



MITREK[®]

Two-Way FM Radio

403-420 MHz and 450-512 MHz
30/50 Watts



Instruction Manual

68P81037E75-B

OPERATION

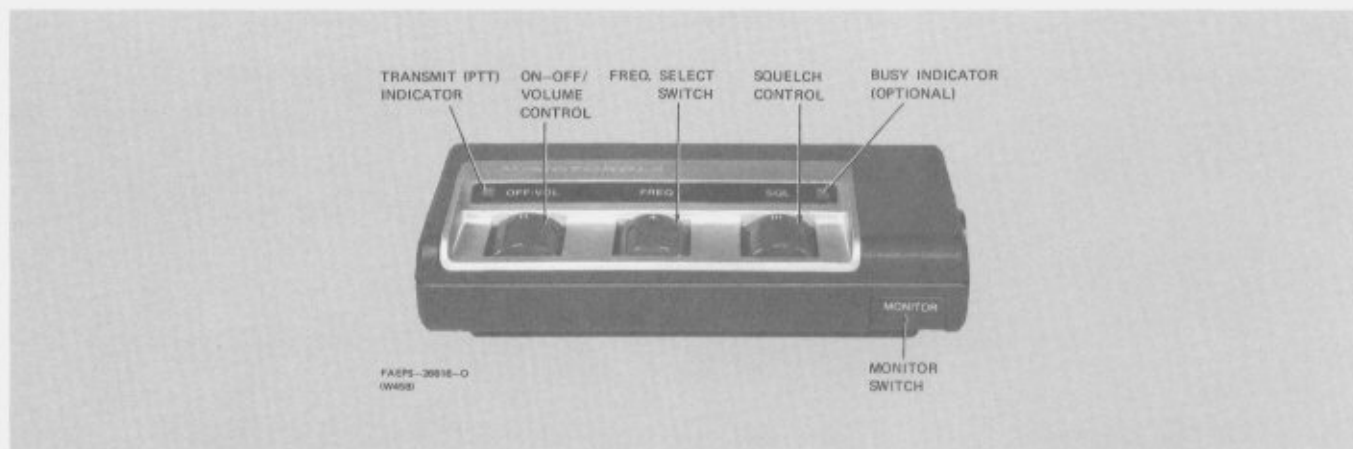


Figure 1. Operating Controls

1. RECEPTION

Step 1. Set the control head ON-OFF switch to the ON position. The receiver operates continuously while the radio is turned on.

Step 2. Select the desired radio channel.

Step 3. On "Private-Line" or "Digital Private-Line" radios remove the microphone or handset from its hang-up box. The receiver now operates with carrier squelch. All signals on the selected channel can be heard.

Step 4. Turn the SQUELCH control fully counterclockwise. Adjust the control head VOLUME control for a comfortable listening level.

Step 5. Turn the control head SQUELCH control clockwise until the speaker noise stops.

Step 6. Replace the microphone or handset in its hang-up box. If your radio is equipped with tone "Private-Line" or "Digital Private-Line" coded squelch, the receiver will now operate in the coded squelch mode; only signals from your radio system can unsquelch the receiver.

2. TRANSMISSION

Step 1. Select the desired radio channel.

Step 2. Remove the microphone or handset from its hang-up box. Monitor the channel for activity.

Step 3. If the radio channel is not in use, hold down the PTT button on the microphone or handset handle and speak slowly and distinctly into the microphone.

3. MONITOR SWITCH (PL OR DPL)

To place the radio in the monitor (carrier squelch) mode while the microphone or handset is still on-hook, press the locking MONITOR switch pushbutton to the in position. To restore coded squelch operation, press this button a second time returning it to the out position.

NOTE

If control head is not equipped with a MONITOR switch, a slide switch on the hang-up box will provide this same function.

4. BUSY LIGHT (OPTIONAL)

If your radio is equipped with the optional busy light, this feature will eliminate the need to continually recheck a busy channel to determine when it becomes idle. Any time there is traffic on the selected channel the busy light will flash; if the channel is available the lamp will be out.

MITREK TWO-WAY FM RADIO

403-420 MHz
450-512 MHz
30/50 WATTS

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service publications
1301 E. Algonquin Road, Schaumburg, IL 60196

MOTOROLA

MODEL CHART FOR MITREK MOBILE RADIO 403-420 MHz 450-512 MHz

CODE:

- ☐ X = ONE ITEM SUPPLIED
- ☐ / = ONE ITEM SUPPLIED DEPENDENT UPON FREQUENCY RANGE
- ☐ 2 = NUMBER INDICATES QUANTITY SUPPLIED
- ☐ * INDICATES BREAKDOWN ON SEPARATE CHART

ITEM	DESCRIPTION	MODEL NUMBER									
*HUE1002A	CHASSIS, (30 WATT), (450-512 MHz)	T34JJA1000AK	1-FREQUENCY CARRIER SQUELCH 30 WATT								
*HUE1012A	CHASSIS, (50 WATT), (450-512 MHz)	T34JJA1000AK	4-FREQUENCY CARRIER SQUELCH 30 WATT								
*HUE1001A	CHASSIS, (30 WATT), (403-420 MHz)	T34JJA3000AK	1-FREQUENCY "PRIVATE-LINE" 30 WATT								
*HUE1011A	CHASSIS, (50 WATT), (403-420 MHz)	T34JJA3000AK	4-FREQUENCY "PRIVATE-LINE" 30 WATT								
HLN4020A	"PRIVATE-LINE" BOARD	T34JJA6000AK	1-FREQUENCY "DIGITAL PRIVATE-LINE" 30 WATT								
HLN4011A	"DIGITAL PRIVATE-LINE"	T34JJA6000AK	4-FREQUENCY "DIGITAL PRIVATE-LINE" 30 WATT								
KLN6209A	"VIBRASPOUNDER" RESONANT REED										
TRN6005A	CODED PLUG										
KXN1086A	CHANNEL ELEMENT RECEIVER										
KXN1088A	CHANNEL ELEMENT TRANSMITTER										
HHN4000A	HOUSING, TOP COVER, LOW POWER										
HLN4034A	HOUSING, BOTTOM COVER, LOW POWER										
HGN4000A	CONTROL HEAD (1-FREQUENCY) CARRIER SQUELCH										
HGN4001A	CONTROL HEAD (4-FREQUENCY) CARRIER SQUELCH										
HGN4002A	CONTROL HEAD (1-FREQUENCY) "PRIVATE-LINE"										
HGN4003A	CONTROL HEAD (4-FREQUENCY) "PRIVATE-LINE"										
HMN4000A	MICROPHONE										
HSN4000A	SPEAKER										
HKN4000A	CABLE (17 FT.) 1-FREQUENCY										
HKN4001A	CONTROL CABLE (17 FT.) 4-FREQUENCY										
HLN4024A	MICROPHONE HANG-UP BOX										
TAE6061B	ANTENNA (406-430 MHz)										
TAE6062B	ANTENNA (450-470 MHz)										
TAE6094B	ANTENNA (470-494 MHz)										
TAE6095B	ANTENNA (494-512 MHz)										
HLN4022A	INSTALLATION KIT										
HLN4023A	TUNING TOOL KIT										

*HUE 1052
mitrek Plus*
Unified Chassis and PA Breakdown

MODELS				DESCRIPTION	SUFFIX
HUE1001A	HUE1002A	HUE1011A	HUE1012A	UHF UNIFIED CHASSIS	
1				HLE1001A PA 30W 403-420 MHz	
	1			HLE1002A PA 30 W 450-512 MHz	
		1		HLE1011A PA 50 W 403-420 MHz	
			1	HLE1012A PA 50 W 450-512 MHz	
		1		HLE4001A Main Board 403-420 MHz	0
	1		1	HLE4002A Main Board 450-512 MHz	0
		1		HLE4050A RF Deck 403-420 MHz	0
	1		1	HLE4051A RF Deck 450-512 MHz	0
1	1	1	1	HLN4015A Hardware	0
1	1	1	1	HLN4018A Interconnect Board	0
1	1	1	1	HLN4019A Hardware Wiring	0
1	1	1	1	HLN4033A Bottom Cover & Gasket	0
HLE1001A	HLE1002A	HLE1011A	HLE1012A	POWER AMPLIFIER ASSEMBLY	
1		1		HFE4000A Harmonic Filter 403-420 MHz	0
	1		1	HFE4001A Harmonic Filter 450-512 MHz	0
1				HLE4011A PA 30 W 403-420 MHz	0
	1			HLE4012A PA 30 W 450-512 MHz	0
		1		HLE4021A PA 50 W 403-420 MHz	0
			1	HLE4022A PA 50 W 450-512 MHz	0
1	1			HLE4041A Transistor Kit 30 W	
		1		HLE4042A Transistor Kit 50 W	0
			1	HLE4043A Transistor Kit 50 W	0
1				HLN4081A Hardware Kit 30 W 403-420 MHz	0
	1			HLN4006A Hardware Kit 30 W 450-512 MHz	0
		1		HLN4082A Hardware Kit 50 W 403-420 MHz	0
			1	HLN4007A Hardware Kit 50 W 450-512 MHz	0
1	1	1	1	HLN4045A Antenna Switch (HLN4120A when using Preamplifier HLE4032A	0
1	1	1	1	HLN4017A Feed Thru Plate	0

MITREK OPTIONS

Time-out Timer HLN4012A
Preamplifier HLE4032A, and Antenna Switch HLN4120A
Busy Light Adapter HLN4119A and Applicable Control Head

Handset TMN6057A and Handset Hang-Up Box TLN4698A
Microphone Hang-Up Box with Monitor Switch HLN4025A
Handset Hang-Up Box with Monitor Switch TLN4507A

Positive Ground Cable Kits
Optional 10 and 22 foot Cable Kits
Ignition Sense Lead HKN4007A

Non Weather-Resistant Control Head HLN4004/5/8-11A
Non Weather-Resistant Microphone HLN4001A

Full Line of SYSTEMS 90 Control Group Options SYSTEM 90 Control Cables

SPECIFICATIONS

GENERAL

DIMENSIONS (30/50 W)	6.35 cm x 25.4 cm x 30.48 cm (2.5" x 10" x 12")
FREQUENCY RANGE	403-420 MHz, 450-512 MHz
WEIGHT (30/50 W) (Less Acc.)	4.76 kg (10.5 pounds)
TEMPERATURE RANGE	-30 to +60°C
NO. OF FREQUENCIES	1 to 4
POLARITY	+/-Ground

TRANSMITTER

POWER OUT	30 W, 50 W
STABILITY	5 PPM
DISTORTION	3%
FM NOISE	70dB
SPURS	85dB
FREQ. SEPARATION	9 MHz

RECEIVER

SENSITIVITY	0.5 uV (0.25 uV with optional preamp)
INTERMODULATION	85 dB (80 dB with optional preamp)
SELECTIVITY	90 dB (25 kHz)
STABILITY	5 PPM
MODULATION ACCEPTANCE	± 7 kHz
SPURS	100 dB
AUDIO POWER	8 Watts
DISTORTION	5%
FREQ. SEPARATION	2 MHz

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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 radiation safety standard which applies to any two-way mobile radio equipment. Normal use of this radio will result in exposures far below the OSHA limit. There are no reported incidents of physical damage resulting from the use of this type radio. However, the following precautions are recommended:

DO NOT operate the transmitter when someone outside the vehicle is within two feet of the mobile antenna.

DO NOT operate the transmitter near unshielded electrical blasting caps or in an explosive atmosphere.

EPS-18196-B

FOREWORD

1. SCOPE OF MANUAL

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by Instruction Manual Revisions (SMR). These SMR's are added to the manuals as the engineering changes are incorporated into the equipment.

2. MODEL AND KIT IDENTIFICATION

Motorola equipments are specifically identified by an overall model number on the nameplate. In most cases, assemblies and kits which make up the equipment also have kit model numbers stamped on them. When a production or engineering change is incorporated, revision suffix numerals are added to the affected kit model number. For example, a TLN4448A becomes a TLN4448A-1 with the first revision, TLN4448A-2 with the second revision, etc.

As diagrams are updated, information about the change is incorporated into a revision column. This revision column appears in the manual next to the parts list or, in some cases, on the diagram. It lists the reference number, part number, and description of the parts removed or replaced when the suffix number changed. With this information, the technician can find the information for the current version, and any previous version, of the equipment covered by the manual.

3. SERVICE

Motorola's National Service Organization offers one of the finest nation-wide installation and maintenance programs available to communication equipment users. This organization includes approximately 800 authorized Motorola Service Stations (MSS) located throughout the United States, each manned by one or more trained, FCC licensed technicians.

These MSS's are independently owned and operated and were selected by Motorola to service its customers. Motorola maintenance is available on either a time and material basis or on a periodic fixed-fee type arrangement.

The administrative staff of this organization consists of national, area and district service managers and

district representatives, all of whom are Motorola employees with the objective to improve the service to our customers.

Should you wish to purchase a service contract for your Motorola equipment, contact your Motorola Service Representative, or write to:

National Service Manager
Motorola Communications Division
1303 E. Algonquin Road
Schaumburg, Illinois 60196

4. REPLACEMENT PARTS ORDERING

Motorola maintains a number of parts offices strategically-located throughout the United States. These facilities are staffed to process parts orders, identify part numbers, and otherwise assist in the maintenance and repair of Motorola Communications Division products.

Orders for all parts *except* crystals, active filters, code plugs, channel elements, and "Vibrasender"® and "Vibrasponder"® resonant reeds should be sent to the nearest area parts center. Orders for instruction manuals should also be sent to the area parts center.

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Orders for crystals, channel elements, active filters, code plugs, and reeds should be sent directly to the factory address listed on the following page. Crystal and channel element orders should specify the crystal or channel element type number, crystal and carrier frequency, and the chassis model number in which the part is used.

Orders for active filters, code plugs, "Vibrasender" and "Vibrasponder" resonant reeds should specify type number and frequency, and should identify the owner/operator of the communications system in which these items are to be used.

5. ADDRESSES

5.1 GENERAL OFFICES

MOTOROLA Communications and Electronics Inc.

Communications and Electronics Parts

1313 E. Algonquin Rd.,

Schaumburg, Illinois 60196

Phone: 312-576-3900

5.2 U.S. ORDERS

WESTERN AREA PARTS

1170 Chess Drive, Foster City,

San Mateo, California 94404

Phone: 415-349-3111

TWX: 910-375-3877

MIDWEST AREA PARTS

1313 E. Algonquin Road

Schaumburg, Ill. 60196

Phone: 312-576-7322

TWX: 910-693-0869

MID-ATLANTIC AREA PARTS

7230 Parkway Drive

Hanover, Maryland 20176

Phone: 301-796-8600

TWX: 710-862-1941

EAST CENTRAL AREA PARTS

12995 Snow Road,

Parma, Ohio 44130

Phone: 216-267-2210

TWX: 810-421-8845

EASTERN AREA PARTS

85 Harristown Road,

Glen Rock, New Jersey 07452

Phone: 201-447-4000

TWX: 710-988-5602

PACIFIC SOUTHWESTERN AREA PARTS

P.O. Box 85036

San Diego, California 92138

Phone: 714-578-2222

TWX: 910-335-1634

GULF STATES AREA PARTS

8550 Katy Freeway

Suite 128

Houston, Texas 77024

Phone: 713-932-8955

SOUTHWESTERN AREA PARTS

P.O. Box 34290

3320 Belt Line Road,

Dallas, Texas 75234

Phone: 214-241-2151

TWX: 910-860-5505

SOUTHEASTERN AREA PARTS

P.O. Box 368

Decatur, Georgia 30031

Phone: 504-981-9800

TWX: 810-766-0876

5.3 CANADIAN ORDERS

CANADIAN MOTOROLA ELECTRONICS COMPANY

National Parts Department

3125 Steeles Avenue,

East Willowdale, Ontario

Phone: 416-499-1441

TWX: 610-492-2713

Telex: 02-29944LD

5.4 ALL COUNTRIES EXCEPT U.S. AND CANADA

MOTOROLA, INC. OR MOTOROLA AMERICAS, INC.

International Parts Dept.

1313 E. Algonquin Road

Schaumburg, Illinois 60196 U.S.A.

Phone: 312-576-6492

TWX: 910-693-0869

Telex: 722443 or 722424

Cable: MOTOL PARTS

5.5 FACTORY ADDRESS FOR CRYSTAL, CHANNEL ELEMENT, ACTIVE FILTER, CODE PLUGS AND RESONANT REED ORDERS

ALL MAIL ORDERS

Motorola, Inc.

Component Products Sales & Service

P.O. Box 66191

O'Hare International Airport

Chicago, Ill. 60666

CORRESPONDENCE

Motorola, Inc.

Component Products Sales & Service

2553 N. Edgington Street

Franklin Park, Illinois 60131

MOCOM•70 RETROFIT CONSIDERATIONS

A. SYSTEM COMPATIBILITY

RADIO TO BE INSTALLED	VEHICLE INSTALLATION			
	MITREK		MOCOM•70	
	—GND	+ GND	—GND	+ GND
MITREK —GND	•	•(Note 3)	•(Note 1)	X
MITREK + GND	•	•	•(Notes 1, 4)	X
MOCOM•70 —GND	•	X	•	•(Note 2)
MOCOM•70 + GND	•(Note 2)	X	•(Note 2)	•

• = Compatible X = Not compatible

NOTES

1. Modify control head as described below.
2. Reverse MOCOM•70 positive ground adapter.
3. Remove JU1 from Interconnect Board of MITREK radio. (JU1 is only required when MITREK radios are used with negative ground MOCOM•70 accessories.)
4. Add JU1 to Interconnect Board of MITREK radio.

B. MODIFICATION TO MOCOM•70 CONTROL HEAD

When installing a MITREK radio into an existing negative ground MOCOM•70 installation, the following modification must be made to the control head:

Step 1. Remove the green lead from pin 5 of the MOCOM•70 control head connector. Remove the lead for the grounded side of the speaker from the same connector.

Step 2. Clip off the terminals from these two leads and strip both back 13mm (1/2 inch).

Step 3. Twist the two leads together and crimp on the closed end splice connector (part number 29-812980) supplied with the installation kit. See Figure.

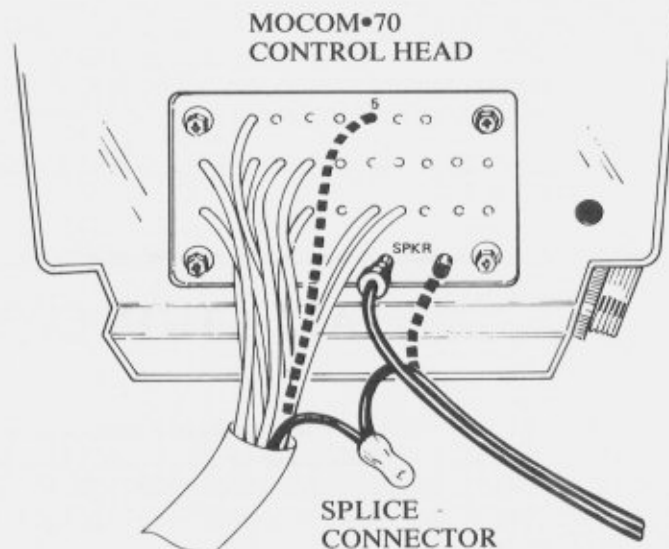
NOTE

If a MITREK control head is used with a MOCOM•70 cable kit in a PL system, then the MOCOM•70 hangup box must also be replaced with a MITREK unit (HLN4024A). Also jumper JU101 must be omitted from the MITREK control head circuit board when the orange ignition switch lead is used.

C. RADIO INSTALLATION

Proceed with radio set mounting instruction on the other side of this sheet.

MOCOM•70 CONTROL HEAD MODIFICATIONS

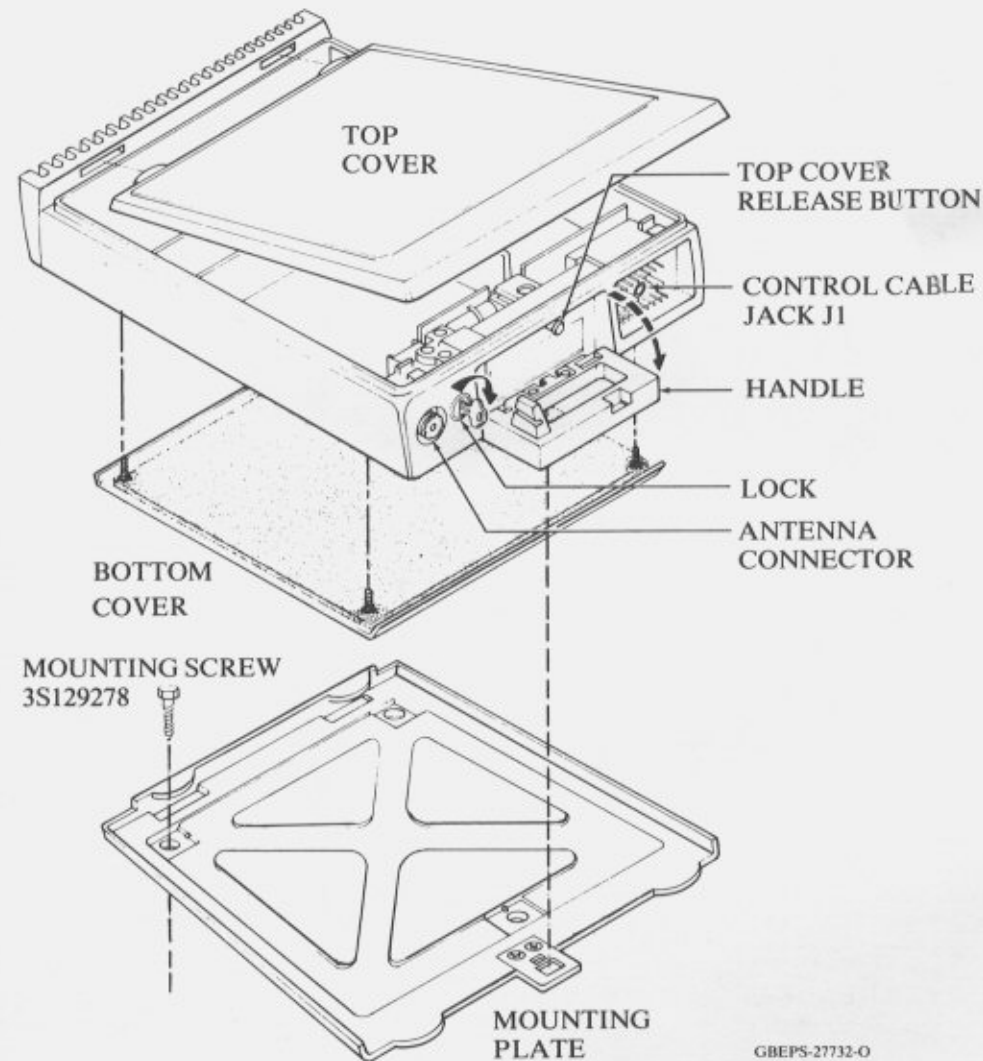


DISASSEMBLY

RADIO SET REMOVAL

Step 1. Insert the key into the lock and turn it clockwise. Pull the handle down.

