than one audio source at the transmitter voice- modulation input. This output is termed "MOD" and appears at pin 10 of the Line Adapter.

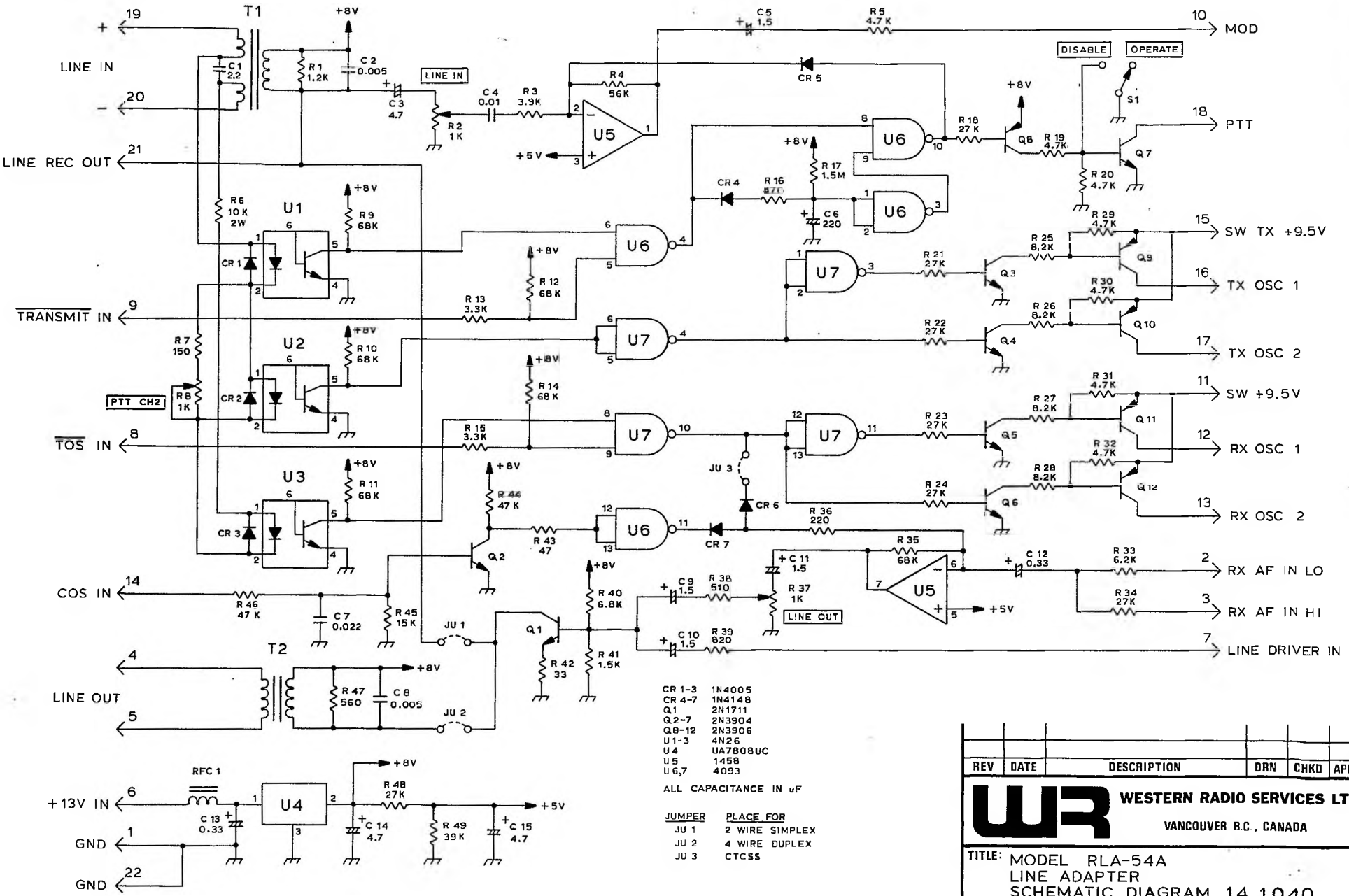
The on-board +8 volt supply is regulated by U4 from the +13 volt input supply. An additional +5 volt supply for the operational amplifier is supplied by R48, R49 and C15.

