MOTOROLA

MICOM•S™/TRITON 40•S™

HF-SSB Base/Mobile Radio

2-13.2/2-18 MHz
100/125/150 Watts

NOTE: SMR-4382 4/20/1982 and IMR-082 July 1986 are included.

MODELS COVERED:

D70HEA1N00AK
D80HEA1N19AK
D80JMA1N00AK
D80JMA1N19AK

THIS MANUAL HAS BEEN
DISCONTINUED

Instruction Manual

68P81060E20-O

MOTOROLA INC.

instruction manual revision

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81060E20-0	MICOM•S/TRITON 40•S HF-SSB Base/Mobile Radio, 2-13.2/2-18 MHz, 100/125/ 150 Watts

REVISION DETAILS:

1. Add the following note after the OPTION CHART on page iv in the instruction manual.

> NOTE
> When more than one of the S96, S122, and S135 options are ordered, different front panel kits are required for each. Refer to the Mechanical Parts and Disassembly Procedures section for the proper front panel Motorola part numbers.

2. Add/replace the following in paragraph 1.3 in the Maintenance section (68P81060E72-0).

2.1 Before Step 1, add: The battery date is the four digit number appearing at the right of the 3 V reference.

Example: 8106 is the 6th week of 1981.

2.2 Replace the CAUTION after Step 7 with the following:

> WARNING
> The lithium battery could explode if overheated.
> DO NOT:
> -- short-circuit the battery,
> -- attempt to recharge the battery, or
> -- dispose of the battery in fire.

3. Add the two following paragraphs (3, 4, and Figures 2 and 3) at the end of the Maintenance section (68P81060E72-0).

3. SERVICING PARTS PROTECTED BY THE RTV™ COMPOUND ON THE SYNTHESIZER ("S") BOARD

3.1 The lithium battery (B1) should be removed when making repairs on the "S" board. FAILURE to remove the battery may result in CMOS device failures.

NOTE

The stored channel data in the RAM will be lost when the lithium battery is removed. After repairs are complete, install the battery and reprogram the RAM to the desired channel frequencies. Refer to the Radio Programming section (68P81060E76) of this manual for detailed programming instructions.

3.2 It IS NOT recommended that the "S" board parts located in the VCO1 area under the RTV compound (see Figure 2) be serviced. If a problem is isolated to that location it is recommended that the "S" board be replaced. However, if repairs are ABSOLUTELY necessary, the RTV compound can be removed with an X-acto™ knife (or similar tool) and a pair of tweezers. While referring to Figure 2 for part placement, cut the RTV compound and remove it with tweezers. TAKE CARE not to damage the underlying component parts.

3.3 After performing the required repairs, the RTV compound must be replaced to reduce the microphonic susceptibility of the radio in mobile/marine environments. If the radio is a mobile/marine unit, the RTV compound (Motorola Part No. 11-10019C70) should be replaced and cured before re-installing the unit. "Skin-over" curing takes 30 minutes, and complete curing depends on humidity, amount of RTV compound used, and exposure to air. Typically, with the synthesizer cover reoved, complete curing takes seven days.

4. OVEN COVER ATTACHMENT

With the rear housing removed, orient the radio so that the heat sink is on the right and the "A" board is visible (see Figure 2). The plastic trimmer inserts in the oven cover should be closer to you than the oven cover locking mechanism. To secure the oven cover to the board, turn the rotating portion of the cover lock fastener 1/4 turn in either direction. The oven cover is locked when the fixed and rotating portions of the cover lock fastener are parallel to each other (see Figure 3). The oven cover is unlocked when the fixed and rotating portions of the cover lock fastener are perpendicular to each other.

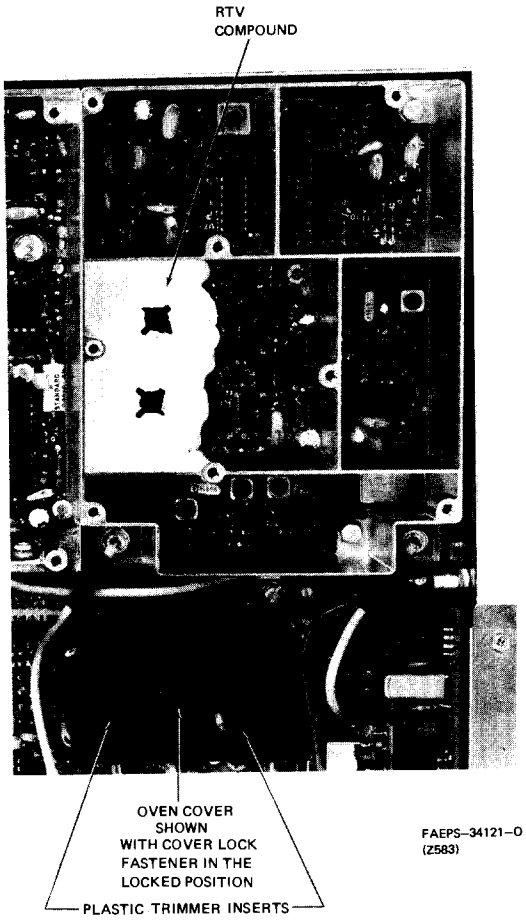


Figure 2. RTV Compound and Oven Cover Details

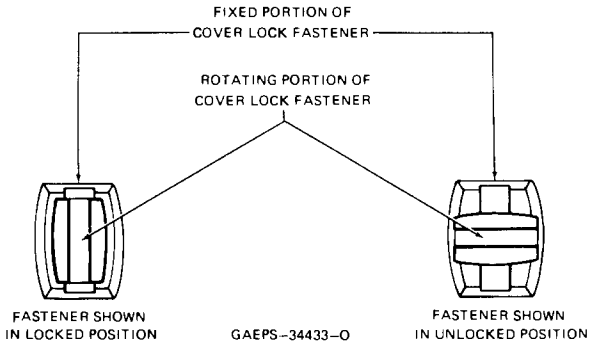


Figure 3. Oven Cover Lock Fastener Details

4. The following table shows the connections made to the pinout functions of the "A" Board schematic diagram on PEPS-33805-0, Sheet 1 of 4, in the Radio Set Theory of Operation instruction section 68P81060E77-0.

Connector & Pin No.	Function Was	Function Should Be
J17-7	HFA	HF-A
J17-19	HFB	HF-B
J17-17	HFC	HF-C
P16-20	RNGØ	SPARE
P16-21	RNG1	RANGE 1 SELECT
P16-22	RNG2	RANGE 2 SELECT
P16-23	RNG3	RANGE 3 SELECT
P16-24	RNG4	RANGE 4 SELECT
P16-25	RNG5	RANGE 5 SELECT
P16-26	RNG6	SPARE
J17-8	CH3 SEL/DISP DATA 4	CH3 SEL/DISP DATA 2
J17-12	CH5 SEL/DISP DATA 0	CH5 SEL/DISP DATA Ø
J17-11	CH1 SEL/DISPLAY STROBE	CH1 SEL/DISPLAY STROBE
J17-9	CH10 SEL/PROG BRD ENABLE	CH10 SEL/PROG BRD ENABLE
J17-3	CH9 SEL/DISP ADDR 0	CH9 SEL/DISP ADDR Ø

5. "A" Board Schematic Diagram PEPS-33805-0, Sheet 3 of 4 (part of the Radio Set Theory of Operation instruction section 68P81060E77-0).

5.1 Change each J20 to J21 and each J21 to J22.

5.2 After making the changes given in paragraph 4.1 (above), the following table shows the corrections made to the pinout functions on the schematic diagram.

Connector & Pin No.	Function Was	Function Should Be
J3-9	-	PTT
J4-17	-	PTT
J5-2	-	PTT
J3-4	-	ANT TUNE/PA TUNE
J3-17	-	ANT TUNE/PA TUNE
J21-2	BLANKER IN	RF IN
J21-6	BLANKER OUT	RF OUT
J22-1	REC IN XMIT OUT	REC IN/XMIT OUT
J22-4	9 V	+8.5 V
J22-8	REC OUT XMIT IN	REC OUT/XMIT IN
J5-1	MIC HI	XMIT AUDIO
J4-5	-	XMIT AUDIO
J4-6	TO FRONT END ATTENUATOR	RGC CONTROL LINE
J2-20	METERING	SPARE
J4-8	SQUELCH INPUT	REC AUDIO
J2-15	AUDIO OUTPUT (TO VOLUME CONTROL)	RCVR AUDIO INPUT

6. "A" Board Schematic Diagram PEPS-33805-O, Sheet 4 of 4 (part of the Radio Set Theory of Operation instruction section 68P81060E77-O).

6.1 Change each J20 to J21 and each J21 to J22.

6.2 After making the changes given in paragraph 5.1 (above), the following table shows the corrections made to the pinout functions on the schematic diagram.

Connector & Pin No.	Function Was	Function Should Be
J4-19	TRG QC1	SPARE
J4-18	QC2	SPARE
J3-2	TX LAMP	XMIT LIGHT
J4-9	9R IN	9R
J2-24	-	ALC
J4-7	9T IN	9T
J21-5	BLANKER ON/OFF	BLANKER
J4-20	8.5 V IN	+8.5 V
J2-2	U/L	USB/LSB
J16-23	HF3	RANGE 3 SELECT
J16-24	HF4	RANGE 4 SELECT
J16-25	HF5	RANGE 5 SELECT
J16-26	HF6	SPARE
J16-22	HF2	RANGE 2 SELECT
J16-21	HF1	RANGE 1 SELECT
J4-13	R3	RANGE 3 SELECT
J4-14	R4	RANGE 4 SELECT
J4-15	R5	RANGE 5 SELECT
J4-3	R6	SPARE
J4-10	R2	RANGE 2 SELECT
J4-11	R1	RANGE 1 SELECT

Change P/O J4 (located to the right of Q41, CR27, and CR28) to P/O J16. Change pin 15 to pin 25 and pin 3 to pin 26. Also note that the output of these two pins goes to the "D" board and not to the "C" board.

J16-25	R5	RANGE 5 SELECT
J16-26	R6	SPARE
J16-14	MUTE DIS	MUTE/DISABLE
J3-1	PA INH	PA INHIBIT
J3-15	PA DIS	PA DISABLE/CH CHANGE
J16-19	RE-TUNE	RETUNE
J4-4	SQ OUTPUT	SQUELCH OUTPUT
J2-21	MUTE	AUDIO MUTE
J2-11	CH1	CHANNEL 1
J2-14	CH2	CHANNEL 2
J2-8	CH3	CHANNEL 3
J2-7	CH4	CHANNEL 4
J2-12	CH5	CHANNEL 5
J2-16	CH6	CHANNEL 6
J2-13	CH7	CHANNEL 7
J2-9	CH8	CHANNEL 8
J2-5	CH9	CHANNEL 9
J2-10	CH10	CHANNEL 10

7. Parts list PL-6752-B on PEPS-33808-O (part of the Radio Set Theory of Operation instruction section 68P81060E77-O) must be revised for the Model TFA6071A Harmonic Filter only. Diodes CR1 and CR2 are hot carrier types (Motorola part no. 48-84616A01).

8. On schematic diagram EEPS-33397-O (part of the Radio Set Theory of Operation instruction section 68P81060E77-O), the turns ratio on T403 should be 1:5.

9. On schematic diagram DEPS-33422-O (part of the Radio Set Theory of Operation instruction section 68P81060E77-O) should be revised as follows:

   a. Pin P21-3 should be +8.5 V.
   b. Every reference to "9 V DECOUPLED" should be changed to read +7.7 V.

10. All three sheets of PEPS-33953-O [part of the Synthesizer ("S") Board instruction section 68P81060E78-O] should be revised as follows:

    a. Revise parts list PL-7827-O to read:

Reference Symbol	Motorola Part No.	Description
C92	21-863147	150 pF ±10%; 500 V
C94	21-11014H45	68 pF ±5%; 100 V
L36	24-82835G36	choke; 0.57 uH

    b. On schematic diagram PEPS-33953-O (Sheet 2 of 3), change C92 to 150 pF and C94 to 68 pF.
    c. On schematic diagram PEPS-33953-O (Sheet 3 of 3), change L36 to 0.57 uH.

11. In the Options instruction section (68P81060E82-O), add the following note after paragraph 7.

> NOTE
> When more than one of the S96, S122, and S135 options are ordered, different front panel kits are required for each. Refer to the Mechanical Parts and Disassembly Procedures section for the proper front panel Motorola part numbers.

MOTOROLA INC.

instruction manual revision

GENERAL

This revision details changes that should be made in your instruction manual. Please emend your manual accordingly.

INSTRUCTION MANUALS AFFECTED

68P02926G15-O MICOM.X, HF-SSB Land Mobile Radio
68P02925G00-O MICOM.S/TRITON 40.S, HF-SSB Base/Mobile Radio
68P02929G85-O MICOM.S CONSOLETTE, HF-SSB Fixed Station
68P02934G85-O MICOM 104, HF-SSB Mobile/Base Radio
68P81063E65-O MICOM.S, HF-SSB RTTY Base Station, 2-18 MHz
68P02933G30-O MICOM.S, HF-SSB RTTY Base Station, 2-30 MHz
68P81047E55-O MICOM 100
68P81060E20-O MICOM.S/TRITON 40.S HF.SSB Base/ Mobile Radio.

REVISION DETAILS

1. Please add the following information to the above manuals in their appropriate location.

CW TRANSMISSION

The Continuous Wave (CW) option adds the circuitry necessary to enable CW telegraphy transmissions. A jack on the front panel accepts a 3/16" two-circuit phone plug to allow connecting of any standard telegraph key. Closing the key puts the push-to-talk (PTT) signal in the transmit condition, and also activates a 900 Hz oscillator for CW operation on the single-sideband, pilot or AM-equivalent mode. Opening the key shuts off the oscillator; the PTT signal, however, remains in the transmit condition for one-half second to prevent rapid transmit-receive switching during CW transmissions.

2. Please add the following interconnection table to the above manuals:

CW J1	B Board J12	Description
1	17	PTT
3	18	SIDE TONE
4	5	XMIT AUDIO
5	19	TELEGRAPH KEY
6	20	8.5 V
10	16	ALL

3. At higher than average CW operating speeds, part of the first character may be lost, due to initial TX turn-on delay.

If this presents a problem in your system - contact your area systems engineering department, which will recommend a solution.

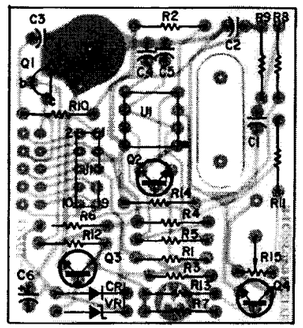
4. Add the attached CW INTERFACE, model FLN5795A schematic diagram to the above manuals.

parts list

FLN5795A CW Interface Board — PL-0220-O

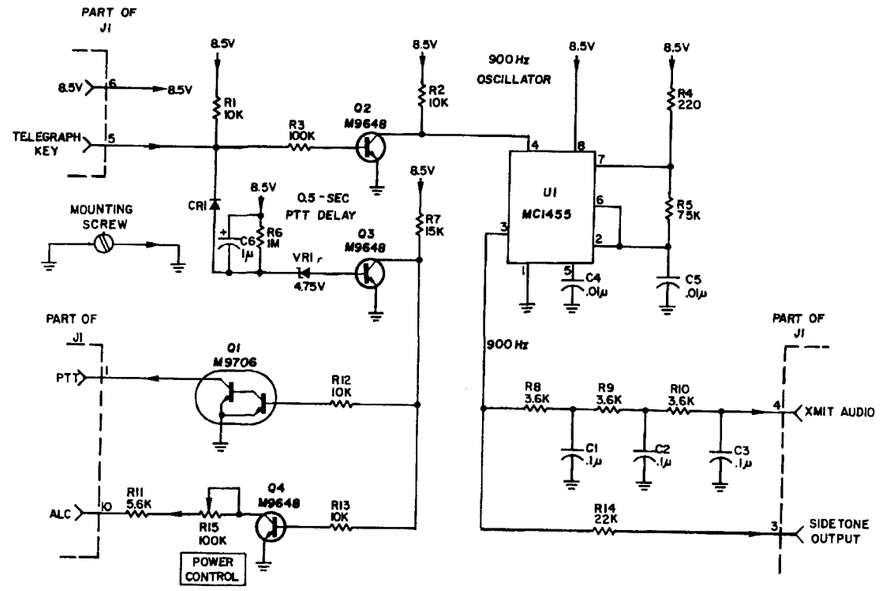
Reference Symbol	Motorola Part No.	Description
		Capacitors
C1-C3	21-84008H28	.1 uF ±5%
C4, C5	21-84008H16	.01 uF ±5%
C6	23-84665F04	1 uF +80% - 20%
		Diode
CR1	48-83654H01	silicon
		Connector
J1	09-08305H01	female, 10 pins
		Transistors
Q1	48-00869706	NPN Darlington, M9706
Q2-Q4	48-00869648	NPN, M9648
		Resistors: ±5% 1/4 W unless otherwise noted
R1, R2	06-11009C73	10k
R3	06-11009C97	100k
R4	06-11009C33	220k
R5	06-11009C94	75k
R6	06-00124B22	1M
R7	06-11009C77	15k
R8-R10	06-11009C62	3.6k
R11	06-11009C67	5.6k
R12, R13	06-11009C73	10k
R14	06-11009C81	22k
R15	18-84944C07	potentiometer 100k
		Zener diode
VR1	48-82256C03	4.75 V
		Integrated circuit
U1	51-84561L23	MC1455

Note: To maintain specified performance, all parts must be ordered by Motorola part numbers.



SHOWN FROM COMPONENT SIDE

OVERLAY • 79A02928G15-O
SOLDER SIDE ◦ 79A02928G16-O
COMPONENT SIDE ◦ 79A02928G17-O



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MOTOROLA INC.
Communications Sector

MICOM•S/TRITON 40•S
HF-SSB BASE/MOBILE RADIO

2-13.2/2-18 MHz
100/125/150 WATTS

CONTENTS

technical writing services
1301 E. Algonquin Road, Schaumburg, Il. 60196

68P81060E20-Q
1/29/82- PHI

PERFORMANCE SPECIFICATIONS

GENERAL

Model Number	Description	Power Output	Number of Channels
D80JMA1N19__K	2-18 MHz, *Triton 40•S*	125 Watts PEP	40 Channels Simplex or Half-Duplex
D80HEA1N19__K	2-13.2 MHz, *Triton 40•S*	150 Watts PEP	40 Channels Simplex or Half-Duplex
D80JMA1N00__K	2-18 MHz, *Micom•S*	125 Watts PEP	40 Channels Simplex or Half-Duplex
D70HEA1N00__K	2-13.2 MHz, *Micom•S*	100 Watts PEP	40 Channels Simplex or Half-Duplex

1-F Frequency	1st 75.0 MHz, 2nd 11.4 MHz
Primary Voltage	13.8 volts nominal ±20%

Current Drain (Oven Stabilized @25 °C Ambient)	Receive		Transmit	
	Standby	Full Audio	Voice Duty	2-Tone PEP
D80HEA1N19__K 150 W PEP	1.25A @13.8 V dc	1.5A @13.8 V dc	15A avg.	23A
D80JMA1N19__K, D80JMA1N00__K 125 W PEP	1.25A @13.8 V dc	1.5A @13.8 V dc	13A avg.	21A
D70HEA1N00__K 100 W PEP	1.25A @13.8 V dc	1.5A @13.8 V dc	6A avg.	13A

Controls	On/Off/Volume, Channel Select and A/B/C/D Switch, Squelch, Clarifier, Dimmer, USB/LSB Select Switch (optional, deletes dimmer), Noise Blanker (optional)
Memory Maintenance Battery	Lithium Battery, 10 years typical life

D80JMA1N19__K, D80JMA1N00__K, D80HEA1N19__K	D70HEA1N00__K
Weight 8.4 kg (18.5 lbs.)	7.5 kg (16.5 lbs.)
Size 38.4cm (15-1/4")L × 26.4cm (10-3/8")W × 8.9cm (4")H	35.6cm (14")L × 26.4cm (10-3/8")W × 8.9cm (4")H

TRANSMITTER

Power Output	D80JMA1N19__K	125 Watts PEP
	D80HEA1N19__K	150 Watts PEP
	D80JMA1N00__K	125 Watts PEP
	D70HEA1N00__K	100 Watts PEP
Intermodulation	−31 dB reference to PEP	
Spurious & Harmonic Emissions	D80JMA1N19__K, D80JMA1N00__K —	−64 dB reference to PEP
	D70HEA1N00__K —	−63 dB reference to PEP
	D80HEA1N19__K —	−65 dB reference to PEP
Carrier Suppression	−46 dB	
Transmission Modes	A3A, A3J, A3H	
Undesired Sideband Suppression	1 kHz tone, −55 dB reference to PEP	
Audio Distortion	5% total distortion	
Frequency Stability	±10 Hz, −20 °C to +50 °C ±20 Hz, −30 °C to +60 °C	
Tuning Adjustments	None	

RECEIVER

Sensitivity	10 dB SINAD: 0.5 uV 1/2 rated audio power: 1.0 uV/2.5 watts
Selectivity	(−6 dB minimum) 350 Hz to 2700 Hz
Spurious	(Ref 10 dB SINAD) at least 70 dB
Intermodulation	−80 dB
Cross Modulation (100 kHz Separation)	−100 dB
Desensitization (100 kHz Separation)	−100 dB
Frequency Stability	±10 Hz, −20 °C to +50 °C ±20 Hz, −30 °C to +60 °C
Audio Output	5 watts with less than 10% total distortion
AGC Characteristics	Audio output varies less than 2 dB for signals between 10 uV and 1 V (100 dB range) Dual slope, fast attack, slow decay AGC threshold 10 uV or less
Squelch	Constant SINAD
Receiver Tuning Adjustments	None
Clarifier Range	±175 Hz, minimum

SPECIFICATIONS (Cont'd.)

FCC & DOC INFORMATION

Model Series	D80HEA	D80JMA	D70HEA
Transmitter Peak Envelope Power (PEP)	150 Watts	125 Watts	100 Watts
Frequency Range	2-13.2 MHz	2-18 MHz	2-13.2 MHz
Emission Authorized	A3A, A3J, A3H, 3F1	A3A, A3J, A3H, 3F1	A3A, A3J, A3H, 3F1
FCC Applicable Parts of Rules	81, 83, 87, 90	81, 83, 87, 90	81, 83, 87, 90
FCC Type Acceptance Number	ABZ89FC1603	ABZ89FC1603	ABZ89FC1602

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

*OPTION CHART

Option	Description	Add	Delete
S280	25 Watts Power Output		
S361	30 Watts Power Output		
S367	50 Watts Power Output		
S372	60 Watts Power Output		
S71	Delete Microphone		
S122	Adds LSB Operation	TRN4961 & TRN4968	TRN4964
S86	Adds Programming Board	TRN4963	
S135	Adds Noise Blanker Board & Changes Front Panel	TRN4962 TRN4966	TRN4964
S96	Inverted Front Panel	TRN4965	TRN4964

* The above options are available on the D80JMA1N00__K and D70HEA1N00__K land mobile radios only.

ACCESSORIES

TLN2374 Programming Board	TMN1023 Base Microphone
TRN4047 Mounting Tray	TLN2375 Noise Blanker (*Triton 40•S* only)
TSN6033 External Speaker	THN6457 White Housing (*Triton 40•S* only)

Micom•S/Triton 40•S Radios meet, or exceed, all applicable CCIR recommendations.

(Sheets v and vi omitted due to irrelevancy)

MODEL CHART

FOR

MICOM•S (LAND MOBILE)/*TRITON 40•S* (MARINE)

HF-SSB RADIOS

2-18 MHz

125-WATTS RF POWER

CODE:

● = ONE ITEM SUPPLIED

MODEL NUMBER		DESCRIPTION
D80JMA1N00AK	D80JMA1N19AK	
		MICOM•S LAND MOBILE RADIO
		TRITON 40•S MARINE RADIO
●	●	TRA1131A CHASSIS, RADIO
●	●	TRN4954A "A" CIRCUIT BOARD
●	●	TRN4955A "B" CIRCUIT BOARD
●	●	TRN4956A "C" CIRCUIT BOARD
●	●	TLN2373A POWER AMPLIFIER
●	●	TRN4958A POWER AMPLIFIER BOARD
●	●	TRN4959A HARDWARE KIT, HEAT SINK
●	●	TFA6071A HARMONIC FILTER BOARD
●	●	TLN2390A SYNTHESIZER
●	●	TRN4957A "S" CIRCUIT BOARD
●	●	TRN5006A HARDWARE KIT
●	●	TRN4960A CHASSIS WIRE AND HARDWARE KIT
●	●	TRN5010A CHASSIS HARDWARE KIT
●		TMN6150A MICROPHONE (TAN)
	●	TMN6151A MICROPHONE (WHITE)
●	●	TRN6679A HANG-UP CLIP, MICROPHONE
●	●	TKN8061A CABLE, POWER
●	●	THM6456A HOUSING (BRONZE)
●	●	TRN4034A ALIGNMENT TOOLS
●		TRN4964A FRONT PANEL (DIMMER) (LAND MOBILE)
	●	TRN4972A FRONT PANEL (DIMMER) (MARINE)
	●	TRN4973A FRONT PANEL (INVERTED) (MARINE)
	●	TRN5008A MOUNTING TRAY

EPS-33480-O

MODEL NUMBER	DESCRIPTION
D70HEA1N00AK	*MICOM•S* LAND MOBILE RADIO

MODEL CHART

FOR

MICOM•S LAND MOBILE

HF-SSB RADIO

2-13.2 MHz

100-WATTS RF POWER

CODE:

● = ONE ITEM SUPPLIED

	ITEM	DESCRIPTION
●	TRA1151A	CHASSIS, RADIO
●	TRN4954A	"A" CIRCUIT BOARD
●	TRN4955A	"B" CIRCUIT BOARD
●	TRN4956A	"C" CIRCUIT BOARD
●	TLN2208A	POWER AMPLIFIER
●	TRN4038A	POWER AMPLIFIER BOARD
●	TRN4039A	HARDWARE KIT, HEAT SINK
●	TFA6061B	HARMONIC FILTER
●	TLN2390A	SYNTHESIZER
●	TRN4957A	"S" CIRCUIT BOARD
●	TRN5006A	HARDWARE KIT
●	TRN4960A	CHASSIS WIRE AND HARDWARE KIT
●	TRN5009A	CHASSIS HARDWARE KIT
●	TMN6150A	MICROPHONE (TAN)
●	TRN6679A	HANG-UP CLIP MICROPHONE
●	TKN8061A	CABLE, POWER
●	THN6456A	HOUSING (BRONZE)
●	TRN4034A	ALIGNMENT TOOLS
●	TRN4964A	FRONT PANEL (DIMMER)

EPS-33481-O

MODEL CHART

FOR

TRITON 40•S MARINE

HF-SSB RADIOS

2-13.2 MHz

150-WATTS RF POWER

CODE:

● = ONE ITEM SUPPLIED

ITEM	DESCRIPTION	MODEL NUMBER D80HEA1N19AK
TRA1141A	CHASSIS, RADIO	●
TRN4954A	"A" CIRCUIT BOARD	●
TRN4955A	"B" CIRCUIT BOARD	●
TRN4956A	"C" CIRCUIT BOARD	●
TLN2373A	POWER AMPLIFIER	●
TRN4958A	POWER AMPLIFIER BOARD	●
TRN4959A	HARDWARE KIT, HEAT SINK	●
TFA6061B	HARMONIC FILTER	●
TLN2390A	SYNTHESIZER	●
TRN4957A	"S" CIRCUIT BOARD	●
TRN5006A	HARDWARE KIT	●
TRN4960A	CHASSIS WIRE AND HARDWARE KIT	●
TRN5009A	CHASSIS HARDWARE KIT	●
TMN6151A	MICROPHONE (WHITE)	●
TRN6679A	HANG-UP CLIP, MICROPHONE	●
TKN8061A	CABLE, POWER	●
THN6456A	HOUSING (BRONZE)	●
TRN4034A	ALIGNMENT TOOLS	●
TRN4972A	FRONT PANEL (DIMMER)	●
TRN4973A	FRONT PANEL (INVERTED)	●
TRN5008A	MOUNTING TRAY	●

EPS-33482-O

GENERAL SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard which applies to the use of this equipment. Proper use of this radio will result in exposure below the OSHA limit. The following precautions are recommended:

DO NOT operate the transmitter of a mobile radio when someone outside the vehicle is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of a fixed radio (base station, microwave and rural telephone rf equipment) or marine radio when someone is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of any radio unless all RF connectors are secure and any open connectors are properly terminated.

In addition,

DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere.

All equipment must be properly grounded according to Motorola installation instructions for safe operation.

All equipment should be serviced only by a qualified technician.

Refer to the appropriate section of the product service manual for additional pertinent safety information.

EPS-28750-O

SAFETY INFORMATION FOR RADIOS INSTALLED IN VEHICLES POWERED BY LIQUEFIED PETROLEUM (LP) GAS

WARNING

It is mandatory that radio installations in vehicles fueled by liquefied petroleum gas conform to the following standard.

National Fire Protection Association standard NFPA 58 applies to radio installations in vehicles fueled by liquefied petroleum (LP) gas with the LP-gas container in the trunk or other sealed-off space within the interior of the vehicles. This standard requires that:

1. Any space containing radio equipment shall be isolated by a seal from the space in which the LP-gas container and its fittings are located.
2. Remote (outside) filling connections shall be used.
3. Venting of the container space to the outside shall be provided.

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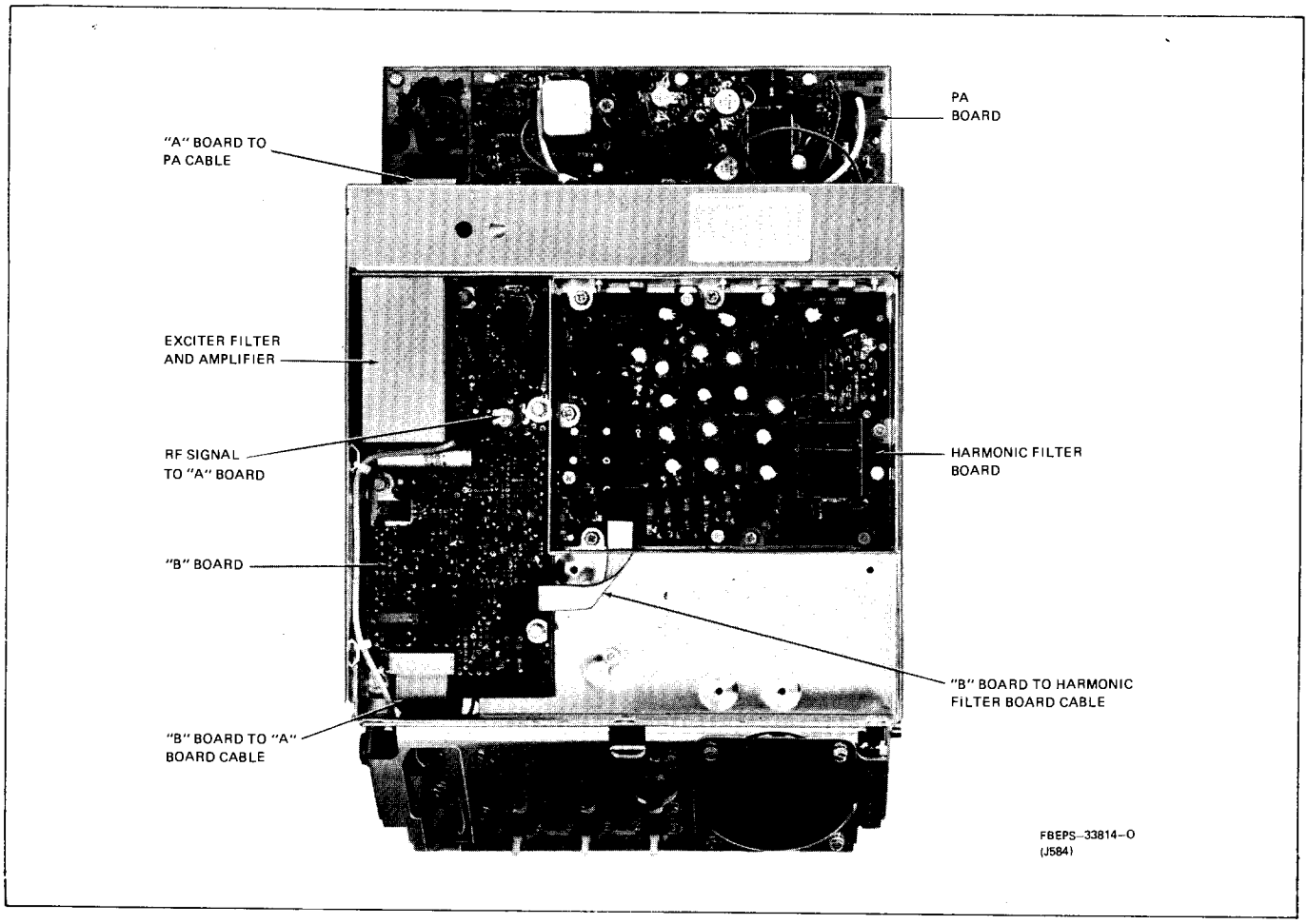


Figure 1. Major Assemblies as Seen From Top of Radio (PA Hinged Open)

1. INTRODUCTION

The Motorola *Micom•S/Triton 40•S* is a synthesized solid-state two-way high frequency single sideband radio. The radio features 100 or 125 watts PEP (peak envelope power) transmitter power output for the *Micom•S* models and 125 or 150 watts PEP transmitter power output for the *Triton 40•S* models. Any frequency within the 2-13.2 MHz or 2-18 MHz range can be programmed on any of the 40 channels which are selected by two front panel switches. Up to 10 channels may be programmed on each position of the **A/B/C/D** switch. The channels may be either simplex or half-duplex (transmit and receive on different frequencies, but not simultaneously). Field programming of any channel can be easily accomplished by using an optional programming board. An extensive line of accessories including several types of antennas and tuners, base station microphone, ac power supplies, mounting tray, and

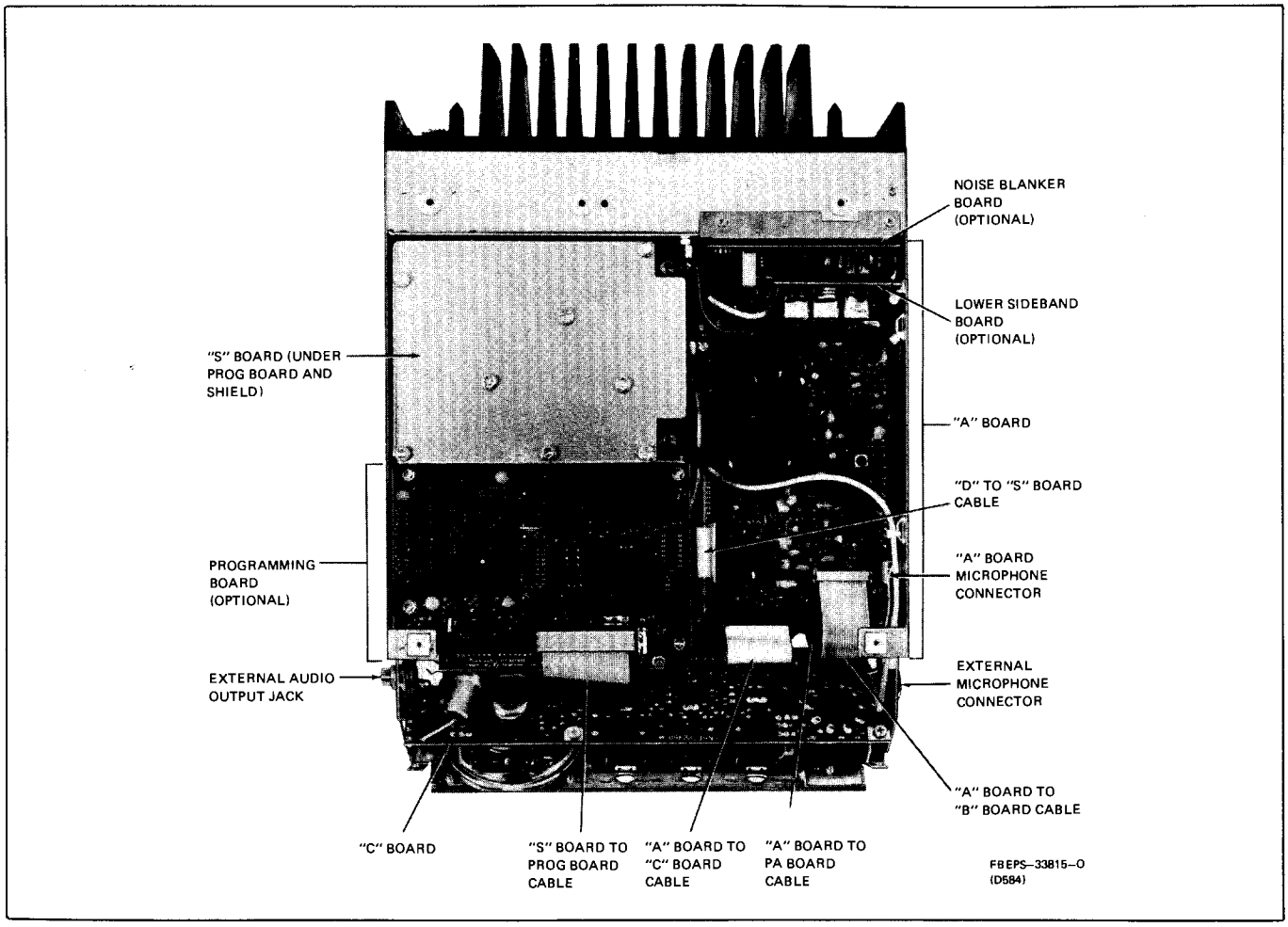


Figure 2. Major Assemblies as Seen From Bottom of Radio

overhead mounting panel are available to meet specific application requirements.

2. PHYSICAL DESCRIPTION

The radio set transmitter, receiver, and control unit, are assembled in a fully enclosed housing. The unit includes an integral speaker and a sloping front panel that places the operating controls within easy reach. The radio may be mounted in any position with the accessory mounting tray.

The radio set is functionally separated onto six printed circuit boards. Interconnections between the boards are made with multi-conductor ribbon cables and coaxial cables with connectors to facilitate easy board removal and repair. Refer to Figures 1 and 2 for locations of major assemblies.

The *Micom•S/Triton 40•S* radio is designed for 12 V dc negative ground operation and may be connected directly to a 12 V battery. The radio is supplied with four rubber feet on the bottom of the housing and can be installed on a flat surface or permanently mounted with the accessory tray. The radio may also be used as a base station. In this application, the ac power supply and base station microphone accessories may be desired.

1. MOUNTING INSTRUCTIONS

Step 1. Determine the desired method of mounting before installation. The radio can be mounted in any convenient position if the accessory mounting tray is used. The selected location should allow enough clearance for connection of cables to the back of the radio.

Step 2. If the overhead mounting front control panel is used, remove the existing front panel as outlined in the Mechanical Disassembly section and replace it with the overhead panel. Also, replace the channel selector knob with the inverted selector knob supplied with the overhead panel kit.

Step 3. If the mounting tray is used, perform the following steps:

- Mount the tray to the appropriate location. The tray can be used as a template if drilling is required.
- Affix the mounting tray bracket to the bottom of the radio housing with the four supplied screws.

Step 4. If a 12 volt battery is used as a power source, perform the following steps:

- Pass the long red, green, and black power cables through any wall necessary to make connections to the battery.
- Connect the lugs on the short red and green cables to the positive (ungrounded) terminal of the battery.
- Affix the supplied lug to the end of the black wire and connect this to the negative (grounded) terminal of the battery.
- Insert the unassembled ends of the fuse holder cap onto the long ends of the red and green wires, and fasten the fuse clips to these wires.
- Install the appropriate size fuses in the cable kit. The 30 amp fuse is for the red lead and the 7-1/2 amp fuse is for the green lead.

Step 5. If using the TPN1177 AC Power Supply, remove the end terminal lugs of each wire (RED, GREEN, BLACK) and replace with the appropriate terminals provided with the TPN1177 Power Supply. The RED and GREEN terminals are then connected to the "+" side of terminal strip TB2 of the power supply (see Figure 2 of Power Supply Manual 68P81111E32). Connect BLACK wire terminal to "–" side of TB2 terminal strip.

Step 6. If using the T1828 Power Supply, follow the instructions supplied with the Power Supply Manual 68P81107E58.

Step 7. Install the antenna and route the coaxial cable and tuner cable (if used) to the radio. Follow instructions supplied with the antenna and tuner.

Step 8. Connect the power cable, antenna coax, and tuner cable (if used) to the radio.

Step 9. Slide the radio into the mounting tray (if used) and fasten the tray bracket (already installed on the radio housing) to the tray with the two screws supplied.

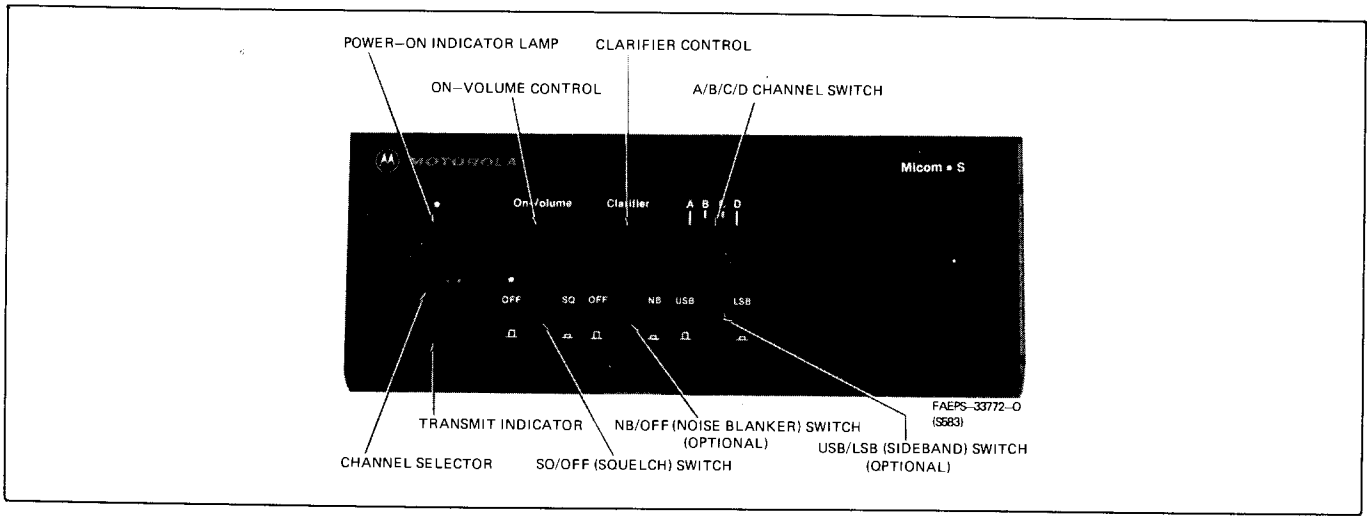
Step 10. Install the microphone hang-up clip in a convenient location. (The base station TMN1023 Microphone does not require a hang-up clip.)

Step 11. Tape or tie up any extra cable.

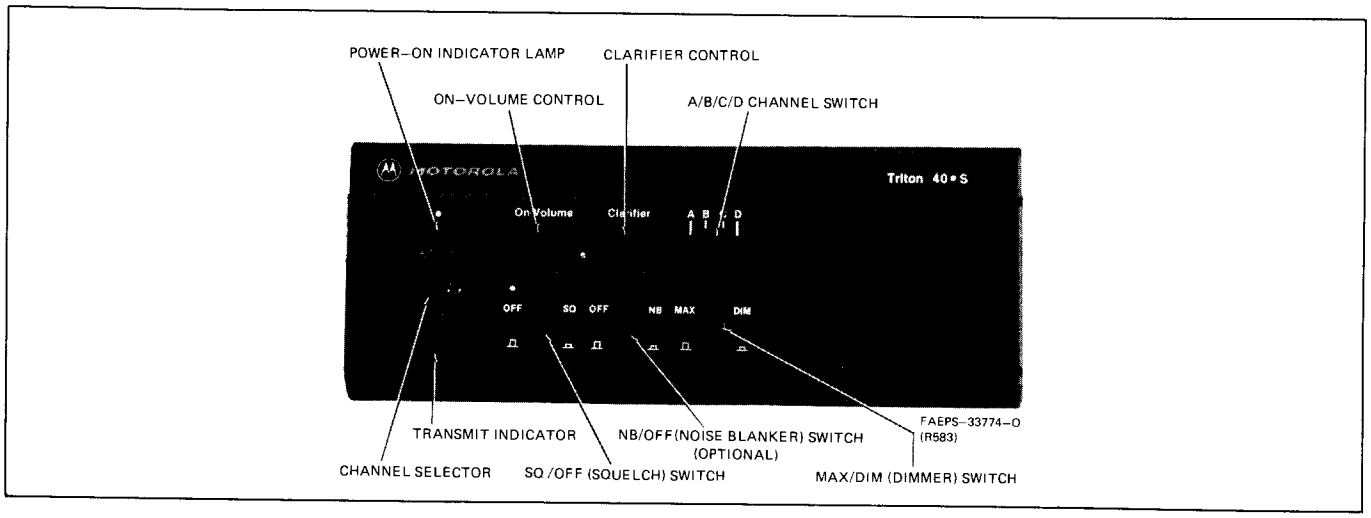
Step 12. An external speaker or headphone set may be plugged into the jack on the side of the radio. A standard 1/4" phone plug is required to make the connection. Any speaker with impedance of 2 ohms or greater may be used. If it is desired to have the internal speaker operational when the external speaker is plugged in, the jumper on the speaker jack must be added.