Step 2. Remove the radio from the mounting plate by pulling forward with the handle.



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RADIO SET REPLACEMENT

Step 1. Lower the radio set onto the mounting plate using the handle. The handle should be in the fully open position.

Step 2. Slide the radio backward until the projections at the front and rear of the mounting plate engage the slots on the front and rear of the radio.

Step 3. Swing the handle up until it locks into position. Lift on the front of the radio to make sure that the latching mechanism on the handle has engaged the latch plate on the front of the mounting plate.

TOP COVER REMOVAL

Step 1. Insert the key into the lock and turn it clockwise. Pull the handle down, exposing the release button.

Step 2. Push the release button. The top cover will pop open.

Step 3. Remove the top cover by raising the front and pulling it forward.

TOP COVER REPLACEMENT

Step 1. Slip the projections at the rear of the top cover into the slots in the radio housing holding the cover with the front tipped slightly upward.

Step 2. Lower the front of the cover in place until it snaps. The top latch will then be engaged.

BOTTOM COVER REMOVAL

Step 1. Remove the radio set from the vehicle and turn it upside down on a workbench.

Step 2. Unscrew the four Phillips head screws securing the bottom cover and lift the cover from the radio.

INSTALLATION PLANNING

CONTROL HEAD LOCATION

Recommended mounting surfaces include under the dashboard, transmission hump, and center console. The installation must not interfere with operation of the vehicle and its accessories, nor disturb passenger seating or leg space. In addition, the unit must be within convenient reach of the user(s).

ANTENNA LOCATION

The best location for the antenna is the center of the vehicle roof. A good alternate location is the center of the trunk lid. If the trunk lid is used, straps must connect the trunk lid to ground points on the vehicle body. Be sure you know that the antenna cable can be acceptably routed to the radio set location *before* you mount the antenna. Refer to the antenna instruction manual for details.

IGNITION SENSE LEAD (OPTIONAL)

The optional fused (1.5 A) orange ignition sense lead should be connected to the ignition switch terminal which is hot in both the "Accessory" and "On" position. Use of this option will allow the radio to be used in the standby (receive only) mode when the ignition key is removed from the vehicle.

PRIMARY POWER CONNECTIONS

The best power connection point for the hot primary power lead and the green lead is at the hot battery terminal. Be sure that the point chosen is always close to 13.6 volts. Some vehicles switch to a higher-than-normal voltage during starting.

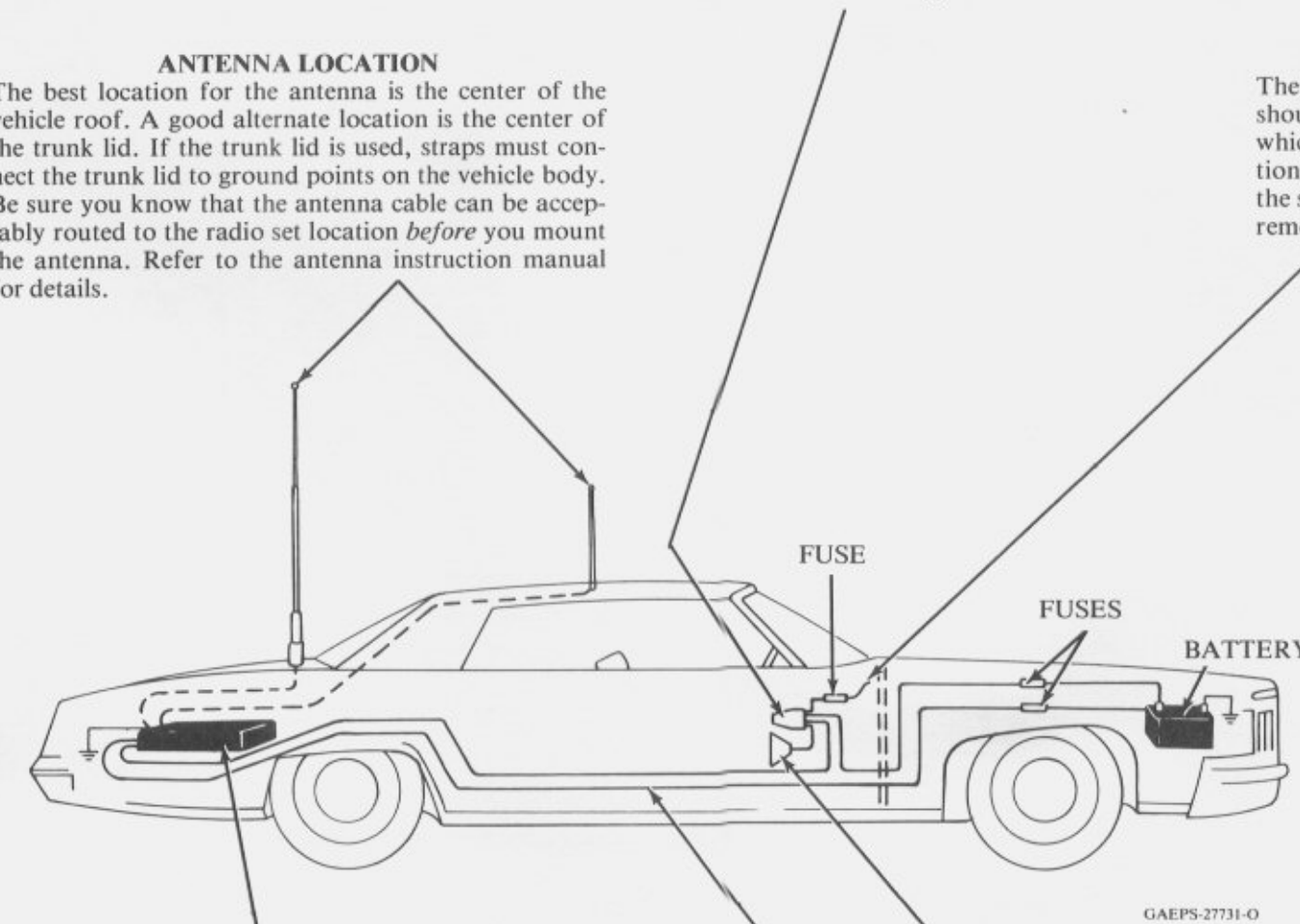
The radio set negative primary power lead should be connected to a good ground point on the vehicle chassis.

SPEAKER

The included trunnion bracket provides a large variety of permanent mountings (dashboard and accessible firewall areas).

CONTROL AND POWER CABLE ROUTING

Many vehicles are equipped with wire troughs in the door sills. If the vehicle has this feature, use it to provide maximum protection for the cable and to simplify the cable installation. In vehicles without wiring troughs the control and power cables must be routed where they are protected from pinching, sharp edges, and crushing. One suggested route is along one side of the drive shaft hump under the carpet. Be sure grommets are used whenever the cable must pass through a hole in a metal panel.



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RADIO SET LOCATION

In most vehicles the best location for the radio unit is the floor of the trunk compartment. Regardless of the location choice, be sure the radio set is protected from dirt and moisture and that there is sufficient space around the radio unit to allow adequate cooling and removal.

MITREK

RADIO AND CONTROL HEAD PREINSTALLATION CONSIDERATIONS

PRE-INSTALLATION BENCH TESTS

A. RADIO SET

Check frequency, power output, modulation, and receiver sensitivity before installing the radio.

B. CONTROL HEAD

Verify operation of all controls and indicators on the control head before and after installation.

IMPORTANT POWER LEAD COLORS

The color convention for power leads used in MITREK represents a departure from the convention used in MOCOM•70 and earlier radios. In the MITREK system the red lead is always positive and the black lead is always negative. The following statements summarize the use in MITREK installations:

Short lead is chassis ground. It is:
Black (-) in negative ground systems
Red (+) in positive ground systems

Fused lead is battery hot. It is:
Red (+) in negative ground systems
Black (-) in positive ground systems

MITREK
RADIO AND CONTROL HEAD
INSTALLATION PROCEDURE

CABLE ROUTING

WARNING
For vehicles equipped with electronic anti-skid braking systems see "ANTI-SKID BRAKING PRECAUTIONS" Publication, Motorola Number 68P81109E34.

Work from the trunk space forward. In some cars there is room above the fiberboard trunk partition to admit the cables. If this is not the case, make an opening through the partition.

Tape the pin-tip connectors into a small bundle. Pass it and the long power lead forward into the passenger compartment.

Remove the back seat. Pull the cables into the back seat area, under the seats and floor mats out the top of the floor mat under the dash. Where no specific channel is provided, route the cable under the floor mat along the side of the drive-shaft hump.

Pull the control cable pin-tip connectors to the approximate location of the control head. Locate or make a hole through the firewall to route the power cable into the engine compartment. The hole must be 28.6 mm (1-1/8") in diameter to fit the supplied rubber grommet. Pull the red power cable and fuse holder through the grommeted hole.

On high power models install the fuse holder clip at a convenient location near the battery.

The cable kit contains an additional separate green wire equipped with an in-line fuse. Pass the pin tip end of the green wire from the engine compartment side of the firewall, through the grommeted hole, into the passenger compartment.

An optional orange wire with fuse may be supplied. This wire will connect from the control head to the ignition switch.

Do not dress the wires at this time but proceed with the radio set mounting procedure.

RADIO SET MOUNTING

Step 1. Determine a location for the radio reasonably protected from dirt and moisture.

Step 2. Place the radio in the desired location and check for proper clearances as shown in the diagram at the right.

Step 3. Determine the exact mounting location and set the radio mounting plate in position. Using the mounting plate as a template mark the location of the three mounting screw holes.

Step 4. Check underneath the vehicle to make sure that the drill and mounting screws will not encounter the gas tank, drive shaft, or other obstacles.

Step 5. Drill three 5 mm (0.199 inch) holes at the marked locations.

Step 6. Install the mounting plate with the three mounting screws provided. These screws are self-locking and require no lock washers or flat washers.

Step 7. Install the radio per the instructions for radio set replacement on the other side of this sheet.

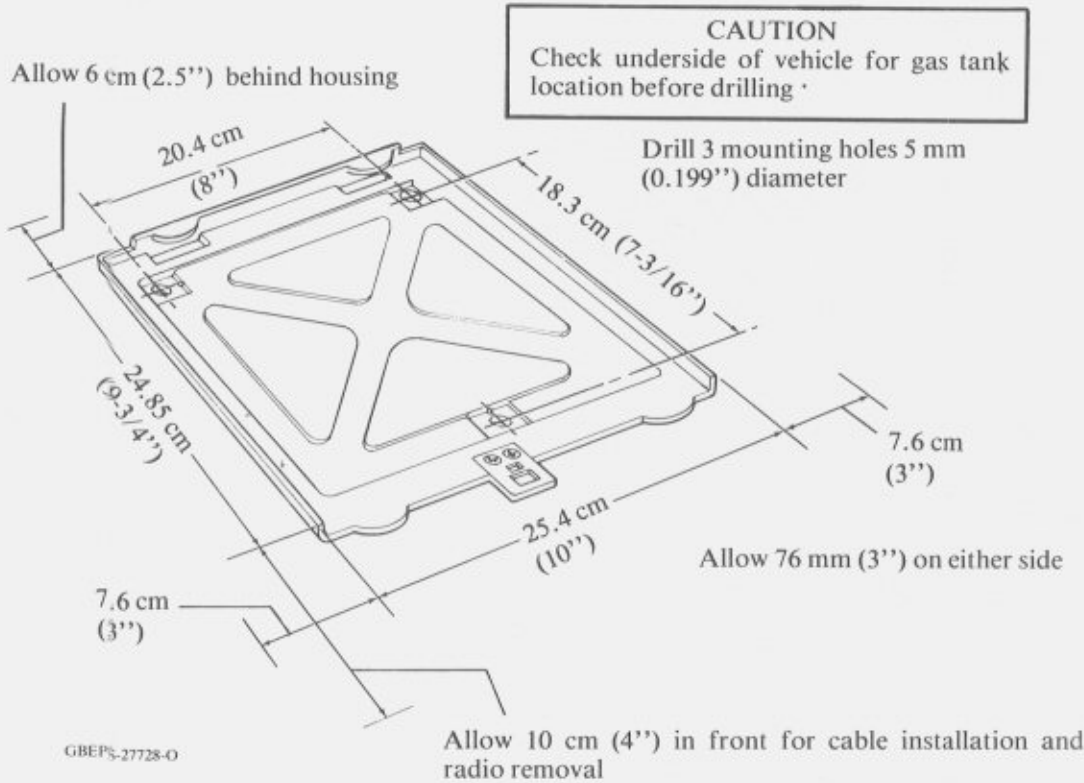
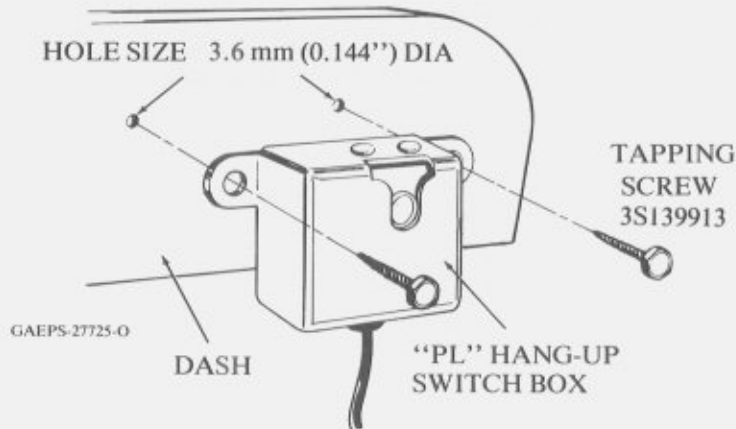


Table 1.
Contents of Installation Kit

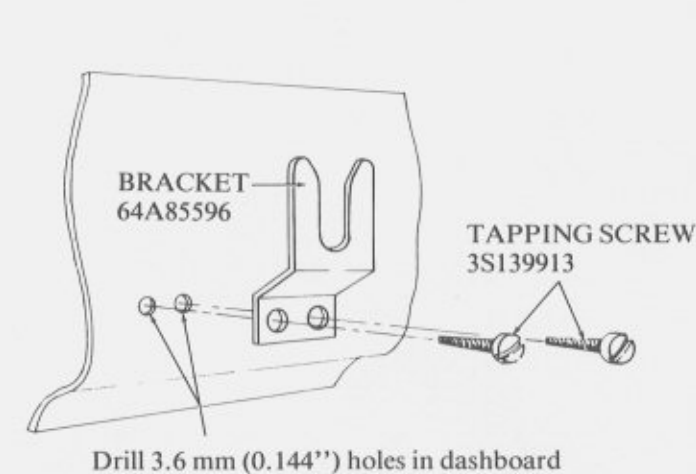
Qty.	Part No.	Description
4	3-139965	Screw, tapping, 1/4-14 x 1/2
1	4-7688	Washer, locking, 1/4 internal
1	29-812980	Terminal, crimp, closed end
1	37-103890	Grommet, rubber
6	42-10217A14	Strap, tie, 0.140 x 5.50, nylon

C. MICROPHONE HANGUP BOX (PL OR DPL MODELS)



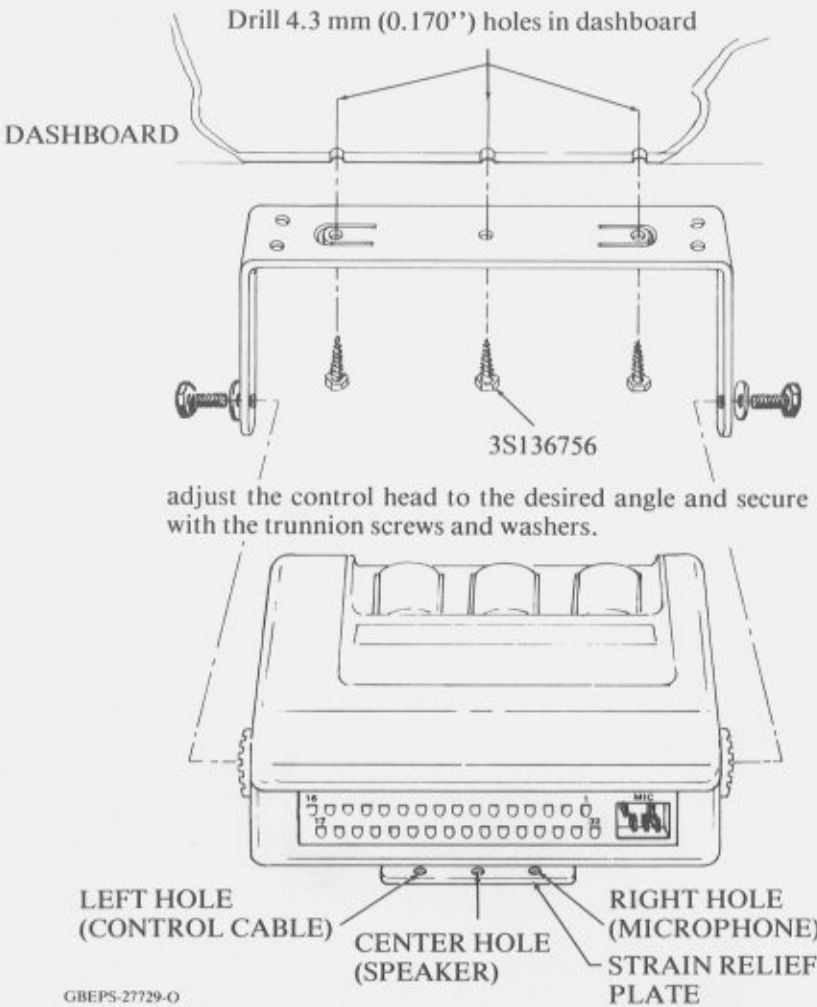
Install hangup box lead pins to correspondingly numbered slots at the rear of the control head; lead labeled 24/30 should be installed into slot 30 for busy light radios with busy light control heads, into slot 24 for all other systems.

D. MICROPHONE HANGUP CLIP (CARRIER SQUELCH MODELS)



CONTROL HEAD, SPEAKER, AND ACCESSORIES

A. CONTROL HEAD



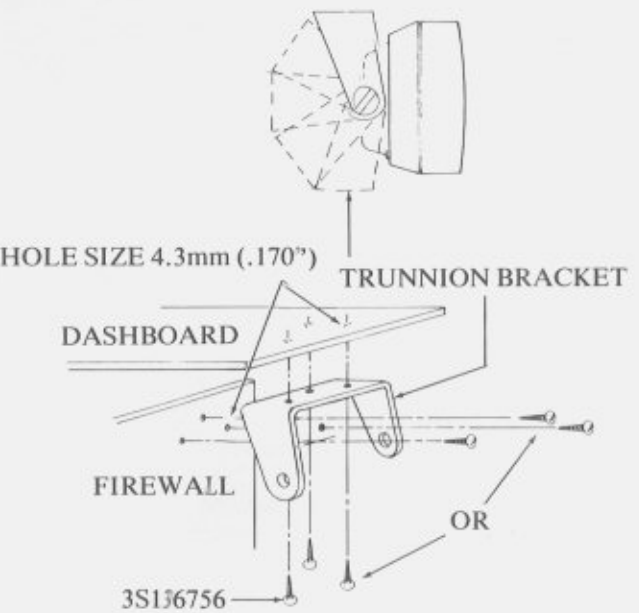
Install the pins from the control cable into correspondingly numbered slots on the radio cable connector at the rear of the control head; also the pin from the green (and orange if supplied) power lead. Connect the S hook on the control cable to the left hole in the strain relief plate.

E. MICROPHONE

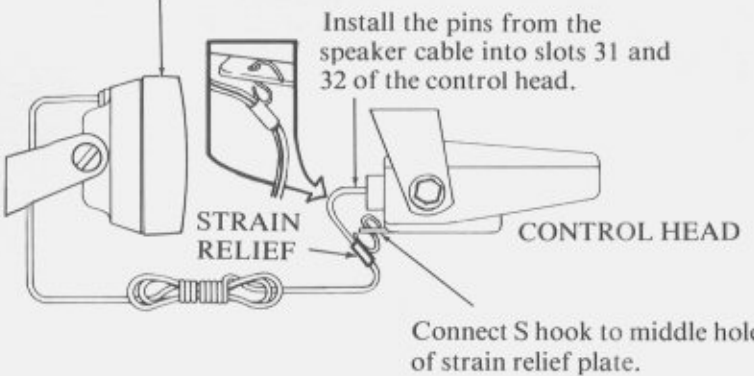
Step 1. Plug the microphone connector into the receptacle on the control head. Connect the S hook to the right hole of the strain relief plate.

Step 2. Hang the microphone in the hangup box or microphone clip.

B. SPEAKER



Position speaker in trunnion bracket and rotate to vertical position with MOTOROLA logo at bottom before tightening screws.



DETAIL B
CONTROL HEAD CONNECTION DETAIL

POWER CONNECTIONS

NOTE

In vehicles where battery is grounded to engine block, the frame and engine block should be connected with a heavy braided grounding strap.