5 ADJUSTMENTS

LINE OUT	-The LINE OUT control, R37, sets the gain of the line driver. Apply a signal to the receiver with 3.5 kHz.deviation using a 1000 Hz.tone. Set R37 for the desired line output level, up to +7 dBm into a 600 ohm line.
PTT CH2	-The PTT CH2 control, R8, sets the sensitivity of the positive high-level line current detector U2. Send, alternately, D.C.signals at +8 mA. (channel 2) and +3 mA. (channel 1). Adjust R8 so that U7 pin 4 is high when +8 mA.is sent on the line and low when +3 mA. is sent on the line. If the radio channel selector switch is in the "LINE" position, pin 17 of the Line Adapter may also be used to check the switching. This pin will be at 0 volts when +3 mA.is sent and at +9.5 volts when +8 mA.is sent.
LINE IN	-The LINE IN control, R2, sets the gain of the line receiver. Apply a 1000 Hz.tone to the input line at -20 dBm or at the expected line input level. Pre-set the transmitter modulation control for limiting at 5 kHz.deviation. Key the transmitter and adjust R2 for 3.5 kHz.deviation with the input test tone applied.

JUMPERS

JU-1	-connect for 2-wire line operation.
JU-2	-connect for 4-wire line operation.
JU-3	-connect for CTCSS.