2. OPERATIONAL CHECKS

After installation, carefully check all operating functions of the radio. Frequency and power output checks should be performed before the transmitter is placed in service. Refer to the Alignment section for procedures. In addition, the antenna must be properly tuned. Refer to the manual supplied with the antenna and tuner (if used) for tuning procedures.



Micom•S Operators Controls/Indicators



Triton 40•S Operators Controls/Indicators

1. TO RECEIVE

Step 1. Turn on the external power source.

Step 2. Set the **DIM** (dimmer) switch to the desired intensity of the power-on indicator lamp. For radios with the LSB option, select the proper sideband using the **USB/LSB** switch.

Step 3. Set the channel selector and **A/B/C/D** channel switch to the desired channel.

Step 4. Turn the **On-Volume** control clockwise to turn the radio on and allow a 3 minute warmup (if radio is at room temperature) to stabilize the oscillator oven temperature.

Step 5. Set the **SQ** (squelch) switch in the **OFF** position.

Step 6. Advance the **On-Volume** control until noise is heard from the speaker.

Step 7. With no signal present, depress the **SQ** switch. The noise will be squelched (silenced) after an approximate 1.5 second delay in squelch response.

Step 8. Adjust the **On-Volume** control for a comfortable listening level during reception of a signal.

Step 9. If the voice quality of the received signal sounds either high-pitched or low-pitched, it is an indication that the incoming signal is off-frequency. Adjust the **Clarifier** control for the most natural voice quality. When the **Clarifier** control is near its mid- position, incoming signals that are on the correct frequency should sound normal.

Step 10. For radios having the noise blanker option, set the **NB** switch to the position that provides improved reception of the signal.

2. TO TRANSMIT

Step 1. Set the channel select and **A/B/C/D** channel switch to the desired channel.

Step 2. Monitor the channel to make sure it is clear. **Do not transmit if the channel is in use.**

Step 3. After determining that the channel is clear, depress the "push-to-talk" (PTT) button on the microphone and speak into microphone using a normal tone of voice. The transmit indicator should light when speaking into the mcirophone indicating that power is being delivered to the antenna.

Step 4. Identify the station being called and then identify your station.

Step 5. To hear the reply, release the PTT button on the microphone.

1. PREVENTIVE MAINTENANCE

1.1 VISUAL INSPECTION

Check all external surfaces of the equipment to see that they are clean. Inspect all connecting cables for damage or loose connections.

If the equipment is dirty, wash the external surfaces with mild soap and water using a clean cloth. Be careful not to allow the electronic components or connectors to get wet.

1.2 PERIODIC CHECKS

It is recommended that both the 9.216 MHz reference oscillator frequency and the 11.4 MHz i-f oscillator frequency be checked and if necessary, adjusted after the first, third, seventh, and twelth months and yearly, thereafter (refer to the Alignment section of this manual for the procedure). If either crystal is replaced, repeat the above schedule for the first year.

At initial installation and yearly thereafter, perform the power output and half power output transmitter tests and the 10 dB SINAD and half power sensitivity receiver tests. Record these readings each time they are made and compare them with previous readings to detect any possible deterioration.

1.3 BATTERY REPLACEMENT

Every five years, the lithium battery must be replaced. (Refer to Figure 1 for the battery location.)

Step 1. Turn the radio "off" and completely remove the programming board (if one is present) and the programming board shield.

Step 2. Rotate the **On-Volume** control clockwise so the power-on indicator is lit.

NOTE

The radio must be on when changing the battery or the channel frequency information will be lost from the memory.

Step 3. Lift the battery socket assembly from the metal casting and remove the insulator and the battery.

Step 4. Plug a new battery into the socket assembly and replace the insulator.

Step 5. Replace the entire battery socket assembly into the compartment in the casting.

Step 6. Turn the radio "off" and replace the programming board shield and the programming board (if one was present).

Step 7. Turn the radio back "on" and verify the proper operation of the radio.

CAUTION

Do not dispose of the used battery in fire because it may explode.

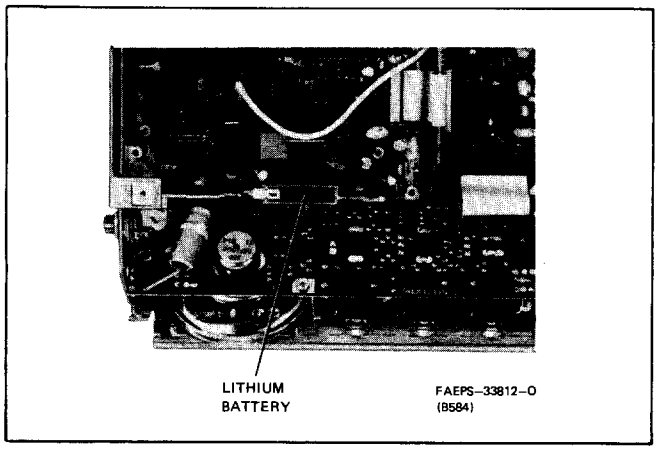
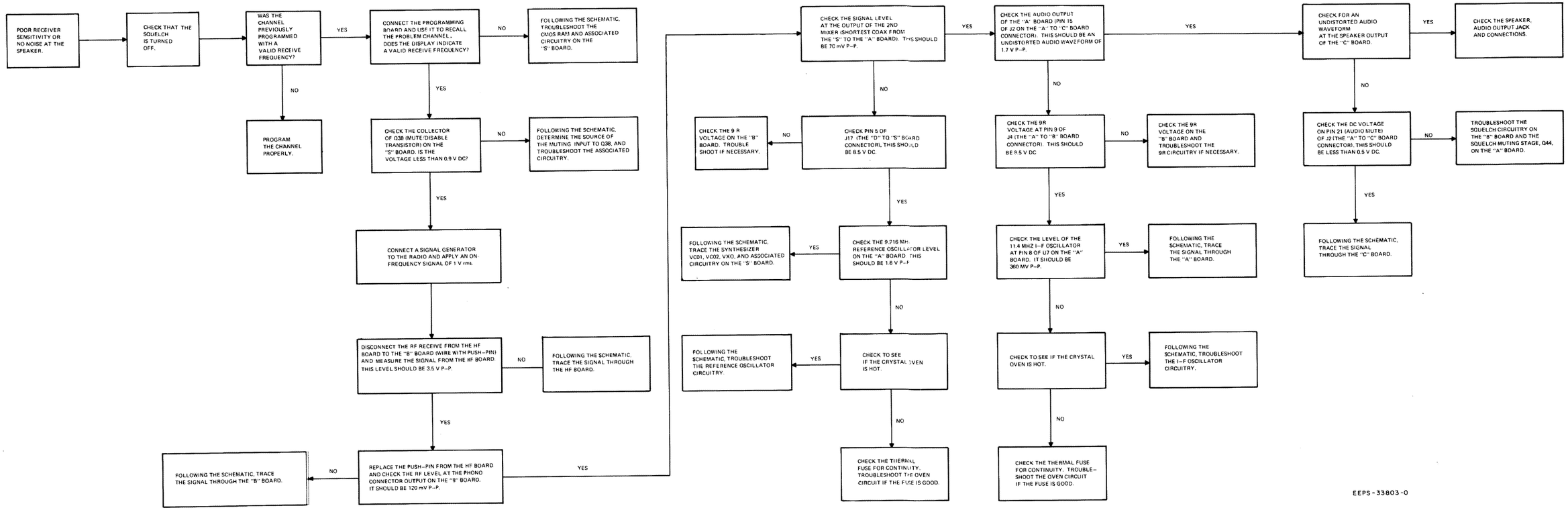


Figure 1. Battery Location Detail

2. RECOMMENDED TEST EQUIPMENT

Item	Purpose
* S-1053 AC Voltmeter	Used to measure all audio voltages.
* R1024A DC Multimeter	Used to measure all dc voltages.
S-1339 Millivoltmeter	Used to measure rf voltages for trouble isolation.
* S-1067 Audio Oscillator	Used for audio troubleshooting and adjustment.
R1029A Oscilloscope (Dual Trace, 20 MHz Bandwidth) or * R1028A Oscilloscope (Single Trace, 10 MHz Bandwidth)	Used for checking waveforms and troubleshooting.
R1025A Frequency Counter (100 MHz) or * R1027A Frequency Counter (80 MHz)	Used for frequency adjustment.
* S-1350 Wattmeter with a * ST1296 Wattmeter Elements	Used for measuring transmitter power output.
* T-1013 RF Load	Dummy load used for transmitter.
SLN6321 In-Line Coupling Unit as per Figure 2 of Alignment section.	Used for coupling a sample of rf output to test equipment.
* R-1020 RF Signal Generator	Used for servicing receiver.
R-1011 High Current Power Supply	Used for supplying power to radio when removed from the vehicle.

* All the test equipment marked with an asterisk (*) may be replaced with a single, portable, R2001-B Communications System Analyzer.


POOR RECEIVER SENSITIVITY OR NO NOISE AT THE SPEAKER.
CHECK THAT THE SQUELCH IS TURNED OFF.
WAS THE CHANNEL PREVIOUSLY PROGRAMMED WITH A VALID RECEIVE FREQUENCY?
YES
NO
PROGRAM THE CHANNEL PROPERLY.
CONNECT THE PROGRAMMING BOARD AND USE IT TO RECALL THE PROBLEM CHANNEL. DOES THE DISPLAY INDICATE A VALID RECEIVE FREQUENCY?
NO
FOLLOWING THE SCHEMATIC, TROUBLESHOOT THE CMOS RAM AND ASSOCIATED CIRCUITRY ON THE "S" BOARD.
YES
CHECK THE COLLECTOR OF Q38 (MUTE/DISABLE TRANSISTOR) ON THE "S" BOARD. IS THE VOLTAGE LESS THAN 0.9 V DC?
NO
FOLLOWING THE SCHEMATIC, DETERMINE THE SOURCE OF THE MUTING INPUT TO Q38, AND TROUBLESHOOT THE ASSOCIATED CIRCUITRY.
YES
CONNECT A SIGNAL GENERATOR TO THE RADIO AND APPLY AN ON-FREQUENCY SIGNAL OF 1 V rms.
DISCONNECT THE RF RECEIVE FROM THE HF BOARD TO THE "B" BOARD (WIRE WITH PUSH-PIN) AND MEASURE THE SIGNAL FROM THE RF BOARD. THIS LEVEL SHOULD BE 3.5 V P-P.
NO
FOLLOWING THE SCHEMATIC, TRACE THE SIGNAL THROUGH THE HF BOARD.
YES
REPLACE THE PUSH-PIN FROM THE HF BOARD AND CHECK THE RF LEVEL AT THE PHONO CONNECTOR OUTPUT ON THE "B" BOARD. IT SHOULD BE 120 mV P-P.
NO
FOLLOWING THE SCHEMATIC, TRACE THE SIGNAL THROUGH THE "B" BOARD.
YES
CHECK THE SIGNAL LEVEL AT THE OUTPUT OF THE 2ND MIXER (SHORTEST COAX FROM THE "S" TO THE "A" BOARD). THIS SHOULD BE 70 mV P-P.
NO
CHECK PIN 5 OF J17 (THE "D" TO "S" BOARD CONNECTOR). THIS SHOULD BE 8.5 V DC.
NO
CHECK THE 9 R VOLTAGE ON THE "B" BOARD. TROUBLESHOOT IF NECESSARY.
YES
CHECK THE 9.216 MHz REFERENCE OSCILLATOR LEVEL ON THE "A" BOARD. THIS SHOULD BE 1.6 V P-P.
YES
FOLLOWING THE SCHEMATIC, TRACE THE SYNTHESIZER VCO1, VCO2, VXO, AND ASSOCIATED CIRCUITRY ON THE "S" BOARD.
NO
CHECK TO SEE IF THE CRYSTAL OVEN IS HOT.
YES
FOLLOWING THE SCHEMATIC, TROUBLESHOOT THE REFERENCE OSCILLATOR CIRCUITRY.
NO
CHECK THE THERMAL FUSE FOR CONTINUITY. TROUBLESHOOT THE OVEN CIRCUIT IF THE FUSE IS GOOD.
YES
CHECK THE AUDIO OUTPUT OF THE "A" BOARD (PIN 15 OF J2 ON THE "A" TO "C" BOARD CONNECTOR). THIS SHOULD BE AN UNDISTORTED AUDIO WAVEFORM OF 1.7 V P-P.
NO
CHECK THE 9R VOLTAGE AT PIN 9 OF J4 (THE "A" TO "B" BOARD CONNECTOR). THIS SHOULD BE 8.5 V DC
NO
CHECK THE 9R VOLTAGE ON THE "B" BOARD AND TROUBLESHOOT THE 9R CIRCUITRY IF NECESSARY.
YES
CHECK THE LEVEL OF THE 11.4 MHZ I-F OSCILLATOR AT PIN 8 OF U7 ON THE "A" BOARD. IT SHOULD BE 360 MV P-P.
YES
FOLLOWING THE SCHEMATIC, TRACE THE SIGNAL THROUGH THE "A" BOARD.
NO
CHECK TO SEE IF THE CRYSTAL OVEN IS HOT.
YES
FOLLOWING THE SCHEMATIC, TROUBLESHOOT THE I-F OSCILLATOR CIRCUITRY.
NO
CHECK THE THERMAL FUSE FOR CONTINUITY. TROUBLE-SHOOT THE OVEN CIRCUIT IF THE FUSE IS GOOD.
YES
CHECK FOR AN UNDISTORTED AUDIO WAVEFORM AT THE SPEAKER OUTPUT OF THE "C" BOARD.
YES
CHECK THE SPEAKER, AUDIO OUTPUT JACK AND CONNECTIONS.
NO
CHECK THE DC VOLTAGE ON PIN 21 (AUDIO MUTE) OF J2 (THE "A" TO "C" BOARD CONNECTOR). THIS SHOULD BE LESS THAN 0.5 V DC.
NO
TROUBLESHOOT THE SQUELCH CIRCUITRY ON THE "B" BOARD AND THE SQUELCH MUTING STAGE, Q44, ON THE "A" BOARD.
YES
FOLLOWING THE SCHEMATIC, TRACE THE SIGNAL THROUGH THE "C" BOARD.

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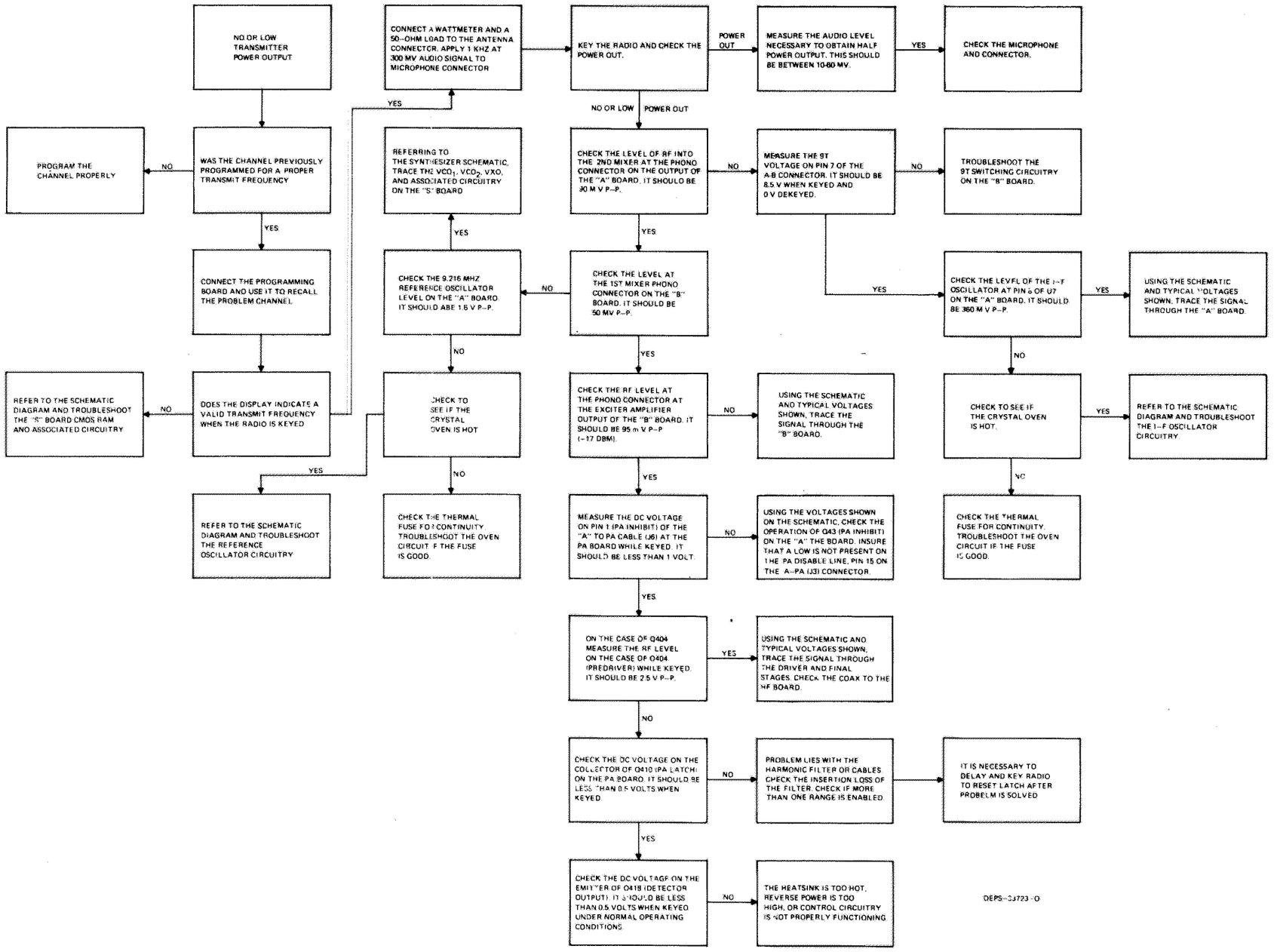
TRANSMITTER TROUBLESHOOTING



MECHANICAL PARTS AND DISASSEMBLY PROCEDURES

MECHANICAL DISASSEMBLY

Refer to the accompanying diagram for part number locations.

RADIO REMOVAL FROM MOUNTING TRAY

Step 1. Loosen the two screws which hold the tray bracket (#63) to the tray (#64).

Step 2. While facing the radio, grasp the sides of the housing and pull the radio forward. The radio should now be released from the mounting tray.

RADIO HOUSING REMOVAL

Step 1. Disconnect power supply, coaxial, and tuner cables from radio.

Step 2. Remove the radio from the mounting tray (if used).

Step 3. Loosen and remove the six screws on the bottom of the housing. Four screws are located along the back of the housing and two screws are located along the front of the housing. It should not be necessary to remove the mounting tray bracket from the housing.

Step 4. Slide off the radio housing.

FRONT CONTROL PANEL REMOVAL

Step 1. Remove the radio housing.

Step 2. Loosen and remove the three screws (#53) located along the inside top front of the radio chassis.

Step 3. Remove all front panel control knobs (#2, 3, 5).

Step 4. Carefully tilt the front panel out from the top.

Step 5. Lift the front panel out of the slots located near the bottom of the front panel housing. Be careful not to break the tabs on the bottom of the front panel.

CONTROL PANEL HOUSING REMOVAL

Step 1. Remove the radio housing and front control panel.

Step 2. Loosen and remove the two screws (#8) located along the bottom of the control panel housing.

Step 3. Remove the control panel housing (#16).

LOCAL OSCILLATOR CRYSTAL ACCESS

Step 1. Remove the radio housing.

Step 2. To remove plastic oven cover, turn slotted head of the rectangular fastener 1/4 turn (clockwise or counterclockwise) and lift off.

Step 3. Remove plastic oven cover.

Step 4. Carefully remove two clips (#47).

Step 5. The local oscillator crystals should now be visible.

POWER AMPLIFIER (PA) BOARD ACCESS

Step 1. Remove the radio housing.

Step 2. Loosen the two screws (#84) on the back of the PA heatsink.

Step 3. The PA heatsink is mounted on hinges and can be tilted down to access the PA board.

POWER AMPLIFIER (PA) BOARD REMOVAL FROM HEATSINK

The PA board can usually be serviced without removal. However, if removal is necessary, the following procedure may be used.

Step 1. Loosen and remove the four screws (#60) that secure the final amplifier devices.

NOTE
Do not lose thermistor clip.

Step 2. Loosen and remove the three screws that secure the three other flat pack transistors, on the board.

Step 3. Loosen and remove the seven screws that hold the board to the heat sink.

Step 4. Remove the five coaxial cables with phone connectors from the receptacles on the inside of the PA compartment.

Step 5. Loosen and remove the screw (#28) that holds the black ground wire to the chassis.

Step 6. Unsolder the red A + wire from the terminal strip inside the PA compartment.

Step 7. Loosen and lift the "B" board to allow removal of the "PA" to "A" board ribbon cable from the radio chassis.

Step 8. Remove the PA board.

"A" BOARD REMOVAL

NOTE
Disregard the number notation on the body of ribbon connectors P2, P3, P4 and P13. Always refer to your manual for connector position numbering.

Step 1. Remove metal radio housing and place radio on flat surface in front of you.

Step 2. Orient radio so that the PA heatsink is closest to you and "A" board directly in front of you.

Step 3. Remove the ribbon cable connectors P2, P3, P4, and microphone connector P5.

Step 4. Cut the tie wrap and remove the coax cable (P114) from the "S" board.

Step 5. Remove the four screws (#28) then remove the programming board (#121) and the shield (#140). Disconnect the ribbon connector from the "S" board (#122) and remove the coax cable (P112) from the "S" board.

Step 6. Disconnect the red SW A + connector located on the upper right-hand corner of the "A" board.

Step 7. Remove the five screws (#28) that secure the "A" board (#58) to the chassis (#45) and VCO casting (#128).

Step 8. Lift the upper right-hand corner of the "A" board past the right chassis mounting tab while keeping the bottom right-hand corner of the board down near the bottom mounting tab.

Step 9. As the board clears the upper right-hand chassis mounting tab, slowly pull the board to the right of the radio keeping components clear from the A + feedthru located on the back wall of the "A" board compartment.

Step 10. Remove the "A" board.

"B" BOARD REMOVAL

Step 1. Remove the housing from the radio.

Step 2. Disconnect the coax cable from the phono jack (#59) on the "B" board.

Step 3. Disconnect the ribbon cable (#99) from the HF board and the ribbon cable that connects the "B" board to the "A" board (#58).

Step 4. Disconnect the green wire on the "B" board from the push pin that runs to the harmonic filter board.

Step 5. Open the PA compartment as outlined in the Power Amplifier Board Access section.

Step 6. Disconnect the coax cable at the phono connector (#102) that runs between the PA and the "B" boards.

Step 7. Loosen and remove the five screws (#28) that secure the "B" board to the chassis.

Step 8. Remove the "B" board.

HARMONIC FILTER (HF) BOARD REMOVAL

Step 1. Remove the radio housing.

Step 2. Remove the harmonic filter cover, (#96).

Step 3. Disconnect the ribbon cable that connects the HF board to the "B" board.

Step 4. Disconnect the green wire on the "B" board push pin that connects the HF board and "B" board.

Step 5. Open the PA compartment as outlined in the Power Amplifier Board Access section.

Step 6. Loosen and remove the three screws (#28) in the PA compartment that secures the harmonic filter shield housing to the chassis.

Step 7. Disconnect the four coax cables that connect the HF board to the PA board from the phono receptacles in the PA compartment.

Step 8. Loosen and remove the seven screws (#107) that secure the HF shield (#91) to the chassis.

Step 9. The HF board and shield assembly may now be removed.

Step 10. If the shield must be removed from the HF board, loosen and remove the five screws (#28) that hold the HF board to the shield.

Step 11. Unsolder the four phono connectors from the bottom of the HF board.

Step 12. The board may now be removed from the shield.

CONTROL ("C") BOARD REMOVAL

Step 1. Remove the radio housing.

Step 2. Remove the front control panel and control panel housing as outlined in the front panel housing and control panel housing removal sections.

Step 3. Loosen and remove the four screws (#28) that secure the heatsink mounting bracket (#20) of the "C" board to the chassis (#45).

Step 4. Loosen and remove the nut that holds the speaker jack (#24) in the chassis and remove the jack from the chassis.

Step 5. Loosen and remove the screw (#28) in the corner of the "C" board near the speaker that holds the "C" board to the chassis.

Step. 6. Disconnect the ribbon cable that connects the "C" board to the "A" board.

Step 7. Disconnect the red switched A + wire push pin on the "S" board that runs between the "C" board and "S" board.

Step 8. Lift "C" board and heatsink assembly out of chassis and rotate.

Step 9. Disconnect push pins number 1, 2, 29, 30 from the "C" board.

Step 10. Removal of "C" board and heatsink assembly from the radio should now be possible.

Step 11. If removal of heatsink from board is required, loosen and remove four screws (#28) that hold the "C" board to the heatsink.

Step 12. Loosen and remove the two screws (#33) that hold the flat pack transistors to the side of the heatsink.

Step 13. Remove the nut and washer (#18, 19) that secure the channel selector switch to the heatsink.

Step 14. It should now be possible to lift the heatsink away from the "C" board.

SYNTHESIZER ("S") BOARD REMOVAL

Step 1. Remove the radio housing.

Step 2. Follow the "A" board removal instructions (Steps 2 through 10).

Step 3. Remove the eight screws (#28) securing the VCO top cover (#129).

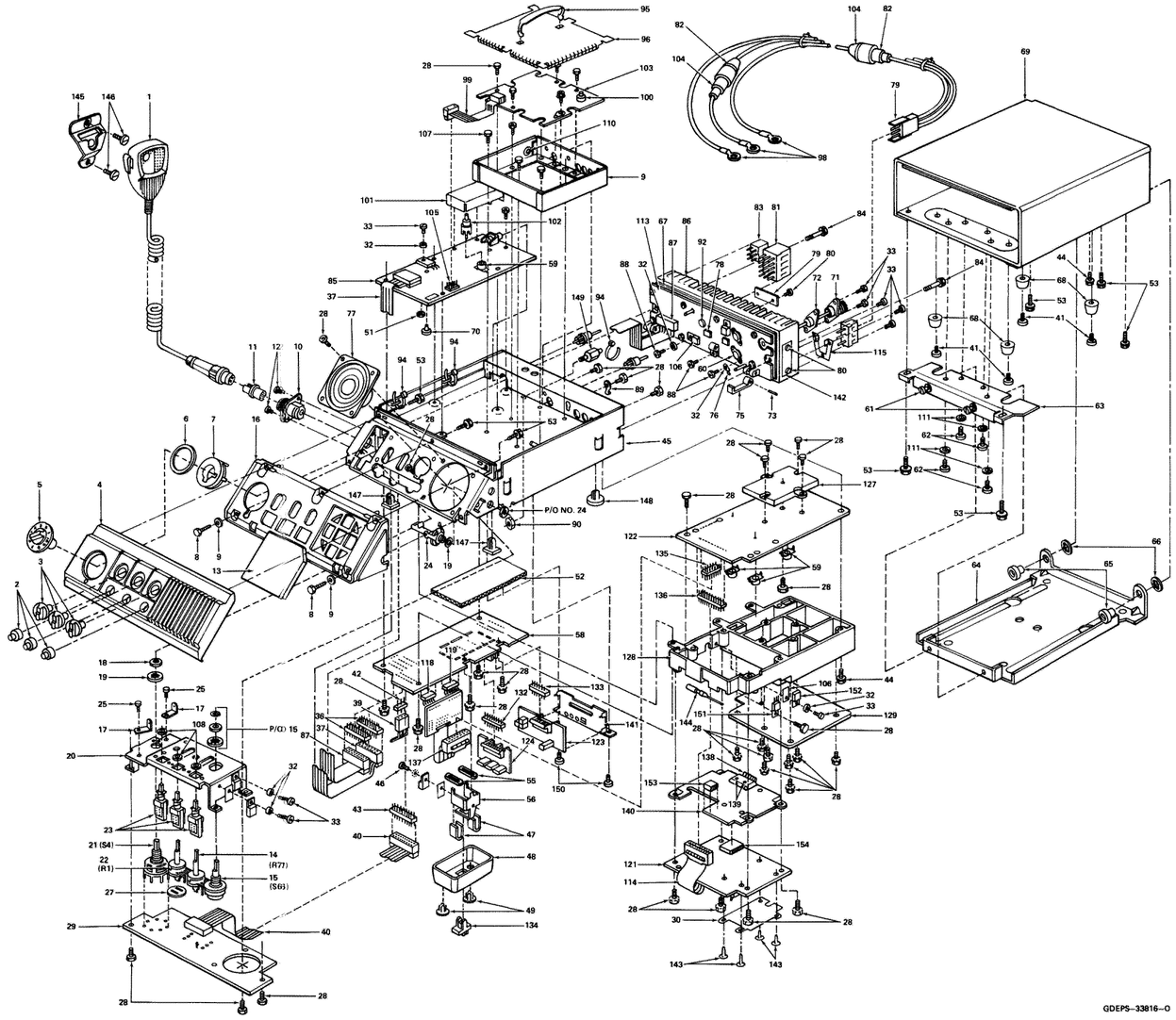
Step 4. Remove four screws (#44) securing the VCO casting to the chassis (#45) and remove the casting.

Step 5. Remove the one screw (#28) that holds the bottom cover (#127) to the "S" board.

Step 6. Invert the VCO casting (#128) and proceed to remove the five screws (#28) that secure the bottom cover (#127).

Step 7. Remove the three remaining screws (#28).

Step 8. Remove the "S" board.



parts list

Radio Mechanical Parts (Marine and Land) PL-7844-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	TMN6150A	Microphone Kit, land mobile
	or TMN6151A	Microphone Kit (marine)
2	38-83448M01	BUTTON, push; 2 used
3	36-84891L01	KNOB, control; 3 used
4	64-83260M05	PANEL, control; land (w/dimmer)
	or 64-83260M06	PANEL, control; land; inverted (w/dimmer)
	or 64-83260M07	PANEL, control; land (w/blanker-dimmer)
	or 64-83260M08	PANEL, control; land; inverted (w/blanker-dimmer)
	or 64-83260M09	PANEL, control; land (USB/LSB)
	or 64-83260M10	PANEL, control; land; inverted (USB/LSB)
	or 64-83260M11	PANEL, control; land (w/blanker-USB/LSB)
	or 64-83260M12	PANEL, control; land; inverted (w/blanker-USB/LSB)
	or 64-83260M13	PANEL, control; marine (w/dimmer)
	or 64-83260M14	PANEL, control; marine; inverted (w/dimmer)
	or 64-83260M15	PANEL, control; marine (w/blanker-dimmer)
5	36-84906L03	KNOB, channel select
	or 36-84906L04	KNOB, channel select (inverted)
6	14-83419M01	INSULATOR
7	61-83282M01	LIGHT GUIDE, diffuser
8	3-132127	SCREW, tapping: 6-20 x 3/4"; 2 used
9	4-7666	WASHER, lock; 2 used
10	15-82060M01	HOUSING, microphone connector
11	9-84981L01	RECEPTACLE, microphone; 5-contact
12	5-83885G04	RIVET
13	35-83598M01	GRILLE CLOTH
14	—	refer to electrical parts list TRN4956A
15	—	refer to electrical parts list TRN4956A
16	15-83261M01	HOUSING, control head
17	9-83549M01	SOCKET, lamp; 2 used
18	2-1376	NUT, hex: 3/8-32 x 1/2 x 3/32"
19	4-7655	WASHER, lock: #3/8 int.; 2 used
20	7-83257M01	BRACKET, heat sink mounting
21, 22, 23	—	refer to electrical parts list TRN4956A
24	9-84257M01	JACK, speaker
25	3-135102	SCREW, machine: 4-40 x 1/4"; 2 used
26	2-8365	NUT, hex: 1/4-32 x 3/8 x 3/32"
27	14-83900M01	INSULATOR
28	3-140193	SCREW, tapping 6-32 x 5/16"; 75 used
29	TRN4956A	CIRCUIT BOARD ("C" Board)
30	13-82476N01	ESCUTCHEON, programming board
31	55-84973E01	HANDLE; 2 used
32	4-84180C01	WASHER, shoulder; 5 used
33	3-134212	SCREW, tapping: 4-40 x 5/16"; 21 used
34	3-134169	SCREW, tapping: 4-40 x 1/4"; 4 used
35	54-83280M01	LABEL, frequency
36	28-83579M01	CONNECTOR, plug; 20-contact; 2 used
37	30-83265M02	CABLE, flat: 20-conductor
38	29-84659D01	CONTACT, pins; 3 used
39	15-83498F28	HOUSING, connector
40	30-83265M03	CABLE, flat: 26-conductor; w/connector
41	3-138891	SCREW, tapping: 6-32 x 7/16; 4 used
42	28-83496F28	CONNECTOR, male: 3-contact
43	28-83579M02	CONNECTOR, plug: 26-contact
44	3-140194	SCREW, tapping; 6-32 x 3/8"; 5 used
45	27-83246M03	CHASSIS, radio
46	3-2950	SCREW, machine; 4-40 x 1/4"
47	42-82371N01	CLIP, crystal; 2 used
48	14-82372N01	INSULATOR, crystal heater
49	38-83017N01	CAP, plastic; 2 used
50	3-135500	SCREW, tapping; 4-40 x 1/4"
51	2-7019	NUT, hex 4-40 x 1/4 x 3/32" (p/o 1-80717D20)
52	14-84005K03	PAD, foam
53	3-139947	SCREW, tapping: 8-18 x 1/2; 8 used
54	42-10217A02	STRAP, tie; 4 used
55	14-84540B01	INSULATOR, spacer; 2 used
56	7-82369N01	BRACKET, crystal holder
57	—	NOT USED
58	TRN4954A	CIRCUIT BOARD ("A" Board)
59	9-82615F01	JACK, phono
60	—	NOT USED
61	—	SCREW, captive (p/o item no. 63)
62	3-3397	SCREW, tapping: 8-18 x 5/16"; 4 used
63	7-83224N01	BRACKET, tray mounting (optional)
64	7-83259M01	TRAY, radio mounting (optional)
65	43-83727M02	BUSHING; 2 used
66	42-83721M01	RETAINER; 2 used
67	14-82398N01	INSULATOR, heat sink

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
68	75-83726M01	BUMPER
69	15-83258M04	HOUSING, radio; bronze
	or THN6457A	HOUSING, radio; wht (marine models only), optional
70	75-84380F01	BUMPER; 3 used
71	9-867432	RECEPTACLE, antenna
72	15-84630L01	HOOD, receptacle antenna
73	47-83255M01	PIVOT
74	28-82365D02	PLUG, phono; 7 used
75	45-83254M01	LINK; 2 used
76	7-80078A01	BRACKET (thermistor mounting)
77	50-84710G02	SPEAKER, dynamic
78	75-83238M02	PAD, transformer; 2 used
79	33-84406L01	NAMEPLATE, PA (100-watt)
80	3-8162	SCREW, drive: 0-6 x 3/16"; 2 used
81	9-83509M01	CONNECTOR, female: 15-contact
82	14-82883A01	INSULATOR, fuse holder cap; 2 used
83	9-83508M01	CONNECTOR, female: 6-contact
84	3-84423G01	SCREW, retaining; 2 used
85	TRN4955A	CIRCUIT BOARD ("B" Board)
86	26-83239M02	HEATSINK (100-watt models)
	or 26-82397N01	HEATSINK (125/150-watt models)
87	30-83265M01	CABLE, flat: 20-conductor
88	3-138813	SCREW, machine: 4-40 x 3/8"; 8 used
89	29-865067	LUG
90	2-115969	NUT, hex: 1/4-28 x 3/8 x 1/8"
91	26-83247M01	SHIELD, harmonic filter
92	—	NOT USED
93	9-84135B04	RECEPTACLE, phono; 4 used
94	42-10217A02	STRAP, tie; 13 used
95	55-84300B01	HANDLE
96	15-83248M01	COVER, harmonic filter
97	15-10183A81	HOUSING, connector: 3-contact
98	29-832116	LUG, ring tongue
99	30-83265M04	CABLE, flat: 10-conductor
100	14-83967A03	WASHER, shoulder
101	26-83249M01	SHIELD, exciter
102	9-83250M01	RECEPTACLE, phono
103	TFA6061B	CIRCUIT BOARD (harmonic filter); 2-13.2 MHz models
	or TFA6071A	CIRCUIT BOARD (harmonic filter); 2-18 MHz models
104	14-82882A01	INSULATOR, fuse holder body; 2 used
105	28-83579M03	CONNECTOR, plug: 10-contact; 1 used
106	14-84268A01	INSULATOR, transistor; 5 used
107	3-134185	SCREW, machine; 6-32 x 1/4"; 7 used
108	4-10058B32	WASHER, felt; 3 used
109	3-136906	SCREW, tapping; 4-40 x 1/2"
110	5-10115A23	GROMMET
111	4-114825	WASHER, 4 used
112	—	NOT USED
113	TRN4038A	CIRCUIT BOARD (power amplifier); 100-watt model
	or TRN4958A	CIRCUIT BOARD (power amplifier); 125/150-watt models
114	30-83265M07	CABLE, flat: 34-conductor w/connector
115	7-82181N01	CLAMP, connector
116	4-1720	WASHER, flat: 0.156-0.375-.030
117	31-132150	TERMINAL STRIP
118	28-83579M05	CONNECTOR, plug: 12-contact
119	28-83579M06	CONNECTOR, plug: 14-contact
120	3-135111	SCREW, tapping: 4-40 x 3/8"
121	TRN4963A	PROGRAMMING BOARD (optional)
122	TRN4957A	CIRCUIT BOARD ("S" board)
123	TRN4962A	CIRCUIT BOARD (blanker board, optional)
124	TRN4961A	CIRCUIT BOARD (lower side band, optional)
125	1-80760D03	CIRCUIT BOARD ("D" board)
126	1-80760D63	CABLE, coaxial (i-f input)
127	15-82082N01	COVER, bottom (VCO)
128	15-82080N01	HOUSING, synthesizer
129	15-82081N01	COVER, top (VCO)
130	54-82643N01	LABEL, top cover (VCO)
131	42-83339A07	CLAMP, cable
132	28-83447L03	CONNECTOR, plug; 8-contact
133	28-83447L02	CONNECTOR, plug; 6-contact
134	55-82370N01	FASTENER, cover lock
135	—	NOT USED
136	28-83579M04	CONNECTOR, plug; 34-contact
137	30-83265M08	CABLE, flat: 20-contact w/connector
138	39-83339N01	CONTACT, finger
139	3-139990	SCREW, tapping: 0-6 x 1/8"; 2 used
140	26-82490N01	SHIELD, circuit board
141	26-83338N01	SHIELD, blanker
142	33-84406L02	NAMEPLATE, PA (125/150-watt)
143	42-83629G01	FASTENER, driver; 4 used
144	—	consists of:
	9-82757N01	SOCKET, battery
	60-82758N01	BATTERY, lithium; 3 V
	38-82642N01	CAP, battery
145	1-851093	BRACKET, assembly
146	3-139913	SCREW, tapping: 8-18 x 1/2"; 2 used
147	5-84220B02	GROMMET, 2 used
148	5-83699M01	GROMMET, 3 used
149	21-84211B01	10,000 pF ± 5%; 500 V (feed-thru)
150	3-134279	SCREW, tapping; 4-40 x 3/16"; 2 used
151, 152	—	refer to electrical parts list TRN5006A
153	75-82200H01	PAD, rubber
154	75-82663M02	PAD, rubber

MECHANICAL PARTS AND DISASSEMBLY PROCEDURES

MISCELLANEOUS PARTS LISTS

parts list

TRN5008A Mounting Tray (Marine)
TRN4047A Mounting Tray (Land Mobile) PL-7837-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-3397	SCREW, tapping: 8-18 x 5/16"; 4 used
	3-139661	SCREW, tapping: 1/4-14 x 1"; 4 used
	4-114825	LOCKWASHER: #8 split; 4 used
	4-119331	LOCKWASHER; 1/4 med. split
	7-83259M01	TRAY, mounting
	7-83224N01	BRACKET
	42-83721M01	RETAINER; 2 used
	43-83727M02	BUSHING; 2 used

TRN4966A Front Panel, Noise Blanker (Land) (Optional)
TRN4964A Front Panel, Dimmer (Land)
TRN4972A Front Panel, Dimmer (Marine)
TRN4965A Inverted Front Panel, Dimmer (Land) (Optional)
TRN4973A Inverted Front Panel, Dimmer (Marine) PL-7834-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-134279	SCREW, tapping; 4-40 x 3/16"; 2 used (TRN4966A)
	4-10058B32	WASHER, felt black (TRN4966A)
	38-83448M01	PUSHBUTTON (TRN4966A)
	36-84906L03	KNOB, channel select (TRN4966A, TRN4964A, TRN4972A)
	36-84906L04	KNOB, channel select (TRN4965A, TRN4973A)
	64-83260M07	PANEL (TRN4966A)
	64-83260M05	PANEL (TRN4964A)
	64-83260M13	PANEL (TRN4972A)
	64-83260M06	PANEL (TRN4965A)
	64-83260M14	PANEL (TRN4973A)

THN6457A Housing (White) PL-7838-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	15-83258M01	HOUSING

THN6456A Housing (Bronze) PL-7829-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-8162	SCREW, drive; 0-6ST x 3/16"; 2 used
	3-132127	SCREW, tapping; 6-20 x 3/4"; 2 used
	3-138891	SCREW, tapping; 6-32 x 7/16"; 4 used
	3-139947	SCREW, tapping; 8-18 x 1/2"; 8 used
	3-140194	SCREW, tapping; 6-32 x 3/8"
	3-140193	SCREW, tapping; 6-32 x 5/16"; 4 used
	4-7666	LOCKWASHER, #6 external; 2 used
	4-10058B32	WASHER, felt (BLK); 2 used
	13-813618	DECAL
	14-83419M01	INSULATOR
	15-83258M04	HOUSING
	15-83261M02	HOUSING, control head
	33-84406L02	NAMEPLATE
	35-83598M01	GRILLE CLOTH
	36-84891L01	KNOB, control; 3 used
	38-83448M01	PUSHBUTTON; 2 used
	61-83282M01	GUIDE, light diffused
	75-83726M01	BUMPER; 4 used

TRN5009A Chassis Hardware Kit
TRN5010A Chassis Hardware Kit PL-7840-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		integrated circuit: (see note 1)
U3	51-83625M45	microprocessor (TRN5009A)
	or 51-83625M46	microprocessor (TRN5010A)
		non-referenced items
	3-134185	SCREW, tapping; 6-32 x 1/4"; 7 used
	3-135500	SCREW, tapping; 4-40 x 1/4"; 2 used
	3-140193	SCREW, tapping; 6-32 x 5/16"; 30 used
	3-140194	SCREW, tapping; 6-32 x 3/8"; 4 used
	3-139990	SCREW, tapping; 0-6 x 1/8"; 2 used
	14-82372N01	INSULATOR, crystal heater
	15-82081N01	COVER, VCO top
	15-83248M01	COVER, harmonic filter
	26-82490N02	SHIELD
	38-83017N01	BUTTON, plug; 22 used
	42-10217A02	STRAP, tie; 4 used
	54-82643N01	LABEL, VCO
	55-82370N01	FASTENER, cover lock
	55-84300B01	HANDLE
	39-83339N01	CONTACT
	75-82663M02	PAD
	75-82200H01	PAD

notes:
1. U3 is located on the synthesizer ("S") board. For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

1. GENERAL

The alignment procedure is divided into two parts. Paragraph 2 describes the ***only*** alignment normally required for the *Micom•S/Triton 40•S* radios. Paragraphs 3 through 6 describe ***all*** the adjustments ever required for these radios. These adjustments have been preset at the factory and normally do not require readjustment. However, if complete readjustment is desired, the procedure ***must*** be followed in the described order, i.e., paragraphs 3 through 6.

CAUTION

Misalignment, or alignment other than in the order presented, can adversely affect the performance of the radio and cause ***serious*** damage.

2. ROUTINE CRYSTAL FREQUENCY ADJUSTMENTS

The crystal frequency setting should be performed as required and when replacing crystals.

NOTE

A frequency counter, accurate to within ±1 Hz, should be used for the 11.4 MHz i-f oscillator and 9.216 MHz reference oscillator frequency adjustments.

2.1 11.4 MHz I-F OSCILLATOR FREQUENCY ADJUSTMENT

Step 1. Turn the radio on and allow 15 minutes for the oven temperature to stabilize.

Step 2. Connect a frequency counter through a 0.1 uF coupling capacitor to the junction of R78 and C6 on the "A" board (see Figure 1).

Step 3. Remove the plastic access plug from the oven insulating cover over the i-f oscillator section of the "A" board (see Figure 1). Using an insulated tuning tool, adjust the piston trimmer capacitor for a reading of 11.400000 MHz ±1 Hz.