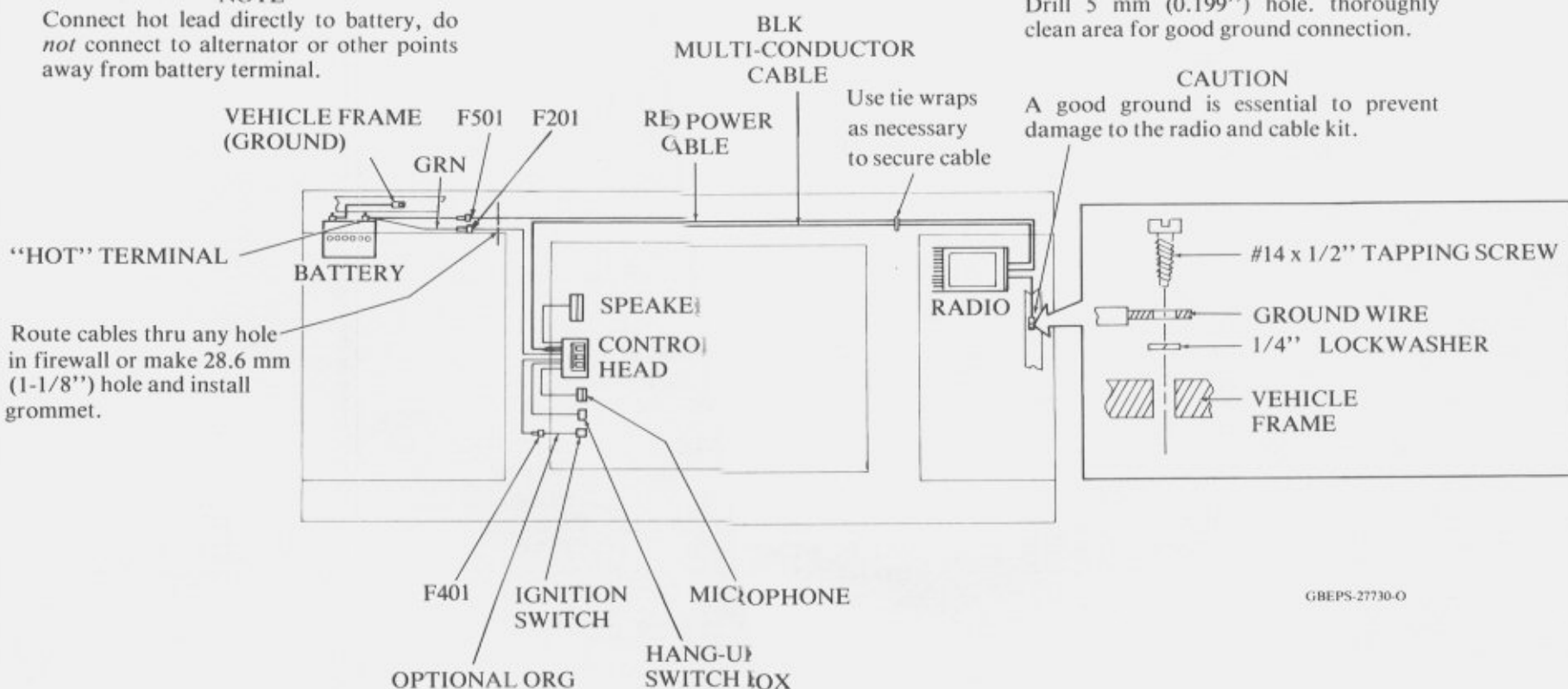
NOTE

Connect hot lead directly to battery, do *not* connect to alternator or other points away from battery terminal.

Drill 5 mm (0.199") hole, thoroughly clean area for good ground connection.

CAUTION

A good ground is essential to prevent damage to the radio and cable kit.



GBEPS-27730-0

Step 1. Connect the fused power cable (red for —Gnd, black for + Gnd) from the trunk to the ungrounded battery terminal.

Step 2. Connect the fused green wire from the control head also to the ungrounded battery terminal.

Step 3. If the ignition switch option is used, connect the orange fused lead from the control head to the ignition switch terminal which is hot when the switch is either in the ON or ACCESSORY position.

Step 4. Locate a good site near the radio for the ground connection. This connection should be made directly to the vehicle frame. Drill a 5mm (0.199 inch)

hole after checking clearance behind the hole location to make sure the drill or screw will not encounter the gas tank or other obstacles. Carefully scrape or wire brush the surface around the hole to assure a good electrical connection.

Step 5. Attach the unfused power lead from the radio (black for —Gnd, red for + Gnd) to the frame using the fourth mounting screw and the lockwasher provided. The lockwasher should be inserted between the wire lug and the grounding surface; the mounting screw does not need an additional lockwasher as it is self-locking.

Step 6. Dress all cables, securing them with tie-straps as required.

ANTENNA INSTALLATION

A diagram and complete installation instructions are supplied with each antenna ordered.

POST-INSTALLATION CHECKOUT

Turn on the radio and perform a complete operational check. If ignition noise or alternator whine are noted refer to Motorola publication 68P81109E33—Reducing Noise Interference in Mobile Two-Way Radio Installations.

3. POWER CONTROL AND PROTECTION CIRCUIT

3.1 GENERAL

3.1.1 The power control and protection circuit protects the rf power amplifier from overcurrent and overtemperature by reducing the drive during these conditions. In addition, it limits the maximum amount of drive that may be developed during undercurrent conditions such as when a driver or final device is faulty or during certain high VSWR conditions. Last, the protection circuit has a 15 ms turn-on delay to delay the generation of rf during antenna switching.

3.1.2 The circuitry may be separated into two portions. A regulation loop has control during normal operation and senses overcurrent and/or overtemperature. A drive limit loop limits the maximum drive when the power amplifier current drops below the operating point of the regulation loop.

3.2 DRIVE LIMIT LOOP

3.2.1 The limit loop, consisting of U901, Q903 and Q904, acts as a limiter for the variable control voltage which is applied to the various exciter and power amplifier stages. Whenever the diode CR902 is reverse biased, the limit loop will go to a condition where the potentials at the inverting and non-inverting inputs to U901 are equal. The control voltage may be varied by R911, the Drive Limit control, which is part of a voltage divider in the feed back path from Q904 to U901. R911 is adjusted during initial alignment by watching a wattmeter and setting the power output about 10% above rated power. The control voltage output in this mode (when CR902 is reverse biased) represents the maximum amount of drive possible under any operating conditions.

3.2.2 Any time CR902 becomes forward biased and a higher potential is applied to the inverting input to U901, the limit loop is upset and the control voltage drops to some value lower than maximum drive. During normal operation CR902 is forward biased by the regulation loop.

3.3 REGULATION LOOP

3.3.1 The regulation loop serves double duty as both a power regulator for the final amplifier and an overcurrent or overtemperature protection circuit. Q902 senses these input sources via CR802. If, for any reason, any of these inputs go lower than normal the output of Q902 will go higher, the inverting input to U901 will go higher, and the control voltage output will go lower reducing the drive to the driver and final amplifier stages. The turn-on of CR902 is controlled by R909, the Power Set control, which is adjusted during alignment for rated power.

3.3.2 One input to CR802 monitors the final current.

The current drawn by the final amplifier must flow through R801, a low series resistance shunt, causing a slight voltage drop which will be applied to Q902 through R802. The second input to CR802 monitors the PA deck temperature. If the temperature in the PA compartment exceeds approximately 95°C. RT801 decreases its resistance enough to allow the voltage, at R804, to forward bias CR801. The input to Q902 will again start to drop. Any low applied to Q902 will cause the output of Q902 to go higher. This will forward bias CR902, upsetting the limit loop, causing the control voltage output to be reduced.

3.4 OPERATION

3.4.1 The normal operating point is set by adjusting R909, the Power Set control, for the rated power output. At this point CR902 will be forward biased. The current drawn by the PA final amplifier flows through R801 and the voltage drop across R801 is applied to Q902. If the final current tries to increase, the input to Q902 will go lower, its output will go higher, the inverting input to U901 will go higher and the control voltage will go lower, reducing the drive level causing the final current to return to normal. If the P.A. current tries to decrease the opposite will take place. The input to Q902 will go higher, its output will go lower, the inverting input to U901 will go lower and the control voltage will go higher causing the PA current to return to normal. If for some reason the PA current cannot be brought up to normal, such as a PA failure, the output of Q902 will not change when the control voltage increases and CR902 will become reverse biased. When this happens the limit loop reverts to its limiting mode.

3.4.2 During the netting procedure 9.5 volts is applied to the inverting input of U901 causing the control voltage to stay at zero. Thus only uncontrolled stages of the exciter are activated.

3.5 INITIALIZATION

3.5.1 When the radio is keyed, SEC PTT goes low allowing Q902 to saturate (C916 charging through the base-emitter junction of Q902 and R926 holds Q902 saturated). This forward biases CR902 which forces U901-2 high and pulls U901-6 low. Q903 and Q904 are cutoff and there is no drive applied to the control stages.

3.5.2 After 15 milliseconds, C916 has charged sufficiently through Q901 to reduce Q902 conduction reverse biasing CR902. This allows U901-2 to be pulled low and U901-6 goes high turning on Q903-Q904. As the power amplifier turns on, the voltage drop across R801 increases allowing Q902 to conduct harder. CR902 is again forward biased allowing the control voltage to be reduced to its adjusted value.

THEORY OF OPERATION

1. GENERAL

Complete theory of operation for the MITREK radio is contained in the theory notes on the schematic diagram. These diagrams together with the functional block diagram provide all of the theory which an experienced technician will require to service the radio. Detailed theory of operation for those circuits unique to the MITREK radio is given in the following paragraphs.

2. METER 4 CIRCUIT

2.1 GENERAL

2.1.1 The Meter 4 circuitry allows the receiver channel elements to be warped on to the correct frequency using the same zero center meters used on radios with discriminators.

2.1.2 The circuit is basically a low frequency oscillator (approximately 30 Hz) that gates the receiver injection circuitry on and off while an on frequency carrier is being applied. The dc voltage at the output of the detector is sampled both when the channel elements are on (indicates actual carrier frequency) and when the channel elements are off (indicates desired i-f frequency). The difference between the two voltages indicates how far off frequency and in what direction the channel element is. When the two voltages are identical the channel element is on frequency.

2.2 DETAILED OPERATION

2.2.1 The low frequency oscillator consists of Q2 and Q3 which are wired as a Schmidt trigger and Q1 which also controls the receive switched 9.5 V. During normal receive operation, Q2 and Q3 will have no supply voltage and will be off. Q1 will be turned on and C1 will be charged via R2.

2.2.2 The Meter 4 circuit is activated whenever 9.5 volts is applied to Q2 and Q3. There are three conditions when 9.5 V is applied: (1) during a transmission, (2) when the mobile is netted, and (3) when it is desired to set the receiver frequency.

2.2.3 The setting of the receiver frequency will be covered first. This sequence is initiated by shorting two pins together which applies regulated 9.5 volts to Q2 and Q3. Q2 is held off by the charge on C1, but

Q3 turns on. The output of Q3 immediately goes high turning off Q1 which removes RX 9.5 volts. C1 will start discharging through R2 soon reaching a point where Q2 will turn on and Q3 turns off.

2.2.4 Q1 is allowed to turn on again recharging C1.

When C1 charges high enough to turn Q2 off the entire sequence repeats itself. The end result is Q2, Q3 and Q1 oscillate at about 30 Hertz. The phase relationships are such that Q1 always turns off when Q3 turns on.

2.2.5 Whenever Q1 turns off, the receiver oscillator is disabled by the removal of the RX 9.5 volts. Q4 is turned on by REG 9.5 V through R13. C3 charges through Q4 and R14 to the dc voltage at the output of the detector buffer. This particular voltage is sampled when the oscillator (and thus the incoming carrier) is disabled.

2.2.6 Whenever Q3 turns off, Q1 turns on restoring the RX 9.5 volts enabling the receiver oscillator and the incoming carrier. When Q3 turns off it outputs a negative going pulse to Q4 via C2 and Q4 temporarily turns off. With Q4 off C3 either charges or discharges to the dc voltage now at the detector buffer.

2.2.7 When a transmission occurs, the push-to-talk circuit activates the TX 9.5 V which is applied to Q2 and Q3. The circuit does not oscillate though because the secondary push-to-talk line clamps the input of Q3 low and Q3 remains turned on for the duration of the transmission. Q3 in turn keeps Q1 turned off disabling the RX 9.5 volts. Thus part of the Meter 4 circuit is used to disable the receiver when transmitting.

2.2.8 The final way the Meter 4 circuit is activated is when the mobile radio is netted. At this time TX 9.5 volts is applied from the protection circuit. The secondary push-to-talk line does not clamp Q3. The Meter 4 circuit oscillates normally, allowing the receiver frequency to be checked against its own transmitter. This procedure should be used as an alternative to that given in the receiver alignment procedure only when the proper equipment is not available.

4. BRIDGE AUDIO CIRCUIT

4.1 The unique bridge audio circuit provides a highly efficient audio output. The circuit uses two differential power amplifiers which provide a balanced push-pull output to the speaker.

4.2 Audio is applied from the audio amplifier to the non-inverting input of U401. The output of U401 is applied to both one side of the speaker and to U402. R422 and R423 form a voltage divider that attenuates the high level output of U401 before it is applied to the inverting input of U402. The output of U402 is equal in amplitude to the output of U401 but 180° out of phase.

MAINTENANCE

1. GENERAL

1.1 The MITREK radio is designed for ease of access and servicing. The entire radio may be aligned from the top after removing the top cover. The radio is easily removable from the vehicle, and the entire solder side of the main circuit board can be accessed for troubleshooting by merely removing the four screws holding on the weatherproof bottom cover.

1.2 Full maintenance information for the radio is provided on the schematic diagram and the functional block diagram. The schematic diagram is highlighted with theory notes for each significant stage and has maintenance notes and ac signal levels distributed at key points in the circuit. These levels are also shown on the functional block diagram. The measurement points for the ac levels are keyed on the circuit board detail to allow rapid location and identification by the technician. DC voltages are provided on the schematic for most transistor leads.

2. RADIO SET DISASSEMBLY

2.1 REMOVAL OF RADIO SET FROM THE VEHICLE

An illustrated step-by-step procedure for removal and replacement of the radio is given on the Pre-installation Considerations pull-out page in this manual.

2.2 TOP AND BOTTOM COVER

An illustrated step-by-step procedure for removal and replacement of the top and bottom covers is given on the Pre-installation Considerations pull-out page in this manual.

2.3 OPTIONAL "PRIVATE-LINE"/"DIGITAL PRIVATE-LINE" BOARD

Removal of the board may be accomplished by removing four mounting screws and unplugging the board from J3 on the interconnect board. To replace the board reverse the removal procedure.

2.4 INTERCONNECT BOARD

Remove the "PRIVATE-LINE"/"DIGITAL PRIVATE-LINE" and time-out timer boards (if used). Remove one Phillips head screw from the mounting bracket, and two Phillips head screws, from the radio connector J1 on the front of the chassis. Slightly lift the board, tilt it toward the rear, and lift it out of the chassis. Replacement may be accomplished by reversing the removal procedure, taking care that J2 is properly seated into P2, on the main board.

2.5 RF DECK AND PREAMPLIFIER

2.5.1 Models Without Preamplifier

To remove the RF Deck, first unsolder the four interconnections and the four ground straps from the main board. Unsolder the exciter filter output and RF Deck input connections under the spring shield. Then remove the two mounting screws from the coax mounting plate (accessible from the bottom of the chassis) and slide the eyelets out, releasing the coax cables. Finally, remove the RF Deck from the bottom of the chassis. To replace the RF Deck reverse the removal procedure.

2.5.2 Models With Preamplifier

To remove the RF Deck, start by removing the coax mounting bracket cover screw from the PA feed-thru plate. Unsolder the cover from the spring shield and remove the cover and spring shield. Then, remove the preamplifier cover screw and cover and unsolder the preamplifier input coax and the exciter output connections. Now, unsolder the four interconnections and the four ground straps from the main board. Unsolder the two preamplifier supply leads. Remove the two screws from the coax mounting bracket and slide the eyelets out releasing the coax cables. Remove the mounting screws from the RF Deck and remove the RF Deck from the bottom of the chassis. To replace the RF Deck, reverse the above procedure taking care to dress the preamplifier supply leads before tightening the RF Deck mounting screws.

2.5.3 Preamplifier Board

To remove the optional preamplifier board, remove the cover screw and cover. Unsolder the input and output coax connections. Remove the mounting screw and lift the board out. Unsolder the supply lead connections. To install the preamplifier board, reverse the above procedure.

2.6 HARMONIC FILTER

Carefully unsolder the input lead from the PA board. *To prevent damage to the harmonic filter, the input lead and mounting hole must be clear of solder.* Remove two hex head mounting screws and lift the harmonic filter out of the chassis. To replace the harmonic filter reverse the removal procedure.

3. POWER AMPLIFIER

3.1 TRANSISTOR REPLACEMENT

3.1.1 To remove the transistors remove the mounting screws, unsolder and remove the clamped mica capacitors, unsolder and remove the transistors. (Special tips ST1160, and ST1161 are available from MOTOROLA Parts Department to aid in the capacitor and transistor removal). Before installing the new transistors apply light coating of Wakefield compound to mounting surface. Mount the transistors with the collector lead marked C facing the proper direction.

CAUTION

The transistor mounting screws must be tightened before the transistor tabs are soldered. *Do not tighten the mounting screws more than 6-7 inch pounds* or damage to the transistor may result.

3.1.2 Solder the transistor tabs to the circuit board so that the connection covers the entire surface of the leads. Resolder the clamped mica capacitors removed earlier.

3.2 RF POWER AMPLIFIER BOARD REMOVAL

3.2.1 Under normal maintenance conditions there should be no need to remove the PA board. All components may be replaced from the top of the circuit board. If, however, replacement becomes necessary the following procedure should be followed. Unsolder six feedthru capacitors, and the harmonic filter input lead.

CAUTION

Damage to the harmonic filter will result if the input lead and mounting hole are not cleared of solder.

3.2.2 Unsolder and remove the input coax cable. Remove four transistor mounting screws (30 watt PA) or remove six transistor mounting screws and one 5/16" stud nut (50 watt PA). Remove seven hex head mounting screws. Lift board out of the chassis.

3.2.3 To replace the board, reverse the removal procedure. PA power transistors should be installed after the circuit board installation is complete. Refer to paragraph 3.1.

4. IGNITION NOISE AND ANTI-SKID BRAKING

If the MITREK radio is to be used in a vehicle employing an anti-skid braking system, refer to Motorola publication 68P81109E34 "Anti-Skid Braking Precautions". If ignition noise or alternator whine are a problem, refer to Motorola publication 68P81109E33 "Reducing Noise Interference in Mobile Two-Way Radio Installations". These two publications are available at no charge from Motorola and may be ordered using the self-mailer in the front of this manual.

REQUIRED TEST EQUIPMENT FOR MITREK RADIO SERVICING

GENERAL TYPE	APPLICATION	RECOMMENDED MODEL	MINIMUM SPECIFICATIONS
AC-DC VOM	DC voltage measurements, general	Motorola T1009A	Measurement range: 0-15 V dc Sensitivity: 20,000 ohms/volt
DC Multimeter	DC voltage readings requiring a high input resistance meter.	Motorola S1063B	Measurement range: 0-15 V dc Input resistance: 11 megohms
AC Voltmeter	Audio voltage measurements	Motorola S1053C	Measurement range: 0-10 V ac Input resistance: 10 megohms
RF Voltmeter	RF voltage measurements	Motorola S1339A	Measurement range: 100 uV-3 V from 1 MHz-512 MHz Inputs: 50 ohm and high impedance
Oscilloscope	Waveform observation	Motorola R1004A	Vertical sensitivity: 5 mV - 10 V/division Horizontal time base: 0.2 usec. 0.5 sec/division
RF Wattmeter	Transmitter output power measurement	Motorola S1350A with appropriate element and T1013A RF Dummy Load	Measurement range: 0-50 Watts, 0-100 Watts
Frequency Meter	Transmitter frequency measurement	Model R1200A Service Monitor with high stability oscillator (X suffix) option. Frequency calibration recommended every 6 months or less.	Measurement range: 1-512 MHz Frequency resolution: 10 Hz
Deviation Meter	Transmitter modulation deviation measurement	Motorola R1200A Service Monitor	Measurement range: 0-10 kHz deviation Frequency range: 403-512 MHz
RF Signal Generator	Receiver Alignment and troubleshooting	Motorola R1200A Service Monitor with attenuator	Frequency range: 403-512 MHz Output Level: 0.1 uV-100,000 uV Must be capable of at least ± 3 kHz deviation when modulated by 1 kHz tone.
Audio Signal Generator	Audio Circuit troubleshooting	Motorola S1067B	Frequency range: 20 Hz-20 kHz Output Level: 50 mV-1 V
PL Tone Generator*	Tone-Coded "Private-Line" Decoder Troubleshooting	Motorola S1333B	Frequency range: 10 Hz-9999 Hz Output Level: 0-3 V rms
DPL Test Set**	"Digital Private-Line" Encoder-Decoder Troubleshooting	Motorola SLN6413A	
Radio Test Set w/appropriate metering cable SKN6012B	Meter readings at circuit metering points for alignment and troubleshooting	Motorola S1056B Portable Test Set, TEK5B-E Metering Panel with RPX4053A Conversion Kit, or TEK5F Metering Panel.	
Tuning Tool Kit	Receiver and transmitter alignment	Motorola HLN4023A	
DC Power Supply	DC power for shop service	Motorola R1011AA	1-20 V DC 0-40 A

*Required for tone-coded "Private-Line" models only

**Required for "Digital Private-Line" models only

NOTE

If version B through E of the TEK-5 Portable Test Set are used *they must first be modified* using RPX4053A Conversion Kit.

FREQUENCY CALCULATIONS

FREQUENCY	CALCULATION
403-420 MHz	$f_o = \frac{f_c - 10.7}{9}$
450-512 MHz	

Where f_o = crystal frequency, f_c = carrier frequency

POSITIVE GROUND SYSTEMS

CAUTION

In positive ground systems the case of the TEK5 Meter Panel and portions of the S1056B Portable Test Set are hot with respect to the vehicle chassis due to the nature of the positive ground installation. Take necessary precautions that the test equipment does not contact the vehicle chassis.

UHF MITREK RECEIVER ALIGNMENT PROCEDURE

1. The tuning procedure should be performed using the Motorola portable test set or the TEK5 set to position A. If using the TEK5-F or modified TEK5-B through TEK5-E meter panels, put the M1, 2 polarity switch in the reverse position and ignore the indicated polarity notes.

2. **IMPORTANT:** When using the Motorola portable test set for M4 place the FUNCTION SELECTOR SWITCH to the proper M4 operation.