CR 1-3	1N4005
CR 4-7	1N4148
Q1	2N1711
Q2-7	2N3904
Q8-12	2N3906
U1-3	4N26
U4	UA7808UC
U5	1458
U6,7	4093

ALL CAPACITANCE IN uF

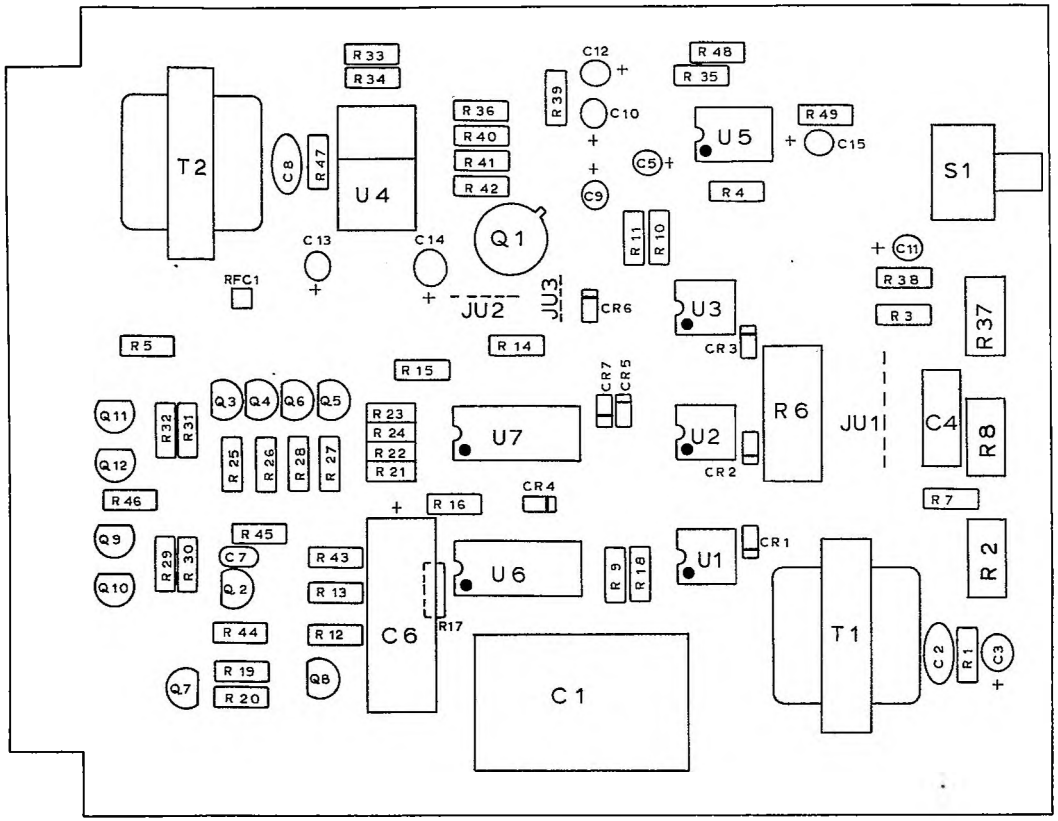
JUMPER	PLACE FOR
JU 1	2 WIRE SIMPLEX
JU 2	4 WIRE DUPLEX
JU 3	CTCSS

REV	DATE	DESCRIPTION	DRN	CHKD	APPVD

WESTERN RADIO SERVICES LTD.
VANCOUVER B.C., CANADA

TITLE: MODEL RLA-54A
LINE ADAPTER
SCHEMATIC DIAGRAM 14.1040

DRAWN T.H.	DATE APR 4, 1977	DRAWING NUMBER
CHECKED	SCALE	46-2
APPROVED		



VIEW FROM COMPONENT SIDE

REV	DATE	DESCRIPTION	DRN	CHKD	APPVD

WESTERN RADIO SERVICES LTD.
VANCOUVER B.C., CANADA

TITLE: MODEL RLA-54A
LINE ADAPTER
P. C. ASSEMBLY 14.1040

DRAWN T.H.	DATE MAY 4, 1977	DRAWING NUMBER
CHECKED J.C.	SCALE	46-3
APPROVED		

Ref	Description	Mfr	Mfr Part No	WR Part No	Qty	Item
C1	2.2 uf, 250V			24.4065	1	
C2	0.005 uf 1KV	CentraLab	DD502	24.4001	1	
C3	4.7uf 20V			26.1021	1	
C4	0.01 uf 250V	Philips	344 ABA 10K	24.4080	1	
C5	1.5uf 35V			26.1032	1	
C6	220uf 40V			27.1060	1	
C7	0.022 uf 100V	Kemet	C330C223M1R5CA	24.4050	1	
C8	0.005uf 1KV	CentraLab	DD502	24.4001	1	
C9	1.5uf 35V			26.1032	1	
C10	1.5uf 35V			26.1032	1	
C11	1.5uf 35V			26.1032	1	
C12	0.33uf 35V D.T.	Kemet		26.1029	1	
C13	0.33uf 35V Blue Max	Kemet		24.4051	1	
C14	4.7uf 20V			26.1021	1	
C15	4.7uf 20V			26.1021	1	
CR1	Silicon, 1N4005		1N4005	37.0500	1	
CR2	Silicon, 1N4005		1N4005	37.0500	1	
CR3	Silicon, 1N4005		1N4005	37.0500	1	
CR4	Silicon, 1N4148		1N4148	37.0600	1	
CR5	Silicon, 1N4148		1N4148	"	1	
CR6	Silicon, 1N4148		1N4148	"	1	
CR7	Silicon, 1N4148		1N4148	"	1	
Q1	NPN, 2N 1711		2N 1711	64.0065	1	
Q2	NPN. 2N 3904		2N 3904	64.0120	1	
Q3	NPN, 2N 3904		2N3904	"	1	
Q4	NPN, 2N 3904		2N3904	"	1	
Q5	NPN, 2N 3904		2N3904	"	1	
Q6	NPN, 2N 3904		2N3904	"	1	
Q7	NPN, 2N 3904		2N3904	"	1	
Q8	PNP, 2N 3906		2N3906	64.0122	1	

RLA-54A
RACK MOUNT DC LINE
ADAPTER CARD

WR communications ltd.
vancouver, b.c., canada.

PARTS LIST

DATE : June 2,1980 | MODEL : RLA-54A

APPROVED : | ASSY. NO. 14.1040

SHEET 1 OF 4

REV	APP	DATE	ITEM	CHANGE TO	WR PART NO.