Step 4. Remove the frequency counter and replace the access plug on the oven cover.

2.2 9.216 MHz REFERENCE OSCILLATOR FREQUENCY ADJUSTMENT

NOTE

This adjustment assumes that both the 11.4 MHz i-f oscillator is set properly and all factory preset adjustments have not been tampered with. If this is not the case, ***be sure*** that those adjustments are made first.

Step 1. Connect a wattmeter and a 50-ohm load to the antenna connector. Couple the frequency counter to the transmitter output using an in-line coupling unit (see Figure 2).

Step 2. Select the highest transmit frequency channel and key the transmitter by using the tune-up plug (provided) which grounds J10-3 of the 6-pin accessory connector (see Figure 3). ***Be sure*** that no audio input is present by disconnecting the microphone.

Step 3. Remove the plastic access plug from the oven insulating cover over the reference oscillator section of the "A" board (see Figure 1). Using an insulated tuning tool, adjust the piston trimmer capacitor for a reading on the frequency counter equal to the carrier frequency ±1 Hz.

Step 4. Remove the tune-up plug and the frequency counter and replace the access plug on the oven cover.

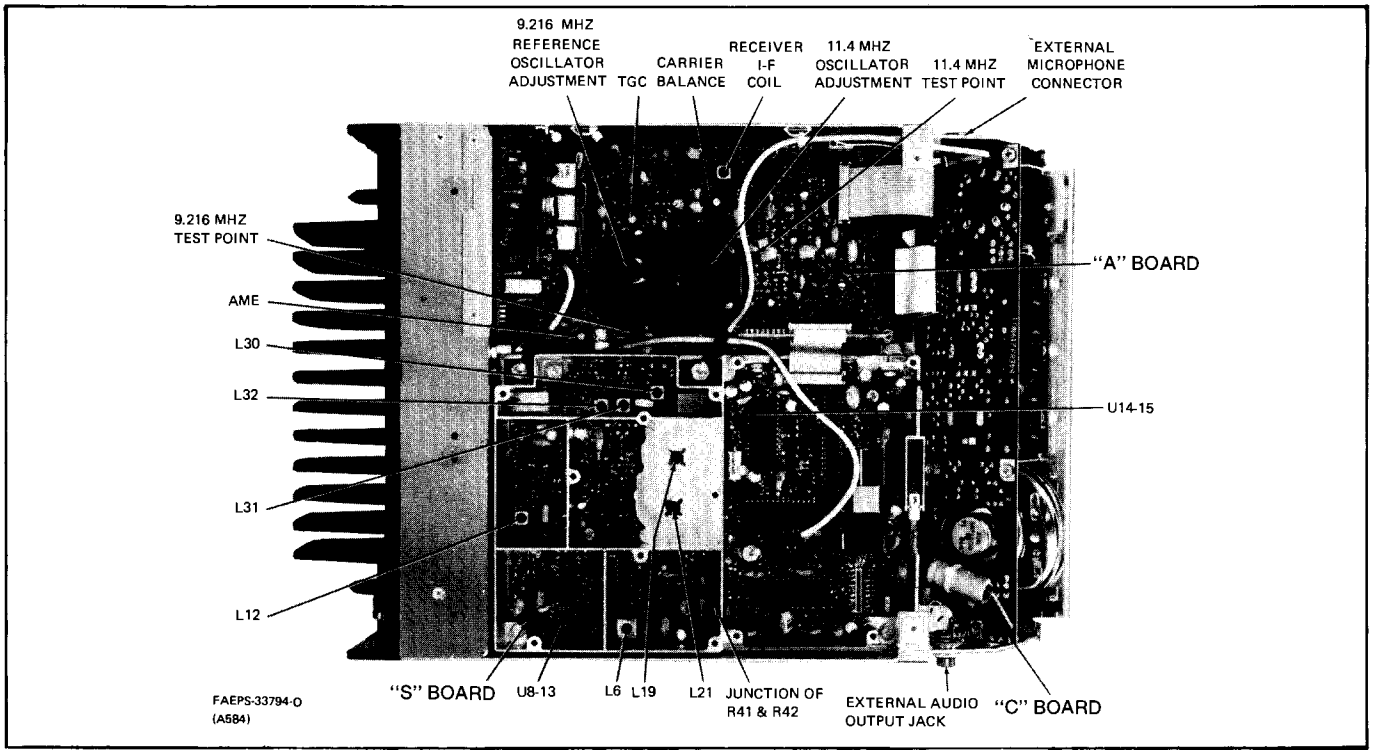


Figure 1. "A" and "S" Board Adjustments

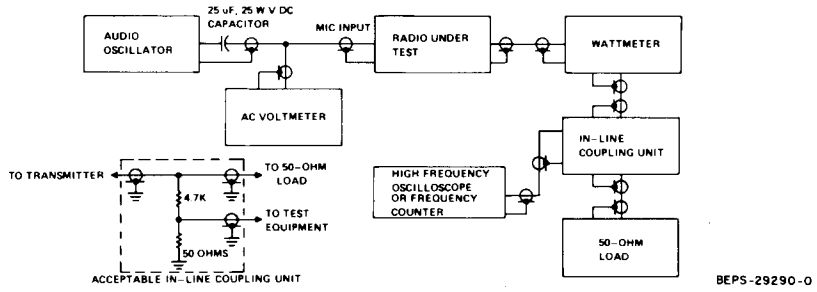


Figure 2. Test Equipment Set-Up

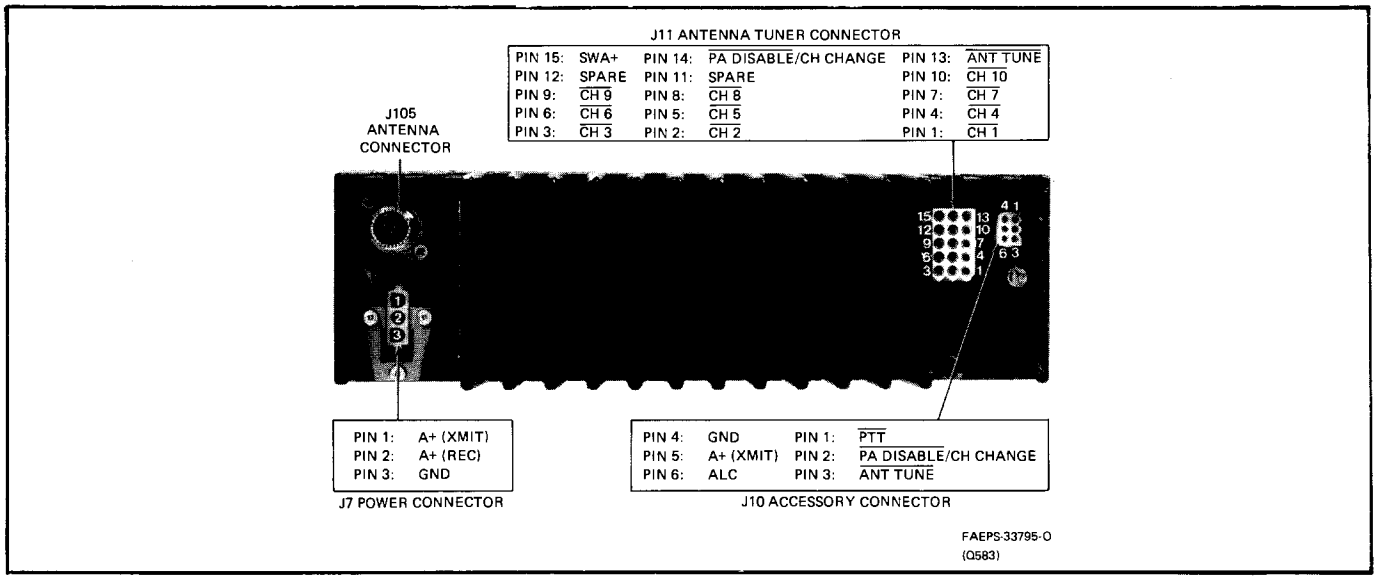


Figure 3. Rear External Connections

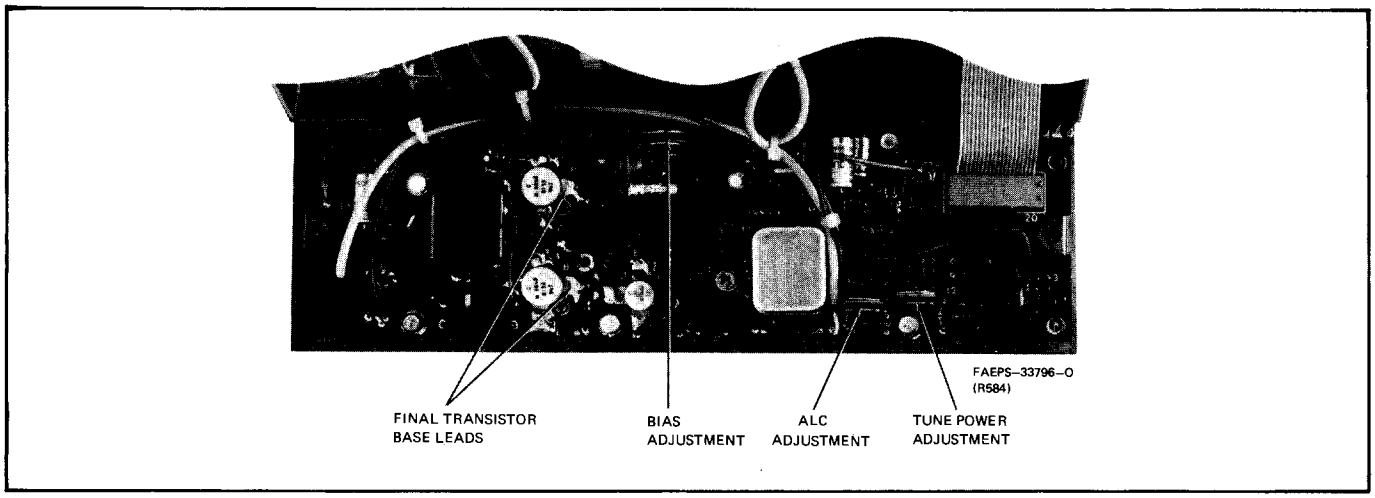


Figure 4. PA Adjustments

3. FACTORY PRESET ADJUSTMENTS

CAUTION

The following adjustments have been factory preset. Misalignment can adversely affect performance or cause serious damage. **All procedures must be performed in the following order.**

3.1 PRELIMINARY PROCEDURES

Step 1. Observe the following standard test conditions:

a. Power supply voltage set at 13.8 V dc.
b. Ambient temperature of 25 ±5 degrees C.
c. SSB (A3J) programmed mode unless otherwise stated.
d. Wattmeter accurately calibrated.
e. To ensure that the power amplifier is not overdriven, use the minimum microphone input level necessary to obtain the required output level. Until the TGC and ALC have been set, limit transmission time to the minimum required.

Step 2. Preset the following controls:
(Refer to Figures 1 and 4 for location details.)

CAUTION

Potentiometer preset position is described from the front (blue side) or top of the control.

a. TGC — ("A" board) fully counterclockwise.
b. AME — ("A" board) fully counterclockwise.
c. ALC — (PA) fully clockwise.
d. TUNE — (PA) fully clockwise.
e. BIAS — (PA) fully clockwise.
f. CARRIER BALANCE — ("A" board) centered.
g. RECEIVER I-F — ("A" board) flush with top of can.
h. Adjust the 11.4 MHz i-f oscillator frequency as described in paragraph 2.1.

Step 3. Connect a wattmeter and 50-ohm load to the antenna jack. Couple an oscilloscope to the transmitter output using a coupling unit constructed as shown in Figure 2. Connect an audio oscillator between pin 1 (audio high) and pin 3 (ground) on the microphone connector (J15).

Step 4. To key the transmitter in those procedures, short pin 2 ($\overline{\text{PTT}}$) of the microphone connector to ground.

3.2 9.216 MHz REFERENCE OSCILLATOR COARSE FREQUENCY ADJUSTMENT

NOTE

If the reference oscillator has been previously adjusted in accordance with paragraph 2.2, this adjustment should ***not*** be made.

Step 1. Be sure that no audio input is present by disconnecting the microphone.

Step 2. Key the radio in the SSB (A3J) mode on any channel.

Step 3. Connect a frequency counter through a .01 uF coupling capacitor to the 9.216 MHz test point node located near C82 on the "A" board (see Figure 1).

Step 4. Remove the plastic access plug from the oven insulating cover over the reference oscillator section of the "A" board (see Figure 1). Using an insulated tuning tool, adjust the piston trimmer capacitor for a reading of 9.216 MHz ±2 Hz.

Step 5. Dekey the radio, remove the frequency counter, and replace the access plug on the oven cover.

Step 6. Be sure to fine-tune the reference oscillator (as described in paragraph 2.2) after completing the remainder of the adjustments.

3.3 VCO1, VCO2, AND VXO ADJUSTMENTS

These adjustments require the use of the TRN4963A Programming Board.

3.3.1 VCO1 Adjustment

Step 1. Program the radio for 2.0016 MHz (refer to the Radio Programming section for the procedure).

Step 2. Adjust L19 on the "S" board (see Figure 1) for 2.4 ± .01 V dc at U14-15.

Step 3. Program the radio for 14.5000 MHz.

Step 4. Adjust L21 on the "S" board (see Figure 1) for 2.4 ± .01 V dc at U14-15.

3.3.2 VCO2 AND VXO Adjustments

Step 1. Using a dc voltmeter, note the voltage level at U8-13 on the "S" board (see Figure 1). Press the **IF** button on the programming board two times and note the voltage for each time. Press the **IF** button as many times as necessary (at most, three times) to read the middle of the three voltages previously noted at U8-13.

Step 2. Program the radio for 7.0000 MHz.

Step 3. Adjust L6 on the "S" board (see Figure 1) for 5.5 ± .01 V dc at the junction of R41 and R42.

Step 4. Adjust L12 on the "S" board (see Figure 1) for 3.5 ± .01 V dc at U8-13.

4. TRANSMIT ADJUSTMENTS

4.1 PA BIAS SET

Step 1. Be sure the PA heatsink temperature is 25 ±5°C and that no audio input is present at the microphone input.

Step 2. Key the radio in the SSB (A3J) mode on any channel.

Step 3. Monitor the base voltage of one of the final amplifier transistors, Q408 or Q409. Adjust BIAS control pot R417 for a reading of 0.63 ±.01 V dc (see Figure 4).

4.2 75 MHz I-F TRANSMIT ADJUSTMENT

NOTE
The following adjustments require the use of the TRN4963A Programming Board.

Step 1. Connect an audio oscillator, a 50-ohm load, and a wattmeter as described in Steps 3 and 4 of paragraph 3.1.

Step 2. Program the radio for 2.0016 MHz (refer to the Radio Programming section for the procedure).

Step 3. Using a dc voltmeter, note the voltage level at U8-13 on the "S" board (see Figure 1). Press the **IF** button on the programming board two times and note the voltage for each time. Press the **IF** button as many times as necessary (at most, three times) to read the middle of the three voltages previously noted at U8-13.

Step 4. Set the audio oscillator to 1000 Hz, key the radio and adjust the audio level to produce 25 W output.

Step 5. Tune L30 on the "S" board (see Figure 1) for maximum power output. Then adjust L31 for maximum power output.

4.3 TRANSMITTER GAIN CONTROL (TGC) SET

Step 1. Connect a 1 kHz tone from the audio oscillator to the microphone input connector.

Step 2. Key the transmitter on any channel in the SSB (A3J) mode and adjust the audio input so that the power output is 50 watts.

Step 3. Leaving the audio input fixed, rotate through all SSB channels and select both USB and LSB (if present) while noting the power output level. The channel with the lowest output power is the lowest gain channel.

Step 4. Select the lowest gain channel (lowest power output) and adjust the audio input to 300 mV ac.

Step 5. Rotate the TGC control (see Figure 1) until the power output is:

- 140 W for the 125 W models or,
- 165 W for the 150 W model or,
- 115 W for the 100 W model.

4.4 AUTOMATIC LEVEL CONTROL (ALC) SET

Step 1. Select the lowest frequency channel for 18 MHz models or the highest frequency channel for 13.2 MHz models.

Step 2. Key the radio in the SSB (A3J) mode.

Step 3. Rotate the ALC control (see Figure 4) on the power amplifier until the power output is:

- 130 ±1 W for 125 W models. The power output on any channel should now be 125 ±10 W.
- 155 ±1 W for the 150 W model. The power output on any channel should now be 150 ±10 W.
- 105 ±1 W for the 100 W model. The power output on any channel should now be 100 ±10 W.

4.5 AME CARRIER SET

Step 1. Select the lowest gain channel (lowest power output) that isprogrammed for AME transmission.

Step 2. Apply a 300 mV ac audio signal at 1 kHz to the microphone connector.

Step 3. With the oscilloscope connected as shown in Figure 2 adjust the AME control (see Figure 1) for the desired waveform shown in Figure 5. There must be no crossover distortion of the rf envelope.

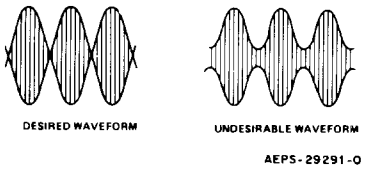


Figure 5. AME Waveform Adjustments

4.6 TUNE MODE OUTPUT POWER SET

Step 1. Key the transmitter in the tune mode using the tune plug which grounds J10-3 of the 6-pin accessory connector on the PA heatsink (see Figure 3).

Step 2. With no audio input signal, adjust the TUNE control (see Figure 4) on the power amplifier for 3 ±1 W rf output.

4.7 CARRIER BALANCE CONTROL

Step 1. Select any channel that is programmed for SSB (A3J).

Step 2. Remove the audio input from microphone connector.

Step 3. Connect an oscilloscope as shown in Figure 2.

Step 4. Key the transmitter and observe the oscilloscope trace.

Step 5. Adjust the carrier balance control (see Figure 1) for a minimum rf level as viewed on the oscilloscope.

5. RECEIVE ADJUSTMENTS

CAUTION
When following the procedures given in paragraphs 5.1 and 5.2, ***make certain*** that the transmitter is not accidentally keyed.

5.1 75 MHz I-F RECEIVE ADJUSTMENT

NOTE
The following adjustments require the use of the TRN4963A Programming Board.

Step 1. Program the radio for 2.0016 MHz (refer to the Radio Programming section for the procedure).

Step 2. Connect a signal generator to the antenna input connector (see Figure 3) and apply a 2.0026 MHz signal at a 1 uV level.

Step 3. Adjust L32 on the "S" board (see Figure 1) for maximum audio at the speaker.

5.2 RECEIVER I-F COIL ADJUSTMENT

Step 1. Connect a signal generator to the antenna input connector and apply a 1 uV signal.

Step 2. Adjust the i-f coil on the "A" board (see Figure 1) for a maximum audio level at the speaker.

5.3 9.216 MHz REFERENCE OSCILLATOR FREQUENCY FINE ADJUSTMENT

Follow the procedure given in paragraph 2.2 to fine tune the reference oscillator.

6. NOISE BLANKER BOARD ADJUSTMENTS

CAUTION
When following the procedures given in paragraphs 6.1 and 6.2, ***make certain*** that the transmitter is not accidentally keyed.

6.1 PRELIMINARY SETTINGS

Step 1. Remove the noise blanker board and the lower sideband board (if present) from the radio.

Step 2. Adjust L1, L2, L4 and T1 (see Figure 6) until each core is flush with the top of the coil form.

Step 3. Replace the noise blanker board in the radio.

6.2 COILS AND TRANSFORMER ADJUSTMENTS

Step 1. Connect a signal generator to the antenna input connector and apply a 0.5 V ac signal 1 kHz above the selected frequency.

Step 2. Monitor P21-6 with an oscilloscope. Adjust L1, L2, and L4 (see Figure 6) clockwise for a peak signal on the oscilloscope.

NOTE

When adjusting L1, the peak will not be as sharp as for L2 and L4.

Step 3. Reduce the signal generator output to 0.2 mV ac.

Step 4. Monitor U3-2 with a digital voltmeter and adjust T1 (see Figure 6) clockwise for a peak dc voltage reading.

Step 5. Replace the lower sideband board (if one was present).

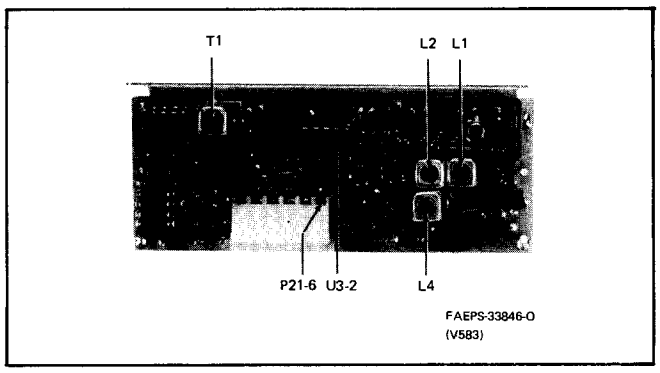


Figure 6. Noise Blanker Board Adjustments

1. GENERAL

1.1 The Model TRN4963A Programming Board is used to specify the carrier frequency and other characteristics for each channel in *MICOM•S* and *TRITON 40•S* radios. The programming board itself is a single circuit card which connects, via a ribbon cable, to a header inside the radio.

1.2 When connected and enabled, the programming board allows the user to program the transmit and receive carrier frequencies, transmission mode, and channel type for each of the 40 possible channels selectable on the radio. The channel information is stored in the radio in an internal RAM. The RAM is protected by a backup battery so that the channel information is not lost when power is removed.

1.3 Each channel can be programmed for any carrier frequency (or separate transmit and receive frequencies for half-duplex operation) in 100 Hz steps within the operating range of the radio. Channels may also be programmed to be transmit-only, receive-only, or non-functional. The operating range for each radio model is shown in Table 1. The receive frequency range for all models has no lower limit. However, there will be a significant reduction in sensitivity below 2 MHz.

Table 1.
Operating Frequency Ranges

Radio Model	Transmit	Receive
D70HEA1N00-K	2.0 MHz — 13.2 MHz	0 Hz — 13.2 MHz
D80HEA1N19-K	2.0 MHz — 13.2 MHz	0 Hz — 13.2 MHz
D80JMA1N00-K	2.0 MHz — 18.1 MHz	0 Hz — 18.1 MHz
D80JMA1N19-K	2.0 MHz — 18.1 MHz	0 Hz — 18.1 MHz

1.4 The programming board operates in two modes: (1) the programming mode, used to enter new channel information into the RAM and (2) the verification mode, used to check channel information previously stored in the RAM. The current mode of the programming board is shown by the KYBD ACSS indicator. When the indicator is illuminated, the board is in the programming mode. When the indicator is extinguished, the board is in the verification mode.

1.5 In addition to programming and verifying channel information, the programming board provides an i-f selection function. For each frequency there are three pairs of first and second injection frequencies resulting in three different first receive i-f selections (all approximately 75 MHz). Some injection pairs may cause unwanted audio tones ("whistlers") during receive. One injection pair is selected by the processor when the receive frequency is programmed. When the **IF** key is pressed, one of the other combinations is selected and the new selection is automatically loaded into the RAM for future use. Pressing the **IF** key repeatedly will rotate through the three possible i-f selections.

1.6 The programming board can also be used to isolate errors in channel information either due to faulty programming or data loss in the radio RAM. Refer to "Error Indications," paragraph 7. of this section.

1.7 When in use, the programming board is normally mounted inside the radio. An extension cable, part of accessory kit Model TLN2374A, may be used to connect the programming board without mounting the board in the radio. After use, the programming board may be removed or left mounted inside the radio (without the extension cable).

2. CONTROLS AND INDICATORS

2.1 PROGRAMMING BOARD CONTROLS AND INDICATORS

Refer to Figure 1. The programming board contains the following controls and indicators to facilitate programming and verification of channel information.

ON/OFF Switch — This switch controls operation of the programming board when connected and enabled. The programming board will initialize in the verification mode.

NOTE

In addition to turning the programming board ON by using the **ON/OFF** switch, the board must be enabled by selecting channel 10 (of any bank) on the radio front panel.

FREQ UP and **FREQ DOWN** (frequency up/down) Keys — Pressing one of these keys will increase or decrease the displayed (previously programmed) frequency by 100 Hz. The new frequency is automatically programmed into the RAM. Holding the key down will repeatedly increase or decrease the frequency by 100 Hz. These keys are used when the board is in the verification mode.

CHAN UP and **CHAN DOWN** (channel up/down) Keys — Pressing one of these keys will increment or decrement the displayed channel number by one (within the bank selected on the radio **A-B-C-D** switch) and display the channel information for that channel. These keys are used only in the verification mode.

DIM (display dim) Key — Pressing this key will dim the programming board display (used specially in low ambient light conditions). If the display has been previously dimmed, pressing this key will return the display to normal brightness.

RSET (reset) Key — Pressing this key terminates the programming mode and initiates the verification mode without programming new channel information (used especially when the programming mode is entered inadvertently). The most recent previously displayed valid channel information is returned.

FREQ ENT (frequency-enter) Key — Pressing this key indicates that numeric entries immediately following specify the desired frequency. This key will also initiate the programming mode if the board is in the verification mode.

XMT/RCV (transmit/receive) Key and Indicators — When programming a half-duplex channel, this key is used to select the side (transmit or receive) currently being programmed. The corresponding indicators to the left of the key toggle each time the key is pressed to show the selection. Pressing this key will initiate the programming mode and select the half-duplex channel type if the board is in the verification mode or the simplex channel type is currently selected. When verifying a half-duplex channel, the indicators show which (transmit or receive) frequency is currently being displayed on the numeric display.

NOTE

When verifying a half-duplex channel, the receive frequency is normally displayed. To display the transmit frequency, key the radio (the radio will then be transmitting normally) or press the **XMT MON** key (the PA will be disabled and the radio will receive on the transmit frequency).

CHAN ENT (channel-enter) Key — Pressing this key indicates that the numeric entries immediately following specify the desired channel (1-10 in the bank selected on the **A-B-C-D** switch).

SMPX/DPLX (simplex/half-duplex) Key and Indicators — This key is used in the programming mode to select the channel type for the channel being programmed. The two selectable channel types are simplex and half-duplex. The corresponding indicators to the left of the key toggle each time the key is pressed to indicate the selection. This key will also initiate the programming mode if the board is currently in the verification mode. In the verification mode, the indicators show the channel-type for the selected channel.

SSB/PLT/AME (single-sideband/pilot/AM-equivalent transmission mode) Key and Indicators — This key is used in the programming mode to select the transmission mode for the channel currently being programmed. The three selectable transmission modes are (1) SSB (single-sideband; mode A3J), (2) PLT (single-sideband with pilot carrier; mode A3A), and (3) AME (AM-equivalent; mode A3H). Pressing this key will also initiate the programming mode if the board is in the verifcation mode. One of the corresponding indicators to the left of the key will be illuminated to show the selection. The selection will rotate through the three modes each time the key is pressed. In the verification mode, the indicators show the transmission mode for the selected channel.

PROG (programming) Key — When the board is in the programming mode this key is pressed to initiate loading of the displayed channel information into the radio. The displayed channel information is programmed into the RAM, the programming board automatically reverts to the verification mode, and the displays show the new channel information as it was loaded into RAM. This feature allows the operator to verify that the channel information was loaded properly.

IF (i-f selection) Key — Pressing this key shifts first receive i-f to remove unwanted audio tones ("whistlers") from the receive audio. Three possible i-f frequencies exist for each receive frequency. Pressing this key will rotate the i-f selection through the three possible frequencies for the current receive frequency.

CHAN RCL (channel recall) Key — This key is pressed after entry of a channel number to recall the information for that channel to the display and load it into the synthesizers. The programming board reverts to the verification mode.

XMT MON (transmit monitor) Key — This key is pressed to display (in the verification mode) the transmit frequency of a half-duplex channel without keying the radio. When a half-duplex channel is selected in the verification mode, the receive frequency will be displayed (if the radio is not keyed). When this key is pressed, the synthesizers are loaded with the transmit frequency but the PA is disabled and the

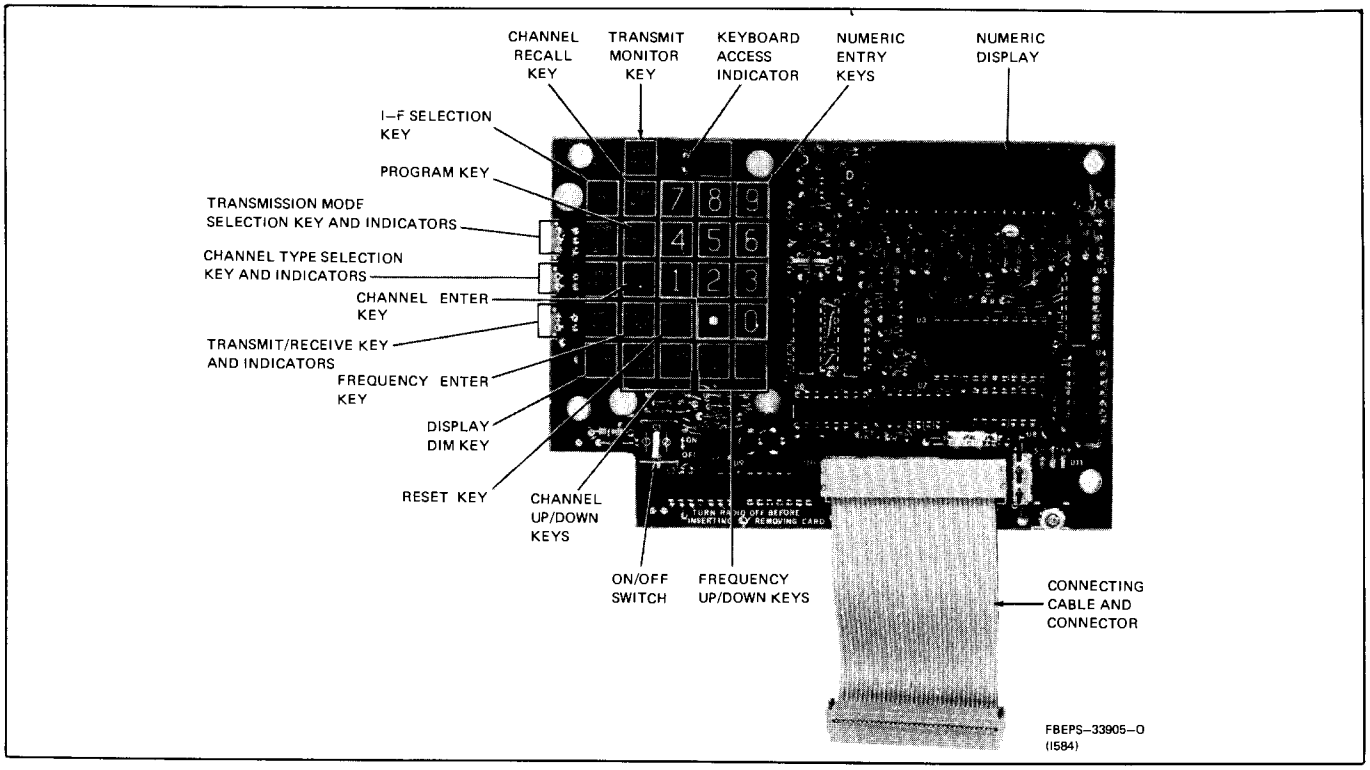


Figure 1. Programming Board Controls and Indicators

radio i-f is in the receive mode. The transmit frequency will be displayed on the programming board and radio will be receiving on the transmit frequency.

KYBD ACSS (keyboard access) Indicator — This indicator shows the current operating mode of the programming board. When the indicator is illuminated, the board is in the programming mode. When the indicator is extinguished, the board is in the verification mode.

NUMERIC ENTRY KEYS — These keys are used to enter the desired channel number (1 through 10) and the desired frequency ***in kHz*** (2000.0 kHz through 13200.0 kHz or 18100.0 kHz, depending upon the radio model).

NUMERIC DISPLAY — This display shows the channel number (the leftmost two digits) and the frequency in kHz (the rightmost six digits) currently being programmed or verified.

2.2 REQUIRED RADIO CONTROLS

2.2.1 In addition to the **ON/OFF** switch, the radio channel bank and channel number controls are used in conjunction with the programming board. The channel bank selector (the **A-B-C-D** switch) is used to select the desired channel bank at all times — when using the programming board and during normal operation. When installed, the programming board is enabled when channel 10 is selected on the front panel channel number selector. When the programming board is used, the channel number to be programmed or verified is entered through the programming board.

2.2.2 When the programming board is in the verification mode, the radio will transmit and receive normally on the channel number displayed on the programming board (the PTT switch operates normally). If it is desired to verify the transmit frequency of a half-duplex channel without keying the transmitter, the transmit monitor switch is pressed. The programming board will display the transmit frequency and the radio will receive on that frequency.

3. INSTALLATION, REMOVAL, AND STORAGE

CAUTION

The radio must be turned OFF before installing or removing the programming board. Otherwise, damage to the programming board and/or the radio may result.

3.1 INSTALLATION

3.1.1 Internal Mounting

Step 1. Turn the radio off.

Step 2. Remove the radio housing as detailed in "Mechanical Parts and Disassembly Procedure," section 68P81060E73 of this manual.

Step 3. Refer to Figure 2. On the bottom of the radio, locate the programming shield and remove the four mounting screws holding the shield in place. Do not remove the shield.

Step 4. Locate the 34-pin programming board connection header on the "S" board through the opening in the shield. Carefully attach the connector on the programming board connection cable to the header. The connector and header are mechanically polarized.

Step 5. Fasten the programming board and shield in place with the four screws previously removed from the programming shield. Refer to Figure 3.

3.1.2 External Connection (Using the Extension Cable)

Step 1. Turn the radio off.

Step 2. Remove the radio housing as detailed in "Mechanical Parts and Disassembly Procedure," section 68P81060E73 of this manual.

Step 3. Refer to Figure 2. On the bottom of the radio, locate the programming shield.

Step 4. Locate the 34-pin programming board connection header on the "S" board through the opening in the shield. Carefully attach the female connector on extension cable to the header. Carefully attach the connector on the programming board cable to the male connecting header on the extension cable. The connectors and headers are mechanically polarized. Refer to Figure 4.

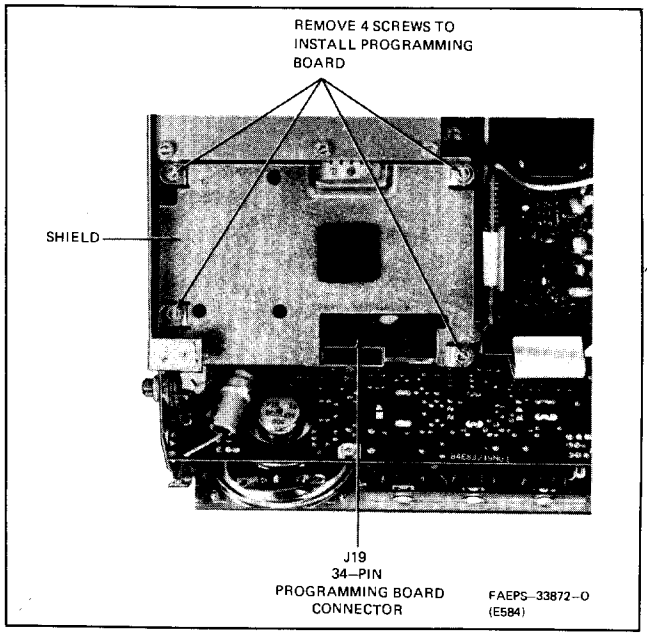


Figure 2. Programming Shield Location

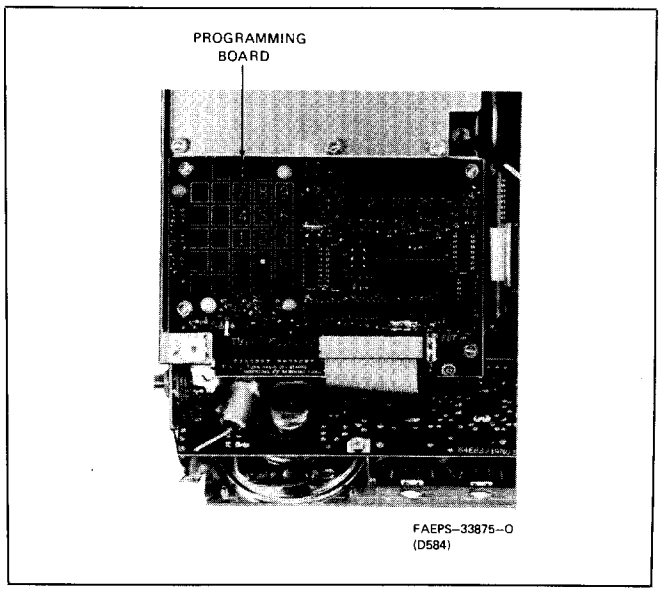


Figure 3. Properly Installed Programming Board

3.2 REMOVAL OR INTERNAL STORAGE

3.2.1 After using the programming board, TURN BOTH THE RADIO AND THE PROGRAMMING BOARD OFF. Turn the programming board off using the programming board **ON/OFF** switch. The programming board may be removed by reversing the installation procedure (especially to prevent unauthorized frequency changes). The programming board may otherwise be stored mounted in the radio to facilitate convienent field programming.

3.2.2 To store the board in the radio, make certain that the programming board **ON/OFF** switch is in the **OFF** position and that the board is securely fastened to the chassis with the four mounting screws. Then re-install the radio housing as detailed in "Mechanical Parts and Disassembly Procedure," section 68P81060E73 of this manual.

4. PROGRAMMING THE RADIO

4.1 GENERAL

4.1.1 The programming procedures for all radio channels and functions follow the same general scheme.

- The programming board is installed, turned on, and enabled.
- The proper channel bank is selected on the radio front panel.
- The desired channel number is selected through the programming board.

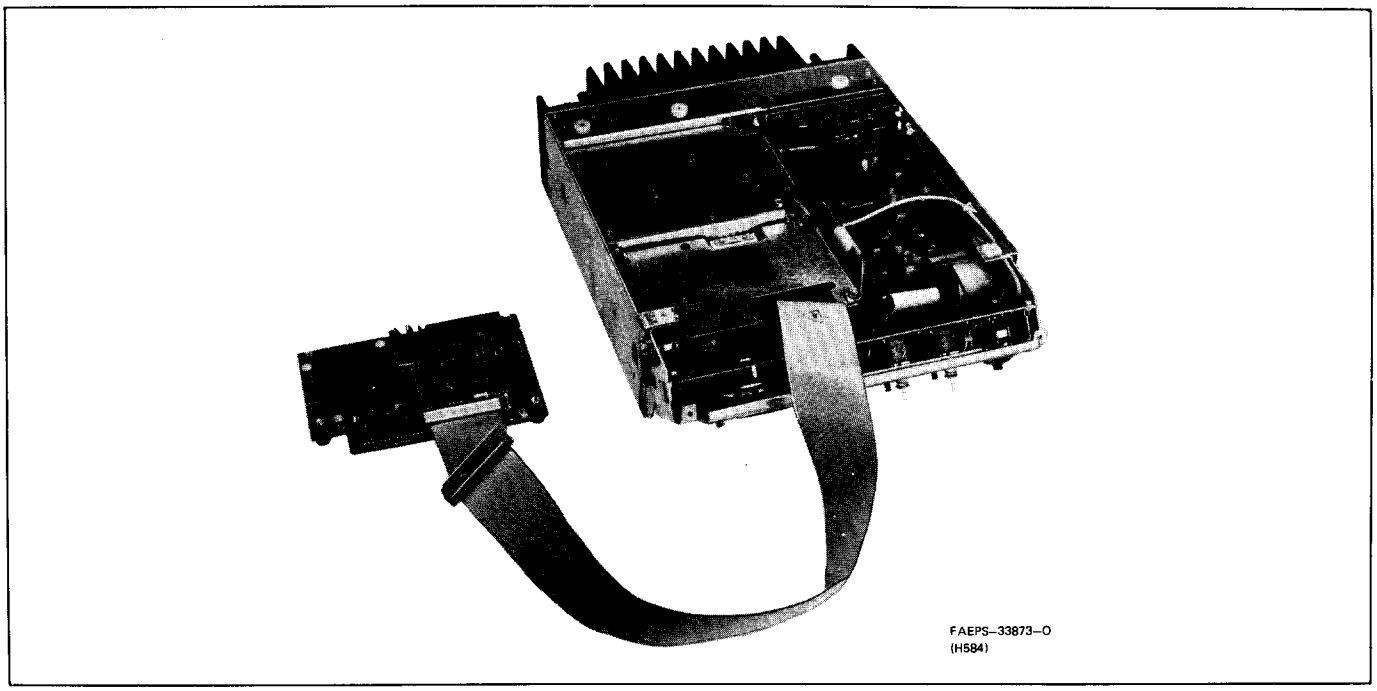


Figure 4. Programming Board With Extension Cable

- The desired transmission mode, channel type, and operating frequency(s) are entered on the programming board.

- The channel information is loaded into the radio RAM.

4.1.2 The only major procedural difference in programming any one channel or another occurs between programming a simplex channel and programming a half-duplex channel. When programming a half-duplex channel, two separate frequencies must be entered and loaded — (1) the transmit frequency and (2) the receive frequency. The two frequencies are loaded in much the same manner as if two simplex channels were programmed (but using the same channel number). A simplex channel requires only one operating frequency.

4.1.3 Three first-intermediate frequencies are possible for each receive frequency. One i-f is selected by the radio processor when the receive frequency is programmed. Harmonics of some injection frequencies may cause unwanted audio tones during receive. If this occurs, the **IF** key is pressed to select another i-f. Pressing the key repeatedly will rotate the i-f selection through the three possible frequencies to find the best selection.

4.2 PROGRAMMING A SIMPLEX CHANNEL

Step 1. Turn the radio on and turn the programming board on. Select the desired channel bank on the radio front panel **A-B-C-D** switch. For example, to program channel 3A, select position **A** on the **A-B-C-D** switch.

Step 2. Enable the programming board by selecting channel 10 on the radio front panel. The programming board initializes in the verification mode on channel 10. The channel information indicators show the current channel information for channel 10 of the bank currently selected on the radio front panel. The **KYBD ACSS** indicator is off.

NOTE

It is not necessary to perform Steps 3-6 in the order shown.

Step 3. Select the desired channel number (if different from that currently displayed) by pressing the **CHAN ENT** key and then the appropriate numeric keys. **CHAN ENT** may be pressed again to clear an erroneous entry. For example, to program channel 3 of the selected bank, press **CHAN ENT** then **3**.

NOTE

The **CHAN ENT** key is not always necessary. Unless **FREQ ENT** has been pressed during the current procedure, the first two digits entered in either the programming or verification procedures are considered to be channel number and are treated as such by the processor and display. **CHAN ENT** is necessary only if the operator wishes to enter the channel number selection *after* entering the frequency information when programming a channel.

Step 4. Select the desired transmission mode by repeatedly pressing the **SSB/PLT/AME** key (if

necessary) until the appropriate indicator, to the left of the key, is lit. For example, if the **SSB** mode is desired and **PLT** indicator is lit, press **SSB/PLT/AME** twice to light the **SSB** indicator.

Step 5. Select the simplex channel type by pressing the **SMPX/DPLX** key (if necessary) to light the **SMPX** indicator. If the **DPLX** indicator is lit, press **SMPX/DPLX** once to light the **SMPX** indicator.

Step 6. Enter the desired frequency *in kHz* by pressing the **FREQ ENT** key followed by the appropriate numeric keys. All frequency entries and displays are in kHz. The possible zero in the 100 Hz position need not be entered. For example, 2100.0 kHz is entered by pressing **FREQ ENT** followed by **2, 1, 0,** and **0,** but 2100.6 kHz is entered by pressing **FREQ ENT** followed by **2, 1, 0, 0, •,** and **6.** For example 2.1 MHz is entered as 2100.0 kHz. Erroneous entries can be cleared by pressing the **FREQ ENT** key again.

NOTE

If the desired frequency is greater than 10000.0 kHz (10 MHz), the possible non-zero 100 Hz digit must be entered but the decimal point need not be entered. For example, to program 12345.6 kHz, press **FREQ ENT** followed by **1, 2, 3, 4, 5,** and **6.**

Step 7. Check the radio **A-B-C-D** switch and all of the programming board indicators to verify that the proper channel bank, channel number, transmission mode, simplex channel type, and frequency have been entered properly. If an error is found, correct the error by repeating only those steps related to the error. For example, if the wrong transmission mode was entered, only Step 4 need be repeated.

Step 8. When all of the information has been checked and is correct, press the **PROG** key. The currently-displayed channel information will be loaded into the radio RAM for the selected channel. The programming board will then revert to the verification mode and the newly-programmed information will be recalled and displayed. If the display flashes, refer to "Error Indications," paragraph 7 of this section.

Step 9. Recheck the displays and indicators to verify that the channel information was loaded correctly.

4.3 PROGRAMMING A HALF-DUPLEX CHANNEL

Step 1. Turn the radio on, and turn the programming board on. Select the desired channel bank on the radio front panel **A-B-C-D** switch. For example, to program channel 3A, select position **A** on the **A-B-C-D** switch

Step 2. Enable the programming board by selecting channel 10 on the radio front panel. The programming board initializes in the verification mode on channel 10.