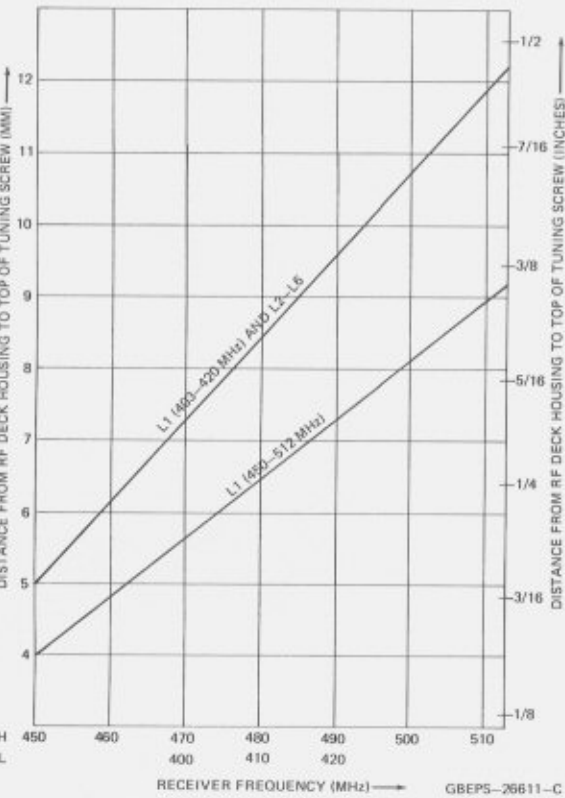
STEP	TEST SET METER POSITION	ADJUST	PROCEDURE
1		L1-L6	Preset the RF preselector tuning screws per the preset chart.
2		L7, L8	Preset the injection filter tuning screws 20mm (3/4 inch) from the top surface of the injection filter housing.
3		L104, L106	Preset the L104 coil slug flush with the top of the coil form. If the receiver frequency is less than 480 MHz, preset the L106 slug flush with the top of the coil form. If not, preset the L106 slug 15 turns from flush with the top of the coil form.
4		L102	Preset the mixer drain coil slug 15 turns from flush with the top of coil form.
5		L204, L206	Preset the i-f matching network coil slugs 8 turns from flush with the top of coil forms.
6	2 (Reverse)	L208	Starting with the slug flush with the top of coil form, adjust the detector coil for the <i>first</i> reading of 24 uA on meter 2. (No input signal is necessary.)
For multiple frequency radios, perform Steps 7, 8, 9, 11, and 12 at the lowest frequency.			
7*	6	L104, L106	Starting with L104 adjust the injection buffer coils for a peak reading on meter 6. Check for multiple peaks and adjust for the <i>maximum</i> indication on meter 6. Repeat until no further improvement is obtained.
8*	6	L7	Adjust L7 for a dip on meter 6.
9	6	L8	Adjust L8 for a peak on meter 6.
10	1 (Reverse) 4	Receiver Oscillator Warp	For each frequency, set rf generator to the carrier frequency (± 100 Hz) and adjust the output lead for a meter 1 reading of 35 uA. Activate the meter 4 circuit by shorting the meter 4 enable pins. Adjust oscillator frequency for a zero reading on meter 4.
11	1 (Reverse)	L1-L6	Adjust L1, L2, L3, L4, L5, L6 in order for peak reading on meter 1 while maintaining meter 1 between 30 uA and 40 uA by adjusting the RF signal generator output.
12	1 (Reverse)	L1-L6	If the receiver frequency is less than 500 MHz, adjust L1 through L6 counterclockwise by 1/2 turn. If the receiver frequency is 500 MHz or greater, adjust L1 through L6 counterclockwise by 1 turn. Repeat Step 11 until no further improvement is noted.
13	1 (Reverse)	L102, L204, L206	Apply standard test modulation (1 kHz tone, ± 3 kHz deviation) to the rf signal generator and adjust the output level for 35 uA on meter 1. Adjust i-f coils for a peak reading on meter 1 while maintaining meter 1 between 30 uA and 40 uA by adjusting the generator output. Repeat until no further improvement is obtained.
14	7 (AC Voltmeter across the speaker)	L208	With the same conditons as in Step 13 adjust L208 <i>slowly</i> for maximum audio voltage across the speaker.
15	1 (Reverse), 4	Receiver Oscillator Warp	Repeat Step 10.
16	(AC Voltmeter across the speaker)	L6, L8	Adjust L6 and L8 for best quieting with the lowest frequency selected. Repeat until no further improvement is obtained.
For single frequency radios and radios with a frequency sepearation less than 250 kHz omit Step 17.			
17	(AC Voltmeter across the speaker)	L8	Adjust L8 for best quieting with the highest frequency selected.
Receiver tuning is now complete.			

*Do not repeat Step 7 (L104, 106) after doing Step 8. Do not repeat Step 8 (L7) after doing Step 9.

Receiver Metering Tables

- 1. Meter readings reflect no signal applied after proper alignment
- 2. Nonpreamp/preamp

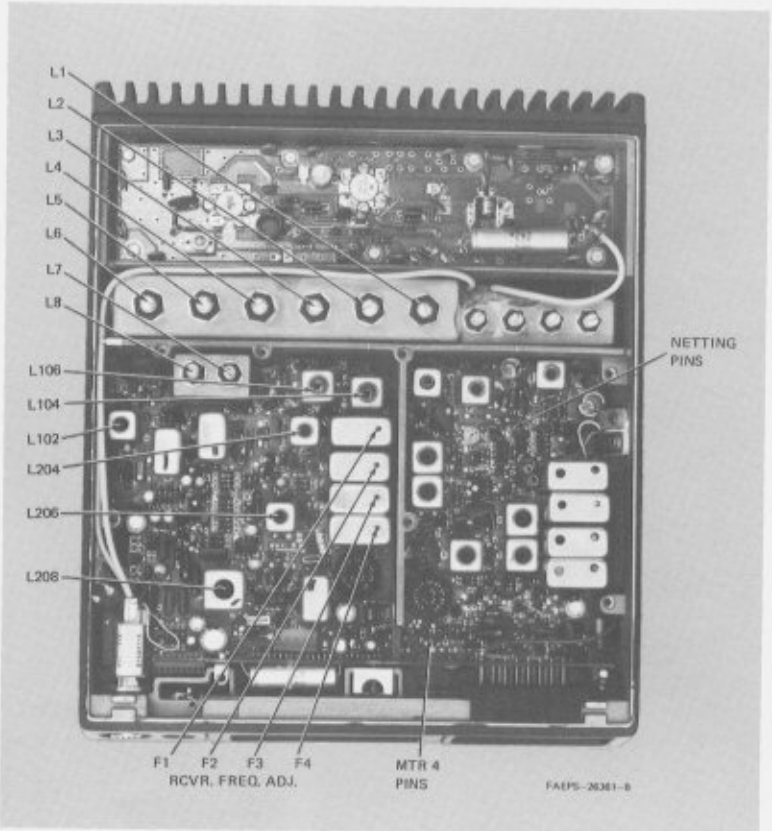
PORTABLE TEST SET SWITCH POSITION	1	2	4	6
METER READING (uA)	15/17 (min) 30/32 (max)	20 (min) 28 (max)	0 (nom)	10 (min)
FUNCTION METERED	SIGNAL STRENGTH	DETECTOR D. C. OUTPUT	CARRIER OFFSET	INJECTION LEVEL



EMERGENCY RECEIVER NETTING PROCEDURE
This procedure should be used as an alternative to that given in the receiver alignment procedure only when the proper equipment is not available. Radio performance specifications are not guaranteed using this emergency procedure. It can only be performed if the receiver and transmitter frequencies are the same, and only after the transmitter oscillators have been set on frequency using a frequency counter.

The procedure is as follows:

- Step 1. Select F1. (R1 must equal T1 or this procedure cannot be used for F1.)
- Step 2. Apply a short (screwdriver) across the two pins of the NET plug.
- Step 3. Adjust R1 FREQ ADJ control for a zero on meter 4.
- Step 4. Repeat for all other frequencies where $F_R = F_T$.



UHF MITREK

TRANSMITTER ALIGNMENT

CAUTION

Do not key the transmitter for more than a few seconds at a time until it is properly tuned. Turn on the transmitter for brief periods while reading the meter and making the adjustments.

FREQUENCY CALCULATIONS

FREQUENCY	CALCULATION
403-420 MHz	f_c
450-512 MHz	$f_o = \frac{f_c}{36}$

Where f_o = crystal frequency, f_c = carrier frequency

UHF MITREK TRANSMITTER TUNING PROCEDURE

1. The tune-up procedure has been written for use with the Motorola portable test set or the TEK-5 set to position A.
2. Start multi-frequency tune-ups at the lowest frequency.

STEP	TEST SET SWITCH POSITION	ADJUSTMENT	PROCEDURE
1	None	L701-708*, L9-12, R909, R911, C800, C813*	Adjust L702, L704, L705, L706, L707 and L708* to be flush with top of can. Set L701 and L703 seven turns in from top of can. Set L9-L12 1/4 inch (6mm) above filter casting. Set R909 fully clockwise, R911 180° from fully counterclockwise or 90° from fully clockwise. Set C800, C813* 1/2 turn from tight.
2	M3	L702, L701, L702, L703	Peak L702, then peak L701, L702, L703
3	M3	L704, L705	Dip L704, then peak L705.
4	M5	L706, L707, L704, L705	Peak L706, L707, L704, L705 in that order.
5	M6	L708*	Peak L708* for peak that is closest to bottom of coil.
For wide-space operation, go to Step 13.			
6	M6	L9, L10, L11	Turn counterclockwise and dip L9, peak L10 and dip L11.
7	M7	L12	Peak L12. If no MTR 7 is observed, then preset L9, L10, L11, L12 and go back to Step 6.
8	M7	C813*	Peak C813*
9	M6	L708*	Peak L708*
10	Wattmeter	C800, R911	Peak C800. If 65 W (50 W radio) or 38 W (30 W radio) is not obtained, then increase R911 until the required power is obtained or no further increase is noted. If power is less than 55 W (50 W radio) or 36 W (30 W radio), then preset L9, L10, L11, L12, L708* and go back to Step 5. If necessary, go back to Step 1.
11	Wattmeter	R911, C813*	Set R911 to 65 W (50 W radio), 38 W (30 W radio), or to power level in Step 10. Retune C813*. Reset R911 if necessary.
12	Wattmeter	R909, C800	Set R909 for 55 W (50 W radio) or 34 W (30 W radio) and peak C800. Reset R909 if necessary.
This completes alignment for single frequency radios. For multi-frequency radios, complete the following steps.			

NOTE

FL = Lowest transmitter frequency.
FH = Highest transmitter frequency.

13	M3	L701, L703	On FH: Peak L701, L703
14	M3	L702	On FL: Peak L702.
15	M5	L704, L706, L707	On FH: Peak L706, L707. If M5 is less than 10, balance M5 between lowest and highest frequency using L704 and L706.
16	M6	L708*	On FH: Peak L708* on peak closest to bottom of coil.
17	M6	L9, L10, L11	On FH: Turn counterclockwise and dip L9, peak L10, dip L11 (L9 may have shallow dip).
18	M7	L12	On FH: Peak L12, if no indication, preset L9, L10, L11, L12 and go back to Step 17.
19	M7	C813*	On FH: Peak C813*
20	Wattmeter	C800	On FH: Peak C800. If power is less than 65 W (50 W radio) or 38 W (30 W radio), then increase R911 until the power is obtained or until no further increase in power is noted. If power is less than 55 W (50 W radio) or 36 W (30 W radio), then preset L9, L10, L11, L12, L708* and go back to Step 16. If needed go to Step 1.
21	M6	L708*	On FL: Peak L708* on lowest frequency on peak closest to bottom of coil.
22	M7	L10, L11	On FL: Turn L10, L11 clockwise in 45° (1/8 turn). If no MTR 7 is shown, then preset L9, L10, L11, L12 and go back to Step 17. If needed go to Step 1.
23	M7	C813*	On FL: Peak C813*.
24	Wattmeter	C800, R911	Peak C800. Set R911 to 65 W (50 W radio) or 38 W (30 W radio), or to the same power obtained in Step 20. If the difference in power between all channels is less than or equal to 5 W (50 W radio) or 3 W (30 W radio), go to Step 25; if not, then go to Step 26.
25	Wattmeter	C800, R909	On lowest power channel, set R909 to 55 W (50 W radio) or 34 W (30 W radio) and repeak C800. Reset R909 if necessary. A balance of C800, may be necessary to achieve difference of less than 5 W (50 W radio) or 3 W (30 W radio). If the required balance cannot be achieved, then reset R909 full clockwise, and go to Step 26.

Transmitter Alignment
Motorola No. PEPS-26613-C
6-10-81 GGI

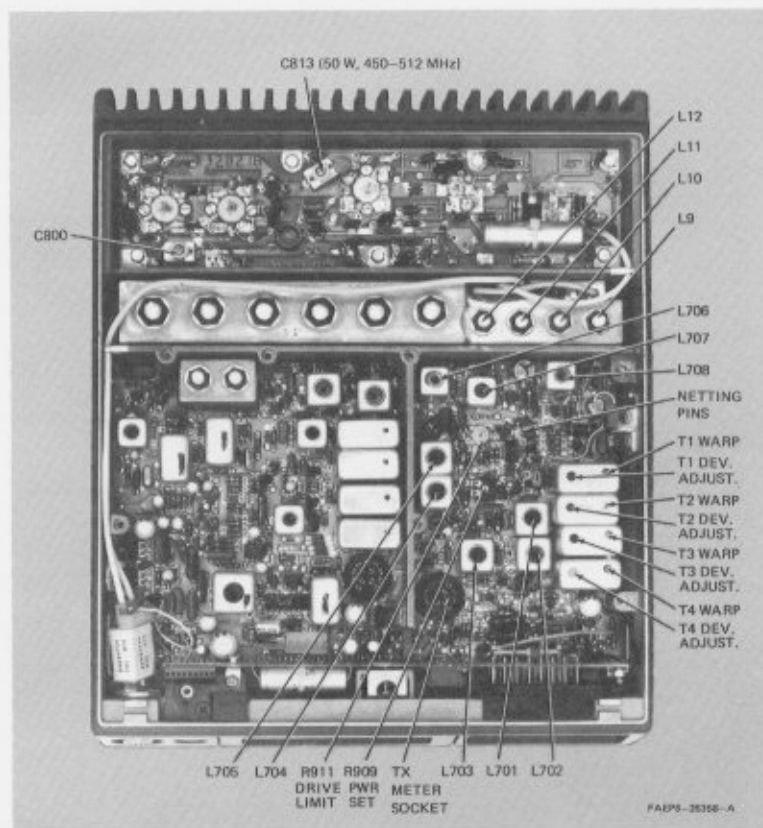
STEP	TEST SET SWITCH POSITION	ADJUSTMENT	WIDE-SPACE ITERATIVE TUNING PROCEDURE
Perform Step 26A if there is a difference of 5-8 W between any two channels. Perform Step 26B if the power difference between any two channels is greater than 8 W.			
26A	Wattmeter	C800, C813*	Balance power on all channels. R911 may have to be turned down to the proper power output. If balance cannot be achieved, go to Step 26B.
26B	Wattmeter	L9, L12	Balance power on all channels. Balancing of L9, L12 should not degrade the output power, of the channel having the highest output power, (as obtained in Step 26A), by more than 2W. If balance cannot be achieved, go to Step 26C.
26C	Wattmeter	L10, L11	On the lowest power channel, tune L10, L11 slightly (less than 1/8 turn). For an increase in power, go back to Step 26B.
Once the required balancing is achieved, go to Step 25. If proper balancing cannot be obtained, preset R911, L708* L9-12, and go to Step 16.			
*C813 adjustments apply only to 50 W (450-512 MHz) radios. L708 is tuneable only in 450-512 MHz radios.			

NOTE

L9-L12 should be all about the same height when properly tuned.

WHEN THE TRANSMITTER IS PROPERLY ALIGNED, METER DEFLECTIONS SHOULD FALL WITHIN THE LIMITS SHOWN IN TABLE BELOW.

	METER 3	METER 5	METER 6	METER 7
METER READING	15 (min) 50 (max)	10 (min) 50 (max)	6 (min) 50 (max)	17 (max) (50 W radio) 13 (max) (30 W radio)
FUNCTION METERED	Base of FIRST DOUBLER	Base of LOW LEVEL AMP	Input of EXCITER FILTER	FINAL AMPLIFIER CURRENT



OSCILLATOR FREQUENCY ADJUSTMENT

Setting the oscillator "on frequency" should be done *after* the transmitter has been aligned, but *before* transmitter deviation is checked and set. To set the oscillator on frequency, perform the following steps:

Step 1. Set up the frequency meter as described in the frequency meter instruction manual.

Step 2. Set the frequency selector switch on the control head to the F1 position (multi-frequency units only).

Step 3. Key the transmitter with no modulation using the portable test set. On "Private-Line" or "Digital Private-Line" coded squelch models, disable the "Private-Line" encoder by shorting the code disable points on the "Private-Line" or "Digital Private-Line" encoder/decoder board.

Step 4. Adjust the T1 FREQ ADJ control for proper readings on the frequency meter. If the frequency as indicated on the frequency meter is too low, turn the T1 FREQ ADJ control counterclockwise, if too high, turn the control clockwise. Set the frequency to within ± 30 MHz.

Step 5. Set the frequency selector switch to the F2 position and repeat Step 4 using the T2 FREQ ADJ control.

Step 6. Repeat Step 4 for F3 and F4, respectively.

Step 7. On "Private-Line" or "Digital Private-Line" models, remove the short added in Step 3.

NOTE

Omit Steps 5 and 6 for single frequency units.

DEVIATION ADJUSTMENTS

NOTE

The oscillator frequency adjustment *must* be made *prior* to this adjustment.

Step 1. Connect the output leads of the tone oscillator through a .33 uF capacitor to the transmitter audio input (microphone receptacle).

Step 2. Connect the ac voltmeter across the same terminals and adjust the tone generator output to 1 volt at 1000 Hz.

Step 3. Place the frequency selector switch in the F1 position (in multiple frequency models) and key the transmitter using the portable test set. Adjusting the T1 DEV ADJ control, for 4.8 kHz deviation as read on the deviation measuring instrument used. For multiple frequency models adjust the F2, F3, and F4 DEV controls with the frequency selector switch in the corresponding position.

Step 4. "Private-Line" tone deviation should be between 0.5 and 1 kHz.



FUNCTIONAL BLOCK DIAGRAM

UHF MITREK RADIO

TRANSMITTER SECTION BOARD DETAIL

Reference Series Key	
REFERENCE	CIRCUIT
0-99	Receiver Meter 4, Receiver 9.5 V Switch
100-199	Receiver Injection and Receiver rf IF
200-299	—
300-399	—
400-459	Detector, Receiver Audio, Squelch
460-480	Busy Light Adapter
500-599	Transmit Audio
600-699	Transmit and Receive Channel Elements
700-799	Exciter
800-899	Power Amplifier
900-999	Power Control and Protection
1000-1099	Regulator, Transmitter 9.5 V Switch, PTT

68P81039E21-B
(Sheet 1 of 5)
6-10-81 GGI

parts list

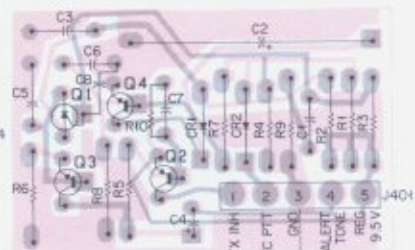
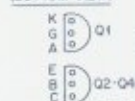
LEGEND		
L = 403-420 MHz		
H = 450-512 MHz		
P/O HLE4001A UHF Main Board, Transmitter Section (403-420 MHz)		
P/O HLE4002A UHF Main Board, Transmitter Section (450-512 MHz)		
PL-6028-C		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed: ± 5%; 500 V; unless otherwise stated		
C501	21-83596E36	.01 uF + 60-40%; 200 V
C502	21-83506E10	220 pF ± 20%
C503, 504	8-84637L31	.047 uF ± 10%; 250 V
C505, 506	21-83596E10	220 pF ± 20%
C507	8-84496D03	.01 uF ± 10%; 250 V
C508	8-82905G40	.03 uF; 50 V
C509	8-83813H44	.0012 uF; 100 V
C511	23-84665F03	100 uF + 100-10%; 25 V
C602	21-84448K02	.01 uF ± 20%; 100 V
C701H	21-83406D82	36 pF
C701L	21-84493B56	47 pF ± 5% NPO; 500 V
C702H	21-82450B13	1.5 pF
C702L	21-82450B18	2 pF ± 5%; 500 V
C703H	21-83406D86	47 pF
C703L	21-80067A54	56 pF ± 5% NPO; 500 V
C704H	21-82450B13	1.5 pF
C704L	21-82450B18	2 pF ± 5% NPO; 500 V
C705H	21-84493B23	120 pF
C705L	21-83798B17	100 pF ± 5% NPO; 200 V
C706H	21-84493B14	68 pF; 200 V
C706L	21-84493B11	100 pF ± 5% NPO; 200 V
C707	21-83596E13	.001 uF ± 10%; 1000 V
C708	21-83596E13	.001 uF ± 10%; 100 V
C709	21-83406D80	4.7 pF ± .25 pF
C710	21-83596E13	.001 uF ± 10%; 1000 V
C711	21-83596E36	.01 uF + 60-40%; 250 V
C712H	21-83406D93	16 pF
C712L	21-83406D67	22 pF ± 5% NPO; 500 V
C713H	21-864518	1 pF
C713L	21-82450B08	1.2 pF ± 5%; 500 V
C714H	21-03406D56	24 pF
C714L	21-83406D87	43 pF ± 5% NPO; 500 V
C715H	21-80067A54	56 pF
C715L	21-83406D87	43 pF ± 5% NPO; 500 V
C716, 717	21-83596E13	.001 uF ± 10%; 1000 V
C718H	21-83406D94	9 pF ± .5 pF;
C718L	21-82204B41	13 pF ± 5% NPO; 500 V
C719H	21-82450B48	0.75 pF
C719L	21-82450B47	1 pF ± 5%; 500 V
C720H	21-80067A29	11 pF ± .5 pF
C720L	21-83406D55	18 pF ± 5% NPO; 500 V
C721H	21-83406D92	36 pF
C721L	21-84493B56	47 pF ± 5% NPO; 500 V
C722	21-83596E13	.001 uF ± 10%; 1000 V
C723	21-83406D52	2.0 pF ± .25 pF
C724	21-83596E13	.001 uF ± 10%; 1000 V
C725	21-82372C10	.05 uF ± 20%; 25 V
C726H	21-83406D87	43 pF
C726L	21-83406D71	33 pF; NPO;
C727H	21-82204B41	13 pF
C727L	21-83406D87	43 pF ± 5% NPO; 500 V
C728H	21-82204B74	24 pF
C728L	21-83406D71	33 pF; NPO
C729	21-82877B24	220 pF ± 10%; 75 V
C730	21-83596E13	.001 uF ± 10%; 1000 V
C731H	21-83406D63	6 pF ± .25 pF
C731L	21-83406D84	6.8 pF ± .25 pF NPO; 500 V
C737, 738	21-82372C10	.05 uF ± 20%; 25 V
C743	21-83596E13	.001 uF ± 10%; 1000 V
C744H	21-80067A35	15 pF
C744L	21-83406D55	18 pF ± 5% NPO; 500 V
C747	21-82372C09	0.1 uF + 80-20%; 25 V
C750	23-84538G14	1 uF ± 10%; 35 V
C753	21-82187B48	.003 uF ± 10%; 100 V
C755	21-83406D68	27 pF
C756	23-84538G03	0.1 uF ± 20%; 35 V
C757	21-83596E13	.001 uF ± 10%; 1000 V
C758		plated on circuit board
C759	21-82372C10	.05 uF ± 20%; 25 V
C760	21-82187B45	470 pF ± 20%; 25 V
C902, 907	21-82187B44	.001 uF ± 10%; 100 V
C908	21-82187B48	.003 uF ± 10%; 100 V
C909	21-82187B44	.001 ± 10%; 100 V
C910	23-84538G04	15 uF ± 20%; 20 V
C914	21-82187B44	.001 uF ± 10%; 100 V
C916	23-84538G22	6.8 uF ± 10%; 20 V
C917	21-82187B44	.001 uF ± 10%; 100 V
C918, 919	21-82372C10	.05 uF ± 20%; 25 V
C920	23-84538G04	15 uF ± 20%; 20 V
C1004	21-83596E37	0.01 uF + 70-30%; 100 V
C1005	23-84665F02	15 uF + 100-10%; 25 V
C1007	21-82372C10	.05 uF ± 20%; 25 V
C1008	23-84665F03	100 uF + 100-10%; 25 V
C1009	21-844163	.0015 uF ± 25%; 250 V
C1010	21-83596E21	0.01 uF + 60-40%; 250 V
diode: (see note)		
CR601 thru 604	48-83654H01	silicon
CR701	48-82466H13	silicon
CR702, 705, 706	48-82139G01	germanium