Q9	PNP, 2N 3906		2N3906	64.0122	1	
Q10	PNP, 2N 3906		2N3906	64.0122	1	
Q11	PNP, 2N 3906		2N3906	"	1	
Q12	PNP, 2N 3906		2N3906	"	1	
R1	1.2K ohms ¼W 5%	Rohm	R25J		1	
R2	Variable, 1K ohms	Spec.	63 x 102	54.5200	1	
R3	3.9K ohms ¼W 5%	Rohm	R25J		1	
R4	56K ohms ¼W 5%	Rohm	R25J		1	
R5	4.7K "	"	"		1	
R6	10K ohms, 2W 10%	IRC			1	
R7	150 ohms ¼W 5%	Rohm	R25J		1	
R8	Variable 1K ohms	Spec.	63 x 102	54.5200	1	
R9	68K ohms ¼W 5%	Rohm	R25J		1	
R10	68K ohms "	"	"		1	
R11	68K ohms "	"	"		1	
R12	68K ohms "	"	"		1	
R13	3.3K ohms ¼W 5%	"	"		1	
R14	68K ohms "	"	"		1	
R15	3.3K ohms "	"	"		1	
R16	470 ohms "	"	"		1	
R17	1.5M ohms "	"	"		1	
R18	27K ohms "	"	"		1	
R19	4.7K ohms "	"	"		1	
R20	4.7K ohms "	"	"		1	
R21	27K ohms "	"	"		1	
R22	27K ohms "	"	"		1	
R23	27K ohms "	"	"		1	
R24	27K ohms "	"	"		1	
R25	8.2K ohms "	"	"		1	
R26	8.2K ohms "	"	"		1	
R27	8.2K ohms "	"	"		1	
R28	8.2K ohms "	"	"		1	
Ref	**Description**	**Mfr**	**Mfr Part No**	**WR Part No**	**Qty**	**Item**

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ADAPTER CARD

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vancouver, b.c., canada.

PARTS LIST

REV	APP	DATE	ITEM	CHANGE TO	WR PART NO.

DATE : June 2,1980 | MODEL : RLA-54A
APPROVED : | ASSY. NO. 14.1040
SHEET 2 OF 4

Ref	Description	Mfr	Mfr Part No	WR Part No	Qty	Item
R29	4.7K ohms ¼W 5%	Rohm	R25J		1	
R30	4.7K " "	"	"		1	
R31	4.7K " "	"	"		1	
R32	4.7K " "	"	"		1	
R33	6.2K " "	"	"		1	
R34	27K " "	"	"		1	
R35	68K " "	"	"		1	
R36	220 " "	"	"		1	
R37	Variable, 1K ohms	Spec.	63 x 102	54.5200	1	
R38	510 ohms ¼W 5%	Rohm	R25J		1	
R39	820 "	"	"		1	
R40	6.8K "	"	"		1	
R41	1.5K "	"	"		1	
R42	33 "	"	"		1	
R43	47 "	"	"		1	
R44	47 "	"	"		1	
R45	15K "	"	"		1	
R46	47K "	"	"		1	
R47	560 "	"	"		1	
R48	27K "	"	"		1	
R49	39K "	"	"		1	
RFC1	Coil. 1½ Turns #224AWG. Enamel			31.1065	1	
	Philips Ferrite Bead		5659065/3B	31.1060	1	
S1	Switch, SPDT, Toggle	JBT	7101A T02-123	61.0601	1	
T1	Transformer, Audio, 600 ohms	Hammond	649G	30.1000	1	
T2	Transformer, Audio, 600 ohms	Hammond	649G	30.1000	1	
U1	Opto-Coupler, 4N26	Moto	4N26	58.0050	1	
U2	" " 4N26	"	4N26	"	1	
U3	" " 4N26	"	4N26	"	1	
U4	Regulator, Voltage,UA7808UC	"	MC7808 CT	41.1603	1	
U5	Integrated Circuit, 1458	"	MC1458 CP1	41.1403	1	
U6	Integrated Circuit 4093		4093	41.1796	1	

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DATE : June 2,1980 | MODEL : RLA-54A

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REV	APP	DATE	ITEM	CHANGE TO	WR PART NO.

SHEET 3 OF 4

Ref	Description	Mfr	Mfr Part No	WR Part No	Qty	Item
U7	Integrated Circuit 4093		4093	41.1796	1	
	Handle .040 AL	HRWST		23-10070	1	
	Front Cover .040 AL			23-10073	1	
	Screw, 4-40 x ½				2	
	Nut, Hex, 4-40			40.1701	2	
	Lock washer, #4			40.1801	2	

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REV	APP	DATE	ITEM	CHANGE TO	WR PART NO.

SHEET 4 OF 4