The channel information indicators show the current channel information for channel 10 of the bank currently selected on the radio front panel. The **KYBD ACSS** indicator is off.

NOTE

It is not necessary to perform Steps 3-7 in the order shown.

Step 3. Select the desired channel number (if different from that currently displayed) by pressing the **CHAN ENT** key and then the appropriate numeric keys. **CHAN ENT** may be pressed again to clear an erroneous entry. For example, to program channel 3 of the selected bank, press **CHAN ENT** then **3.**

NOTE

The **CHAN ENT** key is not always necessary. Unless **FREQ ENT** has been pressed during the current procedure, digits entered in either the programming or verification procedures are considered to be channel number and are treated as such by the processor and display. **CHAN ENT** is necessary only if the operator wishes to enter the channel number selection *after* entering the frequency information when programming a channel.

Step 4. Select the desired transmission mode by repeatedly pressing the **SSB/PLT/AME** key (if necessary) until the appropriate indicator, to the left of the key, is lit. For example, if the **SSB** mode is desired and **PLT** indicator is lit, press **SSB/PLT/AME** twice to light the **SSB** indicator.

Step 5. Select the half-duplex channel type by pressing the **SMPX/DPLX** key (if necessary) to light the **DPLX** indicator. For example, if the **SMPLX** indicator is lit, press the **SMPX/DPLX** key once to light the **DPLX** indicator.

Step 6. Select the desired side (transmit or receive) of the channel to be programmed by pressing the **XMT/RCV** key (if necessary) to light the appropriate indicator. For example, if the **RCV** indicator is lit and you wish to program the transmit frequency, press the **XMIT/RCV** key once to light the **XMIT** indicator.

Step 7. Enter the desired frequency *in kHz* by pressing the **FREQ ENT** key followed by the appropriate numeric keys. All frequency entries and displays are in kHz. The possible zero in the 100 Hz position need not be entered. For example, 2100.0 kHz is entered by pressing **FREQ ENT** followed by **2, 1, 0,** and **0,** but 2100.6 kHz is entered by pressing **FREQ ENT** followed by **2, 1, 0, 0, •,** and **6.** Erroneous entries can be cleared by pressing the **FREQ ENT** key again.

NOTE

If the desired frequency is greater than 10000.0 kHz (10 MHz), the possible non-zero 100 Hz digit must be entered but the decimal point need not be entered. For example, to program 12345.6 kHz, press **FREQ ENT** followed by **1**, **2**, **3**, **4**, **5**, and **6**.

Step 8. Check the radio **A-B-C-D** switch and all of the programming board indicators to verify that the proper channel bank, channel number, transmission mode, half-duplex channel type, the proper (transmit or receive) side, and frequency have been entered properly. If an error is found, correct the error by repeating only those steps related to the error. For example, if the wrong transmission mode was entered, only Step 4 need be repeated.

Step 9. When all of the information has been checked and is correct, press the **PROG** key. The currently-displayed channel information will be loaded into the radio RAM for the selected channel and the programming board will revert to the verification mode.

NOTE

When in the verification mode on a half-duplex channel, the programming board normally displays the receive frequency. If only the transmit side of the channel has been programmed, the displays may flash to indicate currently invalid information for the receive side. If the display flashes after programming both the transmit and receive frequencies, refer to "Error Indications," paragraph 7 of this section.

Step 10. Recheck the displays and indicators to verify that the channel information was loaded correctly. Check the displays while pressing the **XMT MON** key to verify the transmit side information.

Step 11. Select the other side of the channel by pressing the **XMT/RCV** key to light the indicator for the unprogrammed side.

Step 12. Repeat Steps 7-10 to complete programming for the channel.

4.4 PROGRAMMING SPECIAL FUNCTION CHANNELS

Any channel can be programmed to be non-functional, transmit-only, or receive-only. To program a non-functional channel, program the channel as a simplex channel with 0 Hz for the operating frequency. To program a transmit-only or receive-only channel, program the channel as a half-duplex channel, entering the desired frequency for the operating side and 0 Hz for the non-operating side.

5. VERIFYING CHANNEL INFORMATION

5.1 When the programming board is in the verification mode, the current channel information for the selected channel is presented on the displays. The board initializes in the verification mode and reverts to the verification mode after each programming sequence.

5.2 When the programming board is verifying a simplex channel, the **SMPX** indicator is lit and complete channel information is displayed. When the board is verifying a half-duplex channel, the **DPLX** indicator is lit and receive frequency is normally displayed. To display the transmit frequency, press the **XMT MON** key or key the radio.

5.3 To verify a selected channel, perform the following procedure.

Step 1. Turn the radio on and select the appropriate channel bank. To verify channel 3A, select position **A** on the radio **A-B-C-D** switch.

Step 2. Turn the programming board on and enable the programming board by selecting channel 10 on the radio front panel. The programming board will initialize displaying the channel information for channel 10 of the selected bank.

Step 3. Press the **CHAN ENT** key followed by the desired channel number.

NOTE

The **CHAN ENT** key is not always necessary. Digits entered in the verification procedure are considered to be a channel number and are treated as such by the processor and display. **CHAN ENT** is necessary only if the operator wishes to correct an erroneous channel number.

Step 4. Press the **CHAN RCL** key. The channel information for the desired channel will be displayed. If the channel is a half-duplex channel, press **XMT MON** or key the radio to display the transmit frequency.

Step 5. To verify channel information for other channels in the same bank, either repeat steps 3 and 4 or use the **CHAN UP/CHAN DOWN** keys. To change channel banks, select the desired bank on the radio **A-B-C-D** switch. The channel information for the displayed channel number in the new bank will appear on the displays.

6. CONVENIENCE FEATURES

6.1 CHANNEL SELECTION

After programming or verifying a channel, the **CHAN UP** and **CHAN DOWN** keys may be used to

change the channel number (within the selected channel bank) without entering the new channel number. Pressing either key will increment or decrement the channel number by one and display the current channel information for that channel. If either key is held down, the function will repeat to allow scanning of information for all channels within the bank. If invalid information is detected during a scan, the scan will stop for a short period and the displays will flash to indicate the error. Refer to "Error Indications," paragraph 7 of this section. A new channel bank may be selected at any time by changing the setting of the radio front panel **A-B-C-D** switch.

6.2 REPROGRAMMING FREQUENCIES

Previously programmed operating frequencies for any channel can be changed while in the verification mode by using the **FREQ UP** and **FREQ DOWN** keys without entering and loading a new frequency value. Pressing either key will increment or decrement the displayed frequency by 100 Hz and automatically load the new value into the radio RAM. Holding either key down will repeat the function until the key is released. When reprogramming the transmit frequency of a half-duplex channel, the transmit side must be selected by using the **XMT MON** key.

6.3 **RSET** KEY

If the programming mode is entered inadvertently, the **RSET** key may be pressed to revert to the verification mode without loading any new channel information. The most recently displayed valid channel information will be returned to the displays.

6.4 DIMMING THE DISPLAY

In low ambient-light conditions, the **DIM** key may be pressed to dim the programming board displays. Pressing the key again will restore normal brightness. The radio front-panel displays are not affected by this key.

7. ERROR INDICATIONS

7.1 GENERAL

7.1.1 The processor routinely checks channel information for the channel being accessed during both programming and normal operation. If an error is detected, the processor will cause the receive audio path to be muted and disable the transmitter (PA). If the programming board is enabled while invalid channel information is accessed, the programming board displays will flash to indicate an error.

7.1.2 Two classes of errors can be detected — invalid programming entries and errors detected in channel information after valid programming. The two error classes are differentiated on the programming board by the state of the **KYBD ACSS** indicator. If the indicator is on, invalid programming (by the operator) is indicated. If the indicator is off, an error has been detected in data already in the RAM.

7.2 FLASHING DISPLAY WITH **KYBD ACSS** OFF

This condition indicates that an error has been detected in the channel information stored in the RAM. The probable causes of this indication follow.

Insufficient radio supply voltage — Verify that the input supply to the radio is within the recommended voltage range, 13.8 V dc ±20%.

Insufficient supply voltage to RAM — Verify that the dc supply regulation and filtering circuits in the radio are supplying proper voltages to the RAM/processor interface circuits, and the RAM itself while the radio is on. Also verify that the lithium backup battery provides is at least 2.2 V dc to the RAM with the radio off. If not, the battery must be replaced.

NOTE

In the event that the RAM dc supplies have failed, the channel information in RAM is lost and must be reprogrammed (for all channels).

Only one side of a half-duplex channel has been programmed — This indication can occur after pressing the **PROG** key to program the first side of a half-duplex channel which has never been programmed. Enter the appropriate information for the unprogrammed side.

7.3 FLASHING DISPLAY WITH **KYBD ACSS** ON

This condition indicates that the operator has attempted to program invalid data. The processor checked the data upon input, found an error, and therefore remained in the programming mode. The probable causes of this indication follow.

Channel number out of range — The displayed channel number is less than 1 or greater than 10. This condition can occur after pressing the **CHAN RCL, FREQ UP, FREQ DOWN, CHAN UP, CHAN DOWN** or **PROG** keys. Enter a valid channel number.

Frequency value out of range — The displayed frequency value is out of the operating range of the radio. Refer to Table 1. near the beginning of this section. Enter a valid frequency.

Invalid transmission mode selected — This condition normally occurs when accessing a channel that has never been programmed. Verify that one and only one transmission mode (**SSB/PLT/AME**) indicator is lit. If not, press (repeatedly if necessary) the **SSB/PLT/AME** until the desired transmission mode is indicated.

RADIO SET
THEORY OF OPERATION

1. GENERAL

The amplifier circuits in the radio are wideband amplifiers that eliminate the need for most tuning adjustments. Receiver selectivity and transmitter spurious emission attenuation are provided using switchable filters. Filter switching is performed by microprocessor-controlled filter range select lines and highly reliable hermetically sealed reed relays.

The transmitter and receiver share two common intermediate frequencies (11.4 and 75 MHz). They also share the use of the following common circuits: i-f mixer, 1st mixer, 2nd mixer, crystal filters, bidirectional amplifiers, and harmonic filters.

2. PROGRAMMING SIGNAL PATH

2.1 PROGRAMMING ("P") BOARD

When the front panel channel selector switch is set to channel 10 and the programming board switch is "on," the board is activated to allow the channel to be programmed. The display circuitry and the keyboard are used to enter the channel number, the carrier frequency, simplex or half-duplex channel type, and the SSB, pilot, or AME transmission mode.

2.2 SYNTHESIZER ("S") BOARD

The microprocessor monitors the keyboard on the programming board for entries and drives its display accordingly. The microprocessor also checks to verify that the display information is valid and loads that information into the CMOS RAM at a location determined by the displayed channel number and the setting of the **A/B/C/D** channel switch on the front panel. This information is stored in the CMOS RAM which is powered by a lithium battery when the radio is turned off or the power is disconnected. Refer to the Synthesizer ("S") Board section of this manual for detailed theory of operation.

3. RECEIVE SIGNAL PATH

(Refer to radio set block diagram.)

3.1 HARMONIC FILTER

Received signals from the antenna system are applied to the harmonic filter board. The harmonic filters provide rejection of frequencies above the filter range selected. In the receive mode, signals are coupled through the antenna relay to the front end bandpass filter on the "B" board.

3.2 "B" BOARD RECEIVE CIRCUITRY

The bandpass filter attenuates incoming receive signals that fall outside the operating frequency range of the radio. The output of the bandpass filter is applied to the rf attenuator (used with strong receiver signals) and the rf amplifier.

The squelch circuitry is also contained on the "B" board. When no voice information is being received, the squelch circuit generates an audio mute signal. This mute signal is applied to the "C" board to disable the audio at the speaker.

3.3 SYNTHESIZER ("S") BOARD RECEIVE CIRCUITRY

The "S" board contains four primary parts; a bidirectional 75 MHz i-f circuit with a bidirectional mixer at each end, two phase-locked synthesizers, each generating the injection signal for one of the mixers, and the microprocessor based control section. The "S" board performs two frequency conversions to interface the 11.4 MHz circuits to the HF-band circuits in both the transmit and receive modes; 11.4/75 MHz and 75 MHz/HF-band. A single microprocessor controls the two synthesizers to provide the appropriate injection frequencies. Refer to the Synthesizer ("S") Board section of this manual for detailed theory of operation.

3.4 NOISE BLANKER RECEIVE CIRCUITRY

When the noise blanker option is used (and selected by the front panel button), the 11.4 MHz i-f signal from the "S" board is applied to the noise blanker board. The circuitry on this board detects the

presence of noise impulses and prevents the noise from being heard in the speaker. If the noise blanker button is not selected (or the board is not used), the i-f receive signal from the "S" board is coupled unchanged to the bidirectional amplifier on the "A" board.

3.5 "A" BOARD RECEIVE CIRCUITRY

The 11.4 MHz i-f receive signal is applied to the bidirectional amplifier and is then passed through the 11.4 MHz crystal filter. Most of the receiver selectivity is provided by the crystal filter. From the crystal filter, the signal is applied to the i-f amplifier through another bidirectional buffer amplifier.

The i-f amplifier provides most of the gain of the receiver. The gain of the i-f amplifier is controlled by the receiver gain control (RGC) circuitry to provide a fairly constant output for wide input signal variations. From the i-f amplifier the signal goes to the i-f mixer.

An 11.4 MHz oscillator provides the injection for the i-f mixer. The signal and injection are mixed together to provide the receive audio. In this way, the mixer functions as the SSB audio product detector. The receive audio is then applied to the audio preamplifier, then to the active filter.

The "A" board also includes the oven circuitry to maintain the 11.4 MHz i-f oscillator crystal and the 9.216 MHz reference oscillator crystal at a constant 80 °C to insure proper stability.

3.6 LSB BOARD RECEIVE CIRCUITRY

When the LSB board option is used, the 11.4 MHz i-f receive signal can pass through one of two crystal filters. If the **LSB** front panel button is pressed, the upper sideband is stripped by the crystal filter on the LSB board. If the **LSB** button is not selected (or the LSB board is not used), the 11.4 MHz i-f receive signal will pass through the USB crystal filter on the "A" board.

3.7 "C" BOARD RECEIVE CIRCUITRY

The output of the active filter is applied through the ribbon cable to the volume control on the "C" board. From the volume control the signal goes to the audio amplifier stages and out to the 2-ohm speaker. The "C" board also contains the channel selector switch, **A/B/C/D** channel switch, **SQ** (squelch) switch, **Clarifier** control, transmit and power-on lamps, **DIM** (dimmer) switch, or **USB/LSB** (sideband) switch external audio output jack, and **NB** (noise blanker) switch.

4. TRANSMIT SIGNAL PATH

4.1 "A" BOARD TRANSMIT CIRCUITRY

Transmit audio from the microphone is applied to an audio amplifier and onto the i-f mixer. The transmit gain control (TGC) senses the output level of the transmit i-f signal and varies an attenuator at the input of the audio amplifier to maintain a nearly constant level of audio into the i-f mixer.

The i-f injection and transmit audio are applied to the i-f mixer where the output is an 11.4 MHz suppressed carrier double sideband signal. This signal is applied to the crystal filter through the bidirectional buffer amplifier. The crystal filter strips off the unwanted sideband and the desired sideband is then applied to the 2nd mixer through the bidirectional buffer amplifier. Also, at this point, 11.4 MHz carrier is re-inserted if either AME or pilot is programmed.

4.2 LSB BOARD TRANSMIT CIRCUITRY

As described in the receive path, the signal may pass through one of two possible crystal filters. If the LSB board option is used (and the **LSB** front panel button is pressed), the upper sideband will be stripped off. If the **LSB** button is not selected (or the LSB board is not used), the lower sideband will be stripped off.

4.3 SYNTHESIZER ("S") BOARD TRANSMIT CIRCUITRY

The "S" board contains four primary parts; a bidirectional 75 MHz i-f circuit with a bidirectional mixer at each end, two phase-locked synthesizers, each generating the injecton signal for one of the mixers, and the microprocessor based control section. The "S" board performs two frequency conversions to interface the 11.4 MHz circuits to the HF-band circuits in both the transmit and receive modes; 11.4/75 MHz and 75 MHz/HF-band. A single microprocessor controls the two synthesizers to provide the appropriate injection frequencies. Refer to the Synthesizer ("S") Board section of this manual for detailed theory of operation.

4.4 "B" BOARD TRANSMIT CIRCUITRY

The operating frequency signal then goes to the exciter filter which attenuates any components above the highest carrier frequency. From here the signal is applied to a 2-stage exciter amplifier. The output of the exciter is routed by coax cable to the PA input.

4.5 POWER AMPLIFIER BOARD CIRCUITRY

The exciter output is amplified to the rated power level by the power amplifier and applied to the harmonic filter (HF) board.

The PA board also contains automatic level control (ALC) circuitry to ensure proper PA operation and protection. ALC circuitry monitors forward and reflected power levels (from a VSWR detector on the harmonic filter board), and heatsink temperature. Power is reduced if either:

a. heatsink temperature becomes excessive,
b. forward power is low out of the harmonic filter,
c. reverse power is excessive, or
d. the output transformer temperature becomes excessive.

The ALC circuit can also switch the power amplifier to a low power mode (4 watts) when a ground is applied to J10 pin 3. This is an appropriate level for antenna tuner adjustments.

4.6 HARMOINC FILTER BOARD CIRCUITRY

From the PA, the transmit signal is routed to the harmonic filter. The harmonic filter consits of five separate filters, each covering a portion of the entire transmitter frequency range. The appropriate filter is selected by sealed relays which are ultimately controlled by the microprocessor through circuitry on the "S" and "A" board.

From the harmonic filter, the transmit signal is applied to the antenna relay and routed to the antenna connector.

5. REFERENCE DIAGRAMS

Radio Set Block Diagram DEPS-33625

"A" Board
("D" Board Section) Schematic Diagram and
Circuit Board Detail. . . . PEPS-33805 (Sheet 1 of 4)
Circuit Board Detail. . . . . (Sheet 2 of 4)
Schematic Diagram. . . . . (Sheets 3 & 4 of 4)

"B" Board
Circuit Board Detail PEPS-33806
Schematic Diagram. EEPS-33493

"C" Board
Circuit Board Detail PEPS-33807
Schematic Diagram DEPS-33430

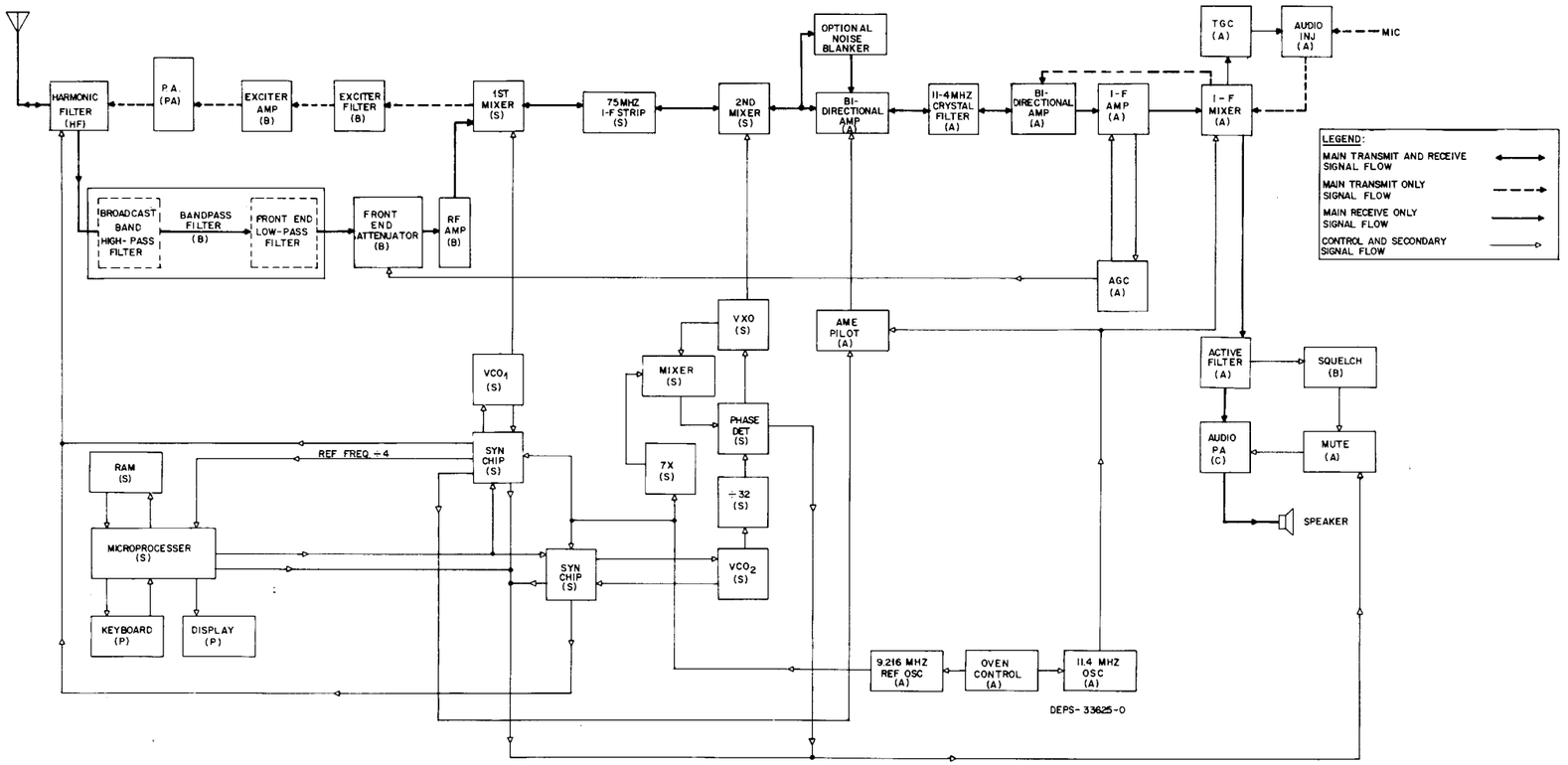
Harmonic Filter Board
Circuit Board Detail PEPS-33808
Schematic Diagram DEPS-29097

125/150 W Power Amplifier Board
Circuit Board Detail PEPS-33809
Schematic Diagram. EEPS-33397

100 W Power Amplifier Board
Circuit Board Detail PEPS-29305
Schematic Diagram. EEPS-29101

Noise Blanker Board
Circuit Board Detail PEPS-33879
Schematic Diagram DEPS-33422

Lower Sideband Board (LSB)
Schematic Diagram and
Circuit Board Detail PEPS-33880



Radio Set Block Diagram
Motorola No. ***DEPS-33625-O***
1/29/82- PHI

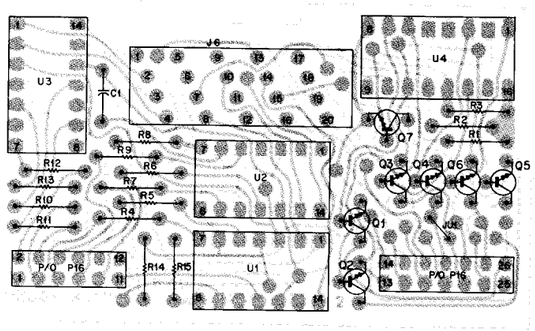
"A" BOARD
("D" BOARD DETAILS)
MODEL TRN4954A

parts list

1-80762D03 "D" Board (P/O TRN4954A "A" Board) PL-7845-O

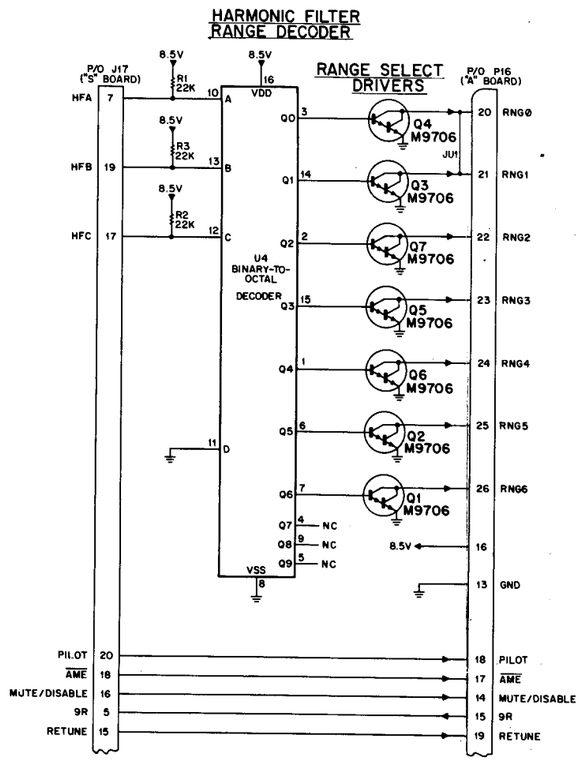
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C1	21-83596E21	.01 uF +80-20%; 200 V
		connector, receptacle:
J6	30-83265M08	CABLE, flat; with connector; 20-contact
J10A	28-83579M06	male; 12-contact
J10B	28-83579M05	male; 14-contact
		transistor: (see note)
Q1 thru 7	48-869706	Darlington; M9706
		resistor, fixed:
R1 thru 15	6-185A81	22k ± 5%; 1/4 W
		integrated circuit: (see note)
U1, 2, 3	51-84371K74	comparator
U4	51-82884L09	binary-octal decoder

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

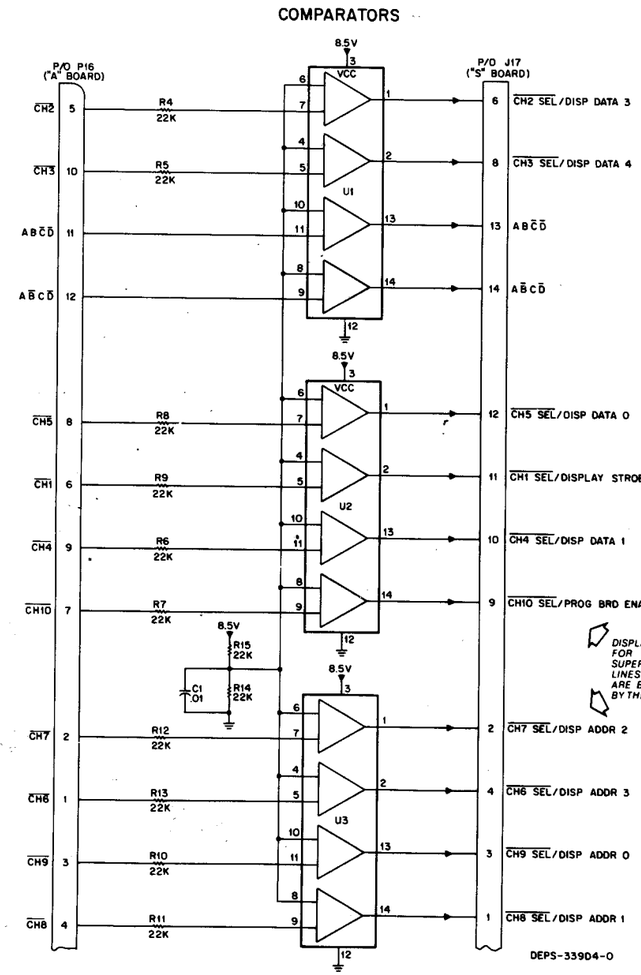


SHOWN FROM COMPONENT SIDE

COMPONENT SIDE = BD-BEPS-33692-O
SOLDER SIDE BD-BEPS-33693-O
OL-CEPS-33694-O



NOTES:
1. UNLESS OTHERWISE STATED, RESISTOR VALUES ARE IN OHMS AND CAPACITOR VALUES ARE IN MICROFARADS.



parts list

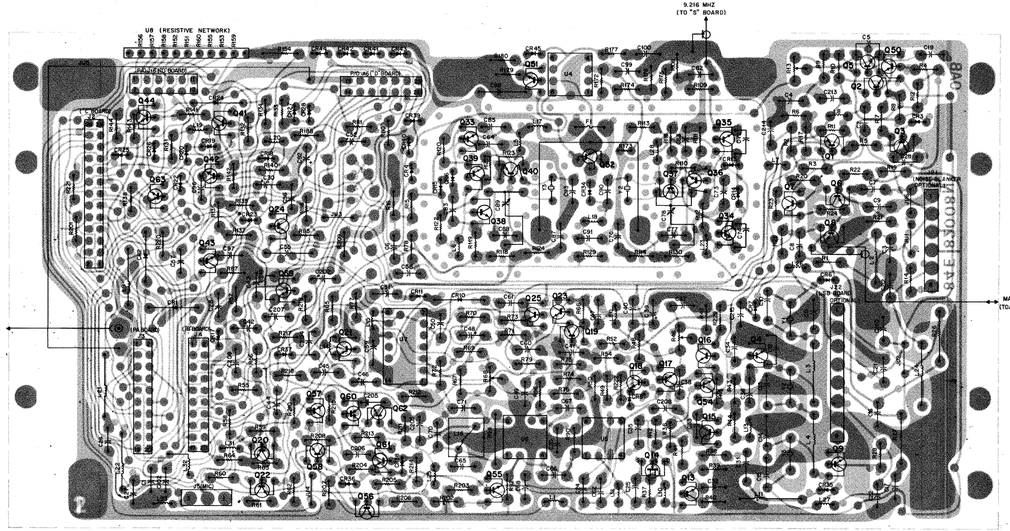
TRN4954A "A" Board — PL-7846-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ± 10%; 50 V; unless otherwise stated
C1	8-11017B08	.01
C2	21-11014A25	10 pF ± 0.5 pF; 100 V
C3	21-11014A49	100 pF ± 5%; 100 V
C4	8-11017B14	.047
C5 thru 9	8-11017B08	.01
C10	21-82355B30	2.7 pF ± 0.1 pF; 500 V
C11 thru 14	21-82204B48	30 pF ± 2%; 500 V
C15	21-82355B30	2.7 pF ± 0.1 pF; 500 V
C16 thru 19	8-11017B08	.01
C20	21-11015B15	.0015; 100 V
C21, 22	8-11017B08	.01
C24	21-11015B15	.0015; 100 V
C25	8-11017B08	.01
C26, 27, 28	8-11017B14	.047
C30	23-11013D01	1; 20 V
C31	21-847091	80 pF ± 2%; 300 V
C32 thru 37	8-11017B08	.01
C38	21-11014A49	100 pF ± 5%; 100 V
C39	23-11013D15	15; 20 V
C40, 41	8-11017B08	.01
C42	23-11013D01	1; 20 V
C43	8-11017B08	.01
C44	23-11013D15	15; 20 V
C45	8-11017B08	.01
C46	23-11013D01	1; 20 V
C47	8-11017B08	.01
C48	23-11013C56	22 ± 20%; 15 V
C49	8-11017B08	.01
C50	8-11017B14	.047
C51	8-11017B08	.01
C52	23-11019A26	15; 20 V
C55	8-82905G04	.068
C56	8-11017B05	.0033
C57	8-11017B17	0.1
C58	8-11017B08	.01
C59	8-11017B14	.047
C60 thru 65	8-11017B08	.01
C66, 67	21-11015B15	.0015; 100 V
C68, 69	8-11017B08	.01
C70	21-84694B19	470 pF ± 5%; 300 V
C71	21-11014A49	100 pF ± 5%; 100 V
C72, 73, 74	8-11017B08	.01
C76	21-84494B19	470 pF ± 5%; 300 V
C77	21-840895	27 pF ± 5%; 500 V
C78	20-84546K01	variable; 2.5-15.5 pF
C82, 83	8-11017B08	.01
C85	8-11017B08	.01
C87	21-84494B18	390 pF ± 5%; 500 V
C88	21-83406D77	30 pF ± 5%; 500 V
C89	20-84546K01	variable; 2.5-15.5 pF
C90	8-11017B08	.01
C91	21-11015B15	.0015; 100 V
C92	23-11013D15	15; 20 V
C93	21-11022G57	120 pF ± 5%
C96	23-84668A25	15 + 150-10%; 25 V
C97	8-11017B08	.01
C98	21-82872C05	0.2 + 80-20%; 25 V
C99, 100	8-11017B08	.01
C102	8-11017B14	.047
C200	8-11017B14	.047
C201	23-11013D01	1; 20 V
C202	23-11013D09	4.7; 20 V
C203	21-11014A25	10 pF ± 0.5 pF; 100 V
C205	21-11014A41	47 pF ± 5%; 100 V
C206	21-11015B15	.0015; 100 V
C207	23-11013D01	1; 20 V
C208	21-11015B15	.0015; 100 V
C210 thru 215	8-11017B08	.01
		diode: (see note)
CR1 thru 4	48-83654H01	silicon
CR6, 7, 8	48-83654H01	silicon
CR10, 11	48-83654H01	silicon
CR13 thru 20	48-83654H01	silicon
CR22 thru 28	48-83654H01	silicon
CR34	48-82190H18	varactor; 4 V
CR35 thru 44	48-83654H01	silicon
		fuse:
F1	65-83964K01	thermal; 109°C
		connector, receptacle:
J2	28-83579M02	male; 26-contact
J3, 4	28-83579M01	male; 20-contact
J5	28-83496F28	male; 3-contact
J8	28-83447L13	male; 8-contact
J9	28-83447L12	male; 6-contact
		coil, rf:
L1	24-82549D37	choke; 100 uH
L2	24-82723H04	choke; 0.29 uH
L3, 4	24-83368M01	choke; 5.3 uH
L5 thru 8	24-82549D37	choke; 100 uH
L9	24-83961B01	3 turns; bead
L10	24-82549D37	choke; 100 uH
L11	24-82835G08	choke; 2.6 uH
L12 thru 15	24-82549D37	choke; 100 uH
L16	24-83471M02	variable; 2.17
L17 thru 33	24-82549D37	choke; 100 uH
		connector, plug:
P112, 114	28-82365D02	male; single contact
		transistor: (see note)
Q1	48-869571	PNP; type M9571
Q2 thru 5	48-869570	NPN; type M9570
Q6, 7, 8	48-869571	PNP; type M9571
Q9	48-869494	NPN; type M9494
Q13	48-869570	NPN; type M9570
Q14	48-869839	field-effect; M9839
Q15, 16	48-869570	NPN; type M9570
Q17	48-869571	PNP; type M9571
Q18	48-869570	NPN; type M9570
Q19	48-869494	NPN; type M9494
Q20	48-134667	NPN; type M54 (GRN)
Q21	48-869571	PNP; type M9571
Q22	48-134667	NPN; type M54 (GRN)
Q23, 24, 25	48-869570	NPN; type M9570
Q33, 34	48-869571	PNP; type M9571
Q35, 36	48-869570	NPN; type M9570
Q37	48-869494	NPN; type M9494
Q38	48-869570	NPN; type M9570
Q39, 40	48-869494	NPN; type M9494
Q41	48-869571	PNP; type M9571
Q42, 43	48-869706	Darlington; type M9706
Q44	48-869570	NPN; type M9570
Q50	48-869571	PNP; type M9571
Q51	48-869570	NPN; type M9570
Q52	48-869807	NPN; type M9807
Q54, 55, 56	48-869570	NPN; type M9570
Q57	48-869571	PNP; type M9571
Q58	48-869570	NPN; type M9570
Q59	48-869571	PNP; type M9571
Q60	48-869570	NPN; type M9570
Q61, 62	48-869571	PNP; type M9571
Q63	48-869706	Darlington; type M9706
Q65	48-869570	NPN; type M9570
		resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R1	6-11009E23	82
R2	6-11009E71	8.2k
R3	6-11009E53	1.5k
R4	6-11009E73	10k
R5	6-11009E61	3.3k
R6	6-11009E57	2.2k
R7	6-11009E29	150
R8	6-11009E37	330
R9	6-11009E57	2.2k
R10	6-11009E71	8.2k
R11	6-11009E49	1k
R12	6-11009E77	15k
R13	18-83452F02	variable; 2k
R14	6-11009E17	47
R15	6-11009E57	2.2k
R16	6-11009E73	10k
R17	6-11009E61	3.3k
R19	6-11009E35	270
R20	6-11009E51	1.2k
R21	6-11009E63	3.9k
R22	6-11009E49	1k
R23	6-11009E35	270
R24	6-11009E39	390
R25	6-11009E41	470
R26	6-11009E39	390
R27	6-11009E49	1k
R28	6-11009E65	4.7k
R36	6-11009E73	10k
R37	6-11009E57	2.2k
R38	6-11009E23	82
R39	6-11009E35	270
R40	6-11009E49	1k
R41	6-11009E63	3.9k
R42	6-11009E49	1k
R43	6-11009E37	330
R44	6-11009E49	1k
R45	6-11009E41	470
R46	18-83452F10	variable; 1k
R47	6-11009E57	2.2k
R48	6-11009E73	10k
R49	6-11009E57	2.2k
R50	6-11009E85	33k
R52	6-11009E73	10k
R54	6-11009E61	3.3k
R55	6-11009E43	560
R56	6-11009E69	6.8k
R57	6-11009E73	10k
R58	6-11009E17	47
R59	6-11009E49	1k
R60	6-11009E71	8.2k
R61	6-11009E49	1k
R62	6-11009E17	47
R63	6-11009E61	3.3k
R64	6-11009E53	1.5k
R65	6-11009E43	560
R66	6-11009E49	1k
R67	6-11009E71	8.2k
R68	18-83452F12	variable; 5k
R69	6-11009A71	8.2k
R70	6-11009E17	47
R71, 72, 73	6-11009E49	1k
R74	6-11009E57	2.2k
R75	6-11009E47	820
R76	6-11009E61	3.3k
R77, 78	6-11009E49	1k
R79	6-11009E65	4.7k
R80	6-11009E49	1k
R81	6-11009E17	47
R85	6-11009E57	2.2k
R86	6-11009E63	3.9k
R87	6-11009E57	2.2k
R90	6-11009E23	82
R92	6-11009E17	47
R94	6-11009A71	8.2k
R96	6-11009E65	4.7k
R108	6-11009E39	390
R109, 110	6-11009E83	22
R111	6-11009E41	470
R112	6-11009E35	270
R113	6-11009E39	2.2k
R114	6-83175C97	4.75k ± 1%
R116	6-13755C67	5.62k ± 1%
R118	6-11009E39	390
R119	6-11009E29	150
R120	6-11009E33	220
R122	6-11009E35	270
R123	6-11009E57	2.2k
R124	6-83175C97	4.75k ± 1%
R125	6-13755C67	5.62k ± 1%
R128	6-83175C22	17.4k ± 1%
R129	6-11009E49	1k
R130	6-10621D09	15.0k ± 1%
R131	6-11009E37	330
R132	6-11009E47	820
R133	6-11009E73	10k
R134	6-11009E37	330
R135	6-11009E85	33k
R136	6-11009E77	15k
R137	6-11009E85	33k
R138	6-11009E73	10k
R140	6-11009E73	10k
R141	6-11009E85	33k
R142	6-11009E43	560
R143, 144	6-11009E73	10k
R151, 152, 153	51-82142K02	100k; resistor network
R154	6-11009E97	100k
R155 thru 160	51-82142K02	100k; resistor network
R172	6-83175C03	10.0k ± 1%
R174	6-10621A97	100 ± 1%; 1/8 W
R175, 176	6-83175C03	10.0k ± 1%
R177	6-10621D36	28.7k ± 1%; 1/8 W
R179	6-11009E31	180
R180	6-11009E23	82
R201	6-11009E65	4.7k
R202	6-11009E91	56k
R203	6-11009E57	2.2k
R204	6-11009E71	8.2k
R205	6-11009E37	330
R206	6-11009E49	1k
R207	6-11009E73	10k
R208	6-124B30	2.2 meg.
R209	6-11009E73	10k
R210	6-11009F16	560k
R211	6-11009E97	100k
R212	6-11009E91	56k
R213	6-11009E65	4.7k
R214	6-11009E85	33k
R215	6-11009E29	150
R216	6-124B30	2.2 meg.
R217	6-11009E09	22
R218	6-11009F16	560k
R219	6-124B30	2.2 meg.
R220	6-11009E57	2.2k
R221	6-11009E65	4.7k
R222	6-11009E39	390
R229	6-11009E25	100
		thermistor:
RT173	6-83600K04	10k @ 80°C
		integrated circuit: (see note)
U4	51-84320A13	operational amplifier (oven control)
U5, 6	51-84320A62	i-f amplifier
U7	51-83222M05	i-f mixer
		voltage regulator: (see note)
VR45	48-82256C26	Zener type; 3.3 V
		crystal: (see note)
Y1	91-83365M02	11.4 MHz crystal filter
Y2	48-83965K11	9.216 MHz ref. osc.
Y3	48-83965K12	11.400 MHz i-f osc.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		non-referenced items
	9-83533H13	RECEPTACLE, female; 2 used
	14-84540B01	INSULATOR; 3 used
	14-84602K02	INSULATOR
	26-82671D27	SHIELD, coil
	42-82371N01	CLIP, crystal; 2 used
	1-80760D64	ASSEMBLY, oven "A" board; includes:
	3-2950	SCREW, machine; 4-40 x 1/4" (oven)
	7-82369N01	BRACKET, mounting (oven)
	1-80760D79	ASSEMBLY, cable coax ref. osc.; includes:
	4-7607	WASHER, flat
	5-136977	EYELET
	30-83794C01	CABLE, coaxial; 10"; WHT
	42-84733F01	RING, refer P112
	1-80760D63	ASSEMBLY, coax; i-f input; includes:
	4-7607	WASHER, flat
	5-136977	EYELET
	30-83794C01	CABLE, coaxial (WHT); 4-1/2"
	42-84733F01	RING

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

"A" BOARD
MODEL TRN4954A



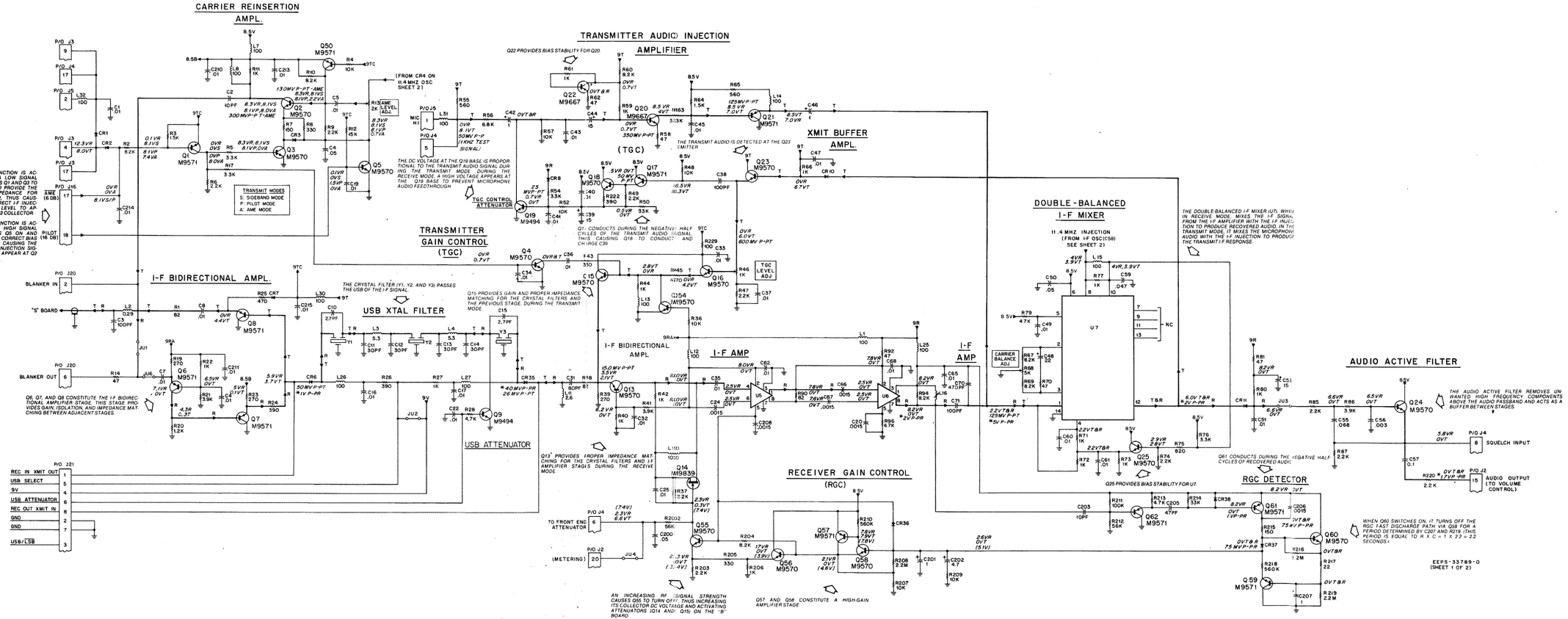
SHOWN FROM COMPONENT SIDE

COMPONENT SIDE = 8D-EEPS-33786-O
SOLDER SIDE = 8D-EEPS-33787-O
OL-EEPS-33788-O

"A" BOARD

Motorola No. PEPS-33805-O
(Sheet 2 of 4)
1/29/82- PHI

"A" BOARD
MODEL TRN4954A



Motorola No. PEPS-33805-O
(Sheet 3 of 4)
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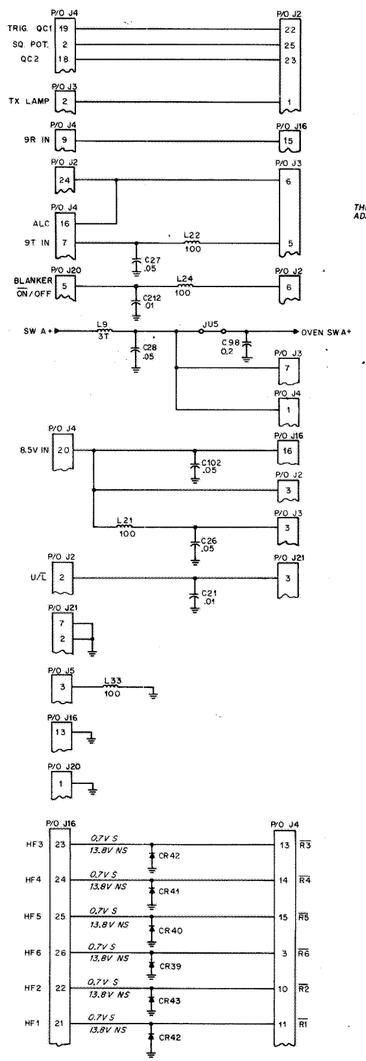
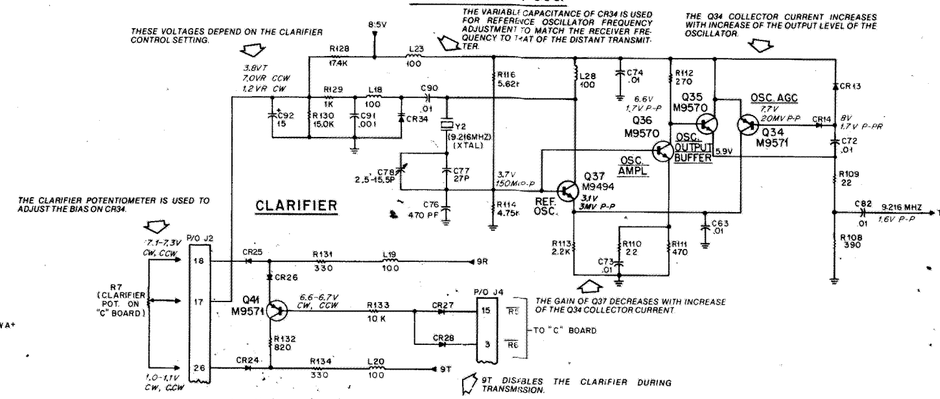
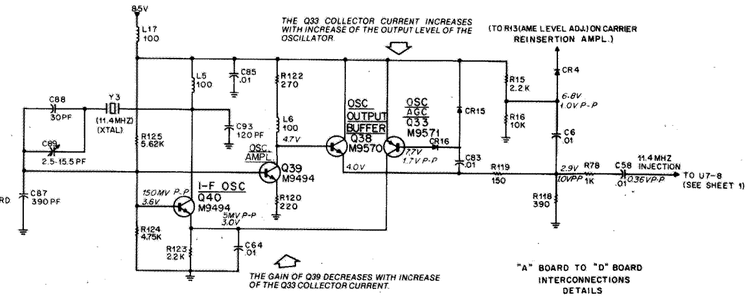
"A" BOARD INTERCONNECTION DETAILS



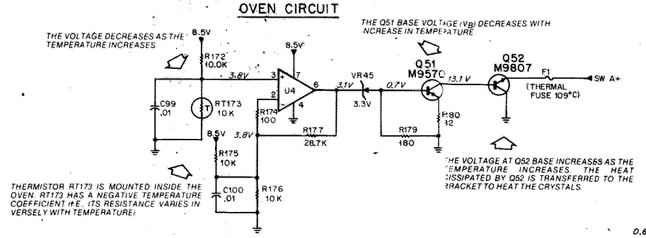
9.216 MHZ REF. OSC.