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
CR902, 906, 907	48-82466H13	silicon
CR903, 905	48-83654H01	silicon
CR1001	48-83654H02	silicon
CR1003	48-83654H01	silicon
CR1005	48-83654H01	silicon
CR1006	48-82466H13	silicon
connector, receptacle:		
J901	9-80028A01	female; 3 contact
J1002	9-82748G01	female; 12 contact
J1003	9-80028A01	female; 3 contact
coils:		
L9, 10, 11, 12H		part of RF DECK HLE4051A
L9, 10, 11, 12L		part of RF DECK HLE4050A
L701	24-83377G11	6-1/2 turns (Violet)
L702, 703	24-80068A17	6-1/2 turns (Yellow)
L704	24-80068A18	4-1/2 turns (Orange)
L705	24-80068A19	4-1/2 turns (White)
L706	24-80034A02	3-1/2 turns (White)
L707	24-80034A03	3-1/2 turns (Red)
L708H	24-80034A03	3-1/2 turns (Red)
L708L	24-80034A04	3-1/2 turns (Red)
L710	24-82835G13	choke; 0.82 uH
L711	24-83977B02	choke 2-1/2 turns
L712	24-82835G13	choke; 0.82 uH
L713	24-83961B07	choke 3-1/2 turns
L714	24-82835G13	choke; 0.82 uH
L715	24-80036A02	choke; 1/2 turns; ferrite
L716H	10-518	BARE WIRE
L716L	24-82723H25	0.033 uH ± 5%
L717H	30-10286C57	22 ga. 0.36"
L717L	24-80096B02	coil, rf
L718H	24-84614A04	1-1/2 turns
L718L	24-80096B01	coil, rf
L722, 723	24-82835G13	choke; 0.82 uH
L724, 725	24-80036A02	choke; 1/2 turn; ferrite
L901	24-82835G23	choke; 33 uH
connector, plug:		
P903	28-80181B04	male; 2 contact
P601 thru 604	28-80096A02	male; 5 contact
transistor: (see note)		
Q501	48-869643	PNP; type M9643
Q502, 503	48-869642	NPN; type M9642
Q504	48-869643	PNP; type M9643
Q701	48-869494	NPN; type M9494
Q702	48-869638	NPN; type M9638
Q703	48-869657	NPN; type M9657
Q704	48-869887	NPN; type M9887
Q901	48-869652	field-effect; type M9652
Q902	48-869643	PNP; type M9643
Q903	48-869642	NPN; type M9642
Q904	48-84411L10	PNP; type M1110
Q1001, 1002	48-869642	NPN; type M9642
Q1003	48-869680	NPN; type M9680
Q1004	48-869643	PNP; type M9643
Q1006	48-84411L10	PNP; type M1110
Q1007	48-869642	NPN; type M9642
Q1008	48-869643	PNP; type M9643
resistor, fixed: ± 10%; 1/4 W; unless otherwise stated		
R501	6-124C43	560
R502, 503	6-124C83	27k
R504, 505	6-124A13	33 ± 5%
R506, 507	6-124C93	68k
R508, 509	6-124C73	10k
R510	6-124A69	6.8k ± 5%
R511, 512	6-124A70	7.5k ± 5%
R513	6-124A32	200 ± 5%
R514	6-124C01	10
R515	6-124A38	360 ± 5%
R601	6-124C65	4.7k
R702	6-124A92	62k ± 5%
R703	6-124C05	15
R704	6-124C73	10k
R706H		not used
R706L	6-124C25	100 ± 10%; 1/4 W
R707	6-124C17	47
R708	6-124C73	10k
R709	6-125C29	150; 1/2 W
R710H	6-124A25	100 ± 5%
R710L	6-124A21	68
R711H		not used
R711L	6-124A49	1k
R712H		not used
R712L	6-124A40	430
R713	17-82036G08	10 ± 5%; 2 W
R714	6-124A49	1k ± 5%
R717	6-124C17	47
R718	6-124C25	100
R719	6-124A90	51k ± 5%
R907	6-124C81	22k
R908	6-124C43	560
R909	18-83311K05	variable; 5k
R910	6-124C81	22k
R911	18-83311K08	variable; 50k
R912	6-124A83	27k ± 5%

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R913	6-124A72	9.1k ± 5%
R914	6-124A97	100k ± 5%
R915	6-124C27	120
R916, 917	6-124C65	4.7k
R918	6-124C39	390
R919	6-125C29	150; 1/2 W
R920	6-124C25	100
R921	6-124C43	560
R922	6-124C49	1k
R924	6-124C29	150
R926	6-124A33	220 ± 5%
R927	6-124C57	2.2k
R1001	6-124C53	1.5k
R1002	6-124A22	75 ± 5%
R1003	6-124A19	56 ± 5%
R1004	6-124C53	1.5k
R1005	6-124C73	10k
R1006	6-124C49	1k
R1007	6-124C73	10k
R1012	6-125C03	12; 1/2 W
R1013	6-124C49	1k
R1014	6-124C73	10k
R1015	6-124C67	5.6k
R1016	6-124C67	5.6k
R1017	6-124C39	390
integrated circuit: (see note)		
U901	51-84621K70	type M2170
voltage, regulator:		
VR904	48-82256C51	Zener type; 5.1 V
VR1002	48-82256C44	Zener type; 7.5 V
VR1007	48-83461E18	Zener type; 18 V
mechanical parts		
	26-80196A01	CAN, coil for L701
	26-80196A01	CAN, coil for L702
	26-80196A01	CAN, coil for L703
	26-80196A01	CAN, coil for L704
	26-80196A01	CAN, coil for L705
	26-80039A01	CAN, coil for L706
	26-80039A01	CAN, coil for L707
	26-80039A01	CAN, coil for L708
note:		
For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.		
HLE4050A and HLE4051A RF Deck and HLN4021A and HLN4045A Antenna Switch are not field repairable and replacements should be ordered as a unit. Mechanical parts for rf deck are available; see Sheet 5 of this section.		
The harmonic filter is not field repairable and replacements should be ordered by Motorola Kit Number HFE4000A (403-420 MHz) or HFE4001A (450-512 MHz). For each harmonic filter ordered one factory formed wire, Motorola Part No. 30-80064A01, must also be ordered.		
HLN4012A Time-Out Timer		
PL-6032-C		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed:		
C1	21-82372C10	.05 uF + 80-20%; 25 V
C2	23-83185D01	120 uF ± 10%; 15 V
C3	8-84637L38	.0033 uF ± 10%; 630 V
C4	23-84538G01	1 uF ± 20%; 35 V
C5	8-84637L32	.0068 uF ± 10%; 630 V
C6, 7	21-83596E10	220 pF ± 20%; 500 V
C8	21-82187B44	.001 uF ± 10%; 100 V
diode: (see note)		
CR1, 2	48-83654H01	silicon
connector, receptacle:		
J11	9-80098A01	female, 5 contact
transistor: (see note)		
Q1	48-869673	Thyristor; type M9673
Q2	48-869467	PNP; type M9467
Q3, 4	48-869642	NPN; type M9642
resistor, fixed: ± 10%; 1/4 W; unless otherwise stated		
R1	6-124C71	8.2k
R2	6-124B11	360k ± 5%
R3	6-124A89	47k ± 5%
R4	6-124A97	100k ± 5%
R5	6-124A53	1.5k ± 5%
R6	6-124C33	220
R7	6-124C73	10k
R8	6-124A61	3.3k ± 5%
R9	6-124C77	15k
R10	6-124A49	1k ± 5%

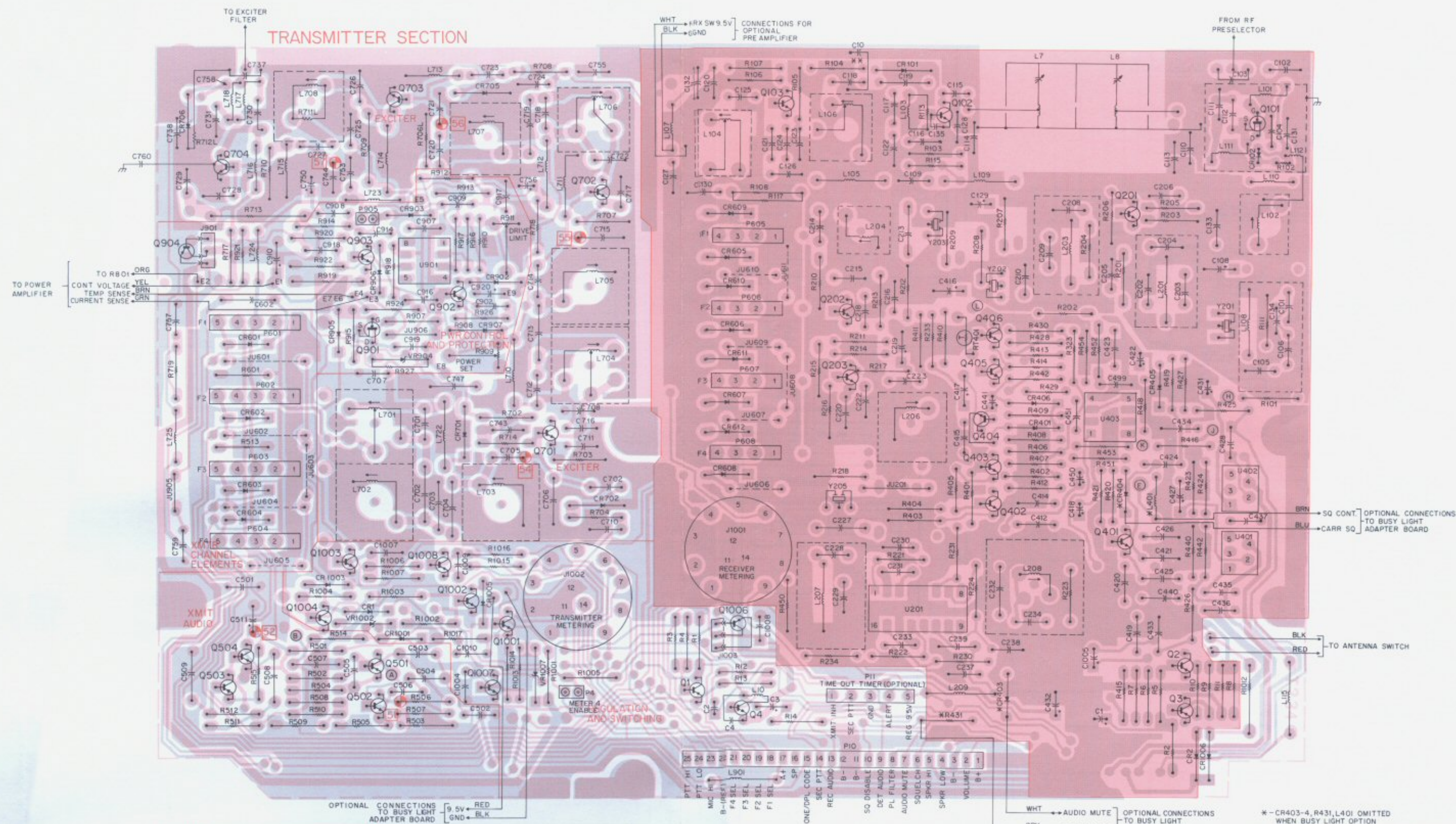
TIME-OUT TIMER

BASE DETAILS
(BOTTOM VIEW)



COMPONENT SIDE= 80-80PS-26137-0
SOLDER SIDE 80-80PS-26137-0
00-80PS-26131-0

SHOWN FROM SOLDER SIDE

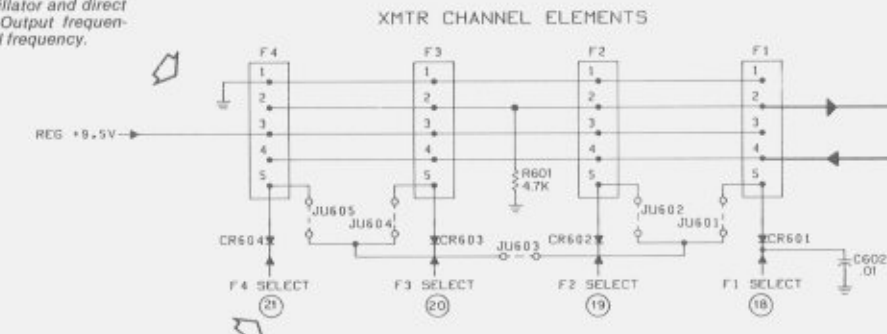


LEGEND
 VOLTAGE OR WAVEFORM TEST POINT SEE SCHEMATIC DIAGRAM

SHOWN FROM SOLDER SIDE

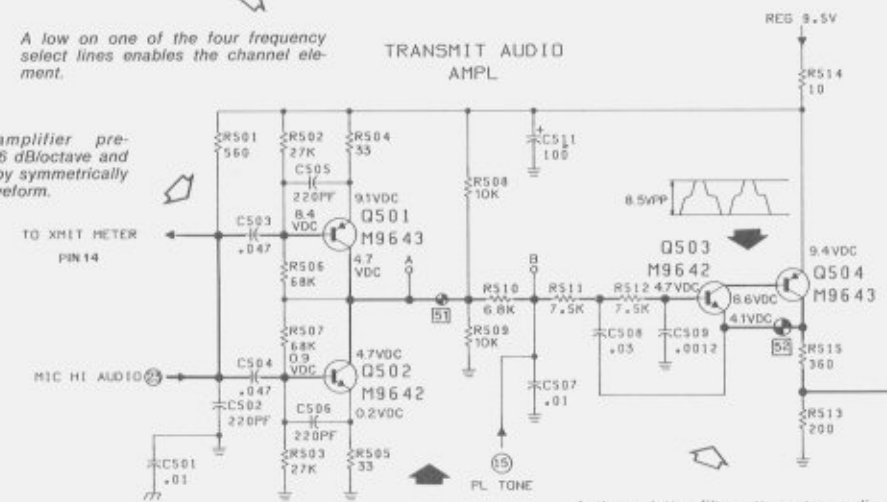
COMPONENT SIDE - BD-EEPS-27564-Q
SOLDER SIDE BD-EEPS-27565-Q
OL-EEPS-27566-A
TVOL-EEPS-27567-Q

A channel element plugs into connector F1, F2, F3, F4. Each channel element contains the oscillator and direct frequency modulator. Output frequency is three times crystal frequency.



A low on one of the four frequency select lines enables the channel element.

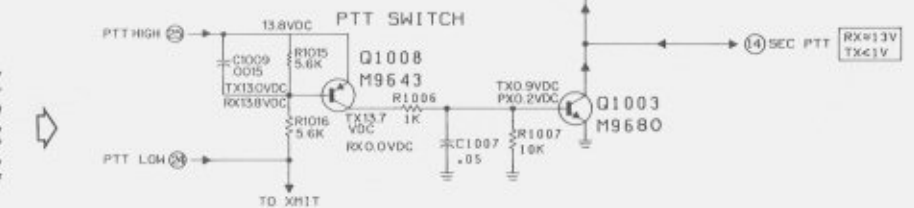
Transmit audio amplifier pre-emphasizes audio at 5 dB/octave and limits peak deviation by symmetrically clipping the output waveform.



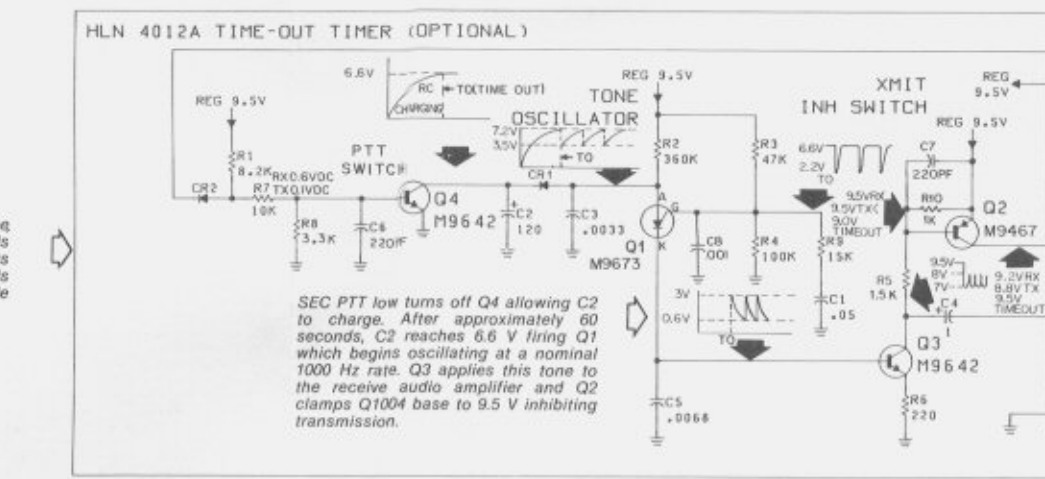
Active splatter filter attenuates audio above 3 kHz at more than 15 dB/octave.

See voltage Note 5

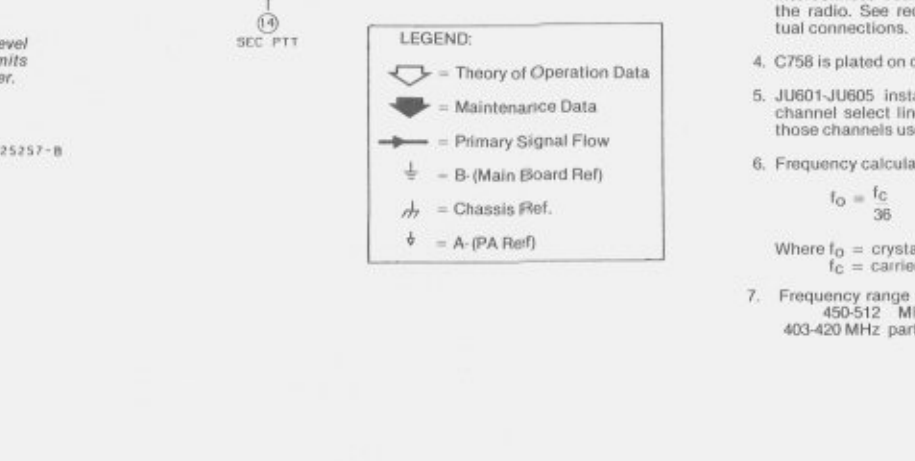
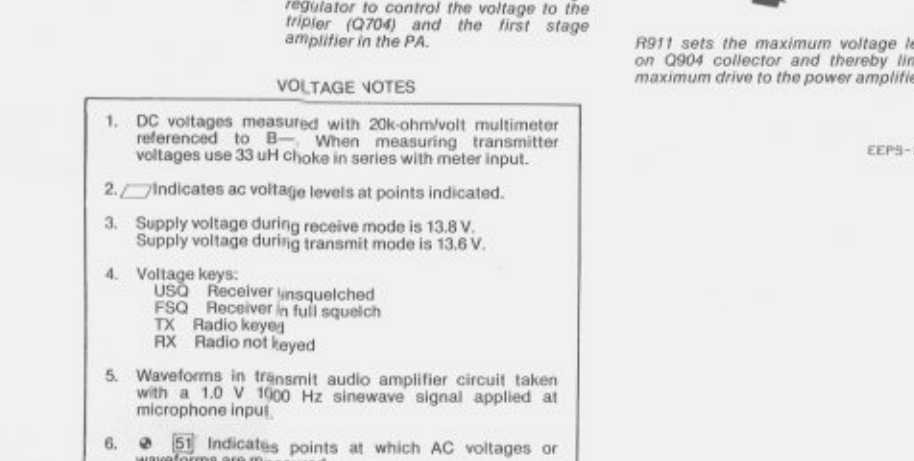
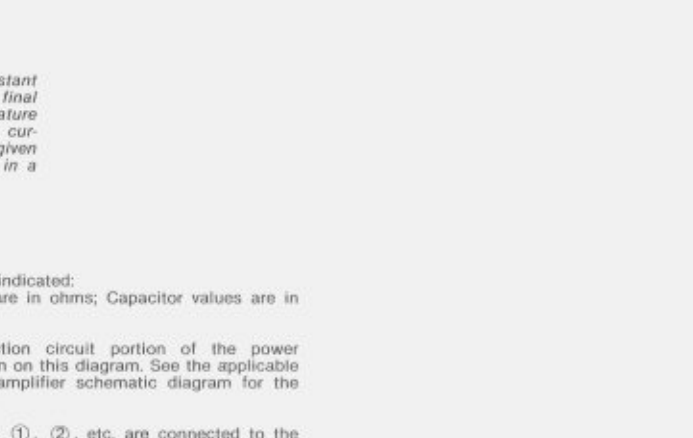
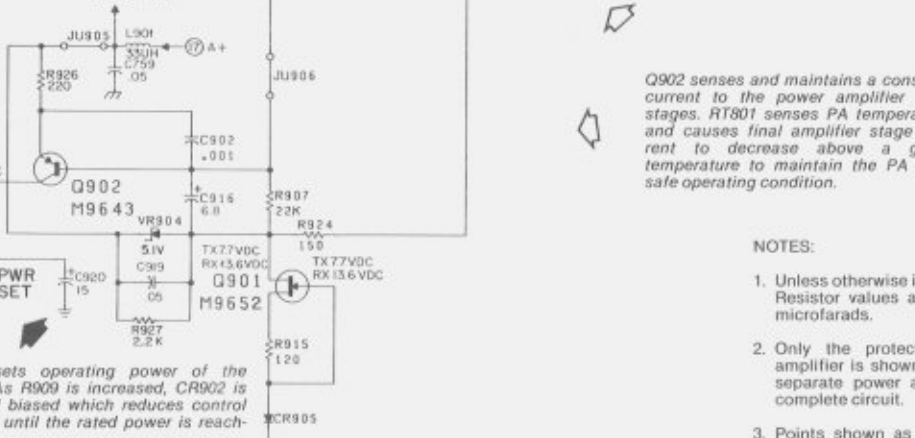
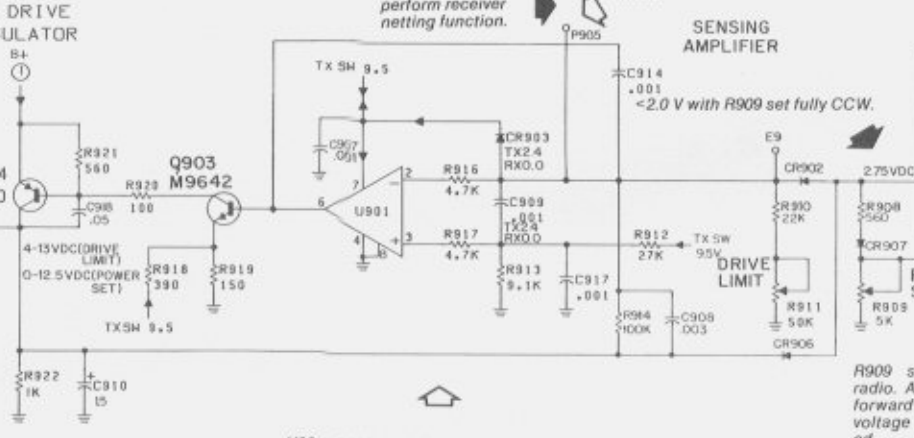
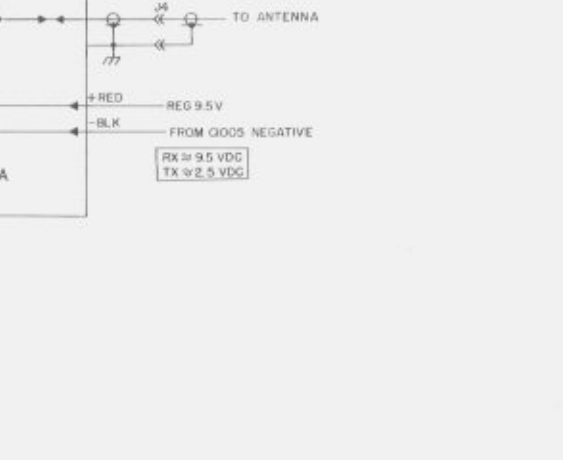
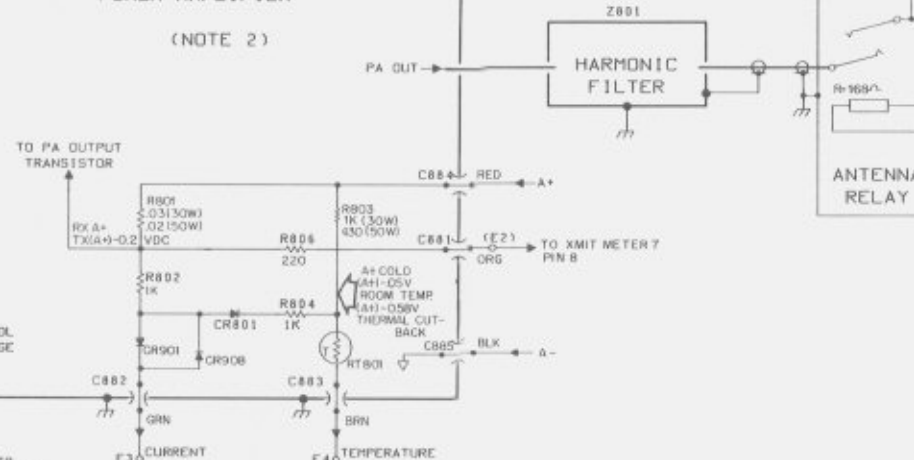
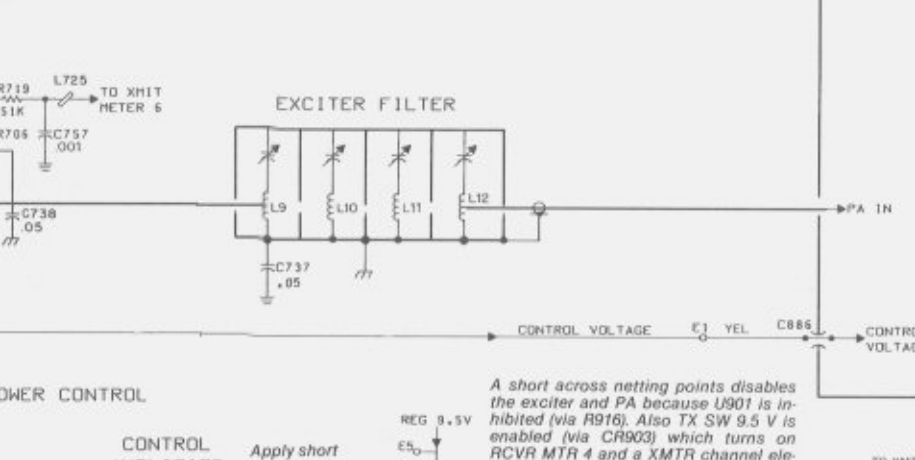
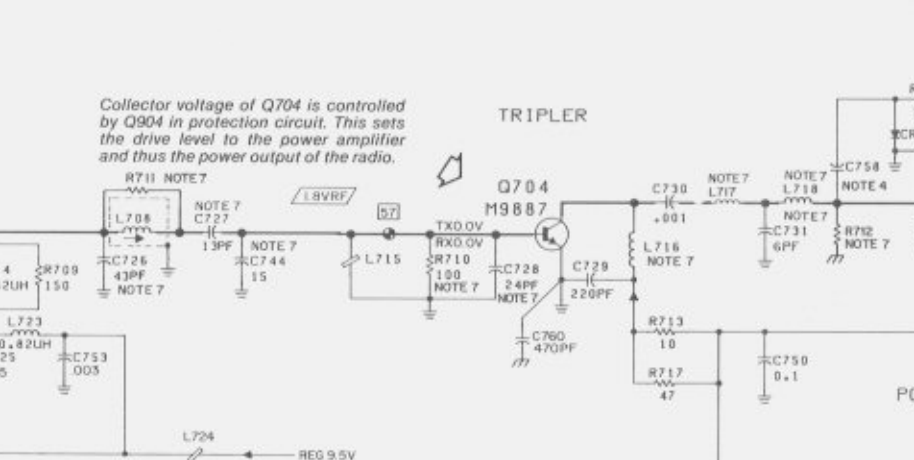
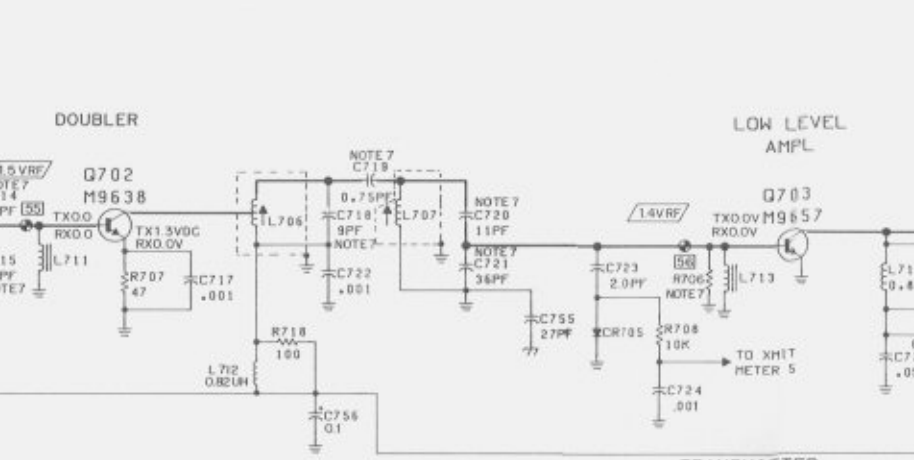
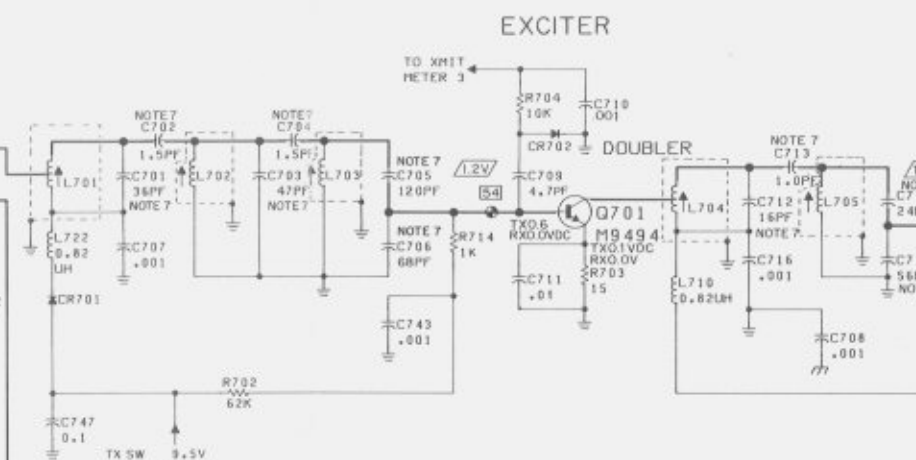
When the radio is keyed there is a 9 V difference between PTT HIGH and PTT LOW which turns on Q1008, Q1003 and Q1004, turns Q1 off, and activates the antenna switch. On "PL" or "DM" radios SECONDARY PTT is held sw during the reverse burst or turnoff code time.



Optional Time-Out-Timer limits the length of transmissions. 50 seconds after PTT is initiated, TOT inhibits XMIT 9.5 V switch Q1004 and sounds an operator alert tone in the mobile speaker.



SEC PTT low turns off Q4 allowing C2 to charge. After approximately 60 seconds, C2 reaches 6.6 V firing Q1 which begins oscillating at a nominal 1000 Hz rate. Q3 applies this tone to the receive audio amplifier and Q2 clamps Q1004 base to 9.5 V inhibiting transmission.



NOTES:
1. Unless otherwise indicated: Resistor values are in ohms; Capacitor values are in microfarads.
2. Only the protection circuit portion of the power amplifier is shown on this diagram. See the applicable separate power amplifier schematic diagram for the complete circuit.
3. Points shown as ①, ②, etc. are connected to the interconnect board for distribution to other points in the radio. See receiver schematic diagram for the actual connections.
4. C758 is plated on circuit board.
5. J601-J605 installed as required to bus 2 or more channel select lines to a single channel element when those channels use the same transmit frequency.
6. Frequency calculation:
 $f_o = f_c$
Where f_o = crystal frequency and f_c = carrier frequency
7. Frequency range sensitive part. Indicated value is for 450-512 MHz. See parts list for the 403-420 MHz part values.

UHF MITREK RADIO

RECEIVER SECTION BOARD DETAIL

parts list

HLN4018A Interconnect Board PL-6030-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1, 2	23-83210A19	capacitor, fixed: 500 uF + 100-10%; 20 V 4.7 uF ± 10%; 25 V 470 pF ± 20%; 25 V (feed thru)
C3	23-82783B25	
C11 thru 29	21-84874K01	
CR1	48-82525G19	diode: (see note) silicon silicon silicon silicon
CR2	48-83654H01	
CR3	1-80700T54	
CR4	48-82466H18	
J1	28-80011A01	connector, receptacle: male; 19 contact female; 9 contact female; 25 contact
J3	9-80180B02	
J10	9-80180B03	
L1, 7, 11, 13, 16, 18, 19	24-83961B01	coil: choke
R2	6-124C55	resistor, fixed: 1.8k ± 10%; 1/4 W 220 ± 10%; 1/4 W
R4	6-124C33	
mechanical parts		
	42-80088A01	CLIP, option

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

HLN4119A Busy Light Adapter Board PL-6323-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C460	23-84665F01	capacitor, fixed: 10 uF
L460		choke: 0.41 uH
R460	6-124A67	resistor, fixed: ± 5%; 1/4 W; unless otherwise stated 5.6k 2k 1k 3.3k 4.7k 1k 8.2k 5.1k 1k 4.7k 5.1k 100
R461	6-124A56	
R462	6-124A49	
R463	6-124A61	
R464	6-124A65	
R465	6-124A49	
R466	6-124A71	
R467	6-124A66	
R468	6-124A49	
R469	6-124A65	
R470	6-124A66	
R471	6-124A25	
CR460 thru CR462	48-83654H02	diode: (see note) silicon
Q460	48-869642	transistor: (see note) NPN; type M9642 PNP; type M9643 NPN; type M9642 PNP; type M9643
Q461	48-869643	
Q462	48-869642	
Q463	48-869643	

68P81039E21-B
(Sheet 3 of 5)
6-10-81 GGI

LEGEND		
L = 403-420 MHz		
H = 450-512 MHz		
P/O HLE4001A UHF Main Board, Receiver Section (403-420 MHz)		
P/O HLE4002A UHF Main Board Receiver Section (450-512 MHz)		
PL-6035-C		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: $\pm 5\%$; 500 V; unless otherwise stated
C1	23-84665F04	1 uF + 150-10%; 50 V
C2	23-84665F01	10 uF + 100-10%; 25 V
C3	23-84538G04	15 uF $\pm 20\%$; 20 V
C4	21-84493B41	100 pF $\pm 10\%$; 100 V
C101	21-80067A68	120 pF $\pm 5\%$; 200 V
C102	21-82187B44	.001 uF; 100 V
C103	21-82372C10	.05 uF $\pm 20\%$; 25 V
C104	21-84493B26	22 pF $\pm 5\%$; 200
C105	21-80067A34	15 pF $\pm 5\%$
C106	21-82204B22	5 pF $\pm 5\%$
C108	23-84538G02	4.7 uF $\pm 20\%$; 20 V
C109	21-82187B44	.001 uF; 100 V
C110	21-82372C10	.05 uF $\pm 20\%$; 25 V
C111	21-84715F31	100 pF $\pm 5\%$
C112	21-83596E38	.0047 uF; 100 V
C113, 114	21-82372C10	.05 uF $\pm 20\%$; 25 V
C115	21-83880G01	.001 uF; 100 V
C116	21-83596E30	270 pF
C117H	21-80069A23	10 pF
C117L	21-82133G43	15 pF $\pm 5\%$
C118H	21-82204B31	8 pF ± 0.25 pF
C118L	21-83406D01	13 pF
C119H	21-82450B05	0.24 pF
C119L	21-82450B29	0.51 pF
C120	21-82187B44	.001 uF; 100 V
C121H	21-845014	3.9 pF $\pm .25$ pF
C121L	21-82204B75	5.6 pF
C122	21-82187B44	.001 uF; 100 V
C123	21-82877B24	220 pF $\pm 20\%$; 500 V
C124H	21-83406D84	6.8 pF $\pm .25$ pF
C124L	21-82204B41	13 pF
C125H	21-83406D52	2 pF $\pm .25$ pF
C125L	21-83406D76	3.9 pF
C126, 127	21-83596E36	.01 uF + 60-20%
C128	21-84493B41	100 pF; 200 V
C129	23-84538G02	4.7 uF $\pm 20\%$; 20 V
C130	21-84493B41	100 pF $\pm 10\%$; 200 V
C131	21-82372C10	.05 uF $\pm 20\%$; 25 V
C132	21-82187B44	.001 uF $\pm 10\%$; 100 V
C133	8-84637L24	.068 uF $\pm 10\%$; 100 V
C134	21-00861443	.01 uF
C135H	21-82877B23	10 pF
C135L	21-00868897	18 pF
C202	21-82372C10	.05 uF $\pm 20\%$; 25 V
C203	21-83406D87	43 pF $\pm 5\%$
C204	21-83406D56	24 pF $\pm 5\%$
C205, 206	21-82372C10	.05 uF $\pm 20\%$; 25 V
C208	21-83406D68	27 pF $\pm 5\%$
C209	21-83406D56	24 pF $\pm 5\%$
C210	21-83406D69	30 pF $\pm 5\%$
C213	21-82450B07	0.39 pF $\pm 5\%$
C214	21-80169A55	57 pF $\pm 5\%$; 200 V
C215	21-80171A61	80 pF; 200 V
C216	21-82372C10	.05 uF $\pm 5\%$; 25 V
C218	21-82187B44	.001 uF; 100 V
C219	23-84538G02	4.7 uF $\pm 20\%$; 20 V
C220	21-82372C10	.05 uF $\pm 20\%$; 25 V
C222	21-82204B68	90 pF $\pm 5\%$; 100 V
C223	21-80171A61	80 pF $\pm 10\%$; 250 V
C227	21-82450B04	0.3 pF
C228	21-83406D85	62 pF $\pm 5\%$
C229	21-82204B41	13 pF $\pm 5\%$
C230	21-82372C10	.05 uF $\pm 20\%$; 25 V
C231	21-83596E36	.01 uF + 60-40%; 250 V
C232	21-82450B46	0.62 pF + 5%
C233	21-83596E38	.0047 uF; 100 V
C234	21-80169A55	57 pF $\pm 5\%$; 200 V
C237	21-83596E38	.0047 uF; 100 V
C238	21-82372C10	.05 uF $\pm 20\%$; 25 V
C239	8-84637L02	.033 uF $\pm 5\%$; 250 V
C240	8-84637L30	.0022 uF; 630 V
C412	8-84637L37	0.1 uF $\pm 10\%$; 100 V
C414	8-84637L31	.047 uF $\pm 10\%$; 630 V
C415	21-84494B18	390 pF
C416	23-84538G04	15 uF $\pm 20\%$; 20 V
C417	23-84538G02	4.7 uF $\pm 20\%$; 20 V
C418	23-84665F01	10 uF + 100-10%; 25 V
C419	8-84637L28	.018 uF; 250 V
C420	8-84637L27	.022 uF; 250 V
C421	8-84637L02	.033 uF $\pm 5\%$; 250 V
C422	23-84665F01	10 uF + 100-10%; 25 V
C423	8-84637L32	.0068 uF; 630 V
C424	8-84637L24	.068 uF; 100 V
C425	8-84637L25	.01 uF; 400 V
C426	8-84637L26	.0047 uF; 630 V
C427, 428	23-84538G04	15 uF $\pm 20\%$; 20 V
C431	23-84665F01	10 uF + 100-10%; 25 V
C432	23-84665F06	220 uF + 150-10%; 25 V
C433, 434	8-84637L33	0.1 uF; 100 V
C435, 436, 437	21-83596E10	220 pF $\pm 20\%$
C440	8-84637L27	.022 uF; 250 V
C441, 450	23-84665F01	10 uF + 100-10%; 25 V
C451	21-83596E10	220 pF $\pm 20\%$; 500 V
C499	21-82187B44	.001 $\pm 10\%$; 100 V

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
CR1, 2	48-83654H01	diode: (see note) silicon germanium hot carrier silicon silicon silicon
CR101	48-82139G01	
CR102	48-84616A01	
CR401	48-83654H01	
CR403 thru 406	48-83654H01	
CR605 thru 612	48-83254H01	connector, receptacle: female; 12 contact
J1001	9-82748G01	
L1-8H		coil: part of RF Deck HLE4051A part of RF Deck HLE4050A 1/2 turn (ferrite) 1-1/2 turns 33-1/2 turns; coded GRN choke; 0.29 uH 4-1/2 turns choke; 10 uH 4-1/2 turns choke; 10 uH choke; 10 uH choke; 1.5 uH choke; 0.29 uH 1-1/2 turns 2-1/2 turns 10 uH choke; 10 uH choke; 12 uH 33-1/2 turns; coded GRN 33-1/2 turns; coded GRN choke; 12 uH 26-1/2 turns choke; 9.3 uH choke; 0.41 uH
L1-8L		
L10	76-83960B01	
L101	24-83884G03	
L102	24-84419D01	
L103	24-82723H04	
L104	24-80065A01	
L105	24-82549D42	
L106	24-80065A05	
L107	24-82549D42	
L108	24-82549D51	
L109	24-82835G25	
L110	24-82723H04	
L111	24-83884G03	
L112	24-83961B01	
L115	24-82549D42	
L201	24-82549D51	
L203	24-82549D52	
L204	24-84419D03	
L206	24-84419D03	
L207	24-82549D52	
L208	24-80133A01	
L209	24-82835G20	
L201	24-82723H05	
P4	28-80181B04	connector, plug: male; 2 contact male; 25 contact male; 5 contact male; 4 contact
P10	28-80181B03	
P11	28-80097A01	
P6 thru 608	28-80096A01	
Q1 thru 3	48-869643	transistor: (see note) PNP; type M9643 NPN; type M9642 field-effect; type M9839 NPN; type M1109 NPN; type M9932 NPN; type M9494 NPN; type M9642 NPN; type M54 NPN; type M9642 NPN; type M9528
Q4	48-869642	
Q101	48-869839	
Q102	48-84411L09	
Q103	48-869932	
Q201 thru 203	48-869494	
Q401 thru 403	48-869642	
Q404	48-134674	
Q405	48-869642	
Q406	48-869528	
R1	6-124C59	resistor, fixed: ± 10%; 1/4 W; unless otherwise stated 2.7k 56k 1.5k; ± 5% 4.7k; ± 5% 15k 22k; ± 5% 39 ± 5% 10k 15k 27k 470 ± 5% 15k 68k 4.7k 100 560 150 ± 5% 15k 91 ± 5% 680 ± 5% 2.2k ± 5% 220 ± 5%; 1/2 W 22k ± 5% 3.3k ± 5% not used 360 ± 5%; 1/4 W 220 ± 5%; 1/2 W 1k ± 5% 18k ± 5% 39k ± 5% 330 ± 5% 22 ± 5% 2.7k ± 5% 27k ± 5% 680 ± 5% 27k ± 5% 6.8k ± 5% 27k ± 5% 820 ± 5% 3.3k ± 5% 27k ± 5% 6.8k ± 5% 820 ± 5%
R2	6-124C91	
R3	6-124A53	
R4	6-124A65	
R5	6-124C77	
R6	6-124A81	
R7	6-124A15	
R8	6-124C73	
R9	6-124C77	
R10	6-124C83	
R11	6-124A41	
R12	6-124C77	
R13	6-124C93	
R14	6-124C65	
R101	6-124C25	
R102	6-124C43	
R103	6-124A29	
R104	6-124C77	
R105	6-124A24	
R106	6-124A45	
R107	6-124A57	
R108	6-125A33	
R111	6-124A81	
R115	6-124A61	
R116H		
R116L	6-124A38	
R117	6-125A33	
R201	6-124A49	
R202	6-124A79	
R203	6-124A87	
R204	6-124A37	
R205	6-124A09	
R206	6-124A59	
R207	6-124A83	
R208	6-124A45	
R209	6-124A83	
R210	6-124A69	
R211	6-124A83	
R212	6-124A47	
R213	6-124A61	
R214	6-124A83	
R215	6-124A69	
R216	6-124A47	