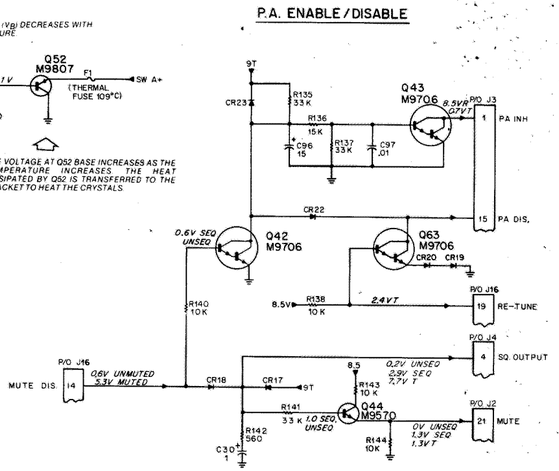
11.4 MHZ I-F OSCILLATOR



OVEN CIRCUIT

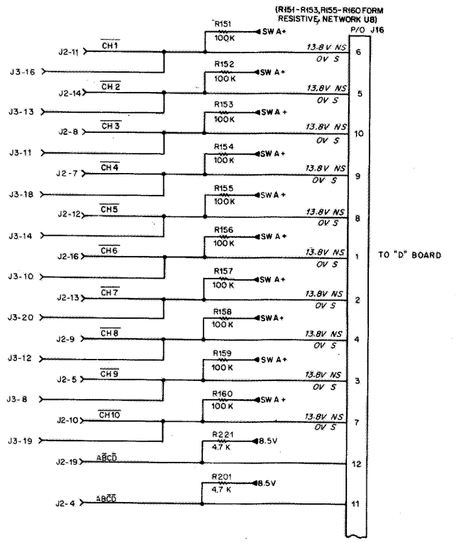


P.A. ENABLE/DISABLE



"A" BOARD TO "D" BOARD INTERCONNECTIONS DETAILS

(R151-R153,R155-R160 FORM RESISTIVE NETWORK U8)



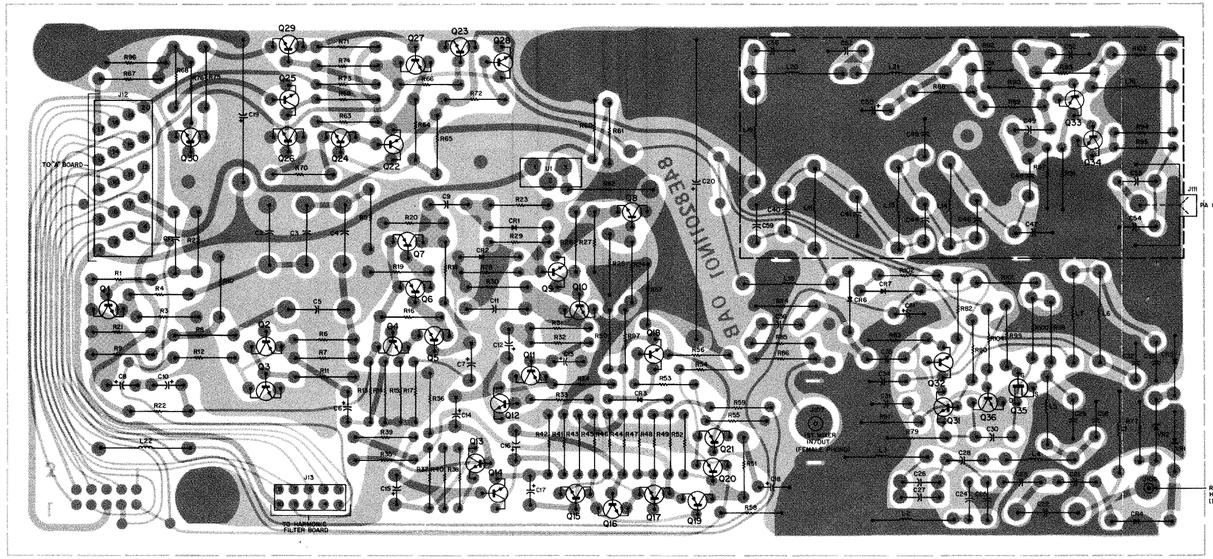
LEGEND:
- THEORY NOTE
- PRIMARY SIGNAL FLOW
- SECONDARY SIGNAL FLOW

EEPS-33789-O
(SHEET 2 OF 2)

"A" BOARD/"B" BOARD

Motorola No. PEPS-33805-O
(Sheet 4 of 4)
1/29/82-PHI

"B" BOARD
MODEL TRN4955A



SHOWN FROM COMPONENT SIDE

COMPONENT SIDE = 8D-EEPS-33571-O
SOLDER SIDE = 8D-EEPS-33572-O
OL-EEPS-33573-O

Motorola No. PEPS-33806-O
1/29/82- PHI

parts list

TRN4955A "B" Board — PL-7818-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ± 20%; 50 V; unless otherwise stated
C1	8-82905G04	.068 ± 10%
C2 thru 5	8-83813H15	.015 ± 5%
C6	23-11019A09	1.0
C7	23-84538G25	33 ± 10%; 10 V
C8	23-11019A38	47; 10 V
C9	21-82187B20	.001 ± 10%; 100 V
C10	23-11019A38	47; 10 V
C11	8-84637L06	.0068 ± 5%; 500 V
C12	23-11019A11	2.2
C13	23-11019A09	1.0
C14 thru 17	23-11019A38	47; 10 V
C18	23-11019A11	2.2; 50 V
C19	23-84668A19	100 + 150-10%; 20 V
C20	23-83210A24	1000 + 150-10%; 20 V
C21	21-82187B27	.002 ± 10%; 100 V
C22	8-82905C14	.01 ± 10%; 100 V
C23	21-82187B20	.001 ± 10%; 100 V
C24	21-84426B73	1500 pF ± 2%; 100 V
C25	21-82187B20	.001 ± 10%; 100 V
C26	21-82187B27	.002 ± 10%; 100 V
C27	21-82187B22	270 pF ± 10%; 200 V
C28	21-82187B31	1500 pF ± 10%; 100 V
C29	21-84857K14	130 pF ± 3%; 300 V
C30 thru 36	21-82372C10	.05; 25 V
C40	21-851846	8 pF ± 0.25 pF; 500 V
C41	21-84494B51	180 pF ± 5%; 500 V
C44	21-83406D39	33 pF ± 5%; 500 V
C45	21-84494B51	180 pF ± 5%; 500 V
C46	21-84493B02	22 pF ± 5%; 200 V
C47	21-82610C71	90 pF ± 5%; 200 V
C48, 49	21-82372C10	.05; 25 V
C50	23-11019A16	4.7; 35 V
C51	21-82372C10	.05; 25 V
C52	21-83596E21	.01 + 80-20%; 200 V
C54	21-84493B14	68 pF ± 5%; 200 V
C55	21-832502	.02 + 60-40%; 250 V
C56	21-83596E21	.01 + 80-20%; 200 V
C57	21-82372C10	.05; 25 V
C58	21-84857K14	130 pF ± 3%; 300 V
C59	21-82610C71	90 pF ± 5%; 200 V
C61	23-11019A05	0.33
		diode: (see note)
CR1, 2, 3	48-83654H01	silicon
CR4, 5	48-82466H13	silicon
CR6, 7	48-83654H01	silicon
		connector, receptacle:
J12	30-83265M02	20-conductor flat cable with connector
J13	28-83579M03	male; 10-contact
J106	29-855943	terminal, pin
J107	9-82615F01	female; single contact
J111	9-83250M01	female; single contact phono
		coil, rf:
L1	24-82835G11	choke; 3.5 uH
L2	24-84250D02	choke; 6.8 uH
L3	24-82723H37	choke; 6.2 uH
L4, 5	24-82723H36	choke; 0.41 uH
L6, 7	24-82549D37	choke; 100 uH
L11	24-82549D39	choke; 0.33 uH
L13, 14	24-82549D39	choke; 0.33 uH
L16	24-82835G30	choke; 1.3 uH
L18, 19, 20	24-82549D37	choke; 100 uH
L21	24-83961B01	3 turns
L22	24-82549D37	choke; 100 uH
		connector, plug:
P4	30-83265M02	20-conductor flat cable with connector
		transistor: (see note)
Q1	48-869642	NPN; type M9642
Q2	48-869643	PNP; type M9643
Q3, 4, 5	48-869642	NPN; type M9642
Q6, 7	48-869643	PNP; type M9643
Q8, 9	48-869642	NPN; type M9642
Q10, 11	48-869643	PNP; type M9643
Q12 thru 17	48-869642	NPN; type M9642
Q18	48-869570	NPN; type M9570
Q19, 20, 21	48-869643	PNP; type M9643
Q22	48-869649	PNP; type M9649
Q23 thru 26	48-869642	NPN; type M9642
Q27	48-869649	PNP; type M9649
Q28, 29, 30	48-869642	NPN; type M9642
Q31, 32	48-869570	NPN; type M9570
Q33	48-869795	PNP; type M9795
Q34	48-869662	NPN; type M9662
Q35	48-869839	field-effect
Q36	48-869570	NPN; type M9570

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R1, 2	6-11009A89	47k
R3	6-11009A57	2.2k
R4	6-11009A61	3.3k
R5	6-11009A77	15k
R6, 7	6-11009A75	12k
R8	6-11009A96	91k
R9, 10	6-11009A82	24k
R11	6-11009A73	10k
R12	6-11009A65	4.7k
R13, 14	6-11009A89	47k
R15	6-11009A57	2.2k
R16	6-11009A45	680
R17	6-124B55	2.7
R18	6-11009A97	100k
R19, 20	6-11009A69	6.8k
R21	6-11009A41	470
R22	6-11009A25	100
R23	6-11009A85	33k
R24	6-11009A91	56k
R25	6-11009A75	12k
R26	6-11009A85	33k
R27	6-11009A57	2.2k
R28, 29	6-11009A81	22k
R30	6-11009A61	3.3k
R31, 32	6-11009A85	33k
R33	6-11009A73	10k
R34	6-11009A49	1k
R35	6-11009A83	27k
R36	6-11009A75	12k
R37	6-11009A57	2.2k
R38	6-11009A49	1k
R39	6-11009A81	22k
R40	6-11009A75	12k
R41, 42	6-11009A57	2.2k
R43, 44	6-11009A85	33k
R45	6-11009A97	100k
R46	6-11009A75	12k
R47	6-11009A71	8.2k
R48	6-11009A81	22k
R49	6-11009A79	18k
R50	6-11009A69	6.8k
R51	6-11009A57	2.2k
R52	6-11009B14	470
R53	6-11009A97	100k
R54	6-11009A91	56k
R55	6-11009A85	33k
R56	6-11009A89	47k
R57	6-11009A81	22k
R58	6-11009A89	47k
R59	6-11009A83	3.9k
R60	6-11009A19	56
R61	6-11009A49	1k
R62	6-125D70	1; 1/2 W
R63	6-11009A97	100k
R64	6-11009B04	180k
R65, 66	6-11009A81	22k
R67	6-11009A71	8.2k
R68	6-11009A49	1k
R69	6-11009A81	22k
R70	6-11009A55	1.8k
R71	6-11009A97	100k
R72	6-11009A81	22k
R73	6-11009B04	180k
R74	6-11009A81	22k
R75	6-11009A55	1.8k
R76	6-11009A49	1k
R77	6-11009A97	100k
R79	6-11009A35	270
R80	6-11009A57	2.2k
R81	6-11009A51	1.2k
R82	6-11009A35	270
R83	6-11009A33	220
R84	6-11009A45	680
R85	6-11009A13	33
R86	6-11009A25	100
R87	6-11009A19	56
R88	6-11009A67	5.6k
R89	6-11009A69	6.8k
R90	6-11009A85	33k
R91	6-11009A45	680
R92	6-11009A31	180
R93	6-11009A17	47
R94	6-11009A45	680
R95	6-11009A09	22
R96	6-11009A49	1k
R97	6-11009A85	33k
R98	6-11009A51	1.2k
R99	6-11009A65	4.7k
R100	6-11009A51	1.2k
R101	6-11009A57	2.2k
R102	6-11009A73	10k
R103	6-11009A43	560
R104	6-11009A73	10k

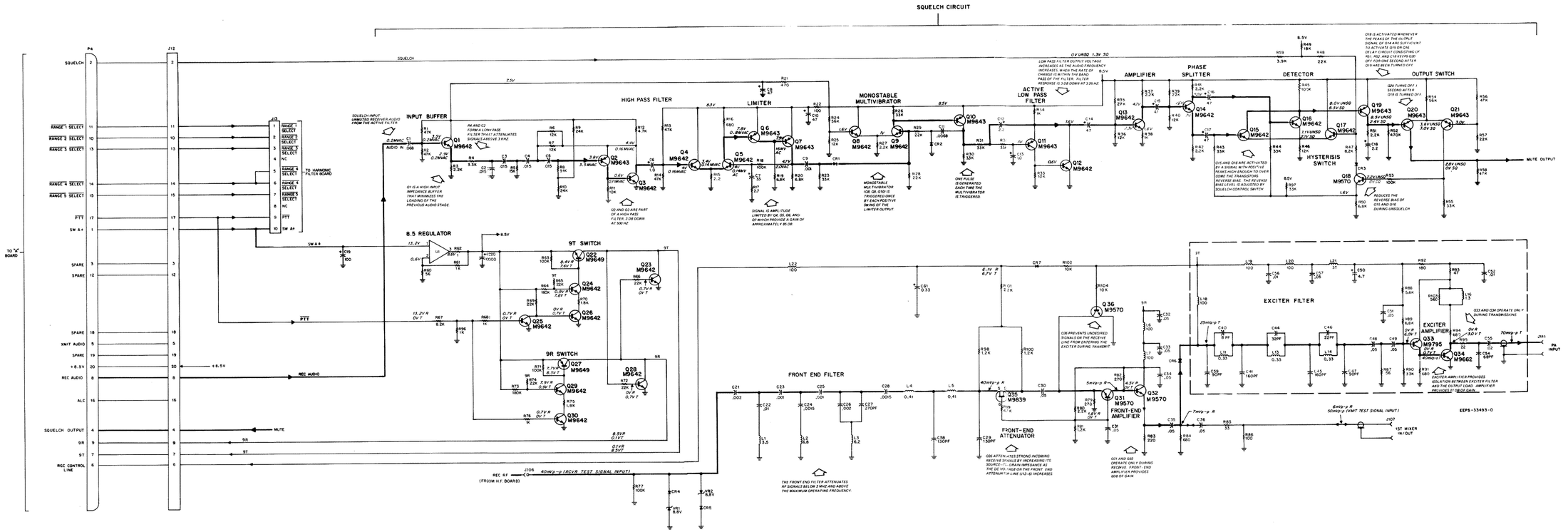
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
U1	51-84621K25	**integrated circuit: (see note)** voltage regulator
		voltage regulator:
VR1, 2	48-82256C56	Zener type; 8.8 V

		mechanical parts
	2-7019	NUT, 4-40 x 1/4 x 3/32"
	3-139506	SCREW, tapping; 4-40 x 5/16"
	4-7683	LOCKWASHER, #4 internal
	4-84180C01	WASHER, shoulder
	26-83249M01	SHIELD
	75-84380F01	BUMPER, plug; 3 used

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

"B" BOARD

MODEL TRN4955A



NOTES

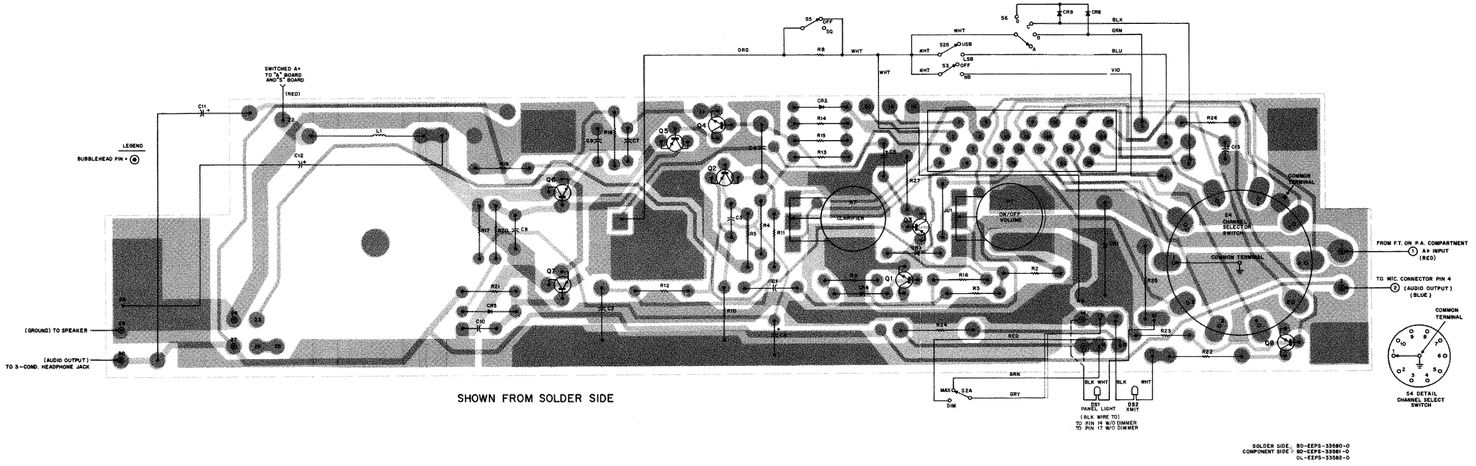
1. UNLESS OTHERWISE NOTED ALL RESISTOR VALUES ARE IN OHMS, CAPACITOR VALUES ARE IN MICROFARADS, AND INDUCTOR VALUES ARE IN MICROHENRYES.
2. DC VOLTAGES ARE MEASURED WITH A DMM.
3. RECEIVE AMPLIFIER VOLTAGES ARE MEASURED WITH A 60 MV P-P 5 MHZ RCV TEST SIGNAL APPLIED TO THE REC RF INPUT. EXCITER AMPLIFIER VOLTAGES ARE MEASURED WITH A 50 MV P-P 5 MHZ XMIT TEST SIGNAL APPLIED AT THE 1ST MIXER IN/OUT PORT.
4. AC VOLTAGES ON D1 THROUGH D7 ARE MEASURED WITH A 1 KHZ 0.2 MV AC TEST SIGNAL AT THE INPUT. READINGS ARE RMS VALUES. A DMM IS USED FOR THESE MEASUREMENTS.

"B" BOARD/"C" BOARD

Motorola No. EEPS-33493-O
1/29/82- PHI

"C" BOARD

MODEL TRN4956A



SHOWN FROM SOLDER SIDE

parts list

TRN4956A "C" Board PL-7915-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF, unless otherwise stated
C1, 2	8-82905G11	.22 ± 10%; 50 V
C3	21-83596E21	.01 + 80-20%; 200 V
C4	8-82905G41	.39 ± 10%; 50 V
C5	23-84665F05	4.7 ± 20%; 16 V
C6	23-11019A40	.47 ± 20%; 16 V
C7	21-83596E21	.01 + 80-20%; 200 V
C8, 9, 10	21-82372C10	.05 ± 20%; 25 V
C11	23-84665F17	1500 ± 20%; 16 V
C12	23-84665F30	2200 ± 20%; 25V
C13	23-11019A27	22 ± 20%; 25 V
		diode: (see note)
CR1	48-82525G13	silicon
CR2	48-82392B12	silicon
CR3, 4, 5	48-83654H01	silicon
CR6, 7	48-82178A04	germanium
		lamp, incandescent:
DS1, 2	65-84991B03	.08A, 14 V
		connector, receptacle:
J1	30-83265M03	p/o 26-conductor cable
		coil, rf:
L1	24-82190C15	1.2 uH
		connector, plug:
P1		p/o 26-conductor cable
		transistor: (see note)
Q1	48-869642	NPN; type M9642
Q2	48-869528	NPN; type M9528
Q3	48-869642	NPN; type M9642
Q4	48-869528	NPN; type M9528
Q5	48-869432	PNP; type M9432
Q6	48-869806	NPN; type M9806
Q7	48-869807	PNP; type M9807
Q8	48-869648	NPN; type M9648
		resistor, fixed: ± 5%; 1/4 W; unless otherwise stated:
R1	18-82520M03	var. 25k, incl. ref. item S1
R2	6-11009A77	15k ± 10%
R3	6-11009A73	10k ± 10%
R4	6-11009A10	330k ± 5%
R5	6-11009A86	36k
R6		NOT USED
R7	18-82519M02	var. 5k
R8	6-11009A66	5.1k (mtg on)
R9	6-11009A33	220 ± 10%
R10	6-11009A29	150
R11	6-11009A53	1.5k
R12	6-11009A55	1.8k
R13	6-11009A93	68k
R14	6-11009A67	5.6k
R15	6-11009A73	10k
R16	6-11009A33	220 ± 10%
R17	6-11009A49	1k
R18	6-11009A35	270
R19	6-11009A13	33
R20	6-124B55	2.7
R21	6-11009A25	100
R22	6-125C15	39 ± 10%; 1/2 W
R23	6-11009A65	4.7k ± 10%
R24	6-125C27	120 ± 10%; 1/2 W
R25	6-125A25	100; 1/2 W
R26	6-11009A41	470
R27	6-11009A81	22k
		switch:
S1		p/o ref. item R1
S2, 3	40-84293D06	2-pole, push-push
S4	40-83542M01	rotary, 10-position
S5	40-84293D06	2-pole, push-push
S6	40-82606N01	rotary, 4-position

non-referenced items

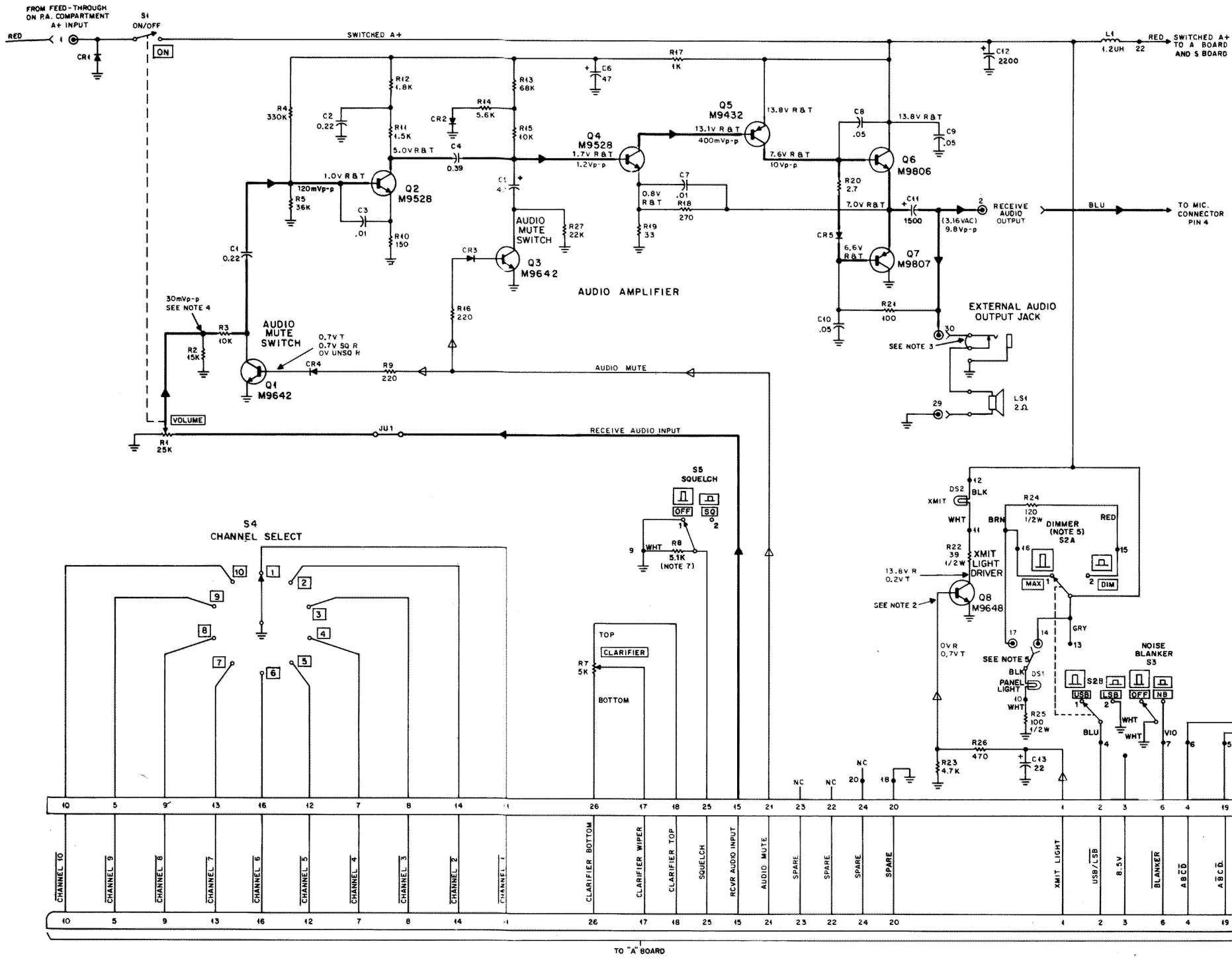
2-1376	NUT, 3/8-32 x 1/2 x 3/32"; 2 used
3-134212	SCREW, tapping; 4-40 x 5/16"; 8 used
3-135102	SCREW, tapping; 4-40 x 1/4"; 2 used
3-139611	SCREW, tapping; 6-32 x 5/16"; 4 used
4-7655	LOCKWASHER, 3/8" internal; 2 used
4-84180C01	WASHER, shoulder; 2 used
14-861196	INSULATOR, transistor
14-83900M01	INSULATOR
14-84268A01	INSULATOR, transistor; 2 used
42-10217A02	STRAP, tie; 4 used
9-83549M01	SOCKET, lens; 2 used
43-867963	SLEEVING, connector
29-83167C01	TERMINAL, strain relief; 12 used
39-10184A10	CONTACT, plug; 7 used
39-10184A24	CONTACT, receptacle
29-855943	PIN, terminal
29-83426B02	LUG, terminal; 2 used
7-83257M01	BRACKET, mounting

notes:

1. For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.
2. For "C" Board parts not listed in the above parts list, refer to the Mechanical Parts List.

Motorola No. PEPS-33807-O
1/29/82- PHI

"C" BOARD
MODEL TRN4956A



LEGEND:
- ◉ DENOTES BUBBLEHEAD PIN CONNECTION
- ● DENOTES PAD

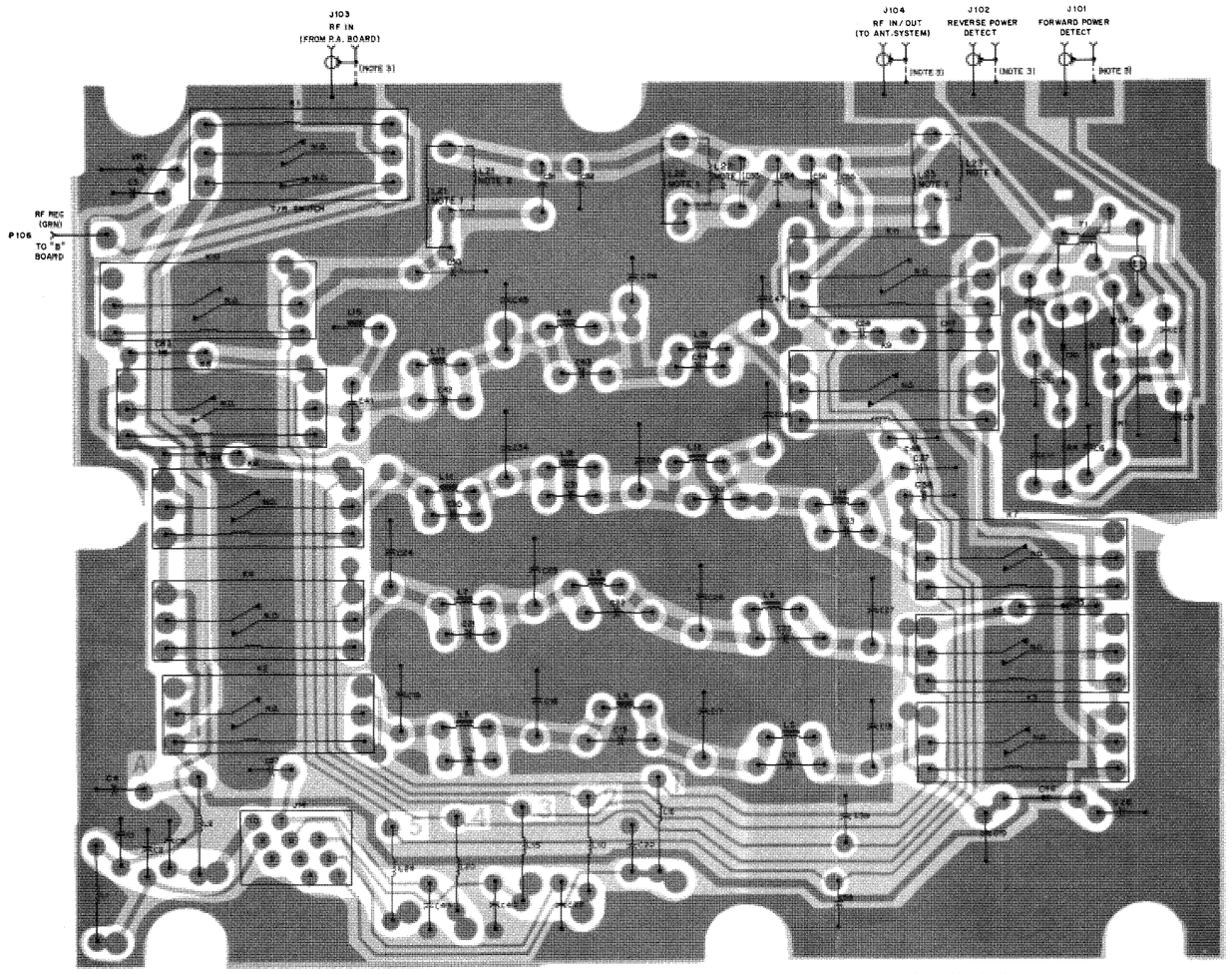
NOTES:
1. UNLESS OTHERWISE STATED, ALL RESISTOR VALUES ARE IN OHMS, CAPACITOR VALUES ARE IN MICROFARADS.
2. XMIT VOLTAGES ARE FOR FULL RF POWER OUTPUT OF RADIO.
3. JUMPER MAY BE CONNECTED WHEN EXTERNAL AUDIO AND SPEAKER AUDIO ARE DESIRED.
4. DESIGNATED P-P VALUES THROUGHOUT ARE INITIALLY SET BY ADJUSTING AUDIO INPUT DRIVE (VOLUME CONTROL) FOR 30 MV P-P AT SPECIFIED NODE R1, R2-R3.
5. A. JUMPER CONNECTS TO PIN 14 FOR USB/LSB OPERATION.
   B. JUMPER CONNECTS TO PIN 17 FOR DIMMER OPERATION.
6. CR8 AND CR9 ARE MOUNTED ON SWITCH S6.
7. R8 IS MOUNTED ON SWITCH S5.

DEPS-33430-O

Motorola No. DEPS-33430-O
1/29/82- PHI

"C" BOARD/HARMONIC FILTER BOARD

HARMONIC FILTER BOARD
MODEL TFA6071A



SHOWN FROM COMPONENT SIDE

Motorola No. ***PEPS-33808-O***
1/29/82- PHI

parts list

TFA6071A Harmonic Filter
TFA6061B Harmonic Filter PL-6752-B

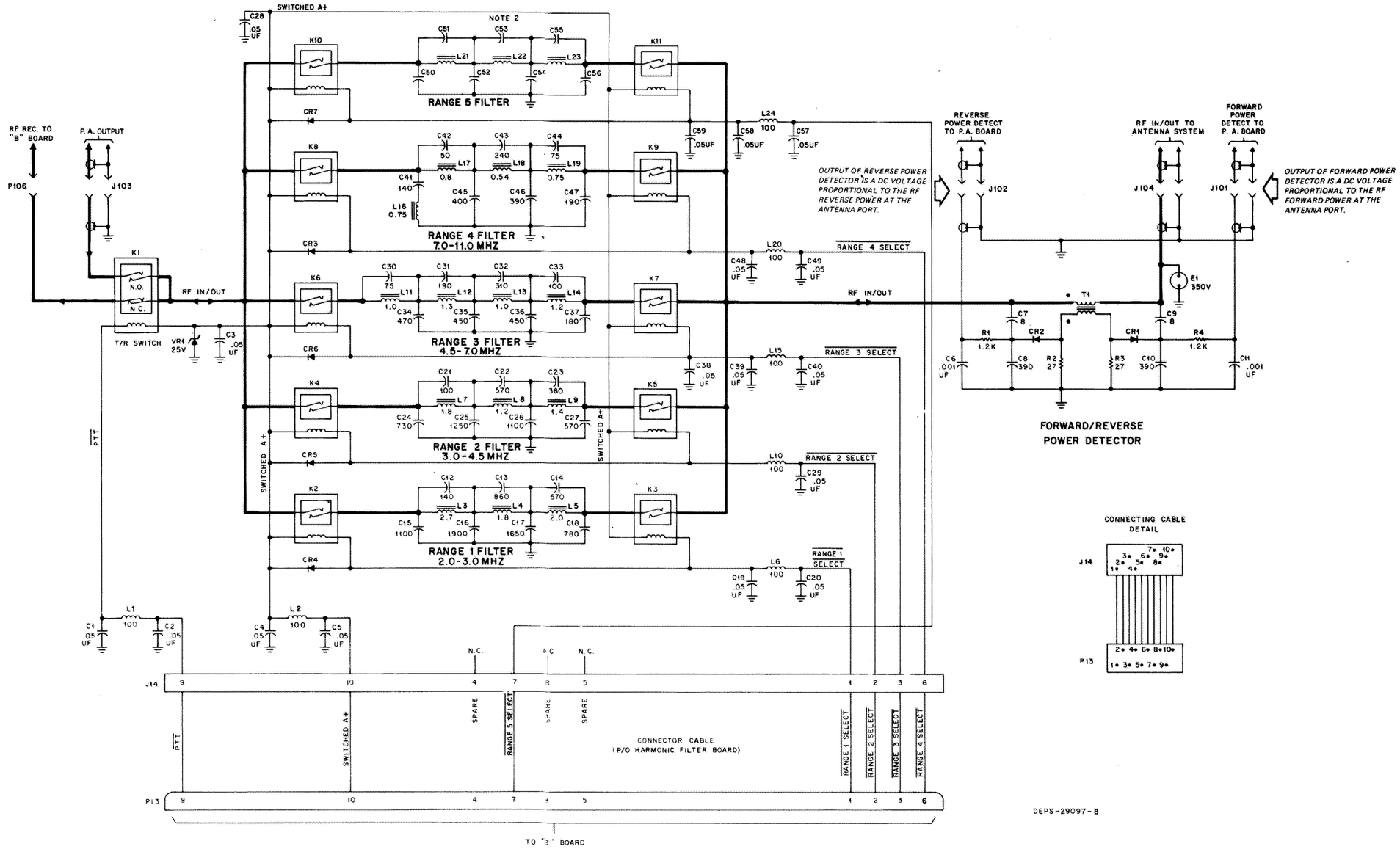
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF ± 2%; 500 V unless otherwise stated
C1 thru 5	21-82372C10	.05 uF ± 20%; 25 V
C6	21-82187B20	.001 uF ± 10%; 100 V
C7	21-82133G22	8 ± 0.5 pF
C8	21-84494B81	390 ± 3%; 300 V
C9	21-82133G22	8 ± 0.5 pF
C10	21-84494B81	390 ± 3%; 300 V
C11	21-82187B20	.001 uF ± 10%; 100 V
C12	21-84857K42	140
C13	21-84857K54	860
C14	21-84857K51	570
C15	21-84857K58	1100
C16	21-84857K57	1900
C17	21-84857K56	1650
C18	21-84857K53	780
C19, 20	21-82372C10	.05 uF ± 20%; 25 V
C21	21-82537B46	100 ± 1%
C22	21-84857K51	570
C23	21-84857K47	360
C24	21-84857K52	730
C25	21-84857K55	1250
C26	21-84857K58	1100
C27	21-84857K51	570
C28, 29	21-82372C10	.05 uF ± 20%; 25 V
C30	21-84857K41	75
C31	21-84857K44	190
C32	21-84857K46	310
C33	21-82537B46	100 ± 1%
C34	21-84857K50	470
C35, 36	21-84857K49	450
C37	21-84857K43	180
C38, 39, 40	21-82372C10	.05 uF ± 20%; 25 V
C41	21-82857K42	140
C42	21-84857K39	50
C43	21-84857K45	240
C44	21-84857K41	75
C45	21-84857K48	400
C46	21-84857K59	390 ± 2%
C47	21-84857K44	190
C48, 49	21-82372C10	.05 ± 20%; 25 V
C50	21-82857K42	140 (TFA6061B)
	or 21-865445	110 ± 3% (TFA6071A)
C51	21-83406D82	36 (TFA6061B)
	or 21-84494B33	30 ± 5% (TFA6071A)
C52	21-84857K45	240 (TFA6061B)
	or 21-84857K43	180 (TFA6071A)
C53	21-82857K42	140 (TFA6061B)
	or 21-84857K44	190 (TFA6071A)
C54	21-84857K44	190 (TFA6061B)
	or 21-865442	160 ± 3% (TFA6071A)
C55	21-82537B46	100 ± 1% (TFA6061B)
	or 21-84857K42	140 (TFA6071A)
C56	21-84857K40	65 (TFA6061B)
	or 21-84494B24	39 (TFA6071A)
C57, 58, 59	21-82372C10	.05 ± 20%; 25 V
		diode: (see note)
CR1, 2	48-82178A06	germanium
CR3 thru 7	48-83654H01	silicon
		spark gap:
E1	80-83029H04	350 V ± 15%
		connector, receptacle:
J13		p/o 10-conductor cable
		relay, reed:
K1	80-83290M02	form 'C'; 13.6 V
K2 thru 11	80-83290M01	1-form 'A'; normally open
		coil, rf:
L1, 2	24-82549D37	100 uH
L3	24-83369M02	2.7 uH, coded RED/VIO
L4	24-83369M04	1.8 uH coded BRN/GRY
L5	24-83369M03	2.0 uH coded RED/BLK
L6	24-82549D37	100 uH
L7	24-83369M04	1.8 uH, coded BRN/GRY
L8	24-83369M07	1.2 uH, coded BRN/RED
L9	24-83369M05	1.4 uH, coded BRN/YEL
L10	24-82549D37	100 uH
L11	24-83369M08	1.0 uH, coded BRN/BLK
L12	24-83369M06	1.3 uH, coded BRN/ORG
L13	24-83369M08	1.0 uH, coded BRN/BLK
L14	24-83369M07	1.2 uH, coded BRN/RED
L15	24-82549D37	100 uH
L16	24-83369M11	0.75 uH, coded VIO/GRN
L17	24-83369M10	0.8 uH, coded BLK/GRY
L18	24-83369M12	0.54 uH, coded GRN/YEL
L19	24-83369M11	0.75, coded VIO/GRN
L20	24-82549D37	100 uH
L21	24-84388M11	11-1/2 T (TFA6061B)
	or 24-83369M14	0.64 uH; coded BLU/YEL (TFA6071A)
L22, L23	24-84388M12	9 T (TFA6061B)
	or 24-83369M13	0.35 uH; coded ORG/GRN
L24	24-82549D37	100 uH

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, plug:
P13		p/o 10-conductor cable
		resistor, fixed:
R1	6-11009A51	1.2k ± 5%; 1/4 W
R2, 3	6-125A11	27 ± 5%; 1/2 W
R4	6-11009A51	1.2k ± 5%; 1/4 W
		transformer:
T1	25-83727K01	toroid, 25-turns: RED
		voltage regulator: (see note)
VR1	48-82256C42	Zener, 25 V

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

HARMONIC FILTER BOARD

MODEL TFA6071A



NOTES:

1. Unless otherwise stated; capacitor values are in picofarads, resistor values are in ohms, inductor values are in microhenrys.
2. Range 5 filter covers 11.0-13.2 MHz for the TFA6061B and 11.0-18.0 MHz for the TFA6071A. See Table 1 for frequency sensitive parts.