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R217	6-124A81	3.3k ± 5%
R218	6-124A79	18k ± 5%
R221	6-124A56	2k ± 5%
R222	6-124C95	82k
R223	6-124A83	27k ± 5%
R224	6-124C65	4.7k
R230	6-124C49	1k
R231	6-124A70	7.5k ± 5%
R232	6-124A21	68 ± 5%
R233	6-124C13	33
R234	6-124B06	220k ± 5%
R401	6-124A94	75k ± 5%
R402	6-124A69	6.8k ± 5%
R403	6-124A45	680 ± 5%
R404	6-124A84	30k ± 5%
R405	6-124A81	22k ± 5%
R406	6-124A73	10k ± 5%
R407	6-124A49	1k ± 5%
R408	6-124A57	2.2k ± 5%
R409	6-124C89	47k
R410	6-124C57	2.2k
R411	6-124A73	10k ± 5%
R412	6-124A72	9.1k ± 5%
R413	6-124A79	18k ± 5%
R414	6-124C29	150
R415	6-124C73	10k
R416	6-124A73	10k ± 5%
R418	6-124A97	100k ± 5%
R419	6-124C73	10k
R420, 421	6-124A67	5.6k ± 5%
R422	6-124A40	430 ± 5%
R423	6-124A09	22 ± 5%
R424	6-124A03	12 ± 5%
R425	6-124A45	680 ± 5%
R426, 427	6-124D55	2.7
R428	6-124A82	24k ± 5%
R429	6-124A86	6.2k ± 5%
R430	6-124A71	8.2k ± 5%
R431	6-124C85	33k
R440	6-124C49	1k
R442	6-124C93	68k
R450	6-124C73	10k
R451	6-124A67	5.6k ± 5%
R452	6-124C61	3.3k
R453	6-124B02	150k ± 5%
R454	6-124C67	5.6k

RT401	6-83600K08	thermistor: 20k ± 10%; @ 25 °C
U201	51-84320A78	integrated circuit: (see note) type M2078
U401, 402	51-84621K60	type M2160
U403	51-84621K76	type M2176

Y201	48-84396K05	coupled Resonator; 10.7 MHz
Y202	48-84396K01	coupled Resonator; 10.7 MHz
Y203	48-84396K02	coupled Resonator; 10.7 MHz
Y205	48-84396K01	coupled Resonator; 10.7 MHz

non-referenced items	
26-84250B01	CAN, shield, for L101
26-84598A02	CAN, coil, for L102
26-80196A01	CAN, coil, for L104
26-80196A01	CAN, coil, for L106
26-80121A01	CAN, shield, for L108
26-80121A01	CAN, shield, for L201
26-80121A01	CAN, shield, for L203
26-80270A01	CAN, coil, for L204, L206
26-80121A01	CAN, shield, for L207
26-80203A01	CAN, coil, for L208
75-05295B01	INSULATOR, crystal (4 used)
26-80210A01	SHIELD, IF
26-80033A01	SHIELD, detector

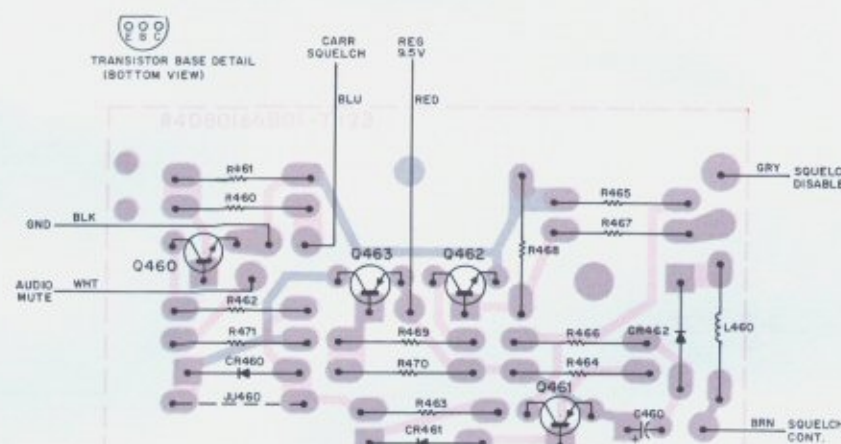
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part number.

HLE4032A RF Preamplifier PL-6351-A

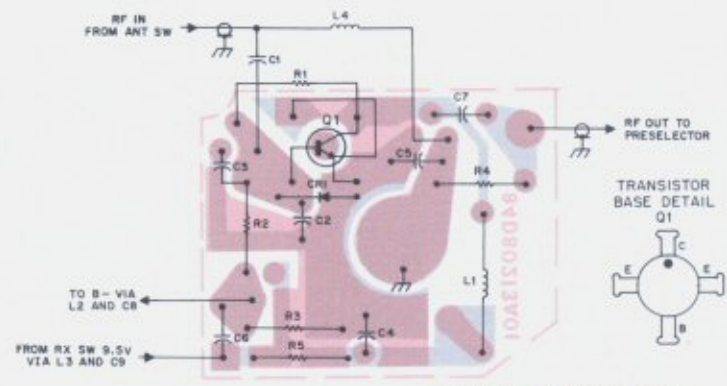
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1	21-82877B18	capacitor, fixed; ± 10%; 500 V: unless otherwise stated
C2	21-82877B17	30 pF ± 5%
C3	21-83068E01	5 pF ± 5%
C4	21-83068E01	0.02 uF; 12 V
C5	21-82877B18	30 pF ± 5%
C6	21-83068E01	0.02 uF; 12 V
C7	21-861603	3.3 pF ± 0.25 pF
C8	21-861219	1000 pF
C9	21-861219	1000 pF
C10	21-865440	180 pF ± 3%
CR1	48-84616A01	diode: (see note) hot carrier
L1	24-82723H25	choke: 33 nH
L2	24-82723H04	0.29 uH
L3	24-82723H04	0.29 uH
L4	24-82723H04	0.29 uH
Q1	48-869870	transistor: (see note) NPN; type M9870
R1	6-185A53	resistor, fixed; ± 10%; 1/8 W: unless otherwise stated
R2	6-185B76	1.5k
R3	6-185B69	560
R4	6-185B67	150
R5	6-185B69	150

mechanical parts	
3-10936C06	SCREW, tapping (B3.5 x 1.27 x 8)
3-10906A02	SCREW, machine (M3.5 x 0.6 x 5)
4-7650	WASHER, lock
5-3172	EYELET (2 used)
15-80092A01	COVER, preamp
30-80351A01	COAXIAL, cable
37-132562	HEAT SHRINK 1/8" (4 used)
42-80000B01	CLIP, housing
42-80001B01	CLIP, cover
42-80002B01	CLIP, ground
42-80192A01	CLIP, cable
43-80190A02	STANDOFF
15-80133B01	COAX, cover preselector
15-80097B01	HOUSING, feed thru

BUSY LIGHT ADAPTER



A channel element
for F1, F2, F3, F4
ment contains an o



SHOWN FROM COMPONENT SIDE

- SOLDER SIDE 80-BEP5-27620-0
- COMPONENT SIDE 80-BEP5-27619-0
- OL-BEP5-27621-A

RECEIVER SECTION

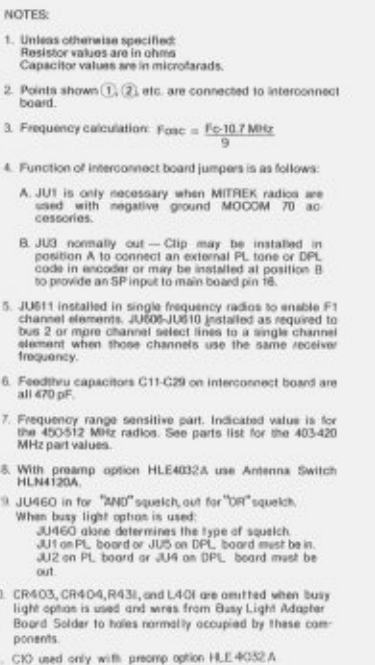


TABLE A. SQUELCH CIRCUIT PARAMETER

MODELS	CONDITION	AUDIO MUTE ⁽¹⁾	SQUELCH DISABLE ⁽²⁾	SQUELCH SWITCH EMITTER Q405	MUTE SWITCH COLLECTOR Q406
CARRIER	NO CARRIER	0.8V	1.2V	1.2-3.5V	1.5-5.0V
	CARRIER PRESENT	0.8V	0.0V	0.0V	0.2V
PL DPL MODELS WITH "AND" SQUELCH	NO CARRIER	1.6V	0.4V	1.2-3.5V	1.5-5.0V
	CARRIER + PL OR DPL	PL 7.5V DPL 0.3V	0.8V	0.0V	0.2V
	CARRIER W/ PL OR DPL	1.6V	0.4V	1.2-3.5V	1.5-5.0V
	NO CARRIER	1.6V	0.4V	1.2-3.5V	1.5-5.0V
PL DPL MODELS WITH "OR" SQUELCH	CARRIER + PL OR DPL	1.6V	PL 8.1V DPL 13.8V	0.0V	0.2V
	CARRIER W/ PL OR DPL	1.6V	0.4V	1.2-3.5V	1.5-5.0V
ALL MODELS	RADIO KEYED	1.1V	0.3V	6.0V	3.5V
MODELS WITH BUSY LIGHT ADAPTER HLH10A	NO CARRIER	TABLE B	TABLE B	1.2-3.5V	4.5V
	CARRIER	TABLE B	TABLE B	0.0V	0.2V

TABLE B. BUSY LIGHT CIRCUIT PARAMETERS.

CONDITION		DISABLE (6)	COLLECTOR	COLLECTOR	MUTE (7)
CARRIER SQUELCH	NO CARRIER	0V	1.4-2.0V**	0.4V	1.4-2.0V
	CARRIER	0V	5.9-8.8V**	0.4V	5.9-8.8V
FL/DPL (AND/OR) SQUELCH*	NO CARRIER	0V	1.4-2.0V**	0.4V	1.4-2.0V
	CARRIER	0V	5.9-8.8V**	0.4V	5.9-8.8V
CARRIER + PL	PL 81V	8.1V	9.4V	0.1V	9.4V

* Voltage depends on whether or not JU460 is in or out, and if mic is on or off hook.

parts list

LEGEND
L = 403-420 MHz
H = 450-512 MHz

HLE4021 Power Amplifier (UHF 50 W; 403-420 MHz) HLE4022A Power Amplifier (UHF 50 W; 450-512 MHz)
HLE4043A Transistor Kit (UHF PA 50 W)
HLN4082A Capacitor Kit (UHF PA 50 W; 403-420 MHz)
HLN4007A Capacitor Kit (UHF PA 50 W; 450-512 MHz) PL-5986-C

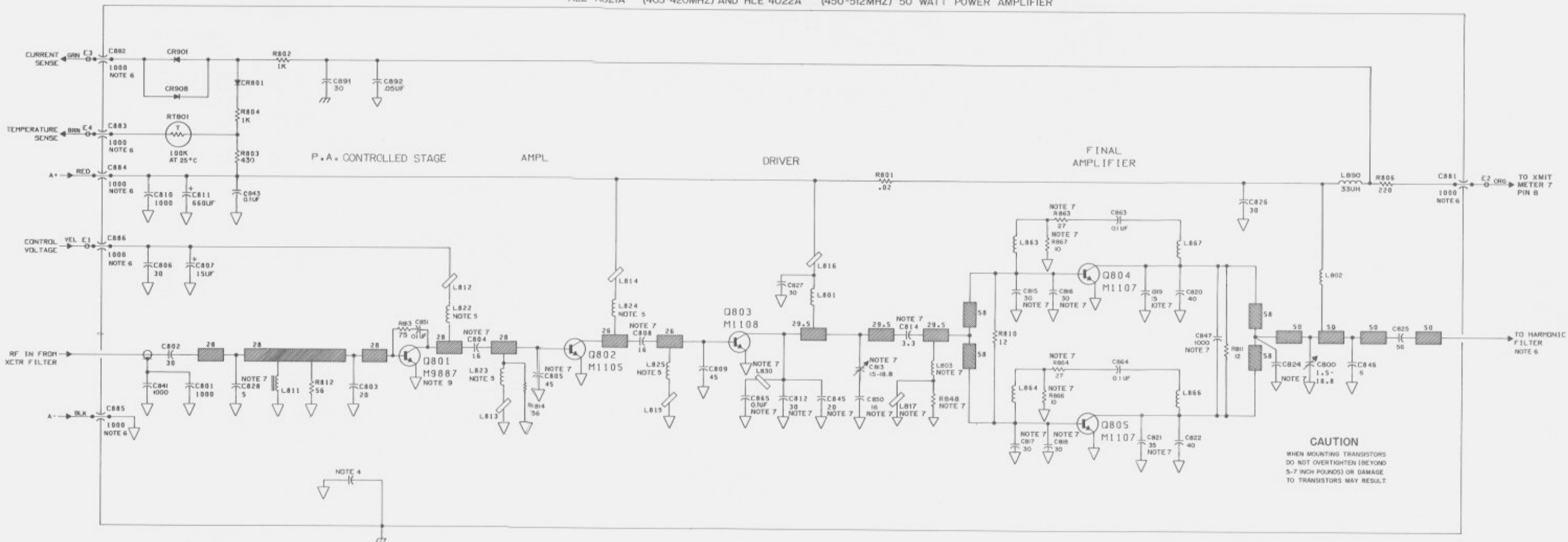
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF $\pm 10\%$; 500 V; unless otherwise stated
C800	20-84579B10	variable 1.5-18.8
C801	21-83596E13	.001 uF; 1000 V
C802	21-83406D69	30; $\pm 5\%$
C803	21-84366F14	20 $\pm 5\%$
C804H	21-80169A36	16 $\pm 5\%$
C804L	21-83596E10	220 $\pm 20\%$
C805H	21-84366F05	45 $\pm 5\%$
C805L	21-84366F23	50 $\pm 5\%$
C806	21-83406D69	30; $\pm 5\%$
C807	23-84538G04	15 uF $\pm 20\%$; 20 V
C808H	21-80169A36	16 $\pm 5\%$
C808L	21-83406D95	14 $\pm 5\%$
C809	21-84366F06	45 $\pm 5\%$
C810	21-83596E13	.001 uF; 1000 V
C811	23-83210A22	660 uF $\pm 150-10\%$; 25 V
C812H	21-84366F04	30 $\pm 5\%$
C812L	21-84366F09	25 $\pm 5\%$
C813H	20-84579B10	variable: 1.5-18.8
C813L		not used
C814H	21-83406D53	3.3 $\pm .25$ pF
C814L	21-83406D65	5 $\pm .25$ pF
C815H	21-84366F04	30 $\pm 5\%$
C815L	21-84366F07	35 $\pm 5\%$
C816H	21-84366F04	30 $\pm 5\%$
C816L	21-84366F08	40 $\pm 5\%$
C817H	21-84366F04	30 $\pm 5\%$
C817L	21-84366F07	35 $\pm 5\%$
C818H	21-84366F04	30 $\pm 5\%$
C818L	21-84366F08	40 $\pm 5\%$
C819H	21-84366F07	35 $\pm 5\%$
C819L	21-84366F06	45 $\pm 5\%$
C820	21-84366F08	40 $\pm 5\%$
C821H	21-84366F07	35 $\pm 5\%$
C821L	21-84366F06	45 $\pm 5\%$
C822	21-84366F08	40 $\pm 5\%$
C824H		not used
C824L	21-84366F11	10 $\pm 5\%$
C825	21-84873H26	56
C826, 827	21-83406D69	30 $\pm 5\%$
C828H	21-83406D65	5.0 $\pm .25$ pF
C828L	21-83406D73	7.5 $\pm .5$ pF
C831	21-83596E13	.001 uF; 1000 V
C833	21-83596E13	.001 uF
C834 thru 838	21-83596E13	.001 uF; 1000 V
C840, 841	21-83596E13	.001 uF; 1000 V
C842	21-83406D69	30 $\pm 5\%$
C843	21-82372C09	0.1 uF $\pm 80-20\%$; 25 V
C845H	21-84366F10	20 $\pm 5\%$
C845L	21-84366F09	25 $\pm 5\%$
C846	21-84366F18	6 $\pm 5\%$
C847H	21-83596E13	.001 uF; 1000 V
C847L		not used
C848		not used
C850H	21-80169A36	16 $\pm 5\%$
C850L	21-83406D72	12 $\pm .5$ pF
C851	21-82372C09	0.1 uF $\pm 80-20\%$; 25 V
C863, 864	21-82372C09	0.1 uF $\pm 80-20\%$; 25 V
C865	8-82905G30	0.1 uF; 500 V
C865L		not used
C891	21-83406D69	30 $\pm 5\%$
C892	21-82372C10	.05 $\pm 20\%$; 25 V
		diode: (see note)
CR801	48-82466H13	silicon
C901, 8	48-82466H13	silicon
		coil:
L801	24-83884G08	5-1/2 turns; coded orange
L802	24-80041A06	5-1/4 turns
L803H	24-83884G06	4-1/2 turns; coded white
L803L	24-83884G07	2-1/2 turns; coded green
L811	24-83961B07	2 turns; coded yellow
L812 thru 816	24-80036A02	1/2 turns; (ferrite)
L817H		jumper
L817L	24-80036A01	1/2 turn; (ferrite)
L830H	76-84069B01	core (ferrite)
L830L		not used
L863, 864	24-83884G04	7-1/2 turns; coded yellow
L866, 867	24-83884G04	7-1/2 turns; coded yellow
L890	24-82835G23	33 uH
		transistor: (see note)
Q801	48-869887	NPN; type M9887 (HLE4043A)
Q802	48-84411L05	NPN; type M1105 (HLE4043A)
Q803	48-84411L08	NPN; type M1108 (HLE4043A)
Q804, 805	48-84411L07	NPN; type M1107 (HLE4043A)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		resistor, fixed: $\pm 5\%$; 1/4 W; unless otherwise stated
R801	17-80087A06	0.02 W.W.
R802	6-124A49	1k
R803	6-124A40	430
R804	6-124A49	1k
R806	6-124C33	220 $\pm 10\%$
R810, 811	6-125C03	12 $\pm 10\%$; 1/2 W
R812	6-124C19	56 $\pm 10\%$
R813	6-124A22	75
R814	6-124C19	56 $\pm 10\%$
R848H		not used
R848L	6-124B61	4.7
R863, 864H	6-125C11	27 $\pm 10\%$; 1/2 W
R863, 864L	6-125C09	22 ohms $\pm 10\%$; 1/2 W
R866, 867H	6-124C01	10 $\pm 10\%$; 1/4 W
R866, 867L	6-124C09	22 ohm $\pm 10\%$
		thermistor:
RT801	6-83600K05	100k $\pm 25^\circ\text{C}$
		mechanical parts
	29-80014A01	CLIP, coax
	30-83794C01	COAXIAL, cable
	7-80157A01	SUPPORT, PA transistor
	7-80078A01	BRACKET, thermistor; 2 used
	42-10217A26	STRAP, cable
	14-80077A01	INSULATOR, PA compartment
	3-10936A06	SCREW, tapping; (B3.5 x 1.27 x 8); 7 used
	3-10905A01	SCREW, machine (M3 x 0.5 x 6); 6 used
	4-80038A01	WASHER, stud
	2-7003	NUT 8-32 x 5/16 x 1/8
	26-80211A01	COVER, PA
	55-8400B04	HANDLE, cover

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

HLN4017A UHF-Feed-thru Plate (PL) PL-5989-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C881 thru 886	21-82812H03	1000 pF $\pm 100-0\%$; 500 V
		mechanical parts
	64-80005A01	PLATE, feed-thru
	3-10904A02	SCREW, machine (M3 x 0.6 x 6) 3 used



CEPS-26068-B

NOTES:

- All parts may be removed from the top of the board.
- Unless otherwise specified:
Resistor values are in ohms.
Capacitor values are in picofarads.
- 50 Indicates microstrip transmission line. Number $\square$ stands for characteristic impedance Z_0 .
- Capacitors C831, C833-8, C840, C842 are connected between circuit board ground and chassis ground.
- L822-5 are plated on board.
- Six feed-thru capacitors C881-6 and one harmonic filter are located below the circuit board and must be accessed from the bottom of the radio.
- Frequency range sensitive part. Indicated value is for 450-512 MHz. See parts list for 403-420 MHz part values.
- When soldering to or near the crimped metal capacitors (used in the harmonic filter, and PA board) care must be used to ensure that solder flux does not contact the dielectric; if contact occurs, the capacitor must be replaced.
- Q801 may be removed from the transistor support bracket without removing the bracket from the PA board.

LEGEND:

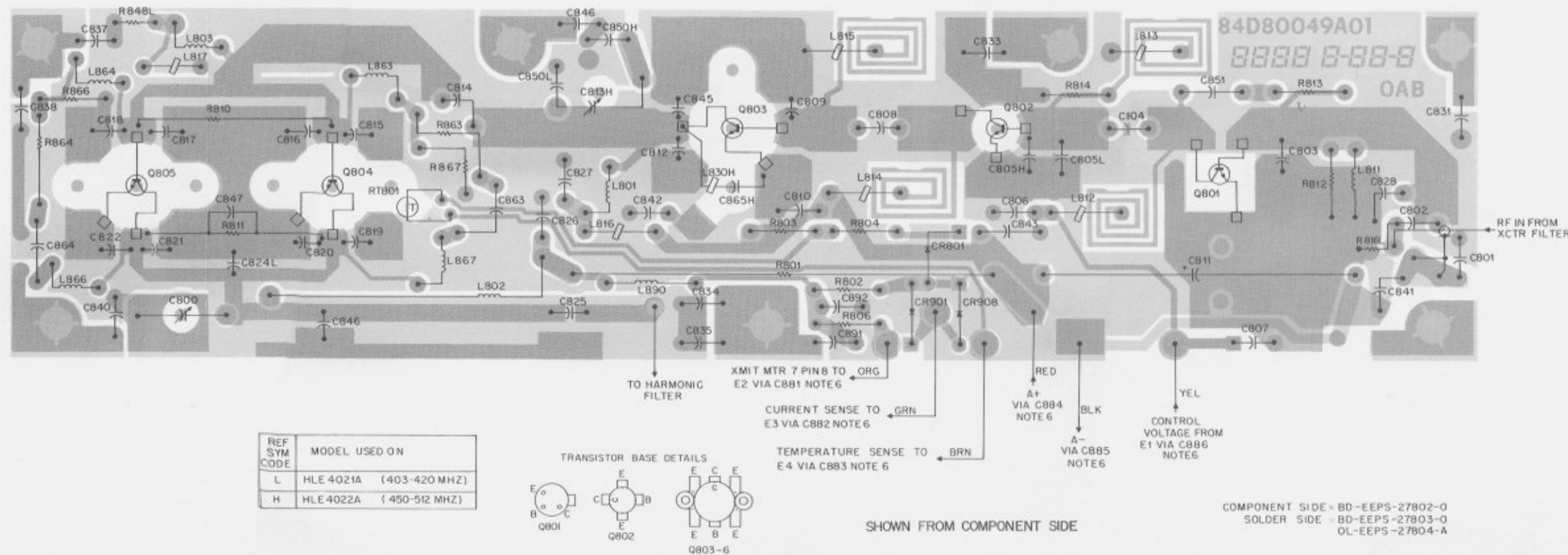
- = PRIMARY SIGNAL FLOW
- ⊥ = CHASSIS REF.
- ⊥ = A- (PA REF.)