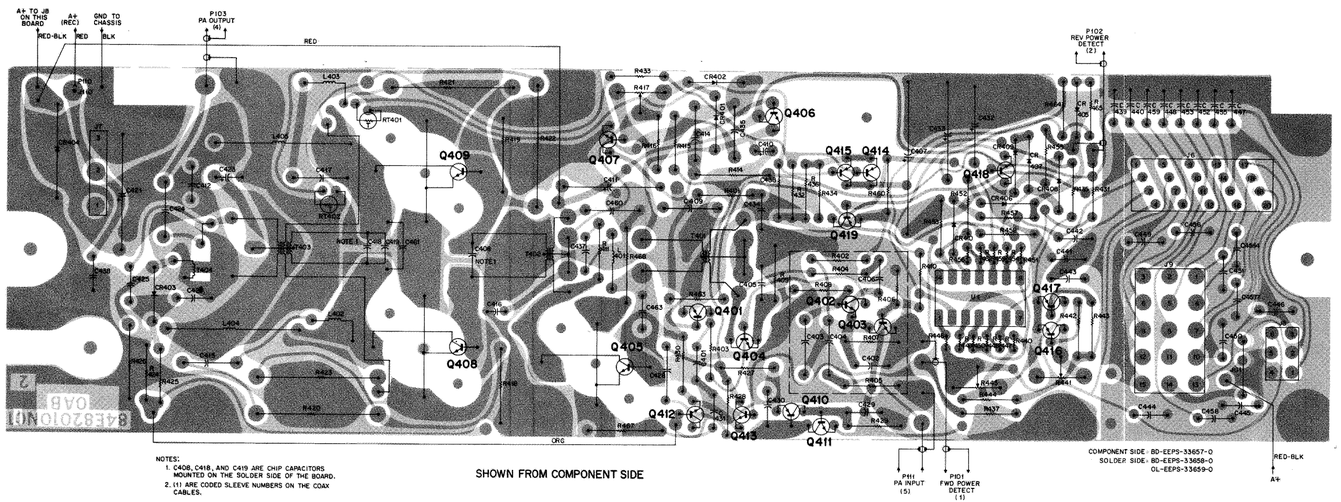
Table 1. Frequency-Sensitive Parts

	TFA6061B	TFA6071A
C50	140 pF	110 pF
C51	36 pF	30 pF
C52	240 pF	180 pF
C53	140 pF	190 pF
C54	190 pF	160 pF
C55	100 pF	140 pF
C56	65 pF	39 pF
L21	11-1/2 T	0.64 uH
L22	9 T	0.35 uH
L23	9 T	0.35 uH

HARMONIC FILTER BOARD/125/150 W POWER AMPLIFIER BOARD

Motorola No. DEPS-29097-B
1/29/82- PHI

125/150 WATT
POWER AMPLIFIER BOARD
MODEL TRN4958A



NOTES:
1. C408, C418, AND C419 ARE CHIP CAPACITORS MOUNTED ON THE SOLDER SIDE OF THE BOARD.
2. (1) ARE CODED SLEEVE NUMBERS ON THE COAX CABLES.

COMPONENT SIDE: 80-EEPS-33657-O
SOLDER SIDE: 80-EEPS-33658-O
OL-EEPS-33659-O

*Motorola No. **PEPS-33809-O***
1/29/82- PHI

parts list

TRN4958A Power Amplifier (125/150 W) PL-7805-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ± 80-20%; 25 V; unless otherwise stated
C401	21-83596E21	.01; 200 V
C402	21-84494B16	330 pF ± 5%; 500 V
C403, 404	8-82905G08	.033 ± 10%; 50 V
C405, 406	21-83596E21	.01; 200 V
C407	23-82601A31	15 + 150-10%
C408	21-84873H54	2700 pF ± 5%; 50 V
C409	21-82372C09	0.1
C410	23-84665F01	10 + 100-10%
C411	23-84669A05	50 + 150-10%
C412	21-82372C10	.05 ± 20%
C414	21-82372C05	0.2
C415	8-82905G17	.047 ± 10%; 100 V
C416	23-84665F01	10 + 100-10%
C417	8-82905G17	.047 ± 10%; 100 V
C418, 419	21-84296M06	1000 pF ± 5%; 50 V
C421	23-84669A05	50 + 150-10%
C423	23-84665F02	15 + 100-10%
C424	8-82905G17	.047 ± 10%; 100 V
C425	21-84494B39	19 pF ± 3%; 500 V
C426	21-840048	240 pF ± 5%; 500 V
C428	21-82372C09	0.1
C429, 430	21-83596E21	.01; 200 V
C431	21-82372C10	.05 ± 20%
C432	23-84665F08	1 + 150-10%; 50 V
C433	23-84669A05	50 + 150-10%
C434	21-82372C10	.05 ± 20%
C435	21-82372C09	0.1
C437	21-82372C10	.05 ± 20%
C438	21-82372C10	.05 ± 20%
C439 thru 443	21-83596E21	.01; 200 V
C444 thru 459	21-82372C10	.05 ± 20%
C460	21-82372C09	0.1
C461	21-84857K02	1200 pF ± 5%; 500 V
C463	21-84494B11	200 pF ± 5%; 500 V
CR401, 402	48-82466H18	**diode: (see note)** silicon
CR403	48-83654H01	silicon
CR404	48-82525D13	silicon
CR405 thru 410	48-83654H01	silicon
J6	30-83265M01	**connector, receptacle:** flat ribbon cable includes 20-contact connector
J7	28-83510M01	male; 3-contact
J8	9-83508M01	female; 6-contact
J9	9-83509M01	female; 15-contact
L401	24-82723H17	**coil, rf:** choke; 0.82 uH
L402, 403	24-83884G05	9-1/2 turns; coded WHT
L404, 405	24-824997	choke; 2.15 uH
P101 thru 103	28-82365D02	**connector, plug:** male; single contact
P111	28-82365D02	male; single contact
Q401	48-869643	**transistor: (see note)** PNP; type M9643
Q402	48-869662	NPN; type M9662
Q403	48-869648	NPN; type M9648
Q404	48-869657	NPN; type M9657
Q405	48-869846	NPN; type M9846
Q407	48-869832	NPN; type M9832
Q410	48-869643	PNP; type M9643
Q411 thru 413	48-869642	NPN; type M9642
Q414 thru 417	48-869643	PNP; type M9643
Q418	48-869642	NPN; type M9642
Q419	48-869643	PNP; type M9643
R401	6-11009A89	**resistor, fixed: ± 5%; 1/4 W;** unless otherwise stated 47k
R402	6-11009A45	680
R403	6-11009A47	820
R404	6-11009A53	1.5k
R405	6-11009A21	68
R406	6-11009A65	4.7k
R407	6-11009A15	39
R408	6-11009A81	22k
R409	6-11009A13	33
R410	6-11009A49	1k
R411	6-11009A19	56
R414	6-125A29	150; 1/2 W
R415	6-11009A53	1.5k
R416	6-11009A15	39
R417	18-83083G15	variable; 100
R418, 419	6-125B62	5.1; 1/2 W
R420, 421	6-127A22	75; 2 W
R422, 423	6-127C19	56 ± 10%; 2 W
R424	6-11009A51	1.2k
R425	6-11009A71	8.2k
R426	6-125A23	82; 1/2 W
R427	6-11009A49	1k
R428	6-11009A81	22k
R429	6-11009A89	47k
R430, 431	6-11009A65	4.7k
R432	6-11009A67	5.6k
R433, 434	6-11009A65	4.7k
R435	6-11009A85	33k
R436	6-11009A61	3.3k
R437	6-11009A89	47k
R438	6-11009A61	3.3k
R440	6-11009C91	56k
R441	18-83083G01	variable; 100k
R442, 443	6-11009A81	22k
R444	6-11009A61	3.3k
R445	18-83083G01	variable; 100k
R446	6-11009C89	47k
R447 thru 451	6-11009C97	100k
R452	6-11009A65	4.7k
R453	6-11009A89	47k
R454	6-11009C31	180
R455	6-11009A81	22k
R456	6-11009C71	8.2k
R457	6-11009A61	3.3k
R458	6-11009A91	56k
R459	6-11009C65	4.7k
R460	6-11009A57	2.2k
R462	6-11009C97	100k
R463	6-11009A57	2.2k
R464	6-11009A91	56k
R465	6-11009A61	3.3k
R467, 468	6-125B70	1; 1/2 W
RT401, 402	6-83600K05	**thermistor:** 100k @ 25°C
T401	1-80760D72	**transformer:** assembly transformer; coded BLU
T402	1-80718D22	assembly transformer; coded GRN
T403	25-83471K05	5 turns; coded BLU
T404	25-83727K01	toroid
U1	51-84320A63	**integrated circuit: (see note)** detector

mechanical parts

	14-861196	INSULATOR, transistor
	14-83256M01	INSULATOR
	14-83256M02	INSULATOR
	14-83256M03	INSULATOR
	42-10217A02	STRAP, tie; 2 used
	75-83238M02	PAD, transformer; 2 used
	1-80717D25	ASSEMBLY, wire and lug; includes:
	29-865067	LUG, ring tongue
	1-80717D26	ASSEMBLY, coaxial and plug in; includes:
	4-7607	WASHER, flat
	5-136977	EYELET
	30-83794C01	CABLE, coaxial (WHT); 7-1/4"
	37-82603D05	SLEEVING, coded #5
	42-84733F01	RING, crimp refer P111
	1-80717D27	ASSEMBLY, coaxial and plug out; includes:
	4-7607	WASHER, flat
	5-136977	EYELET
	30-83794C01	CABLE, coaxial (WHT); 9-1/4"
	37-82603D04	SLEEVING, coded #4
	42-84733F01	RING, crimp refer P103
	1-80717D28	ASSEMBLY, coaxial and plug VSWR; FWD; includes:
	4-7607	WASHER, flat
	5-3152	EYELET
	30-83361G01	CABLE, coaxial (RG178B/U); 10-1/2"
	37-82603D01	SLEEVING, coded #1
	42-84733F01	RING, crimp refer P101
	1-80717D29	ASSEMBLY, coaxial plug VSWR RCRS; includes:
	4-7607	WASHER, flat
	5-3152	EYELET
	30-83361G01	CABLE, coaxial (RG178B/U); 9-1/2"
	37-82603D02	SLEEVING, coded #2
	42-84733F01	RING, crimp refer P102

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

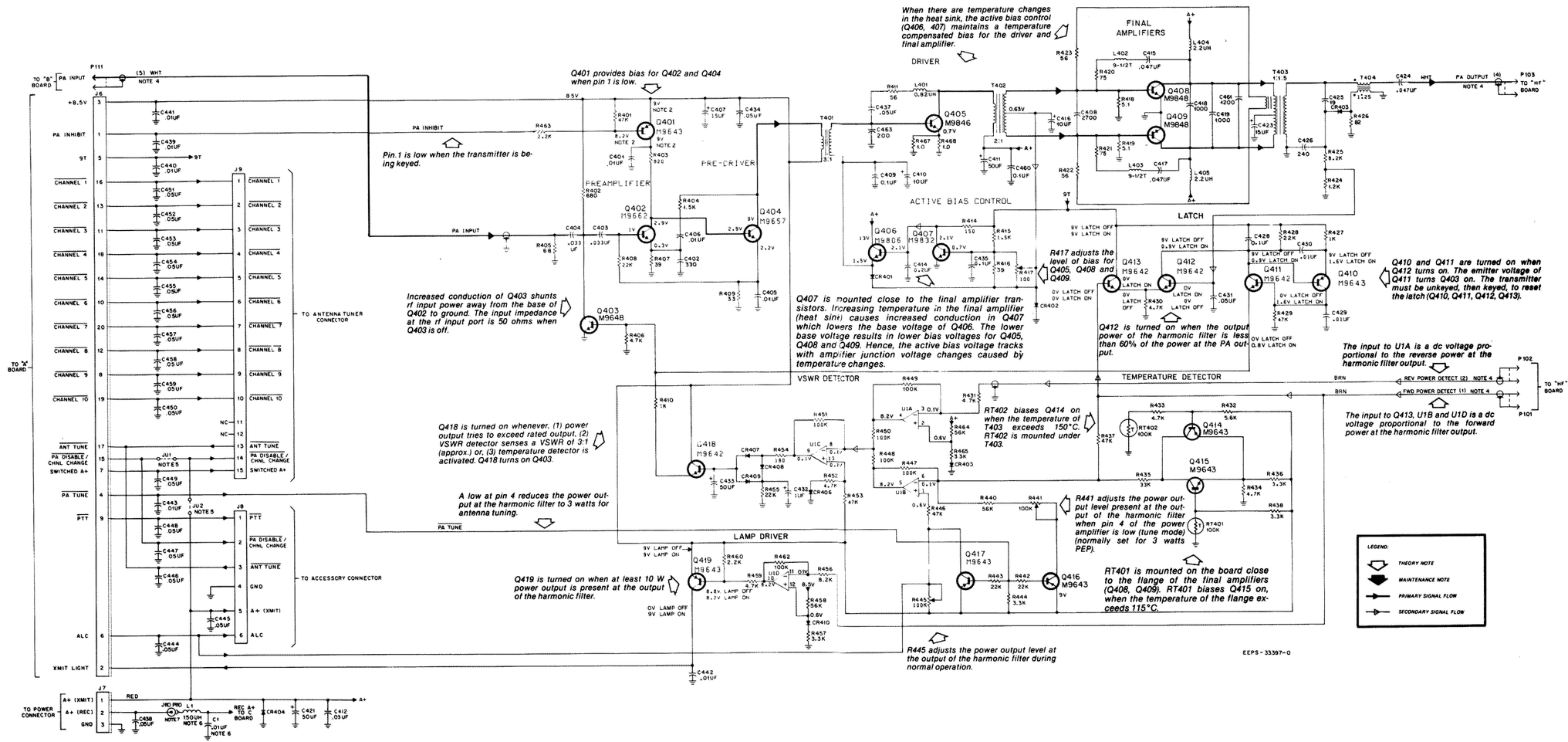
TRN4959A Heatsink Hardware Kit PL-7806-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J105	9-867432	**connector, receptacle:** female; single contact
Q406	48-869806	**transistor: (see note 1)** NPN; type M9806
Q408, 409	48-869848	NPN; type M9848
P104	28-82365D02	**connector, plug:** male; single contact
		non-referenced items
	3-7467	SCREW, tapping; 8-18 x 3/8"; 7 used
	3-134212	SCREW, tapping; 4-40 x 5/16"; 5 used
	3-138813	SCREW, machine; 4-40 x 3/8"; 8 used
	3-84423G01	SCREW, retainer; 2 used
	4-84180C01	WASHER, shoulder
	7-80078A01	BRACKET, thermistor
	7-82181N01	BRACKET, connector
	14-82398N01	INSULATOR
	14-84268A01	INSULATOR, transistor
	26-82397N01	HEAT SINK
	26-83423K03	SHIELD
	29-5369	LUG, soldering; 4 used
	42-10217A02	STRAP, tie
	45-83254M01	LINK; 2 used
	47-83255M01	PIVOT; 2 used
	1-80717D22	ASSEMBLY, connector PA and heatsink; includes:
	4-7607	WASHER, flat
	5-136977	EYELET
	15-84630L01	HOOD, receptacle
	30-83794C01	CABLE, coaxial (WHT) 8"
	37-82603D03	SLEEVING; coded #3
	42-84733F01	RING, retainer

notes:
1. For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.
2. For Heatsink hardware part not listed in the above parts list refer to the Mechanical Parts section.

125/150 WATT
POWER AMPLIFIER BOARD

MODEL TRN4958A



NOTES:

1. Unless otherwise noted, all capacitors are in picofarads and all resistors are in ohms.
2. Voltage measured when transmitter is keyed.
3. U1 voltages are measured with Q418 off and no rf input to Q402.
4. (1) are the coded sleeve numbers on the coax cables.
5. JU1 is always in and JU2 is always out.
6. L1 and C1 are part of chassis kit TRN4960.
7. • Denotes mold push pin connection.

Peak to Peak RF Voltages at 125 W Power Output

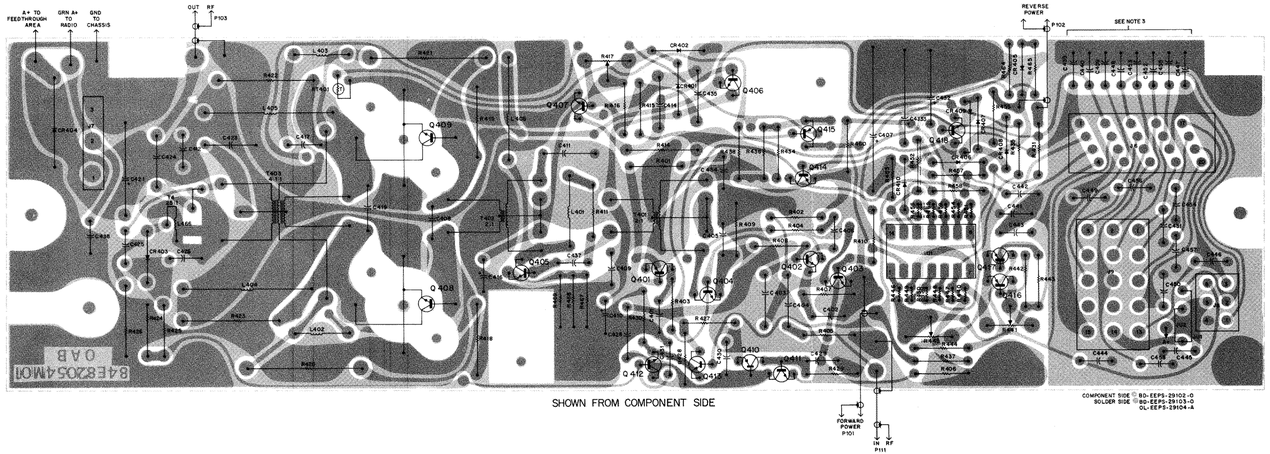
Frequency (MHz)	2	18	13
Q408 (or Q409) Collector	27	40	32
Q408 or Q409 Base	2.5	4	3.6
Q405 Collector	10	20	15
Q405 Base	0.7	3	1.8
Q404 Collector	2.4	4	5.0

125/150 W POWER AMPLIFIER BOARD/100 W POWER AMPLIFIER BOARD

Motorola No. EEPS-33397-O
1/29/82- PHI

100 WATT POWER AMPLIFIER BOARD

MODEL TRN4038A



SHOWN FROM COMPONENT SIDE

Motorola No. PEPS-29305-B
1/29/82-PHI

parts list

TRN4038A Power Amplifier Board (100-Watt) PL-6756-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF:
C401	21-83596E21	.01 + 80-20%; 200 V
C402	21-84494B19	470 pF ± 5%; 300 V
C403, 404	8-829050G6	.033 ± 10%; 50 V
C405	21-82372C10	.05 ± 20%; 25 V
C406	21-83596E21	.01 + 80-20%; 200 V
C407	23-82601A31	15 + 150-10%; 25 V
C408	21-83596E22	.001 ± 10%; 200 V
C409	21-82372C10	.05 ± 20%; 25 V
C410	23-84538G04	15 ± 20%; 20 V
C411	8-83813H01	.0068 ± 10%; 100 V
C412	21-82372C10	.05 ± 20%; 25 V
C414	21-82372C05	0.2 + 80-20%; 25 V
C415	21-82372C10	.05 ± 20%; 25 V
C416	23-84538G04	15 ± 20%; 20 V
C417	23-82372C10	.05 ± 20%; 25 V
C419	21-84494B54	2000 pF ± 5%; 500 V
C421	23-84858C01	15 ± 20%; 25 V
C423	21-82372C05	0.2 + 80-20%; 25 V
C424	8-829050G17	.047 ± 10%; 100 V
C425	21-82133G22	8 pF ± 5pF; 500 V
C426	21-84494B53	110 pF ± 5%; 500 V
C428	21-82372C09	0.1 + 80-20%; 25 V
C429, 430, 431	21-83596E21	.01 + 80-20%; 200 V
C432	23-83214C04	1.0 ± 20%; 15 V
C433	23-83214C10	47 ± 20%; 6 V
C434, 438	21-82372C10	.05 ± 20%; 25 V
C435	21-82372C09	0.1 + 80-20%; 25 V
C437	21-82372C10	.05 ± 20%; 25 V
C439 thru 443	21-83596E21	.01 + 80-20%; 200 V
C444 thru 459	21-82372C10	.05 ± 20%; 25 V
		diode: (see note)
CR401, 402	48-82466H18	silicon
CR403	48-83654H01	silicon
CR404	48-82525G13	silicon
CR405 thru 410	48-83654H01	silicon
		connector, receptacle:
J6	30-83265M01	p/o 20-conductor, flat cable
J7	28-83510M01	male; 3-contact
J8	9-83508M01	female, 6-contact
J9	9-83509M01	female, 15-contact
		coil, rf:
L401	24-82835G13	.82 uH
L402, 403	24-83961B01	3-turns
L404, 405	24-824997	2.15 uH
L406	24-824968	1.8 uH
		connector, plug:
P3	30-83265M01	p/o 20-conductor flat cable
		transistor: (see note)
Q401	48-869643	PNP; type M9643
Q402	48-869662	NPN; type M9662
Q403	48-869648	NPN; type M9648
Q404	48-869657	NPN; type M9657
Q407	48-869832	NPN; type M9832
Q410	48-869643	PNP; type M9643
Q411, 412, 413	48-869642	NPN; type M9642
Q415, 416, 417	48-869643	PNP; type M9643
Q418	48-869642	NPN; type M9642
Q419	48-869643	PNP; type M9643
		resistor, fixed: ± 5%; 1/4 W unless otherwise stated
R401	6-11009A89	47k ± 10%
R402	6-11009A45	680
R403	6-11009A47	820
R404	6-11009A51	1.2k
R405	6-11009A21	68
R406	6-11009A85	4.7k ± 10%
R407	6-11009A15	39
R408	6-11009A81	22k
R409	6-11009A13	33
R410	6-11009A49	1k ± 10%
R411	6-11009A25	100
R414	6-125A29	150; 1/2 W
R415	6-11009A53	1.5k
R416	6-11009A11	27
R417	18-83083G15	var. 100
R418, 419	6-125B62	5.1; 1/2 W
R420, 421	6-127C17	47 ± 10%; 2 W
R422, 423	6-126C25	100 ± 10%; 1 W
R424	6-11009A53	1.5k
R425	6-11009A71	8.2k
R426	6-125A23	82; 1/2 W
R427	6-11009A49	1k ± 10%
R428	6-11009A81	22k ± 10%
R429	6-11009A89	47k ± 10%
R430, 431	6-11009A85	4.7k ± 10%
R434	6-11009A65	4.7k ± 10%
R435	6-11009A85	33k
R436	6-11009A61	3.3k
R437	6-11009A89	47k ± 10%
R438	6-11009A67	5.6k
R440	6-11009A89	47k ± 10%

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R441	18-83083G01	var. 100k
R442, 443	6-11009A81	22k ± 10%
R444	6-11009A61	3.3k
R445	18-83083G01	var. 100k
R446	6-11009A91	56k
R447 thru 451	6-11009A97	100k
R452	6-11009A65	4.7k ± 10%
R453	6-11009A89	47k ± 10%
R454	6-11009A31	180
R455	6-11009A81	22k
R456	6-11009A71	8.2k
R457	6-11009A61	3.3k
R458	6-11009A91	56k
R459	6-11009A65	4.7k ± 10%
R460	6-11009A57	2.2k ± 10%
R462	6-11009A97	100k
R463	6-11009A57	2.2k ± 10%
R464	6-11009A91	56k
R465	6-11009A61	3.3k
R467, 468, 469	6-124B55	2.7 ohm
		thermistor:
RT401	6-83600K05	100k ± 5%; @ 25°C
		transformer:
T401, 402	1-80718D22	assy., 2 turns green
T403	24-83227M01	4-turns, coded blu.
T404	25-83727K01	torried, 25-turn; .380" dia.
		integrated circuit: (see note)
U1	51-84320A63	type MC3301P
		non-referenced items
	14-861196	INSULATOR, transistor
	14-83256M01	INSULATOR, connector; 15-position
	14-83256M02	INSULATOR, connector; 3-position
	14-83256M03	INSULATOR, connector; 6-position
	42-10217A02	STRAP, tie; 2 used
	14-83967A03	INSULATOR, washer shoulder
	29-855943	PIN, terminal
	42-10217A20	STRAP, tie
	29-865067	LUG, ring tongue
	1-80717D26	ASSEMBLY, cable coax and plug-out; includes:
	4-7607	WASHER, flat
	5-136977	EYELET
	28-82365D02	CONNECTOR, plug
	30-83794C01	CABLE, coaxial; 7-1/2"
	37-82603D05	SLEEVING, coded #5
	42-84733F01	RING
	1-80717D27	ASSEMBLY, cable coax and plug-in; includes:
	4-7607	WASHER, flat
	5-136977	EYELET
	28-82365D02	CONNECTOR, plug
	30-83794C01	CABLE, coaxial; 9-1/4"
	37-82603D04	SLEEVING, coded #4
	42-84733F01	RING
	1-80717D28	ASSEMBLY, cable and plug VRWR FWD; includes:
	4-7607	WASHER, flat
	5-3152	EYELET
	28-82365D02	CONNECTOR, plug
	30-83361G01	CABLE, coax; RG178B/U; 10-1/2"
	37-82603D01	SLEEVING, coded #1
	42-84733F01	RING
	1-80717D29	ASSEMBLY, cable and plug; VRWR RVRS; includes:
	4-7607	WASHER, flat
	5-3152	EYELET
	28-82365D02	CONNECTOR, plug
	30-83361G01	CABLE, coaxial; RG178B/U; 9-1/2"
	37-82603D02	SLEEVING, coded #2
	42-84733F01	RING
	30-87388C01	GASKET; 2 used
	75-83238M01	PAD, transformer
	76-83240M01	CORE, ferrite

notes:
1. For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.
2. For power amplifier parts not listed in the above parts list, refer to the Mechanical Parts List.
3. Capacitors C439, C440, C447, C448, C452, C453, and C455 to be dressed toward the left side as viewed.

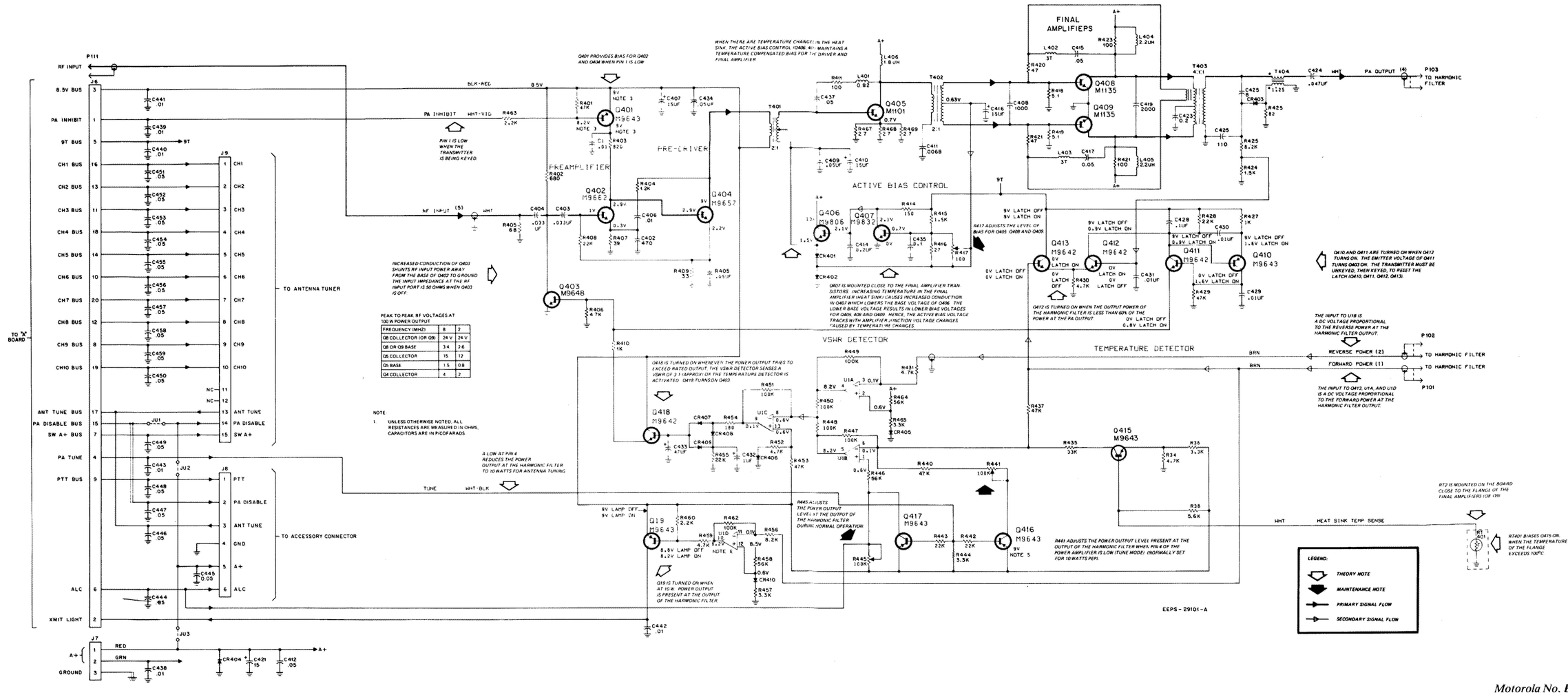
TRN4039A PA Heatsink Hardware Kit (100-Watt Models) PL-6754-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		transistor (see note 1)
Q405	48-84411L01	NPN; type M1101
Q406	48-869806	NPN; type M9806
Q408, 409	48-84411L35	NPN; type M1135
		non-referenced items
	3-134212	SCREW, tapping; 4-40 x 5/16"; 5 used
	3-7467	SCREW, tapping; 8-18 x 3/8"; 7 used
	3-138813	SCREW, machine; 4-40 x 3/8"; 7 used
	3-84423G01	SCREW, retaining; 2 used
	4-490774	WASHER, flat; 2 used
	4-84180C01	WASHER, shoulder
	7-80078A01	BRACKET, thermistor mounting
	7-82181N01	BRACKET, dc connector locking
	14-83288M01	INSULATOR, heatsink
	14-84268A01	INSULATOR, transistor
	26-83239M02	HEATSINK
	47-83255M01	PIVOT; 2 used
	75-83238M02	PAD, transformer
	1-80717D22	ASSEMBLY, connector rf, PA heatsink; includes:
	4-7607	WASHER, flat
	5-136977	EYELET
	9-867432	CONNECTOR, female
	15-84630L01	HOOD, receptacle antenna
	28-82365D02	CONNECTOR, male (phono)
	30-83794C01	CABLE, coaxial; 8" (WHT)
	37-82603D03	SLEEVING, coded #3
	42-84733F01	RING, compression

notes:
1. For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.
2. For Heatsink Hardware parts not listed in the above parts list refer to the Mechanical Parts List.

100 WATT POWER AMPLIFIER BOARD

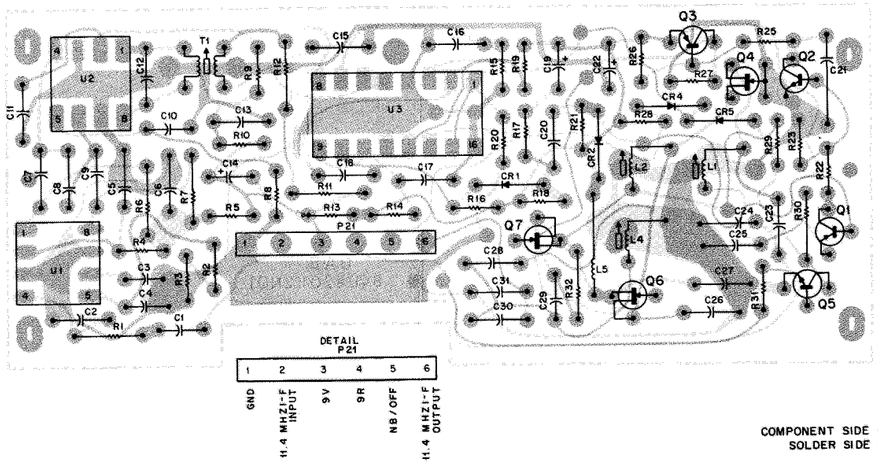
MODEL TRN4038A



100 W POWER AMPLIFIER BOARD/NOISE BLANKER BOARD

Motorola No. EEPS-29101-B
1/29/82- PHI

NOISE BLANKER BOARD
MODEL TRN4962A



COMPONENT SIDE = BD CEPS-33568-O
SOLDER SIDE = BD CEPS-33569-O
OL CEPS-33570-O

SHOWN FROM COMPONENT SIDE

Motorola No. ***PEPS-33879-O***
1/29/82- PHI

parts list

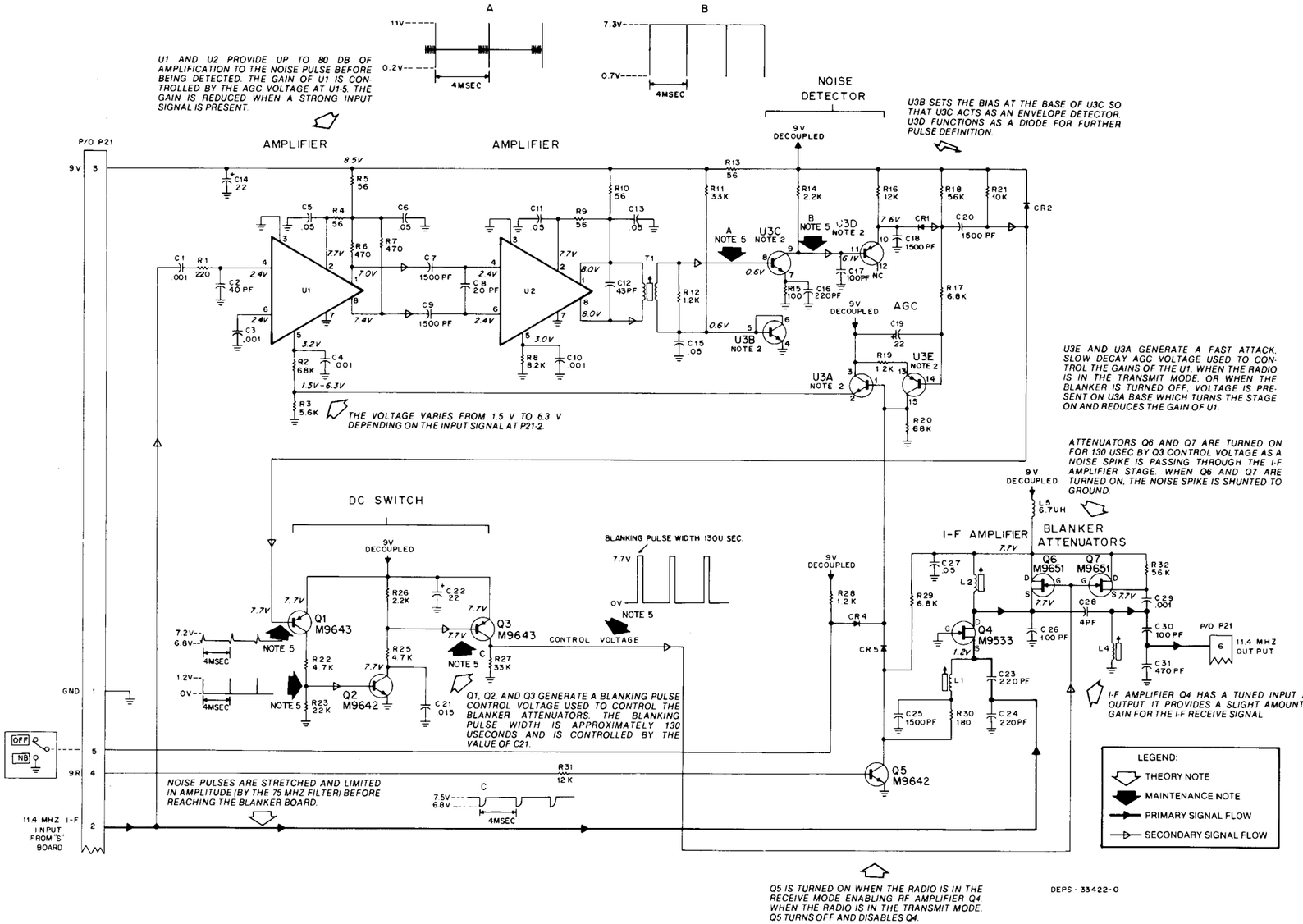
TRN4962A Noise Blanker Board — PL-7810-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ± 5%; 500 V; unless otherwise stated
C1	21-83880G01	.001 ± 10%; 100 V
C2	21-84493B24	40 pF; 200 V
C3, 4	21-83880G01	.001 ± 10%; 100 V
C5, 6	21-82372C10	.05 ± 20%; 25 V
C7	21-82187B31	1500 pF ± 10%; 100 V
C8	21-83406D81	20 pF
C9	21-82187B31	1500 pF ± 10%; 100 V
C10	21-83880G01	.001 ± 10%; 100 V
C11	21-82372C10	.05 ± 20%; 25 V
C12	21-83406D42	43 pF
C13	21-82372C10	.05 ± 20%; 25 V
C14	23-11019A27	22 ± 20%; 25 V
C15	21-82372C10	.05 ± 20%; 25 V
C16	21-82187B08	220 pF ± 10%
C17	21-83798B17	100 pF; 200 V
C18	21-82187B31	1500 pF ± 10%; 100 V
C19	23-11019A27	22 ± 20%; 25 V
C20	21-82187B31	1500 pF ± 10%; 100 V
C21	8-82905G10	.015 ± 10%; 50 V
C22	23-11019A27	22 ± 20%; 25 V
C23, 24	21-82187B08	220 pF ± 10%
C25	21-82187B31	1500 pF ± 10%; 100 V
C26	21-84493B58	100 pF; 200 V
C27	21-82372C10	.05 ± 20%; 25 V
C28	21-83406D54	4 pF ± .25 pF
C29	21-83880G01	.001 ± 10%; 100 V
C30	21-84493B58	100 pF; 200 V
C31	21-82187B39	470 pF ± 10%
		diode: (see note)
CR1	48-84616A01	hot carrier
CR2	48-83654H01	silicon
CR4, 5	48-83654H01	silicon
		connector, receptacle:
P21	9-83445L02	female; 6 contact
		coil, rf:
L1, 2	24-83471M03	20-1/2 turns
L4	24-83471M03	20-1/2 turns
L5	24-82723H06	choke; 6.2 uH
		transistor: (see note)
Q1	48-869643	PNP; type M9643
Q2	48-869642	NPN; type M9642
Q3	48-869643	PNP; type M9643
Q4	48-869533	field-effect
Q5	48-869642	NPN; type M9642
Q6, 7	48-869651	field-effect
		resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R1	6-185A33	220; 1/8 W
R2	6-11009E69	6.8k
R3	6-11009E67	5.6k
R4, 5	6-11009E19	56
R6, 7	6-185A41	470; 1/8 W
R8	6-11009E71	8.2k
R9, 10	6-11009E19	56
R11	6-185A85	33k; 1/8 W
R12	6-185A51	1.2k; 1/8 W
R13	6-11009E19	56
R14	6-11009E57	2.2k
R15	6-11009E25	100
R16	6-11009E75	12k
R17	6-11009E69	6.8k
R18	6-11009E91	56k
R19	6-11009E51	1.2k
R20	6-11009E93	68k
R21	6-11009E73	10k
R22	6-11009E65	4.7k
R23	6-11009E81	22k
R25	6-11009E65	4.7k
R26	6-11009E57	2.2k
R27	6-11009E85	33k
R28	6-11009E51	1.2k
R29	6-11009E69	6.8k
R30	6-185A31	180; 1/8 W
R31	6-11009E75	12k
R32	6-185A91	56k; 1/8 W
		transformer:
T1	24-84758A01	pri.: pins 1 and 2; 37-1/4 turns sec.: pins 3 and 4; 16-3/4 turns
		integrated circuit: (see note)
U1, 2	51-84320A62	amplifier
U3	51-83629M10	array
		non-referenced items
	26-83338N01	SHIELD; for board
	26-82671D27	SHIELD; for T1
	26-82671D31	SHIELD; for L2, 3, 4; 3 used

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

NOISE BLANKER BOARD

MODEL TRN4962A



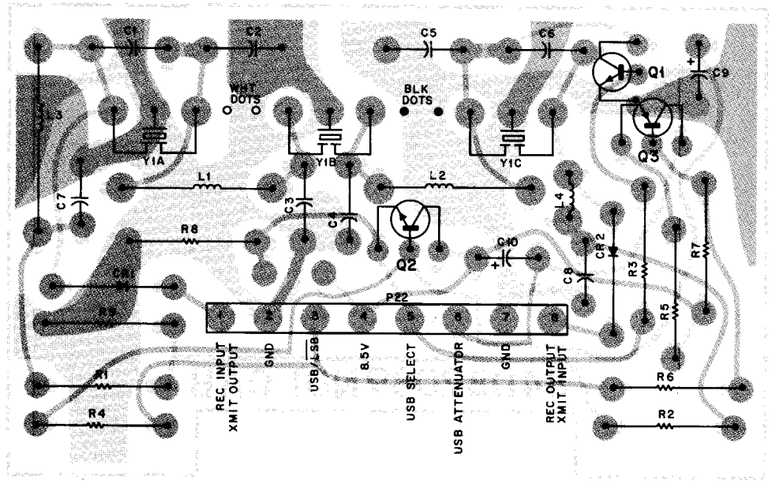
NOTES:

1. Unless otherwise stated: capacitor values are in microfarads, resistor values are in ohms.
2. Transistors U3A-E are part of a single integrated circuit.
3. Unless otherwise stated DC voltages are measured with noise blanker on, radio in the receive mode on 10 MHz, and no i-f signal input.
4. Noted voltages are measured with an 11.4 MHz, 30 mV p-p signal input at the P21-2.
5. Noted waveforms are measured with a 250 Hz, 20 nsec wide 20 volt pulse signal at the rf connector of the radio with the radio receiving a 10 MHz signal.

NOISE BLANKER BOARD/LOWER SIDEBAND BOARD (LSB)

Motorola No. DEPS-33422-O
1/29/82- PHI

LOWER SIDEBAND BOARD (LSB)
MODEL TRN4961A



SHOWN FROM COMPONENT SIDE

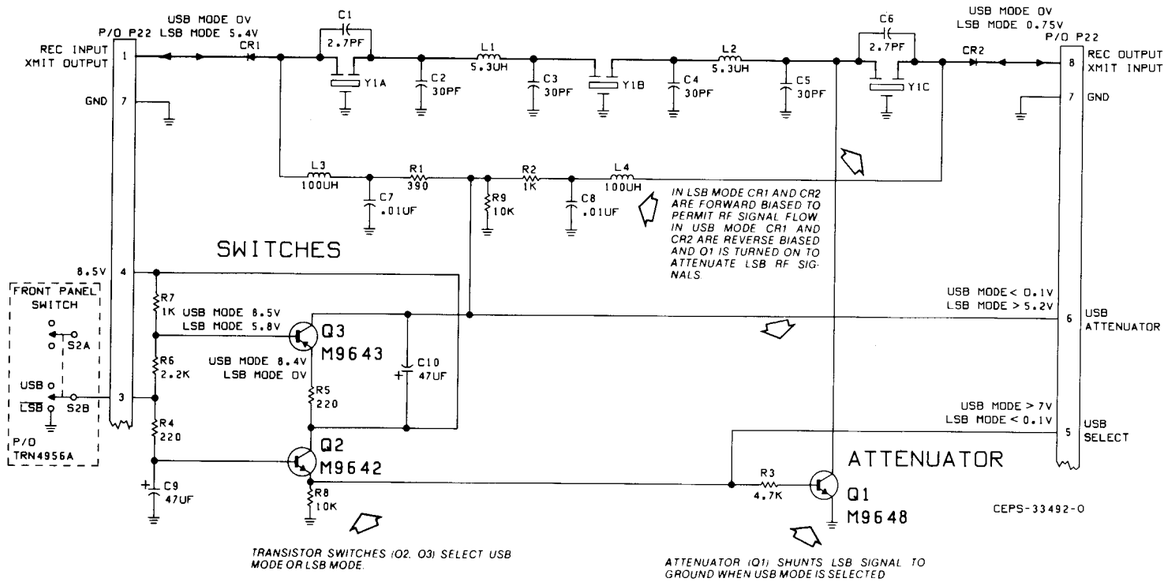
COMPONENT SIDE = BD-BEPS-33577-O
SOLDER SIDE = BD-BEPS-33578-O
OL-BEPS-33579-O

parts list

TRN4961A Lower Sideband Board (LSB) PL-7817-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF
C1	21-82355B30	2.7 ± 0.1 pF; 500 V
C2 thru 5	21-82204B48	30 ± 2%; 500 V
C6	21-82355B30	2.7 ± 0.1 pF; 500 V
C7, 8	21-82213E12	.01 uF ± 20%; 100 V
C9, 10	23-11019A38	47 uF ± 20%; 10 V
		diode: (see note)
CR1, 2	48-83654H01	silicon
		coil, rf:
L1, 2	24-83368M01	choke; 5.3 uH
L3, 4	24-82549D37	choke; 100 uH
		connector, plug:
P22	9-83445L03	female; 8 contact
		transistor: (see note)
Q1	48-869648	NPN; type M9648
Q2	48-869642	NPN; type M9642
Q3	48-869643	PNP; type M9643
		resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R1	6-11009A39	390
R2	6-11009A49	1k
R3	6-11009A65	4.7k
R4, 5	6-11009A33	220
R6	6-11009A57	2.2k
R7	6-11009A49	1k
R8, 9	6-11009A73	10k
		filter:
Y1	91-83365M01	crystal
		non-referenced item
	14-84540B01	INSULATOR; 3 used

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.



Motorola No. PEPS-33880-O
1/29/82- PHI

SYNTHESIZER ("S") BOARD
MODEL TLN2390A

1. OVERALL OPERATION

1.1 The transmission and receiving circuits in the *TRITON 40•S/MICOM•S* radio can be generally divided into three parts; (1) the HF-band circuits, (2) the synthesizer, and (3) fixed frequency transmit/receive circuits. The "S" (synthesizer) board may be considered as a converter from a fixed frequency transceiver operating at 11.4 MHz to HF-band circuitry. The HF-band circuitry includes a broad-band receiver front end and transmit circuitry (the harmonic filter and power amplifier).

1.2 The "S" board contains four primary sections; (1) a bidirectional 75 MHz i-f circuit with a bidirectional mixer at each end, (2,3) two phase-locked synthesizers, each generating the injection signal for one of the mixers, and (4) the microprocessor based control section. The "S" board performs two frequency conversions to interface the 11.4 MHz circuits to the HF-band circuits in both the transmit and receive modes — 11.4/75 MHz and 75 MHz/HF-band. A single microprocessor controls the two synthesizers to provide the appropriate injection frequencies.

1.3 The processor operating program is stored in ROM within the processor, but the characteristics of each channel are programmable and stored in RAM. The "P" (programming) board is used to program the frequency, mode (SSB, SSB with pilot carrier, or AM equivalent), and channel type (simplex or half-duplex) for each channel. The "P" board is connected to the synthesizer circuits in a wire-OR configuration for programming and may be removed from the radio during normal radio operation.

2. "S" BOARD BLOCK THEORY
(Refer to Figure 1)

2.1 I-F SECTION

2.1.1 General

The 75 MHz i-f section performs the actual interface between the 11.4 MHz circuits and the HF-band circuits. The i-f contains four basic parts; (1) the first mixer (HF-band/75 MHz conversion), (2) a 75 MHz crystal filter, (3) a bidirectional amplifier, and (4) the second mixer (75 MHz/11.4 MHz conversion).

2.1.2 Receive Mode

2.1.2.1 The first mixer interfaces the HF-band circuits with the 75 MHz i-f circuit by mixing the first injection signal with the HF-band received signal. The first injection frequency is controlled by the processor to operate in 3.2 kHz steps between 77 MHz and 93 MHz. The first injection frequency is selected such that the difference of the injection and the incoming signal equals approximately 75 MHz, the first receive i-f.

2.1.2.2 The crystal filter provides most of the 75 MHz i-f selectivity. The filter removes unwanted mixing products and noise from the first mixer output.

2.1.2.3 The bidirectional i-f amp consists of two amplifier stages, one for transmit and one for receive, connected in parallel and operating in opposite directions. Only one of the stages is active at a time. In the receive mode, the receive stage amplifies the signal from the crystal filter and outputs the result to the second mixer.

2.1.2.4 The second mixer operates in much the same manner as the first mixer. The second injection frequency is controlled to 63.600 MHz ±5 kHz in 100 Hz steps. In the receive mode, the injection frequency is selected such that the difference of the first receive i-f and the second injection frequency equals 11.4 MHz, the second receive i-f.

2.1.2.5 The combination of the first mixer, controlled in 3.2 kHz steps, and the second mixer, controlled in 100 Hz steps, converts the HF-band receive frequency to 11.4 MHz the second receive i-f. In this manner, the radio can be programmed to receive any frequency (in 100 Hz steps) from 100 Hz to 13.2 MHz (Models D70HEA1N00-K and D80HEA1N19-K) or from 100 Hz to 18.1 MHz (Models D80JMA1N00-K and D80JMA1N19-K). However, there will be a significant decrease in sensitivity below 2 MHz.

2.1.3 Transmit Mode

2.1.3.1 The second mixer interfaces the first transmit i-f with the 75 MHz i-f circuit by mixing the 11.4 MHz first transmit i-f signal with the second injection signal. The second injection frequency is controlled to 63.600 MHz ±5 kHz in 100 Hz steps. The injection frequency is selected such that the sum of the injection and the 11.4 MHz first transmit i-f frequency equals approximately 75 MHz, the second transmit i-f. The output of the second mixer is applied to the i-f amplifier.

2.1.3.2 The bidirectional i-f amp consists of two amplifier stages, one for transmit and one for receive, connected in parallel and operating in opposite directions. Only one of the stages is active at a time. In the transmit mode, the transmit stage amplifies the signal from the second mixer and applies the result to the crystal filter.

2.1.3.3 The crystal filter provides most of the 75 MHz i-f selectivity. The filter removes unwanted mixing products (from the second mixer) and noise from the i-f amp output.

2.1.3.4 The first mixer interfaces the 75 MHz i-f circuit with the HF-band circuits by mixing the first injection signal with the 75 MHz second transmit i-f. The first injection frequency is controlled by the processor to operate in 3.2 kHz steps between 77 MHz and 93 MHz. The first injection frequency is selected such that the difference between the 75 MHz second transmit i-f and the injection frequency equals the desired transmit frequency.

2.1.3.5 The combination of the first mixer, controlled in 3.2 kHz steps, and the second mixer, controlled in 100 Hz steps, converts the 11.4 MHz first transmit frequency to the desired HF-band transmit frequency. In this manner, the radio can be programmed to transmit on any frequency (in 100 Hz steps) from 2 MHz to 13.2 MHz (Models D70HEA1N00-K and D80HEA1N19-K) or 2 MHz to 18.1 MHz (Models D80JMA1N00-K and D80JMA1N19-K).

2.2 CONTROL SECTION

2.2.1 The control section includes a microprocessor with internal ROM for program storage and scratchpad RAM, an external RAM for programmable channel information storage, and various device selection circuitry (address decoding). The processor and its support circuits control the synthesizers to generate the desired injection frequencies and also control the harmonic filter board and the automatic antenna tuner (when equipped). The channel information RAM is protected from loss of power by a lithium backup battery. In this manner, all channel information is retained if the radio is turned off, or if input power to the radio is interrupted.

2.2.2 Channel information (from the programming board) for each channel, specifying transmit and receive frequencies, simplex or half-duplex operation, and single sideband (SSB), SSB with pilot carrier (PLT), or AM equivalent (AME) transmission mode is stored in the external RAM. When the operator selects a channel on the front panel, the processor recovers the channel information from RAM for that channel. The processor uses this information to determine the appropriate values to be loaded into the two synthesizer programmable dividers to generate the two injection signals.

2.2.3 Both of the programmable dividers include buffer latches which are directly loaded by the processor. The buffer output lines are used to interface the processor to the rest of the radio and control the transmission mode, the harmonic filter board, and the automatic antenna tuner (when equipped).

2.3 FIRST INJECTION SYNTHESIZER

2.3.1 The first injection frequency is generated by a single-loop, phase-locked synthesizer. The synthesizer consists of a dual-programmable divider, a sample-and-hold phase detector, and a two-range VCO (voltage controlled oscillator). The synthesizer is controlled by the processor to generate the first injection frequency in the range 77-93 MHz in 3.2 kHz steps.

2.3.2 The divider circuit is loaded by the processor with two numbers. The 9.216 MHz reference input is divided by one of the numbers to produce the 3.2 kHz divided reference signal. The feedback signal from the VCO is divided by the second number to provide the divided feedback signal. When the VCO is operating at the desired frequency, the divided feedback frequency will be 3.2 kHz. The two divided outputs are applied to the phase detector. The phase detector outputs a dc control signal to the VCO to raise or lower the VCO frequency until the divided feedback frequency equals 3.2 kHz. When this occurs, the synthesizer is locked.

2.3.3 The first injection VCO (VCO1) consists of two VCO stages. One stage is capable of generating signals in the range 77-89.5 MHz. The other is capable of generating signals in the range 89.5-93 MHz. Only one of the stages is active at a time under control of the processor via one of the buffer latch outputs from the divider circuit.

2.4 SECOND INJECTION SYNTHESIZER

2.4.1 The second injection signal is generated by a dual-loop phase-locked synthesizer. The dual-loop synthesizer consists of one synthesizer (the VCO2 synthesizer) providing a programmable reference input to another synthesizer (the VXO synthesizer) which generates the desired second injection frequency in the range 63.595-63.605 MHz in 100 Hz steps.

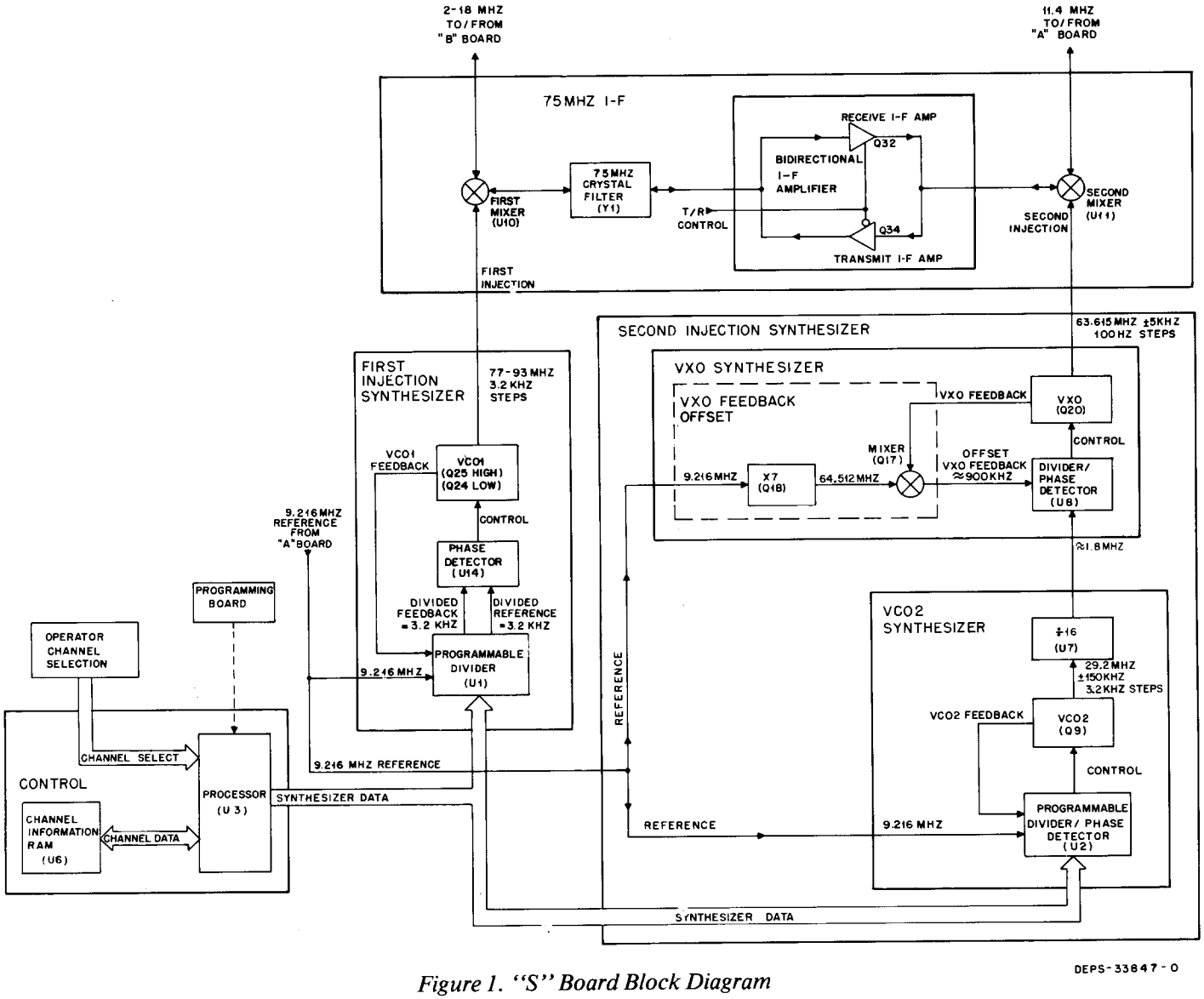


Figure 1. "S" Board Block Diagram

2.4.2 The VCO2 synthesizer is very similar to the VCO1 synthesizer used to generate the first injection signal. The only major differences are the output frequency range and the fact that the VCO2 synthesizer uses the phase detector internal to the divider circuit (an internal phase detector is present in the VCO1 divider, but is unused).

2.4.3 The VCO2 divider/phase detector is loaded by the processor with two numbers used to divide the reference input and the desired VCO feedback frequencies to a common frequency. The two divided signals are phase-compared internally to provide an output which controls the VCO via a discrete charge pump. The output of VCO2 (29.184 MHz ±154 kHz in 3.2 kHz steps) is divided by 16 to provide the programmable reference input (approximately 1.8 MHz) to the VXO (voltage-controlled crystal oscillator) synthesizer.

2.4.4 The VXO synthesizer is composed of three major parts; (1) a fixed divider/phase detector, (2) a VXO, and (3) a VXO feedback offset circuit. The VXO synthesizer is essentially a conventional phase-locked loop except that it uses a variable reference input frequency and a voltage-controlled crystal oscillator instead of a normal VCO. The VXO provides a high output frequency that is variable in very small increments compared to the output frequency. The output frequency is controlled in 100 Hz steps over the range 63.595 MHz to 63.605 MHz.

2.4.5 The 63.6 MHz VXO feedback signal is down-converted to approximately 900 kHz by mixing the feedback signal with a signal at approximately 64.5 MHz (seven times the 9.216 MHz reference frequency) and then applied to the divider/phase detector. The reference input (approximately 1.8 MHz; from VCO2) is also applied to the divider/phase detector. The divider circuit divides the offset feedback input by 2 and the reference input by four to yeild two signals at approximately 450 kHz. The two signals are phase-compared and the result is a dc control signal which

warps the crystal oscillator to the desired output frequency.

2.4.6 The output of the VXO synthesizer, the second injection frequency, is controlled by the programming applied to the VCO2 divider/phase detector. As the programming is varied, the output frequency of VCO2 is varied and, since the VXO synthesizer uses this signal as its reference input, the output frequency of the VXO is varied.

3. DETAILED CIRCUIT THEORY

(Refer to the schematic diagram, PEPS-33953.)

3.1 I-F SECTION

3.1.1 First Mixer

3.1.1.1 The first mixer (U10) is a bidirectional passive device which interfaces the 75 MHz i-f circuit with the HF-band circuits (the PA and the receiver front-end). The input from either the 75 MHz i-f circuit or the "B" board is mixed with the first injection signal and connected to the alternate circuit.

3.1.1.2 In the transmit mode, the 75 MHz second transmit i-f input (U10-1) is mixed with the first injection signal input (U10-8) from VCO1. The resulting HF-band output (U10-3,4) is connected to the "B" board via a coaxial cable and connector P/J113. The first injection frequency is selected to convert the 75 MHz second transmit i-f to the final HF-band transmit frequency.

3.1.1.3 In the receive mode, the HF-band received signal input (U10-3,4) from the "B" board is mixed with the first injection signal input (U10-8). The resulting mixed output is connected to the crystal filter. The first injection signal is selected to convert the HF-band received signal to a 75 MHz intermediate frequency.

3.1.2 Crystal Filter

The crystal filter, Y1 and its associated components comprise a bidirectional bandpass filter passing 75 MHz between the first mixer and the i-f amplifier. The filter tuning coils, L30 and L31, are factory set and should require no further adjustment.

3.1.3 I-F Amplifier Overall Operation

The i-f amplifier consists of two amplifier stages operating in opposite directions and connected in parallel. Each stage is controlled by a switching stage to be enabled only when the appropriate mode is selected.

3.1.4 I-F Amplifier Receive Path

3.1.4.1 When the radio is operating in the receive mode, the 9R (+9 V during receive) line is at high level. This high level turns on the receive path switch (Q33), providing bias current to the receive i-f amplifier stage, Q32. A high level on 9R also turns off the transmit path switch (Q35), removing base bias current from the transmit i-f amplifier (Q34) and forward biases CR24 via R113.

3.1.4.2 The 75 MHz first receive i-f signal is coupled into the source of Q32, the receive i-f amplifier, via C93. The amplified signal from the drain of Q32 is coupled to the second mixer (U10-3,4) via C114, CR24, and C121.

3.1.5 I-F Amplifier Transmit Path

3.1.5.1 When the radio is operating in the transmit mode, the 9R line is at low (ground) level. This low level turns on the transmit path switch, Q35, providing bias current to the base of the transmit i-f amplifier, Q34. The low level on the 9R line also turns off the receive path switch (Q33), removing bias current to the receive i-f amplifier, and reverse biases CR24, disabling the path from the second mixer to the receive i-f amplifier.

3.1.5.2 The 75 MHz transmit i-f output from the second mixer (U10-3,4) is coupled into the base of Q34, the transmit i-f amplifier, via C121 and C100. The amplified signal from the collector of Q34 is coupled to the crystal filter via C96 and C93.

3.1.6 Second Mixer

3.1.6.1 The second mixer (U11) operates in the same manner as the first mixer (U10), it is a bidirectional passive device which interfaces the 75 MHz i-f circuit with the 11.4 MHz transmit/receive circuits. The input from either the 75 MHz i-f circuit or the "A" board is mixed with the second injection signal and connected to the alternate circuit.

3.1.6.2 In the transmit mode, the 11.4 MHz first transmit i-f input (U11-1) from the "A" board, via P/J114, is mixed with the second injection signal input (U11-8) from the VXO. The resulting output (U11-3,4) is connected to the i-f amplifier. The second injection frequency is selected to convert the 11.4 MHz first transmit i-f to a 75 MHz second transmit i-f.

3.1.6.3 In the receive mode, the 75 MHz first receive i-f signal input (U10-3,4) from the i-f amplifier is mixed with the second injection signal input (U10-8). The resulting output is connected to the "A" board via P/J114. The second injection frequency is selected to convert the 75 MHz first receive i-f to the 11.4 MHz second receive i-f.

3.2 PROCESSOR CONTROL SECTION

3.2.1 Overall

Operational control of the radio is provided by a microprocessor (U3). The processor accepts operator inputs for channel and transmit/receive selection. The processor then retreives previously programmed information in RAM for the desired channel and uses the stored data to control the two injection synthesizers, the harmonic filter, and the automatic antenna tuner (when equipped). Except during programming, the RAM acts as read-only memory. The operating program and scratchpad memory are contained in the processor itself.

3.2.2 Operator (Front Panel) Interface

3.2.2.1 Two lines, $A\overline{B}C\overline{D}$ (J18-14) and $AB\overline{C}\overline{D}$ (J18-13) are used to inform the processor of the channel bank selected on the front panel. The signal names indicate the level of each line when each bank is selected. For example when bank "C" is selected J18-14 will be at low level and J18-13 will be at high level. These two lines are input to the processor on I/O port 5, lines 4 and 5 (P5-4 and P5-5; pins U3-29 and U3-28, respectively). The same two signals are used as the two highest-order RAM address lines (the data in RAM is organized in the same manner as channel selection — as four blocks of ten entries, each entry containing all of the required channel information).

3.2.2.2 The one-of-ten channel selection from the front panel is indicated on the "S" board by a low level (ground) on the corresponding channel select line ($\overline{\text{CH1 SEL}}$ through $\overline{\text{CH10 SEL}}$; J18 pins 1-4, 6, and 8-12). Channel select lines 1 through 9 are connected to the processor at I/O port 0, line 7 and port 1, lines 0 through 7, respectively (note that the same processor I/O lines are used to interface the programming board). Selection of channel 10 is indicated to the processor by a high level on all of the channel 1-9 select lines. The channel 10 select line is not connected to the processor and is used as the programming board enable line, $\overline{\text{PROG BRD ENABLE}}$. The programming board can be used *only* when channel 10 (of any bank) is selected on the front panel.

3.2.2.3 The transmit/receive mode selection is indicated by the status of the 9R line (pin J18-5). This line will be at approximately 9 V during receive and ground during transmit. The 9R line is connected to the processor external interrupt input via CR9. When half-duplex operation is programmed for the selected channel, the operating software monitors the level of this line. When the line is at low level, the transmit frequency data is loaded into the synthesizers. When the line is at high level, the receive frequency data is loaded into the synthesizers. A similar function is provided by the $\overline{\text{XMIT MON}}$ line which is also connected to the interrupt input. Refer to "Programming Board Interface," paragraph 3.2.3 of this section, for details concerning operation of the transmit monitor signal.

3.2.3 Programming Board Interface

3.2.3.1 The programming board is connected to J19 and is used to store channel information in RAM via the processor. The interface lines between the "S" board and the programming board are divided into three groups; (1) the keypad interface, (2) the display interface, and (3) operational control lines. The programming board interface takes place over processor I/O lines which are used to interface other "S" board circuits during normal (not programming) operation. The programming board is connected to the processor circuits in a wire-OR configuration.

3.2.3.2 The keypad interface consists of four keypad address lines and four keypad data lines. These lines are connected to the processor at I/O lines P4-0 through P4-7 (pins U3-8 through 15). The programming board includes a cross-point keypad. To detect keypad entries, the processor sends keypad row addresses over the KYPAD ADDR lines to the programming board and monitors the $\overline{\text{KYPAD DATA}}$ lines for the presence of a contact closure (a short between a row and a column). Refer to "Programming Board Theory of Operation," section 68P81060E79 of this manual, for further details.

3.2.3.3 The programming board display interface is multiplexed in much the same manner as the keypad. The interface lines consist of four display address lines (DISP ADDR0-3), four display data lines (DISP DATA0-3), and the display strobe line ($\overline{\text{DISPLAY STROBE}}$). These lines are connected to the processor at I/O lines P0-7 and P1-0 through P1-7 (these lines are used to interface the channel selection inputs during normal operation). The processor provides the display element address and the data to be displayed by that element, then pulses the strobe line to low level to latch the address and data on the programming board. Refer to "Programming Board Theory of Operation," section 68P81060E79 of this manual, for further details.

3.2.3.4 The synthesizer load disable line ($\overline{\text{SYN LOAD DISABLE}}$) is forced to low level when the programming board keypad is enabled to inhibit loading of erroneous data into the synthesizers. The synthesizers and the keypad interface are multiplexed over the same processor I/O lines. When the programming board is enabled, the keypad and the synthesizers are time-division multiplexed using the $\overline{\text{SYN LOAD DISABLE}}$ line. When the line is at high level, the synthesizers are loaded. When the line is at low level, the programming keypad is enabled. When the programming board is turned off or not connected, or the keypad is not being monitored, the load disable line is held at high level and allows normal loading of the synthesizers.

3.2.3.5 The transmit monitor ($\overline{\text{XMIT MON}}$) line is forced to low level to display the transmit carrier frequency of a duplex channel during programming/verification. A low level on the transmit monitor line will also cause the processor to load the synthesizers to provide the appropriate injection signals for that frequency (the i-f section will, however, be in the receive mode, so the radio will be receiving on the programmed transmit frequency).

3.2.3.6 The processor and RAM write enable lines ($\overline{\text{uP WRITE}}$ and $\overline{\text{RAM WRITE}}$) are interconnected when the programming board is connected and turned on. This feature allows the processor to write to RAM only during programming.

3.2.4 RAM Interface

3.2.4.1 The channel information RAM, U6, contains programmed information for each of the 40 possible operating channels. During normal operation, the RAM operates as a read-only memory. Data is written to the RAM only during programming. The data in RAM is protected by a lithium backup battery which supplies RAM + when the radio is turned off or input power is removed.

3.2.4.2 Data in RAM is structured in the same manner as the front-panel channel selection — four blocks of ten entries. Each entry corresponds to one channel and contains several four-bit words specifying the carrier frequency (two frequencies are specified for half-duplex channels), the transmission mode (SSB, Pilot, or AME), and channel type (simplex or half-duplex). During programming, the processor retreives operator inputs from the programming board and writes the data into RAM via I/O lines P0-0 through P0-3. During normal operation, the processor retrieves the data from RAM, and operating from that data, generates the appropriate load words for the two synthesizers.

3.2.4.3 The higher-order two address bits, A8 and A9 (pins U6-16 and U6-15, respectively) are used to select one of the four ten-entry blocks of channel data. These lines are controlled by the four-position channel bank select switch on the front panel during programming and normal operation via the two channel bank select lines $A\overline{B}C\overline{D}$ and $AB\overline{C}\overline{D}$. The lower order eight address lines are controlled by the processor. A0 through A3 (pins U6-4 through U6-7) are controlled by processor I/O lines P4-4 through P4-7. A4 through A7 (pins U6-1 through U6-3 and U6-17) are controlled by processor I/O lines P5-0 through P5-3.

3.2.4.4 The RAM is selected via U16A and U4A. The output of U4A (U4-6) is connected to the RAM access control switch, Q7. Under normal input power conditions, a high level on U4-6 (RAM selected) turns Q7 on and grounds the $\overline{\text{RAM ENABLE}}$ line, allowing access to (chip-enabling) the RAM. If the SW A + line is below approximately 9 V, Q42 in the power supply monitor is allowed to turn off. This action turns Q41 on and grounds the $\overline{\text{RAM DISABLE}}$ line. The disable line is connected to the base of Q7 via CR28 so that when the line is at low level (indicating low SW A + input voltage), Q7 is not allowed to turn on when RAM is selected. This feature prevents erroneous writes to the RAM due to transients on the power and signal lines during power-up and power-down.

3.2.4.5 The RAM input power supply is backed-up by a lithium battery, B1. The battery is connected to the RAM + line via CR8. If the RAM supply voltage drops below approximately 2.5 V, CR8 is forward biased and B1 supplies standby current to the RAM.

3.2.5 Synthesizer Interface

3.2.5.1 The processor controls the two injection synthesizers by loading the two programmable dividers, U1 and U2 with the appropriate presets. The dividers are interfaced via processor I/O lines P4-0 through P4-7 and the device strobe line ($\overline{\text{ST}}$). During both programming and normal operation, the synthesizers are repeatedly loaded (about once every 250 ms). The dividers are selected for access via U4B and U4C.

3.2.5.2 Each of the dividers contains several internal latches and requires several four-bit load words for operation. When a word is transferred from the processor to one of the dividers, the data appears on the divider data lines DIV DATA0-3 (P4-4 through P4-7) and the internal latch address appears on the divider address lines DIV ADDR0-2 (P4-0 through P4-2). The appropriate device is selected by a high level on the corresponding divider strobe line (U1-27 or U2-27). When the strobe line returns to low level, the data is stored in the addressed latch.

3.2.5.3 The data stored in each divider circuit includes the divisors (presets) for the internal reference and feedback frequency dividers. Both divider circuits also include latches which are loaded by the processor and are directly connected to output pins on each divider chip. These latches are used as buffer registers for control signals from the processor to circuits external to the "S" board.

3.2.6 External Control Signals

3.2.6.1 Processor-driven control signals from the "S" board to other radio circuits include the harmonic filter range selection, the transmission mode selection, and the antenna tuner RETUNE signal. These signals are controlled by the processor via the buffer registers in the two divider circuits. The only other control signal from the "S" board is the MUTE/DISABLE signal. This line is controlled by the processor and the synthesizers in a wire-OR configuration.

3.2.6.2 The harmonic filter range selection signals HF-A, HF-B, and HF-C form the binary representation of the range numbers 1 through 5. HF-A is

the least significant bit and HF-C is the most significant bit. HF-A is loaded into a buffer latch in U1 and is connected to J18-7 from U1-20. HF-B and HF-C are buffered in U2 and are connected to J18-19 and J18-17 from U2-19 and U2-20, respectively.

3.2.6.3 The transmission mode selection signals, PILOT and $\overline{\text{AME}}$ are buffered in U1 and connected to J18-20 and J18-18 from U1-18 and U1-17, respectively. Both lines are at low level during receive and SSB is selected when both lines are at their inactive level (PILOT at low level and $\overline{\text{AME}}$ at high level).

3.2.6.4 The RETUNE line is buffered in U2 and connected to J18-15 from U2-17. This line is used when an automatic antenna tuner is connected to the radio. RETUNE is pulsed to high level when retuning of the antenna tuner is required by a change in the radio operating frequency.

3.2.6.5 The MUTE/DISABLE line is used to mute the receiver and disable the transmitter either under processor control or when the synthesizers are out-of-lock. If the VXO phase detector (U8), the VCO1 phase detector (U14), or the VCO2 divider/phase detector (U2) is out-of-lock or the processor forces P0-5 (U3-18) to high level, the out-of-lock ($\overline{\text{OOL}}$) line is forced to low level. This low level turns the mute/disable switch, Q38, off and forces MUTE/DISABLE to high level (active).

3.2.7 System Clock

The fundamental reference clock signal for the "S" board is provided by the "A" board via P/J112. The 9.216 MHz REFERENCE signal is connected to the VCO1 divider and the VCO2 divider for use as the loop reference frequency. This signal is also used to provide the feedback frequency offset in the VXO synthesizer. The reference frequency is also divided by four in U1 to provide the processor clock input.

3.3 FIRST INJECTION SYNTHESIZER

3.3.1 VCO1 Divider

3.3.1.1 The VCO1 divider, U1, contains two programmable dividers which are loaded by the processor. The reference divider is programmed to divide the 9.216 MHz reference input (U1-2) by 2880 to provide a 3.2 kHz divided reference signal (FR; U1-5). The feedback divider is programmed to divide the first injection feedback frequency (U1-25) to provide a 3.2 kHz divided feedback signal (FV; U1-9) when VCO1 is operating at the desired injection frequency. These two signals are connected to the sample-and-hold phase detector, U14.

3.3.1.2 The VCO1 divider is also loaded with a band select signal. This signal is connected from U1-19 to the VCO1 band select switch Q27 and is used to enable one of the two oscillator circuits in VCO1. When at high level, the low-band oscillator is selected.

3.3.2 VCO1 Phase Detector

3.3.2.1 The phase detector U14 compares the phase of the divided reference and divided feedback signals. On the positive transition of the reference input (U14-2), the ramp generator (Q2) is turned on and controlled by U14 to draw a constant current through the ramp capacitor C101. This action generates a linear ramp voltage at U14-24.

3.3.2.2 On the positive transition of the loop (divided feedback) input (U14-23), the ramp is stopped for a period determined by the sample timing capacitor C104. During this time, the two hold capacitors are charged to a level determined by the voltage present at U14-24 (the terminal ramp voltage). At the end of the sample time, the ramp generator is reset in preparation for the next cycle (C101 is discharged).

3.3.2.3 The voltage level on the hold capacitors is used to control a push-pull output driver. The driver consists of an internal NPN transistor and an external PNP transistor (Q1). The driver provides a dc frequency control signal to VCO1 to maintain the desired injection frequency.

3.3.3 VCO1

3.3.3.1 VCO1 contains two oscillator stages. The high band oscillator, Q25, operates in the range 89.5-93 MHz. The low band oscillator, Q24, operates in the range 77-89.5 MHz. Only one of the stages is enabled (supplied bias current from the VCO1 supply filter) under control of the BAND SELECT signal.

3.3.3.2 The two stages operate in much the same manner. The dc level on the VCO1 CONTROL line from the phase detector (U14) controls the frequency of the enabled stage by varying the capacitance of two varactor diodes connected to the gate of the oscillator transistor.

3.3.3.3 Each stage includes an output buffer which is connected to a common output amplifier circuit, Q39 and Q40. The output of Q40 is the first injection signal (77-93 MHz controlled in 3.2 kHz steps) and is connected to the first mixer (U10-8). The VCO1 FEEDBACK signal is connected from the input of the output amplifier (the base of Q39) via Q36 and Q37 to the VCO1 divider (U1-25).

3.4 SECOND INJECTION SYNTHESIZER

3.4.1 Overall

The second injection synthesizer is composed of two phase-locked synthesizers; the VCO2 synthesizer

and the VXO synthesizer. The output of the VCO2 synthesizer is used as the reference input to the VXO synthesizer. The VCO2 synthesizer is controlled directly by processor programming and the output frequency of the VXO synthesizer (the second injection signal) is controlled by the frequency of the VCO2 synthesizer. Therefore, by when the processor changes the VCO2 output frequency, the VXO output frequency is changed.

3.4.2 VCO2 Divider

3.4.2.1 The VCO2 divider, U2 operates in much the same manner as the VCO1 divider. U2 is programmed by the processor to divide the 9.216 MHz reference input (U2-2) and the desired VCO2 feedback frequency input (U2-25) to provide two signals at 3.2 kHz. The divided reference and feedback signals are present at U2-5 and U2-9, respectively.

3.4.2.2 The two divided signals are phase-compared by an internal phase detector to provide two pulsed control outputs, $\overline{UP}$ (U2-6) and DOWN (U2-8). The two control outputs are connected to a charge pump consisting of Q4 and Q5. The charge pump integrates the two pulsed control signals to provide a dc frequency control signal to VCO2.

3.4.3 VCO2

VCO2 operates in the range 29.03-29.34 MHz and is controlled in 3.2 kHz steps by the VCO2 control line. The dc level on the control line controls the frequency of the oscillator stage (Q9) by varying the capacitance of the varactor diode CR13. The output of Q9 is buffered and amplified by Q10 and Q11. The output of VCO2 is connected to the feedback amplifier Q6 and, via Q12, to the fixed divide-by-16 circuit U7. U7 provides a variable-frequency reference input to the VXO divider/phase detector (U8) via Q13.

3.4.4 Divider/Phase Detector

3.4.4.1 The divider/phase detector, U8, contains two programmable dividers and a phase detector. The two dividers are strapped to divide the approximately 1.8 MHz input from VCO2 (U8-9) by four and the approximately 900 kHz offset feedback input (U8-1) from the multiplier/mixer by two. The divided feedback signal is connected from U8-3 (the divider output) to U8-14 (the phase comparator loop input). The divided VCO2 signal is internally connected from the divider output to the phase detector reference input.

3.4.4.2 The two divided signals, both at approximately 450 kHz, are phase compared to provide a dc frequency control signal output (U8-13) to the VXO. In this manner the VXO control signal is determined by the phase comparison of a variable reference signal (from VCO2) and the offset VXO feedback signal with both signals divided by fixed numbers (the more common method operates from a fixed reference frequency and a variable feedback frequency divider).

3.4.5 VXO

3.4.5.1 The VXO (voltage-controlled crystal oscillator) is a crystal oscillator which can be frequency-warped by the VXO control signal. The VXO control signal from the divider/phase detector (U8-13) controls the capacitance of the varactor diode, CR15 to control the frequency of the oscillator stage, Q20.

3.4.5.2 The output of Q20, at the second injection frequency, is buffered by Q21 and applied to the feedback amplifier Q22 and to the second injection amplifier, Q23. The output of Q23 is the second injection signal and is applied to the second mixer (U11-7). By programming the VCO2 divider, the processor controls the second injection frequency over the range 63.595-63.605 MHz in 100 Hz steps.

3.4.6 Multiplier/Mixer

3.4.6.1 The multiplier/mixer is used to offset the VXO feedback frequency from approximately 63.6 MHz to about 900 kHz for input to the divider/phase detector. This is accomplished by mixing the VXO frequency with an approximately 64.5 MHz signal (seven times the 9.216 MHz reference frequency).

3.4.6.2 The 9.216 MHz reference signal is connected to the base of Q18. Q18 is biased to produce many high-level odd harmonics of the input frequency. The output of the VXO feedback amplifier, Q22 is connected to Q19. Q19 does not produce high-level harmonics. The amplified feedback signal and (mainly) the seventh harmonic of the reference signal are mixed by Q17. The result is filtered by Q16 (900 kHz bandpass) to remove unwanted mixing products. The filtered signal is applied to the divider/phase detector (U8-1) via Q15 and Q14.

parts list

TRN4957A Synthesizer ("S") Board — PL-7827-O

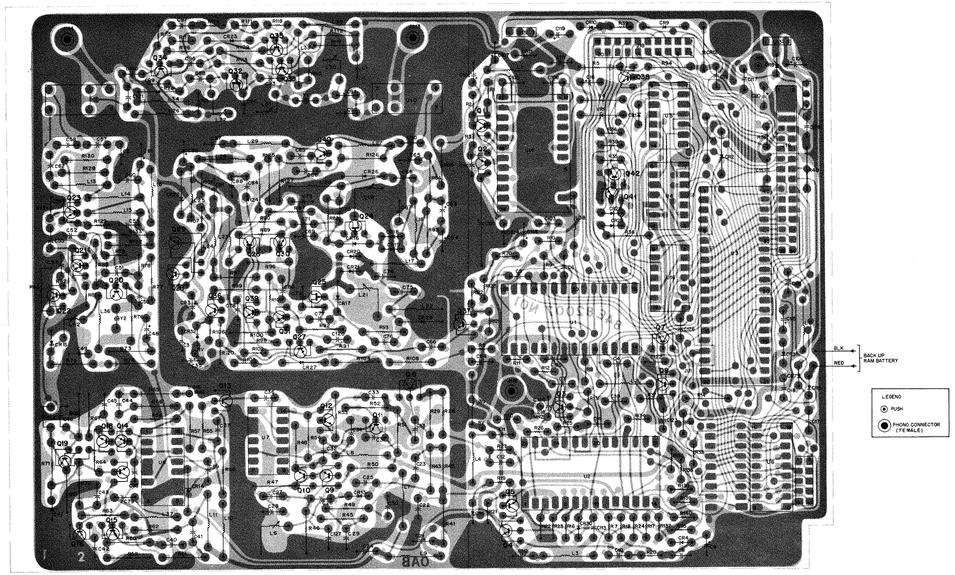
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ± 10%; 100 V; unless otherwise stated
C1	21-11015B15	.0015
C2, 3	8-11017B08	.01; 50 V
C4	8-11017B14	.047; 50 V
C5	21-11014H17	4.7uF ± 0.25 pF
C6	8-11017B14	.047; 50 V
C7	21-11015B15	.0015
C8	8-11017B08	.01; 50 V
C9	23-11019A27	22 ± 20%; 25 V
C10	8-11017B01	.001; 50 V
C11	8-11017B14	.047; 50 V
C12	21-11015B05	220 pF
C13	21-11014H17	4.7 pF ± 0.25 pF
C14, 15	8-11017B14	.047; 50 V
C16	23-11019A27	22 ± 20%; 25 V
C17, 18, 19	8-11017B17	0.1; 50 V
C20	23-11019A27	22 ± 20%; 25 V
C21	23-84538G27	2.2; 25 V
C22	8-11017B17	0.1; 50 V
C23	8-11017B08	.01; 50 V
C24	23-11019A27	22 ± 20%; 25 V
C25, 26	21-11015B15	.0015
C27	21-11014H49	100 pF ± 0.5%
C28	21-11014H41	47 pF ± 5%
C29	8-11017B17	0.1; 50 V
C30	8-11017B14	.047; 50 V
C31	8-11017B08	.01; 50 V
C32	21-11014H32	20 pF ± 5%
C33	21-11014H38	36 pF ± 5%
C34	8-11017B14	.047; 50 V
C35	23-11013A27	22 ± 20%; 25 V
C36	23-11014H41	47 pF ± 5%
C37	8-11017B14	.047; 50 V
C38	21-11014H49	100 pF ± 0.5 pF
C39	21-11014H41	47 pF ± 5%
C40, 41, 42	21-11015B05	220 pF
C43	8-11017B14	.047; 50 V
C44	21-11015B05	220 pF
C45	21-11015B15	.0015
C46	21-11014H41	47 pF ± 5%
C47	8-11017B14	.047; 50 V
C48	23-84538G27	2.2; 25 V
C49	8-11017B08	.01; 50 V
C50	21-11014H41	47 pF ± 5%
C51	21-11014H38	36 pF ± 5%
C52	21-11014H32	20 pF ± 5%
C53	21-11015B15	.0015
C54	21-11014H32	20 pF ± 5%
C55	21-11014H38	36 pF ± 5%
C56, 57	21-11015B15	.0015
C58	21-11014H49	100 pF ± 0.5 pF
C59	21-11015B15	.0015
C60	8-11017B14	.047; 50 V
C61	23-11014A27	22 ± 20%; 25 V
C62	21-11014H36	30 pF ± 5%
C63	23-84538G28	0.33; 35 V
C64	23-84538G27	2.2; 25 V
C65	8-11017B14	.047; 50 V
C66	21-11014H17	4.7 pF ± 0.25 pF
C67, 68	21-11014K43	110 pF ± 5%
C69, 70	21-11015B15	.0015
C71	21-11014H17	4.7 pF ± 0.25 pF
C72, 73	21-11015B15	.0015
C74, 75	21-11014H49	100 pF ± 0.5 pF
C76	21-11015B15	.0015
C77	21-11014H17	4.7 pF ± 0.25 pF
C78	21-11014H38	36 pF ± 5%
C79	8-11017B08	.01; 50 V
C80	21-11015B15	.0015
C81	21-11017B14	.047; 50 V
C82	23-11019A27	22 ± 20%; 25 V
C83	23-11019A45	100 ± 20%; 16 V
C84	21-11014H36	30 ± 5%
C85	21-11015B05	220 pF
C86	21-11015B15	.0015
C87	21-11014H32	20 pF ± 5%
C88	21-11014H17	4.7 pF ± 0.25 pF
C89	21-11015B05	220 pF
C90	21-11014H36	30 pF ± 5%
C91	21-11014H32	20 pF ± 5%
C92	21-11014H49	100 pF ± 0.5 pF
C93	21-11014H36	30 pF ± 5%
C94	21-11014H41	47 pF ± 5%
C95	8-11017B08	.01
C96, 97	21-11015B15	.0015
C98	21-11014H27	12 pF ± 5%
C99, 100	21-11014H49	100 pF ± 0.5%
C101	8-84326A17	.00865 ± 2%; 50 V
C102	23-11019A27	22 ± 5%
C103	21-11014H49	100 pF ± 0.5%
C104, 105	8-11017B08	.01; 50 V
C106	8-11017B01	.001; 50 V
C107, 108	23-11019A27	22 ± 20%; 25 V
C109	8-11017B08	.01; 50 V
C110	21-11014H36	30 pF ± 5%
C111	23-11019A27	22 ± 20%; 25 V
C112	8-11017B08	.01; 50 V
C113	8-11017B17	0.1; 50 V
C114	23-84538G27	2.2; 25 V
C115	23-11019A27	22 ± 20%; 25 V
C116	23-11015A45	100 ± 20%; 16 V
C117, 118	23-11019A27	22 ± 20%; 25 V
C119	23-11015A45	100 ± 20%; 16 V
C120, 121	21-11015B15	.0015
C122 thru 125	21-11014H49	100 pF ± 0.5 pF
C126	21-11014H41	47 pF ± 5%
C127	21-11014H32	20 pF ± 5%
		diode: (see note 1)
CR1 thru 5	48-83654H01	silicon
CR6 thru 9	48-84616A01	hot carrier
CR10	48-83654H01	silicon
CR11	48-84616A01	hot carrier
CR12	48-82466H18	silicon
CR13	48-82190H32	silicon
CR14	48-83654H01	silicon
CR15	48-82190H32	silicon
CR16, 17	48-84616A01	hot carrier
CR18 thru 21	48-82190H49	silicon
CR22, 23	48-83654H01	silicon
CR24	48-83510F03	current control
CR25, 26	48-83654H01	silicon
CR27, 28, 29	48-84616A01	hot carrier
CR30	48-83654H01	silicon
CR31	48-84616A01	hot carrier
		connector, receptacle:
J18	28-83579M01	male;26-contact
J19	28-83579M04	male;34-contact
J112, 113, 114	9-82615F01	female; single contact (phono)
		coil, rf:
L1	24-82549D42	choke; 10 uH
L2	24-83961B01	3 turns
L3	24-82549D37	choke; 100 uH
L4, 5	24-83961B01	3 turns
L6	24-82556N02	9-1/2 turns
L7 thru 11	24-82549D37	choke; 140 uH
L12	24-82307M03	12-1/2 turns
L13	24-82549D38	choke; 0.22 uH
L14, 15	24-82549D42	choke; 10 uH
L16	24-82549D37	choke; 100 uH
L17, 18	24-82549D42	choke; 10 uH
L19	24-82556N03	2-1/2 turns; variable
L20	24-82549D42	choke; 10 uH
L21	24-82556N03	2-1/2 turns; variable
L22, 23, 24	24-82549D42	choke; 10 uH
L25	24-83961B01	3 turns
L26	24-82549D37	choke; 100 uH
L27	24-82549D42	choke; 10 uH
L28, 29	24-82723H05	choke; 0.41 uH
L30, 31	24-82307M02	10-1/2 turns
L32	24-82307M03	12-1/2 turns
L33, 34	24-82723H06	choke; 0.2 uH
L35	24-82549D37	choke; 100 uH
L36	24-82835G32	choke; 0.64 uH
L37	24-82723H01	choke; 1.2 uH
L38, 39	24-83961B01	3 turns
		transistor: (see note 1)
Q1, 2	48-869643	PNP, type M9643
Q3	48-869642	NPN, type M9642
Q4	48-869643	PNP, type M9643
Q5	48-869642	NPN, type M9642
Q6	48-869494	NPN, type M9494
Q7, 8	48-869642	NPN, type M9642
Q9 thru 12	48-869494	NPN, type M9494
Q13	48-869642	NPN, type M9642
Q14, 15, 16	48-869643	PNP, type M9643
Q17 thru 23	48-869494	NPN, type M9494
Q24, 25	48-869830	field-effect
Q26, 27	48-869643	PNP, type M9643
Q28	48-869642	NPN, type M9642
Q29	48-869643	PNP, type M9643
Q30, 31	48-869494	NPN, type M9494
Q32	48-869651	field-effect
Q33	48-869642	NPN, type M9642
Q34	48-869494	NPN, type M9494
Q35	48-869643	PNP, type M9643
Q36, 37	48-869494	NPN, type M9494
Q38	48-869706	Darlington
Q39	48-869494	NPN, type M9494
Q40	48-869932	NPN, type M9932
Q41, 42	48-869642	NPN, type M9642
		resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R1	6-11009E01	10
R2	6-11009E29	150
R3	6-11009E53	1.5k
R4	6-11009A81	22k
R5	6-11009A65	4.7k
R6	6-11009E81	3.3k
R7	6-11009FP22	1 meg.
R8	6-11009E65	4.7k
R9, 10	6-11009E49	1k
R11	6-11009E37	330
R12	6-11009E65	4.7k
R13	6-11009E97	100k
R14	6-11009A49	1k
R15	6-11009A65	4.7k
R16	6-11009E71	8.2k
R17	6-11009E53	1.5k
R18	6-11009E71	8.2k
R19	6-11009E53	1.5k
R20, 21	6-11009E29	150
R22, 23, 24	6-11009E65	4.7k
R25, 26, 27	6-11009E49	1k
R28	6-11009A41	470
R29	6-11009A97	100k
R30	6-11009E37	330
R31	6-11009E65	4.7k
R32, 33	6-11009E49	1k
R34	6-11009E61	3.3k
R35	6-11009E71	8.2k
R36	6-11009A61	3.3k
R37	6-11009A57	2.2k
R38	6-11009E65	4.7k
R39	6-11009E49	1k
R40	6-11009A65	4.7k
R41	6-11009A57	2.2k
R42	6-11009A81	22k
R43	6-11009A89	47k
R44		NOT USED
R45, 46	6-11009A81	22k
R47, 48	6-11009A49	1k
R49	6-11009A29	150
R50	6-11009A43	560
R51	6-11009A49	1k
R52	6-11009A97	100k
R53	6-11009A81	22k
R54	6-11009A49	1k
R55	6-11009A97	100k
R56, 57	6-11009E61	3.3k
R58	6-11009A97	100k
R59	6-11009E61	3.3k
R60	6-11009A97	100k
R61	6-11009A49	1k
R62	6-11009A73	10k
R63	6-11009A49	1k
R64	6-11009A65	4.7k
R65	6-11009A43	560
R66	6-11009A65	4.7k
R67, 68	6-11009A43	560
R69	6-11009A65	4.7k
R70	6-11009E49	1k
R71	6-11009A65	4.7k
R72	6-11009A73	10k
R73	6-11009A37	320
R74	6-11009E43	3.3k
R75	6-11009A89	47k
R76	6-11009A49	1k
R77	6-11009A81	22k
R78	6-11009E81	33k
R79	6-11009E49	1k
R80	6-11009A33	270
R81	6-11009E49	1k
R82	6-11009A33	220
R83	6-11009A49	1k
R84	6-11009A81	22k
R85	6-11009A61	3.3k
R86	6-11009A65	4.7k
R87	6-11009A25	100
R88	6-11009A29	150
R89	6-11009A65	4.7k
R90	6-11009A61	3.3k
R91	6-11009A65	4.7k
R92	6-11009A25	100
R93	6-11009A29	150
R94	6-11009A73	10k
R95	6-11009E65	4.7k
R96, 97	6-11009A41	470
R98	6-11009A33	330
R99	6-11009E29	150
R100	6-11009A61	3.3k
R101	6-11009A65	4.7k
R102, 103	6-11009E61	3.3k
R104	6-11009A65	4.7k
R105	6-11009E61	3.3k
R106	6-11009E77	15k
R107	6-11009E81	22k
R108	6-11009A65	4.7k
R109	6-11009A53	2.2k
R110	6-11009E71	8.2k
R111	6-11009E37	330
R112	6-11009A65	4.7k
R113	6-11009A57	2.2k
R114	6-11009E15	39
R115	6-11009E29	150
R116	6-11009A71	8.2k
R117	6-11009E61	3.3k
R118	6-11009E71	8.2k
R119	6-11009A73	10k
R120	6-11009E43	330
R121	6-11009E97	100k
R122	6-11009E29	150
R123	6-11009E43	330
R124	6-11009A61	3.3k
R125	6-11009A57	2.2k
R126	6-11009A33	220
R127	6-11009A29	150
R128	6-11009A49	1k
R129	6-11009E29	150
R130	6-11009A73	10k
R131	6-11009E65	4.7k
R132	6-11009A29	150
R133	6-11009A43	560
R134 thru 136	6-11009E65	4.7k
R137 thru 140	6-11009E59	2.7k
		integrated circuit: (see note 1)
U1, 2	51-84768F803	divider/phase detector
U3	51-83625M45	microprocessor (note 2)
	or 51-83625M46	microprocessor (note 2)
U4	51-84561L44	triple 3-input AND
U5	51-84561L03	hex inverter
U6	51-83627M02	1k x 4 RAM
U7	51-84561L02	4-bit counter
U8	51-84887K55	divider/phase detector
U9	51-84621K27	+ 5 V regulator
U10, 11	1-83366M01	mixer
U12		NOT USED
U14	51-84768F59	phase detector
U16	51-84561L45	dual 4-input AND
		voltage regulator: (see note 1)
VR1	48-82256C56	Zener type; 8.8 V
		crystal: (see note 1)
Y1	91-82474N01	75 MHz
Y2	48-82559K03	63.615 MHz
		non-referenced items
	14-84602K02	XTAL INSULATOR; 2 used
	9-84186L01	SOCKET; IC; 40-contact
	26-82671D27	SHIELD; coil; 4 used
	30-83361Q01	CABLE; coaxial; RG178B/U
	28-83579M03	RECEPTACLE, male; 10-contact

TRN5006A Synthesizer ("S") Board Hardware Kit — PL-7828-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		battery:
B1	60-82758N03	3 V; lithium
		integrated circuit: (see note)
U13	51-83629M01	+ 5 volt regulator
U15	51-84621K25	+ 8 volt regulator
		mechanical parts
	3-134212	SCREW, tapping; 4-40 x 5/16"
	3-140193	SCREW, tapping; 6-32 x 5/16"; 1 used
	4-84180C01	WASHER, shoulder
	9-82757N01	SOCKET, battery
	14-84268A01	INSULATOR, transistor
	15-82080N01	HOUSING
	15-82082N01	COVER, button; VCO
	38-82642N01	CAP

notes:
1. For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.
2. The 51-83625M45 microprocessor is a part of the TRN5009A Chassis Hardware Kit (100 W and 150 W radios). The 51-83625M46 microprocessor is a part of the TRN5010A Chassis Hardware Kit (125 W radios).

SYNTHESIZER ("S") BOARD
MODEL TLN2390A



SHOWN FROM COMPONENT SIDE

COMPONENT SIDE "B"-EEPS-33797-O
SOLDER SIDE "B"-EEPS-33798-O
DL-EEPS-33799-O

SYNTHESIZER ("S") BOARD

Motorola No. PEPS-33953-O
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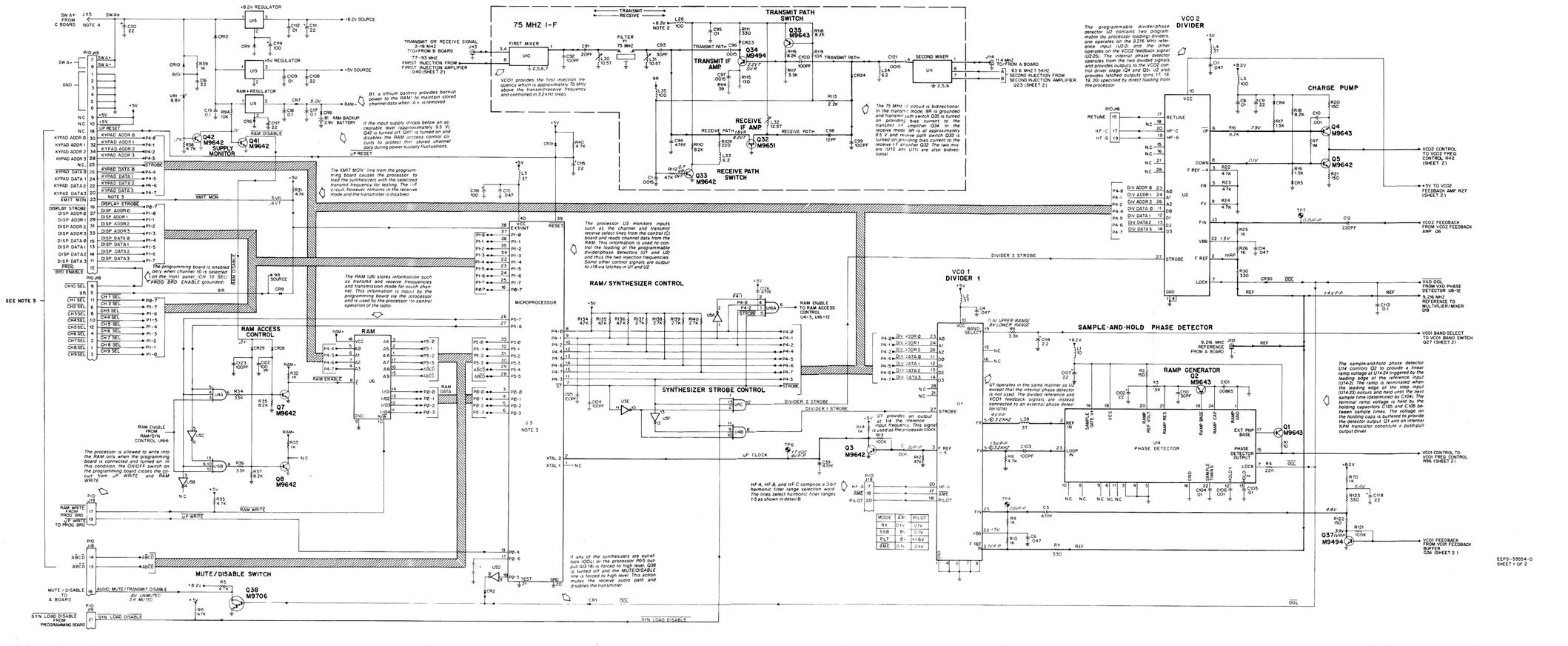
SYNTHESIZER ("S") BOARD

MODEL TLN2390A



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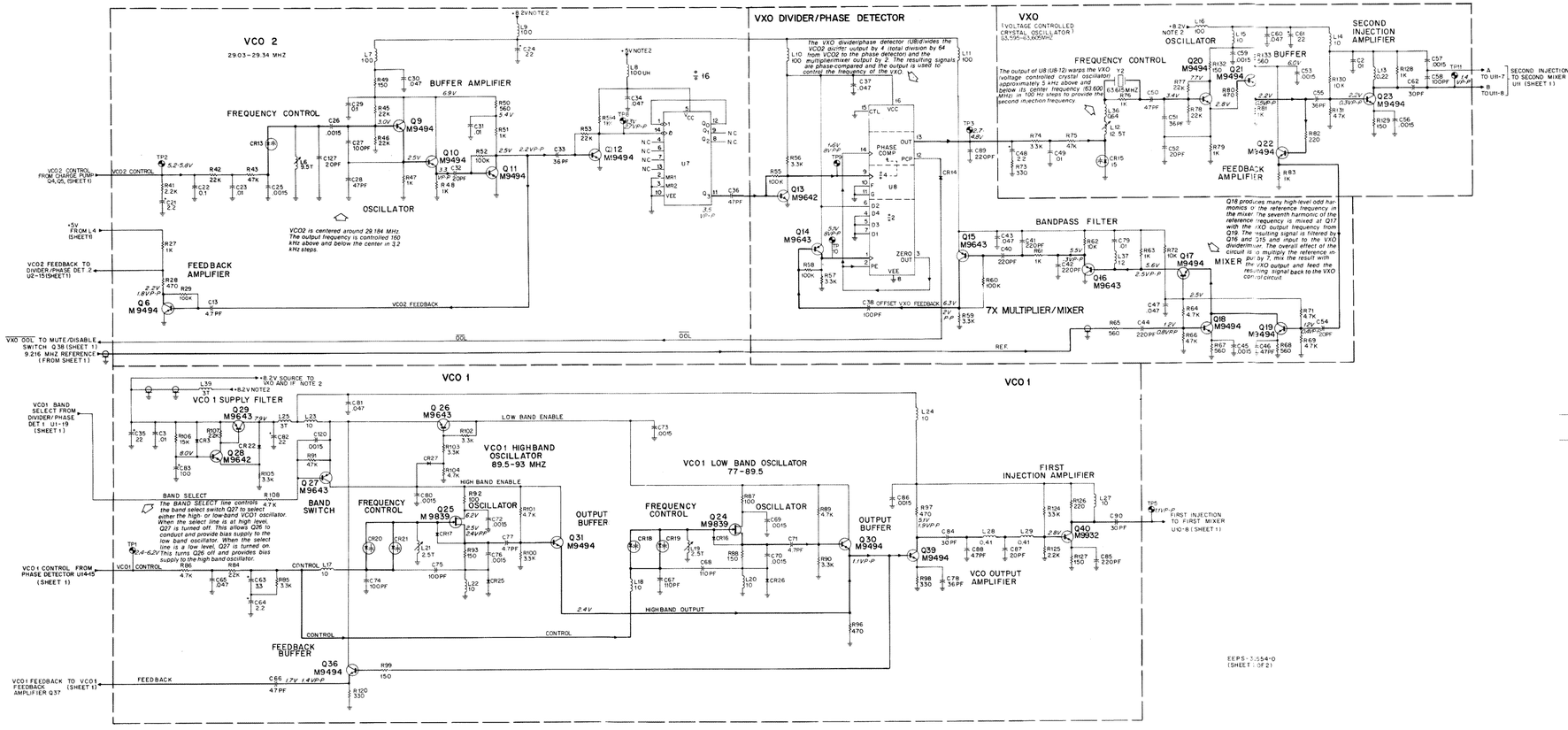
(Sheet 2 of 3)
1/29/82- PHI

SYNTHESIZER ("S") BOARD
MODEL TLN2390A



NOTES:

1. Unless otherwise stated, all resistor values are in ohms, capacitor values are in microfarads, and inductor values are in microhenries.
2. For clarity, +8.2 V and ground lines which cross casting boundaries are not shown. The input supply to each area is connected directly to the regulator circuits in the processor area except the VXO and IF 8.2 V supplies which are connected to a point in the VCO1 area.
3. Many of the board and processor input/output lines are multi-functional. Therefore each of these lines is identified by the processor port and line number throughout and by functional name where applicable. For example, U3-37 is identified as P1-0 (port 1, line 0) throughout but also as the CH9 SEL near J18 (connection to the D board) and as DISP ADDR 0 near J19 (connection to the PROG board). Refer to Detail A.
4. The S board is supplied SW A + input power via PIJ115 from the C board. The S board is grounded to the radio chassis by its mounting screws, no dedicated ground lines are used.

IC Table

Reference Designation	Description	VCC	Gnd
U1, U2	Synthesizer	10 (+5 V)	1
U3	Microprocessor	40 (+5 V)	20
U4	Triple 3-Input AND	14 (+5 V)	7
U5	Hex Inverter	14 (+5 V)	7
U6	1k x 4 RAM	18	9
U7	4-Bit Counter	5 (+5 V)	10
U8	Divider/Phase Detector	16 (+8.2 V)	8
U9	+5 V Regulator	—	—
U10, U11	Mixer	—	—
U13	+5 V Regulator	—	—
U14	Phase Detctor	18 (+8.2 V)	1
U15	+8 V Regulator	—	—
U16	Dual 4-Input AND	14 (+5 V)	7

Detail B. Harmonic Filter Range Selection

Filter Range	HF-C	HF-B	HF-A
1	.1 V	.1 V	8 V
2	.1 V	8 V	.1 V
3	.1 V	8 V	8 V
4	8 V	.1 V	.1 V
5	8 V	.1 V	8 V

Detail A. Multi-Functional Line Cross Reference Table

U3 Port-Line Number	D Board Connection (J18)	Prog Board Connection (J19)	On-Board Connections
P0-0	—	—	RAM DATA 0
P0-1	—	—	RAM DATA 1
P0-2	—	—	RAM DATA 2
P0-3	—	—	RAM DATA 3
P0-4	—	$\overline{\text{UP WRITE}}$	—
P0-5	—	—	uP MUTE/DISABLE
P0-6	—	—	—
P0-7	CH1 SEL	DISPLAY STROBE	—
P1-0	$\overline{\text{CH9 SEL}}$	DISP ADDR0	—
P1-1	$\overline{\text{CH8 SEL}}$	DISP ADDR1	—
P1-2	$\overline{\text{CH7 SEL}}$	DISP ADDR2	—
P1-3	$\overline{\text{CH6 SEL}}$	DISP ADDR3	—
P1-4	$\overline{\text{CH5 SEL}}$	DISP DATA0	—
P1-5	$\overline{\text{CH4 SEL}}$	DISP DATA1	—
P1-6	$\overline{\text{CH3 SEL}}$	DISP DATA2	—
P1-7	$\overline{\text{CH2 SEL}}$	DISP DATA3	—
P4-0	—	KYPAD ADDR0	DIVADDR0, RAM SELECT
P4-1	—	KYPAD ADDR1	DIVADDR1, RAM SELECT
P4-2	—	KYPAD ADDR2	DIVADDR2, RAM SELECT
P4-3	—	$\overline{\text{KYPAD ADDR3}}$	SYN STROBE CONTROL
P4-4	—	$\overline{\text{KYPAD DATA0}}$	DIVDATA0, RAM ADDR0
P4-5	—	$\overline{\text{KYPAD DATA1}}$	DIVDATA1, RAM ADDR1
P4-6	—	$\overline{\text{KYPAD DATA2}}$	DIVDATA2, RAM ADDR2
P4-7	—	KYPAD DATA3	DIVDATA3, RAM ADDR3
P5-0	—	—	RAM ADDR4
P5-1	—	—	RAM ADDR5
P5-2	—	—	RAM ADDR6
P5-3	—	—	RAM ADDR7
P5-4	A B C D	—	RAM ADDR8
P5-5	A B C D	—	RAM ADDR9
P5-6	—	—	RAM ACCESS CONTROL
P5-7	—	—	RAM ACCESS CONTROL
Other multi-functional lines			
—	CH10 SEL	PROG BRD ENABLE	—

Motorola No. PEPS-33953-O
(Sheet 3 of 3)
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SYNTHESIZER ("S") BOARD

PROGRAMMING ("P") BOARD
MODEL TRN4963A

1. GENERAL

The Model TRN4963A Programming Board is used to load channel information into *MICOM•S/ TRITON 40•S* radios. The programming board connects to the microprocessor circuits on the radio "S" (synthesizer) board in a wire-OR configuration (the programming board interface signals are multiplexed with other processor I/O signals). The programming board circuits consist of three basic sections; (1) the board enable circuit, (2) a multiplexed display section including a numeric display and status indicators, and (3) a cross-point keypad section with an output-control circuit.

2. BOARD ENABLE CIRCUIT
(Refer to the schematic diagram, PEPS-33954.)

2.1 To operate, the programming board **ON/OFF** switch must be in the **ON** position and the board must be enabled by selecting channel 10 on the radio channel-selection switch. The board enable circuit controls the operation of the programming board in response to the setting of the **ON/OFF** switch (S1) and the $\overline{\text{PROG BRD ENABLE}}$ signal. The $\overline{\text{PROG BRD ENABLE}}$ line is connected on the "S" board to the $\overline{\text{CHANNEL 10 SELECT}}$ line and is at low level when channel 10 is selected on the radio channel-selection switch.

2.2 The keypad and display are enabled when S1 is in the **ON** position (S1A open) — providing a high level to U7-13 and the $\overline{\text{PROG BRD ENABLE}}$ line (P19-12) is at low level — providing a high level to U7-12 via U8A. The resulting output from U7-11 enables the display address decoder (U3) and, via U8E, enables the open-collector keypad output gates (U7A and U10A-D).

2.3 S1 is also used to control writing to the radio RAM. When S1 is in the **ON** position, S1B closes the circuit between the $\overline{\text{uP WRITE}}$ (P19-19) and $\overline{\text{RAM WRITE}}$ (P19-17) lines. The processor is allowed to write information into the RAM only when the programming board is turned on.

3. DISPLAY SECTION
(Refer to the schematic diagram, PEPS-33954.)

3.1 When the programming board is enabled, the radio processor manipulates the $\overline{\text{DISPLAY STROBE}}$ line, display address lines (DISP ADDR0-DISP ADDR3), and display data lines (DISP DATA0-DISP DATA3 to generate the appropriate displays. Two types of displays are used. The channel number and frequency information is shown by a nine-digit, seven-segment numeric display. Status information such as transmission mode and channel type is shown by a row-and-column network of single LED's.

3.2 When data is to be displayed, the appropriate data is forced onto the DISP DATA bus. At the same, time the appropriate display element is selected by the signals on the DISP ADDR lines. Each digit of the numeric display and each column of status LED's is selected by a unique code on the DISP ADDR lines. The display address decoder, U3 decodes and latches the signals on the DISP ADDR lines and generates individual element-select signals. By repeatedly lighting each desired digit element and status LED, an apparently constant display is generated.

3.3 To display numeric information, the BCD-coded information for one digit is forced on the DISP DATA lines by the radio processor. The signals are decoded to a seven-segment format and latched by U2. The output of U2 is applied to the segment anodes of the numeric display, DS11. The anodes of the corresponding segments of each digit are common. At the same time, common cathode of the appropriate digit is grounded by the address decoder, via the corresponding digit driver (Q1-Q8), to form the digit on the display.

3.4 The status displays are driven in much the same manner, except that the row-select information is not encoded when generated by the processor. The row-select signals on the DISP DATA lines are latched by U1 and applied to the anodes of the status LED's. At the same time, one column is selected by the DISP ADDR lines via U3 and the corresponding column driver (Q9-Q11). When the row and column selection for a status LED coincide, the LED lights.

4. KEYPAD SECTION

(Refer to the schematic diagram, PEPS-33954.)

4.1 All of the programming board entry keys, except the **XMT MON** key, are part of a cross-point keypad (S2-S26). The processor scans the keypad by selecting one row at a time and monitoring the column outputs for a key closure (a short between a row and a column). The keypad section also includes an output gating circuit.

4.2 The processor selects each keypad row by generating a unique code on the KEYPAD ADDR lines. The keypad row decoder, U6, generates an active-low signal on the corresponding $\overline{\text{ROW SELECT}}$ line. If a key is pressed on the selected row, the corresponding column output is forced to low level. The column outputs are applied to the keypad output control section.

4.3 The processor also manipulates the keypad control latch (U7-B and U7-C) via the KEYPAD ADDR lines and the keypad row decoder. When the latch is reset (by a low-going pulse on the $\overline{\text{CONTROL LATCH RESET}}$ line, the keypad outputs are disabled by a high level on the $\overline{\text{KEYPAD ENABLE}}$ line (U7-6) and the SYNTHESIZER DISABLE LINE is at low level (inactive). When the control latch is set (by a low-going pulse on the $\overline{\text{CONTROL LATCH SET}}$ line) the keypad out puts are gated through U9A-D to U10A-D and the SYNTHESIZER DISABLE line is at high level (active). If the board is enabled, the keypad outputs are further gated through U10A-D to the "S" board in the radio via the connection cable and connector.

NOTE

On the radio "S" board, the $\overline{\text{KEYPAD DATA}}$ signals are wire-ORed with some of the processor/synthesizer interface signals. The radio synthesizers are operating normally while the programming board is operating. The control latch will be repeatedly set and reset by the processor while the programming board is operating to allow normal processor/synthesizer interface functions (loading of the synthesizers) to be performed without interference from the keypad output signals.

(Sheet 3 is blank)

PROGRAMMING BOARD
MODEL TRN4963A

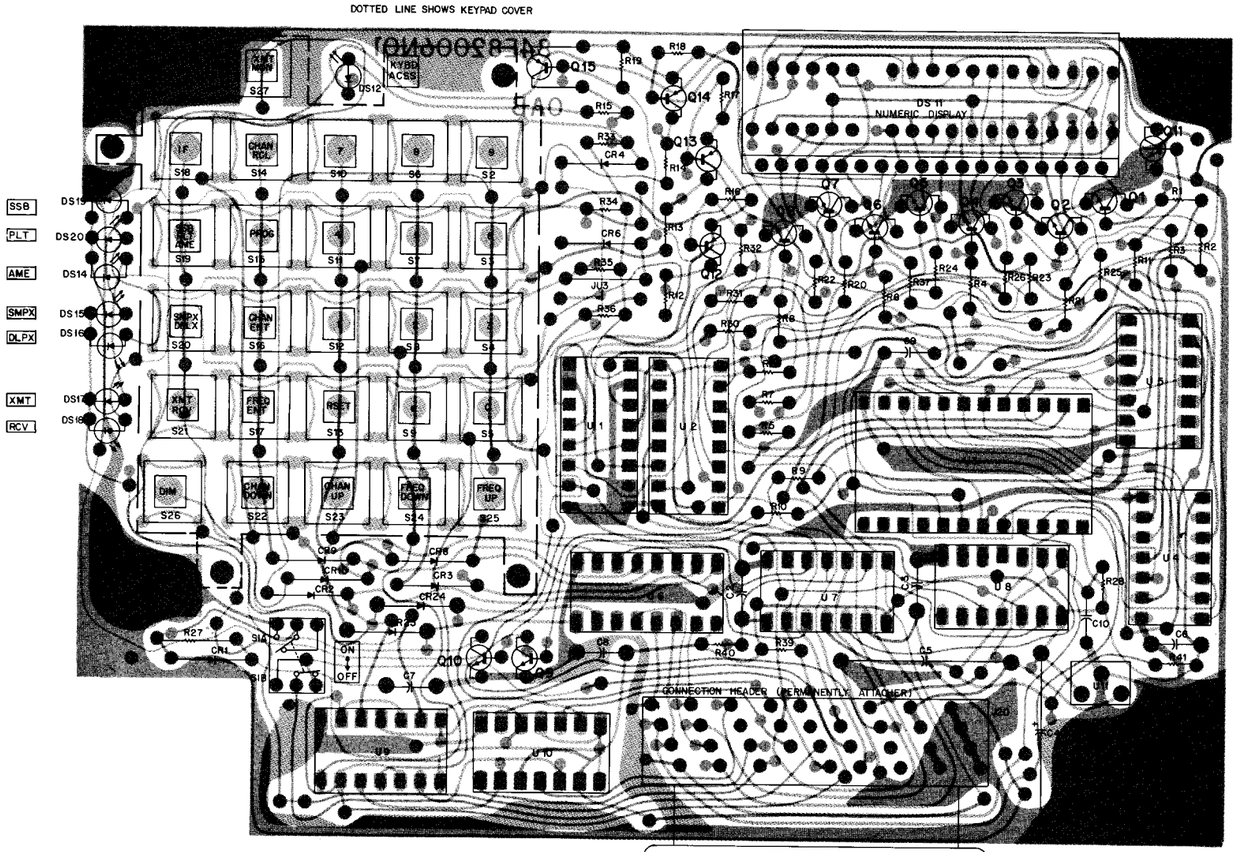
parts list

TRN4963A Programming Board — PL-7826-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF
C2	21-82428B09	.0047 ± 10%; 100 V
C3	21-82372C07	.05 + 80-20%; 25 V
C4, 5	23-84669A35	10 + 50-10%; 25 V
C6 thru 10	21-82372C07	.05 + 80-20%; 25 V
		diode: (see note 1)
CR1	48-83654H01	silicon
CR2 thru 4	48-82178A04	germanium
CR6	48-82178A04	germanium
CR8 thru 10	48-82178A04	germanium
CR23, 24	48-82178A04	germanium
		indicator:
DS11	48-84738K02	9-digit, 7-segment display
DS12	48-84404E01	light emitting diode, RED
DS14 thru 20	48-84404E01	light emitting diode, RED
		connector, receptacle:
J20	—	34-contact; p/o ribbon cable assembly
		connector, receptacle:
P19	—	34-contact; p/o ribbon cable assembly
		transistor: (see note 1)
Q1 thru 11	48-869648	NPN; type M9648
Q12 thru 15	48-869649	PNP; type M9649
		resistor, fixed: ± 5%; 1/4 W
R1 thru 11	6-11009E33	220
R12 thru 15	6-11009E19	56
R16 thru 19	6-11009E81	22k
R20 thru 26	6-11009E22	75
R27, 28	6-11009A65	4.7k
R29 thru 32	6-11009E55	1.8k
R33 thru 36	6-11009E65	4.7k
R37	6-11009E33	220
R39 thru 41	6-11009E65	4.7k
		switch:
S1	40-82932N01	toggle, dpdt
S2 thru 27	39-82036M01	pushbutton, momentary
		integrated circuit: (see note 1)
U1	51-82884L41	4-bit latch
U2	51-82884L44	BCD to 7-segment decoder
U3	51-83627M83	4 to 16 line decoder/latch
U4, 5	51-84561L03	hex inverter
U6	51-84561L62	BCD to decimal decoder
U7	51-84371K83	quad 2-input NAND
U8	51-84561L03	hex inverter
U9	51-84561L06	quad 2-input NOR
U10	51-84371K83	quad 2-input NAND
U11	51-84320A47	5 V regulator
		non-referenced items
	2-131435	NUT, hex; 4-40 x 1/4 x 3/32"
	3-1943	SCREW, machine; 4-40 x 5/16"
	22-84835F01	PIN, polarizing
	28-82776N01	CONNECTOR, display: 18-contact
	75-82154D17	PAD, LED display

notes:
1. For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.
2. For Programming Board parts not listed in the above parts list refer to the Mechanical Parts section.

DOTTED LINE SHOWS KEYPAD COVER



SHOWN FROM COMPONENT SIDE

DETAIL A
P19 CONNECTIONS

PIN NO	DESCRIPTION	PIN NO	DESCRIPTION
1	GND	2	GND
3	GND	4	GND
5	GND	6	GND
7	SW A+	8	SWA+
9	KEYING PLUG	10	SPARE
11	DISP DATA 3	12	$\overline{\text{PROG BRD ENABLE}}$
13	DISP DATA 1	14	DISP DATA 2
15	DISP DATA Ø	16	$\overline{\text{DISPLAY STROBE}}$
17	$\overline{\text{RAM WRITE}}$	18	SPARE
19	$\overline{\mu\text{P WRITE}}$	20	$\overline{\text{KYPAD DATA 3}}$
21	$\overline{\text{SYN LOAD DISABLE}}$	22	$\overline{\text{KYPAD DATA 2}}$
23	$\overline{\text{XMIT MON}}$	24	$\overline{\text{KYPAD DATA 1}}$
25	SPARE	26	$\overline{\text{KYPAD DATA Ø}}$
27	DISP ADDR Ø	28	KYPAD ADDR 3
29	DISP ADDR 1	30	KYPAD ADDR Ø
31	DISP ADDR 2	32	KYPAD ADDR 1
33	DISP ADDR 3	34	KYPAD ADDR 2

NOTE:
EACH OF SWITCHES S2-S27 CONSISTS OF A METAL DIAPHRAGM WHICH RESTS ON FOIL PADS AT ITS PERIMETER. CONTACT IS MADE TO THE CENTER PAD WHEN THE SWITCH IS DEPRESSED.

COMPONENT SIDE BD-DEPS-33887-O
SOLDER SIDE BD-DEPS-33886-O
OL-DEPS-33888-O

Motorola No. PEPS-33954-O
(Sheet 1 of 2)
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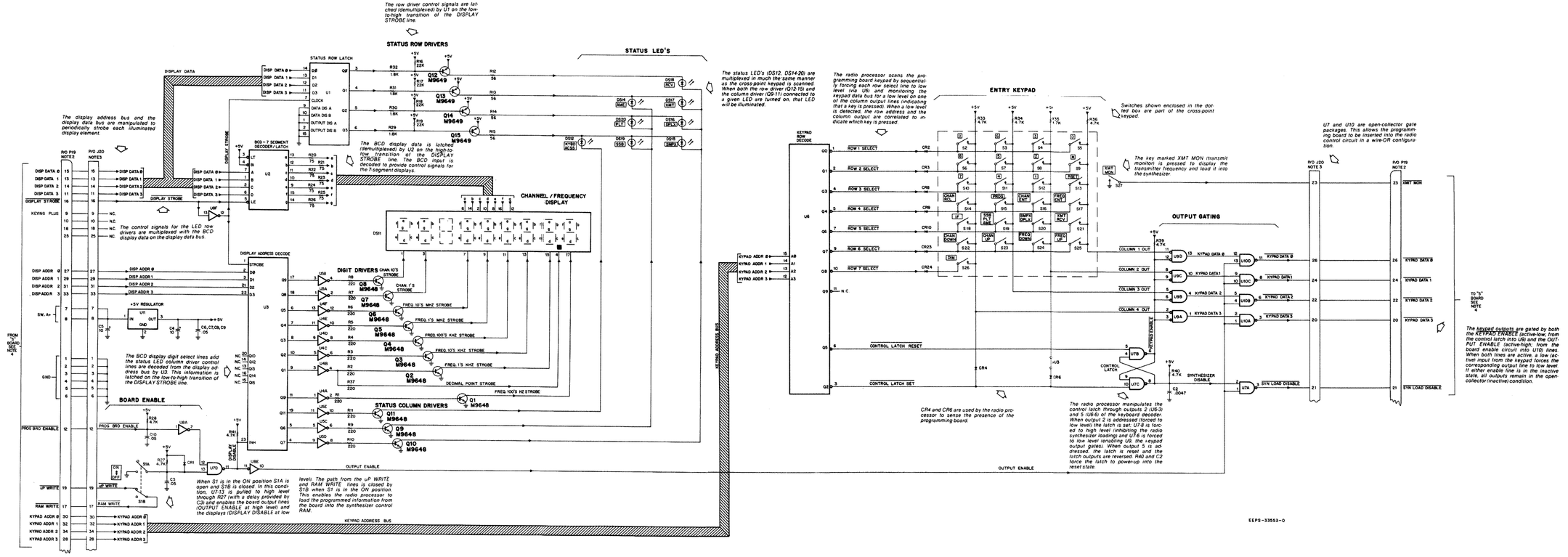


NOTES:

1. Unless otherwise stated, all resistor values are in ohms and capacitor values are in microfarads.
2. All inputs to and outputs from the programming board are made via a ribbon cable terminated with a 34-pin socket (P19) which mates with a connection header in the radio.
3. J20 is a permanently attached cable connection header.
4. Lines used to interface the programming wire-OR multiplexed with other functions on the radio "S" board. These additional signals will be present on the programming board lines. Refer to the "S" board schematic diagram and theory section.

IC Table

Reference Designation	Description	+5 V	Gnd
U1	4-Bit Latch	16	8
U2	BCD to 7-Segment Decoder/Latch	16	8
U3	4-16 Line Decoder/Latch	24	12
U4,5	Hex Inverter	14	7
U6	BCD to Decimal Decoder	16	8
U7	Quad 2-Input NAND; Open Collector	14	7
U8	Hex Inverter	14	7
U9	Quad 2-Input NOR	14	7
U10	Quad 2-Input NAND; Open Collector	14	7
U11	+5 V Regulator	—	—

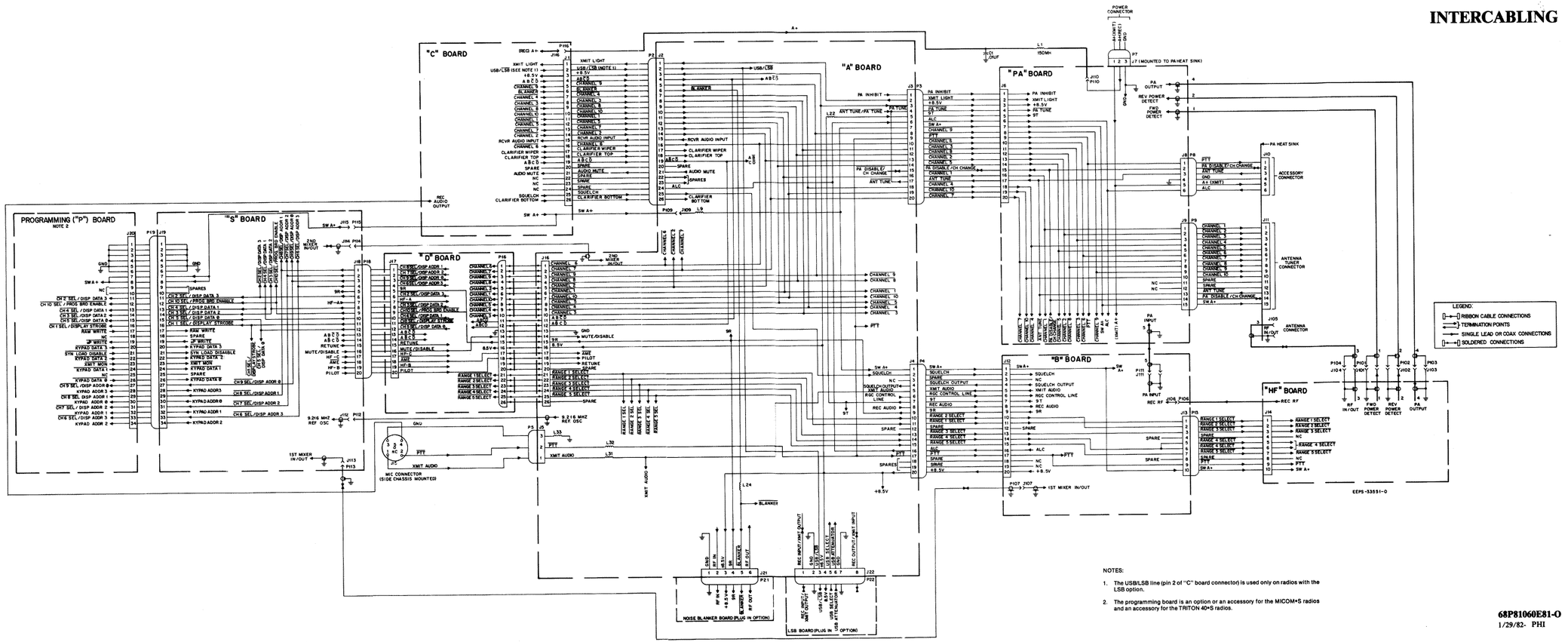
parts list

TRN4900A Chassis Wire & Hardware Kit — PL-7847-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C1	21-84211B01	.01 uF ± 20%; 250 V
		connector, receptacle:
J15	9-84981L01	female; 5-contact
		coil, rf:
L1	24-83220N01	choke; 150 mH
		speaker:
LS1	50-84710G02	3" dynamic
		mechanical parts
	2-115968	NUT, 1/4-28 x 3/8 x 1/8"
	3-135111	SCREW, tapping; 4-40 x 3/8"
	3-140193	SCREW, tapping; 6-32 x 5/16"; 4 used
	4-1720	WASHER, flat
	5-83699M01	GROMMET, screw; 3 used
	5-83885G01	RIVET; 2 used
	5-84220B02	GROMMET; 2 used
	9-84257M01	CONNECTOR, female (phono)
	14-84005K03	INSULATOR
	15-82060M01	HOUSING, microphone
	15-83498F28	HOUSING, connector
	31-132143	TERMINAL, board
	42-83339A07	CLIP, cable
	55-84973H01	HANDLE
	75-83238M01	PAD, transformer; 2 used
	1-80760D78	ASSEMBLY, cable coax and plug; includes:
	4-7607	LOCKWASHER; 2 used
	5-136977	EYELET; 2 used
	28-82365D02	CONNECTOR, male; 2 used
	30-83794C01	CABLE, coaxial (WHT); 19-1/2"
	42-84733F01	RING; 2 used

TKN8061A Power Cable — PL-6758-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	65-20986	FUSE, 30A; 32 V
	65-86099	FUSE, 7.5A; 32 V
	42-82884A01	CLIP, fuseholder; 4 used
	41-82885A01	SPRING, fuseholder; 2 used
	14-82883A01	CAP, fuseholder; 2 used
	14-82882A01	BODY, fuseholder; 2 used
	42-83790M01	RETAINER, strain relief
	3-119947	SCREW, tapping; 6-20 x 3/8"; 2 used
	39-83600M01	CONTACT, receptacle; 3 used
	15-10183A81	HOUSING, connector receptacle
	29-832116	LUG, ring tongue; 3 used



NOTES:

1. The USB/LSB line (pin 2 of "C" board connector) is used only on radios with the LSB option.
2. The programming board is an option or an accessory for the MICOM•S radios and an accessory for the TRITON 40•S radios.

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1. APPLICABILITY

The options which follow are **only** available on the following land mobile radio models.

- D80JMA1N00__K
- D70HEA1N00__K

2. POWER OPTIONS

The power options shown in Table 1 are factory adjustment options requiring no additional parts. Refer to the "Alignment" section for proper power adjustment.

Table 1. Available Power Options

Option Number	Description
S280	25-watt power option
S361	30-watt power option
S367	50-watt power option
S372	60-watt power option

3. DELETE MICROPHONE OPTION (S71)

Option S71 deletes the request for a microphone.

4. SIDEBAND OPTION

The lower sideband option is available as shown on Table 2.

Table 2. Sideband Options

Option Number	Description	Add	Delete
S122	Add LSB operation	TRN4961 *TRN4968	TRN4964

* The TRN4968 Model consists of channel select knob (Motorola Part No. 36-84906L03) and a front panel (Motorola Part No. 64-83260M09).

5. PROGRAMMING BOARD OPTION

The internal programming option is available as shown in Table 3.

Table 3. Programming Board Option

Option Number	Description
S86	TRN4963 Programming Board

6. NOISE BLANKER OPTION

The internal noise blanker option is available as shown in Table 4.

Table 4. Noise Blanker Option

Option Number	Description	Add	Delete
S135	Noise Blanker Front Panel	TRN4962 TRN4966	TRN4964

7. INVERTED FRONT PANEL OPTION

The inverted front panel option (for overhead mounting) is available as shown in Table 5.

Table 5. Inverted Front Panel Option

Option Number	Description	Add	Delete
S96	Inverted Front Panel	TRN4965	TRN4964

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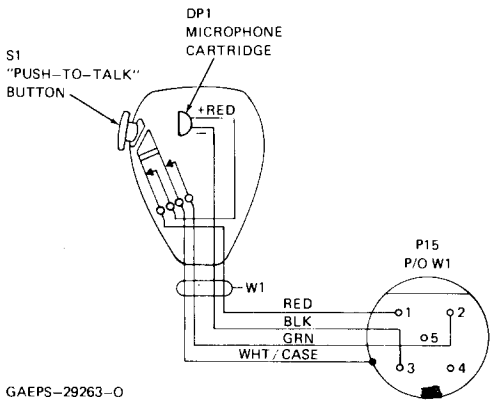
MOTOROLA INC.
Communications Sector

MICROPHONE
MODELS TMN6150A, TMN6151A

This microphone is a palm-type unit with a transistorized preamplifier. The preamplifier is an integral part of the cartridge. The microphone includes a coiled cord, a five-prong microphone connector, and a built-in push-to-talk switch.

The cartride incorporated in the microphone provides fidelity inherently greater than that of carbon microphones. Superior voice quality is retained by amplifying the voice signals in the transistorized preamplifier before these signals become subject to the influence of noise due to stray electrical fields. This results in a high signal-to-noise ratio and high output. The preamplifier derives its operating power from the standard microphone voltage supplied by the associated Motorola radio equipment.

The unit is housed in a corrosion-proof high impact plastic case that minimizes the effects of severe shock and vibration.



GAEPS-29263-O

parts list

TMN6151A Marine Microphone Kit
TMN6150A Land Mobile Microphone Kit PL-6766-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		cartridge, microphone:
DP1	50-82625L01	transistor amplifier
		connector, plug:
P15	28-82005M01	5-contact, male
		switch, PTT:
S1	40-82263G02	dpst
		cord, microphone:
W1	1-80723D43	assembly; includes: ref. items P15, S1
	29-83277G02	LUG, insulator; 8 used
	30-852742	CORD, coiled
	41-852707	SPRING, strain relief
	15-82062M01	HOUSING, cord plug
	43-82061M01	COLLAR, connector (TMN6150A)
	43-82063M01	COLLAR, connector (TMN6151A)
	42-82061M01	CLIP, cable
		non-referenced items
	3-13999	SCREW, tapping: 6-19 x 3/8"; 3 used
	3-140000	SCREW, tapping: 6-19 x 3/4"; 3 used (TMN6150A)
	3-139096	SCREW, machine: 6-32 x 3/4"; 3 used (TMN6151A)
	32-82703B01	GASKET, microphone
	38-84559B01	BUTTON, microphone
	42-82702B02	RETAINER, cartridge
	13-84599B01	EMBLEM (TMN6150A)
	33-82599D01	NAMEPLATE (TMN6150A)
	33-84052E03	NAMEPLATE (TMN6151A)
	35-852701	GRILLE, cloth (TMN6151A)
	4-2645	WASHER, lock: #6 ext.; 3 used (TMN6151A)
	4-139097	WASHER, lock: #6 int.; 3 used (TMN6151A)
	4-139098	WASHER, flat: 0.156"-0.250"-.015") 3 used (TMN6151A)
	4-82418B97	WASHER, nylon; 3 used (TMN6151A)
	42-852710	STRAP (TMN6150A)
	42-84422D01	STRAP (TMN6151A)
	35-82652K01	BAFFLE (TMN6150A)
	15-82662M12	HOUSING, microphone front (TMN6150A)
	1-80709B93	HOUSING ASSEMBLY (TMN6150A) includes:
	4-82705B01	WASHER, back-up
	4-82707B01	WASHER, flat
	15-82662M13	HOUSING, microphone rear
	1-80788B68	HOUSING ASSEMBLY (TMN6151A) includes:
	4-82705B03	WASHER, back-up
	4-82707B01	WASHER, flat
	15-82662M17	HOUSING, microphone rear

END OF DOCUMENT

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