MITREK POWER AMPLIFIER

UHF 50 WATTS
MODELS HLE1011A (403-420 MHz)
HLE1012A (450-512 MHz)

FUNCTION

Increases power output of radio to 50 watts. Contains circuitry to sense temperature and current of final amplifier for application to power control and protection circuit in radio.



REF SYM CODE	MODEL USED ON
L	HLE 4021A (403-420 MHz)
H	HLE 4022A (450-512 MHz)

68P81039E27-C
6-10-81 GGI

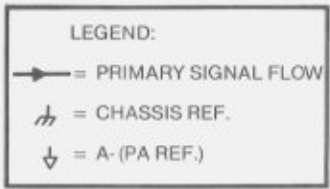
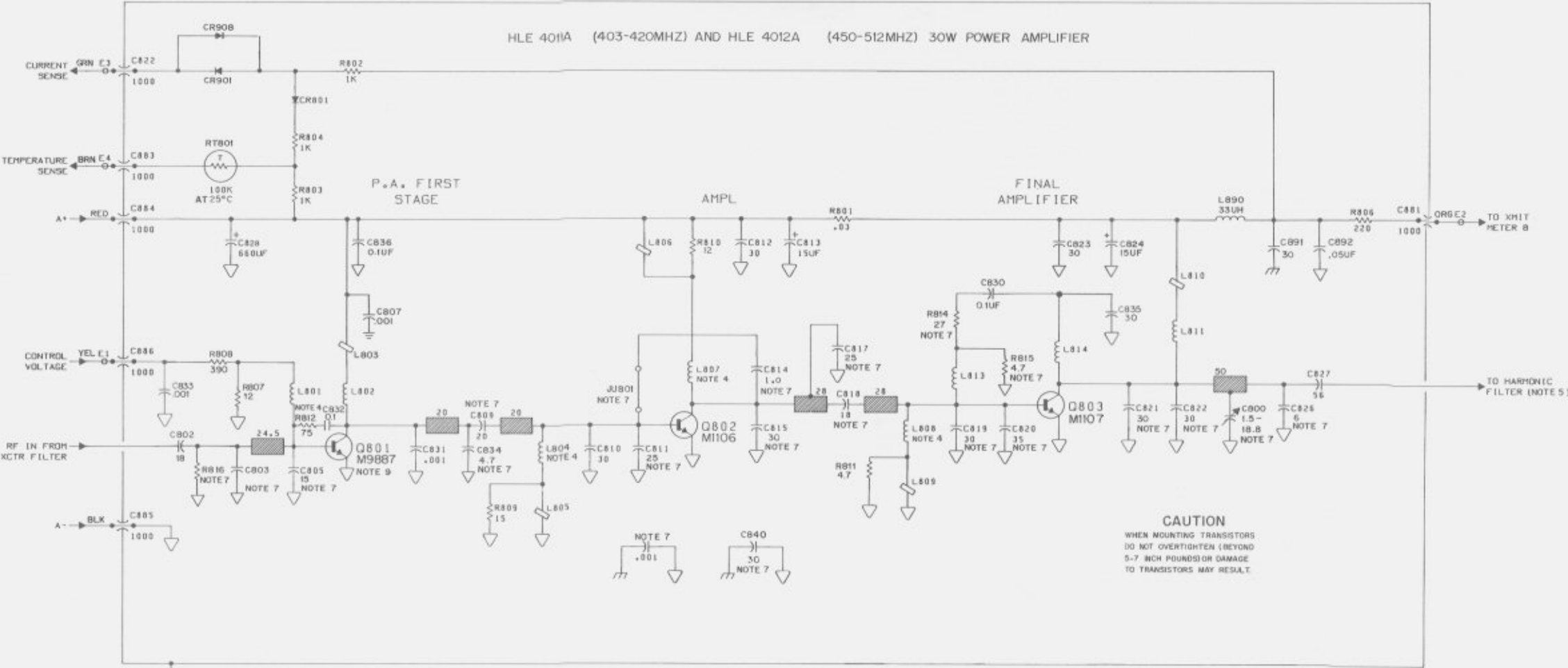
MITREK POWER AMPLIFIER

UHF 30 WATT
MODELS HLE1001A (403-420 MHz)
HLE1002A (450-512 MHz)

FUNCTION

Increases power output of radio to 30 watts. Contains circuitry to sense temperature and current of final amplifier for application to power control and protection circuit in radio.

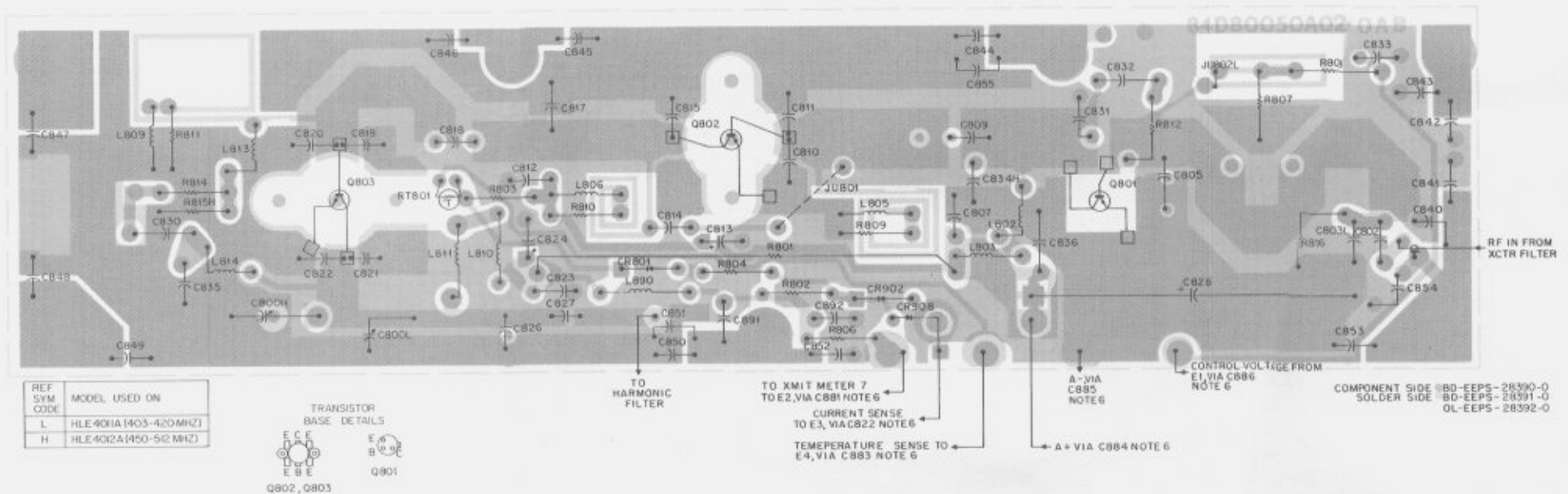
68P81039E28-C
6-10-81 GGI



NOTES:

- All parts may be removed from top of the board.
- Unless otherwise specified, resistor values are in ohms and capacitor values are in picofarads.
- 20 Indicates microstrip transmission line. Number stands for characteristic impedance Z₀.
- L801, L804, L807, and L808 are plated on board.
- Six feed-thru capacitors and one harmonic filter are located below the circuit board and must be accessed from the bottom of the radio.
- C840 thru C853 and C855 are connected between chassis and circuit board ground.
- Frequency range sensitive part. Indicated value is for 450-512 MHz. See parts list for 403-420 MHz part values.
- When soldering to or near the crimped metal capacitors (used in the harmonic filter and PA board) care must be used to ensure that solder flux does not contact the dielectric; if contact occurs, the capacitor must be replaced.
- Q801 may be removed from the transistor support bracket without removing the bracket from the PA board.

DCP-24087-B



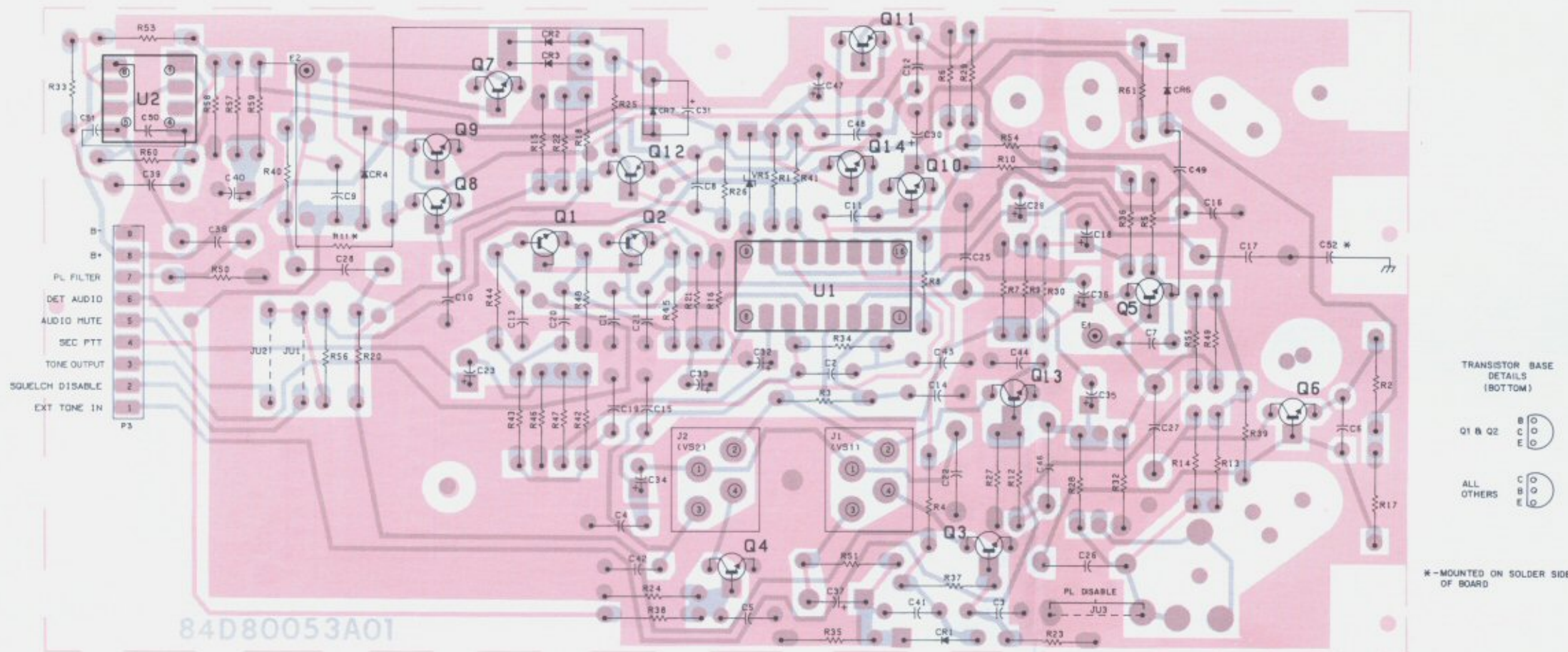
REF. SYM.	MODEL USED ON
L	HLE401A (403-420 MHz)
H	HLE402A (450-512 MHz)



parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Legend L = 403-420 MHz H = 450-512 MHz		
HLE4011A Power Amplifier (UHF; 30 W; 403-420 MHz) HLE4012A Power Amplifier (UHF; 30 W; 450-512 MHz) HLE4041A Transistor Kit (UHF; PA; 30 W) HLN4081A Capacitor Kit (UHF; PA; 403-420 MHz) HLN4008A Capacitor Kit (UHF; PA; 450-512 MHz)		
		PL-5980-C
capacitor, fixed: pF ± 10%; 500 V; unless otherwise stated		
C800H	20-84579B10	variable 1.5-18.8
C800L	19-84774B03	variable; 2-10
C802	2183406D55	18 pF ± 5%
C803H		not used
C803L	21-83406D66	2.7 ± 5%
C805H	21-84366F16	15 ± 5%
C805L	21-84366F14	20 ± 5%
C807	21-83596E13	.001 uF; 1000 V
C809H	21-84366F14	20 ± 5%
C809L	21-84366F11	10 ± 5%
C810	21-84366F04	30 ± 5%
C811H	21-84366F09	25 ± 5%
C811L	21-84366F04	30 ± 5%
C812	21-83406D69	30 ± 5%
C813	23-84538G04	15 uF ± 20%; 20 V
C814H	21-83255B62	1.0 ± 25 pF
C814L		not used
C815H	21-84366F04	30 ± 5%
C815L	21-84366F07	35 ± 5%
C817H	21-84366F09	25 ± 5%
C817L	21-84366F14	20 ± 5%
C818H	21-83406D55	18 ± 5%
C818L	21-83406D87	43 ± 5%
C819H	21-84366F04	30 ± 5%
C819L	21-84366F08	40 ± 5%
C820H	21-84366F07	35 ± 5%
C820L	21-84366F06	45 ± 5%
C821H	21-84366F04	30 ± 5%
C821L	21-84366F08	40 ± 5%
C822H	21-84366F04	30 ± 5%
C822L	21-84366F08	40 ± 5%
C823H	21-83406D69	30 ± 5%
C823L	21-82372C10	.05 uF ± 20%; 25 V
C824	23-84538G04	15 uF ± 20%; 20 V
C826	21-84366F18	6 ± 5%
C827	21-84873H26	56
C828	23-83210A22	680 uF ± 150-10%; 25 V
C829		not used
C830	21-82372C09	0.1 uF ± 80-20%; 25 V
C831	21-83596E13	.001 uF; 1000 V
C832	21-82372C09	0.1 uF ± 80-20%; 25 V
C833	21-83596E13	.001 uF; 1000 V
C834H	21-82355B39	4.7 ± 25 pF
C834L		not used
C835	21-83406D69	30 ± 5%
C836	21-82372C09	0.1 uF ± 80-20%; 25 V
C840H	21-83406D69	30 ± 5%
C840L	21-83596E13	.001 uF; 1000 V
C841	21-83596E13	.001 uF; 1000 V
C842H	21-83406D69	30 ± 5%
C842L		not used
C843-845	21-83596E13	.001 uF; 1000 V
C846H	21-83596E13	.001 uF; 1000 V
C846L		not used
C847-850	21-83596E13	.001 uF; 1000 V
C851H		not used
C851L	21-83596E13	.001 uF; 1000 V
C852,853	21-83596E13	.001 uF; 1000 V
C854		not used
C855H		not used
C855L	21-83596E13	.001 uF; 1000 V
C891	21-83406D69	30 ± 5%
C892	21-82372C10	.05 ± 20%; 25 V
diode: (see note)		
CR801, CR901,908	48-82466H13	silicon
	48-82466H13	silicon
coil:		
L802	24-83884G01	3-1/2 turns (code PINK)
L803, L805, 806, 809, 810	24-80036A02	1/2 turn: ferrite
L811	24-83547G06	7-1/2 turns (code YELLOW)
L813, 814	24-83384G08	5-1/2 turns (code ORANGE)
L890	24-82835G23	33 uH
transistor: (see note)		
Q801	48-869887	NPN; type M9887; (HLE4041A)
Q802	48-84411L06	NPN; type M1106 (HLE4041A)
Q803	48-84411L07	NPN; type M1107 (HLE4041A)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
resistor, fixed: ± 5%; 1/4 W:		
R801	17-80087A07	.03 WW
R802, 803, 804	6-124A49	1k
R806	6-124C33	220 ± 10%
R807	6-124A03	12
R808	6-125A39	390; 1/2 W
R809	6-124A05	15
R810	6-124A03	12
R811	6-124B61	4.7
R812	6-124A22	75
R814H	6-125A11	27; 1/2 W
R814L	6-125A17	47
R815H	6-124B61	4.7
R815L		not used
R816H		not used
R816L	6-124A38	360
thermistor:		
RT801	6-83600K05	100k @ 25 °C
mechanical parts		
	29-80014A01	CLIP, coax
	30-83794C01	COAXIAL, cable
	7-80157A01	SUPPORT, PA; transistor
	7-80078A01	BRACKET, thermistor
	42-10217A26	STRAP, cable
	14-80077A01	INSULATOR, PA; compartment
	3-10936A06	SCREW, tapping (B3.5 x 1.27 x 8) 7 used
	32-80084A01	SCREW, machine (M3.0 x 0.5 x 6) 4 used
	26-80211A01	GASKET, stud device
	55-84300B04	COVER, PA
		HANDLE, cover
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.		
HLN4011A UHF-Feed-thru Plate (PL)		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed:		
C881 thru 886	21-82812H03	1000 pF ± 100-0%; 500 V
mechanical parts		
	64-80005A01	PLATE, feed-thru
	3-10904A02	SCREW, machine (M3 x 0.6 x 6) 3 used



SHOWN FROM SOLDER SIDE

COMPONENT SIDE: BD-DEPS-26146-A
SOLDER SIDE: BD-DEPS-26145-0
DL-DEPS-26144-B

parts list

HLN4020A Tone "Private-Line" Encoder Decoder Board

PL-6029-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1 thru 12	21-83596E10	capacitor, fixed: 220 pF ± 20%; 500 V
C13	21-82187B48	.003 uF ± 10%; 100 V
C14, 15, 16	21-83596E38	.0047 uF ± 10%; 100 V
C17	8-83813H38	.006 uF ± 10%; 100 V
C18	23-84665F01	10 uF ± 100-10%; 32 V
C19, 20	8-84637L31	.047 uF ± 10%; 250 V
C21	21-82428B28	.002 uF ± 10%; 200 V
C22	21-82372C09	0.1 uF ± 80-20%; 25 V
C23	23-84665F01	10 uF ± 100-10%; 25 V
C25 thru 28	8-84637L22	0.22 uF ± 10%; 100 V
C29	23-84665F04	1 uF ± 150-10%; 50 V
C30	23-84538G01	1 uF ± 20%; 35 V
C31	23-84538G22	6.8 uF ± 10%; 20 V
C32 thru 34, 36	23-84665F01	10 uF ± 100-10%; 25 V
C35	23-84538G01	1 uF ± 20%; 20 V
C37	23-84538G04	15 uF ± 20%; 20 V
C38	8-84637L37	0.1 uF ± 5%; 100 V
C39	8-84637L36	.082 uF ± 5%; 100 V
C40	23-84665F01	10 uF ± 100-10%; 25 V
C41 thru 44	21-83596E10	.00022 uF ± 20%; 500 V
C46	21-82372C09	0.1 uF ± 80-20%; 25 V
C47	23-84665F01	10 uF ± 100-10%; 25 V
C48	21-83596E10	.00022 uF ± 20%; 500 V
C49	8-84637L22	0.22 uF ± 10%; 100 V
C50	21-82187B44	.001 uF ± 10%; 100 V
C51	21-83596E10	220 pF ± 20%; 500 V
C52	21-84493B41	100 pF ± 10%; N750
CR1, 2, 3	48-83654H01	diode: (see note) silicon
CR4	48-82178A01	germanium
CR6	48-83654H01	silicon
CR7	48-83654H01	diode silicon
J1, 2	9-80132A01	connector, receptacle: JU1 & JU2 each consist of four 9-80132A01 parts
P3	28-80181B02	connector, plug: male: 9 contact

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q1, 2	48-134674	transistor: (see note) NPN; type M54
Q3 thru 8	48-869642	NPN; type M9642
Q9	48-869568	NPN; type M9568
Q10	48-869642	NPN; type M9642
Q11	48-869467	PNP; type M9467
Q12	48-869643	PNP; type M9643
Q13, 14	48-869642	NPN; type M9642
R1	6-124A37	resistor, fixed ± 10%; 1/4 W; unless otherwise stated
R2	6-124A44	620 ± 5%
R3	6-124C43	560
R4	6-124C47	820
R5	6-124A59	2.7k ± 5%
R6	6-124C49	1k
R7	6-124C53	1.5k
R8	6-124A60	3k ± 5%
R9	6-124C57	2.2k
R10	6-124C61	3.3k
R11	6-124A53	1.5k ± 5%; 1/4 W
R12	6-124A81	22k ± 5%
R13	6-124A61	3.3k ± 5%
R14	6-124A81	3.3k ± 5%
R15	6-124A65	4.7k ± 5%
R16	6-124C55	1.8k
R17	6-124A71	8.2k ± 5%
R18	6-124A65	4.7k ± 5%
R20	6-124A85	33k ± 5%; 1/4 W
R21	6-124C71	8.2k
R22	6-124A71	8.2k ± 5%
R23 thru 26	6-124C73	10k
R27	6-124C85	33k
R28	6-124A67	5.6k ± 5%
R29	6-124A73	10k ± 5%; 1/4 W
R30	6-124A77	15k ± 5%
R32	6-124A81	22k ± 5%
R33	6-10621C79	7.5k ± 1%; 1/8 W
R34	6-124C81	22k
R35	6-124C83	27k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R36	6-124C57	2.2k
R37, 38	6-124C89	47k
R39	6-124A89	47k ± 5%; 1/4 W
R40	6-124C93	68k
R41	6-124C97	100k
R42	6-124A78	16k ± 5%
R43	6-124A99	120k ± 5%
R44	6-124A80	20k ± 5%
R45	6-124A99	120k ± 5%
R46	6-124D02	150k
R47	6-124C99	120k
R48	6-124C73	10k
R49	6-124A99	120k ± 5%
R50	6-124A93	68k ± 5%
R51	6-124C93	68k
R53	6-10621C79	7.5k ± 1%; 1/8 W
R54	6-124D02	150k
R55	6-124A49	1k
R56	6-124C33	220
R57, 58	6-10621C91	10k ± 1%; 1/8 W
R59	6-124A61	3.3k ± 5%
R60	6-10621D18	18.7k ± 1%; 1/8 W
R61	6-124C73	10k
U1	51-84768F76	integrated circuit: (see note) type M6876
U2	51-84621K76	type M2176
VR5	48-82256C38	voltage regulator: zener type; 9.1 V
mechanical parts		
	3-10904A02	SCREW, machine (M3.5 x 0.6 x 6) 3 used
	3-10904A45	SCREW, machine (M3.5 x 0.6 x 13) 3 used
	4-80149A01	WASHER, captive: 4 used
	7-80023A01	BRACKET, reed hold-down
	29-10271A15	TERMINAL, pin: 2 used
	46-80174A01	STUD
	75-80173A01	COMPRESSION PAD; 2 used

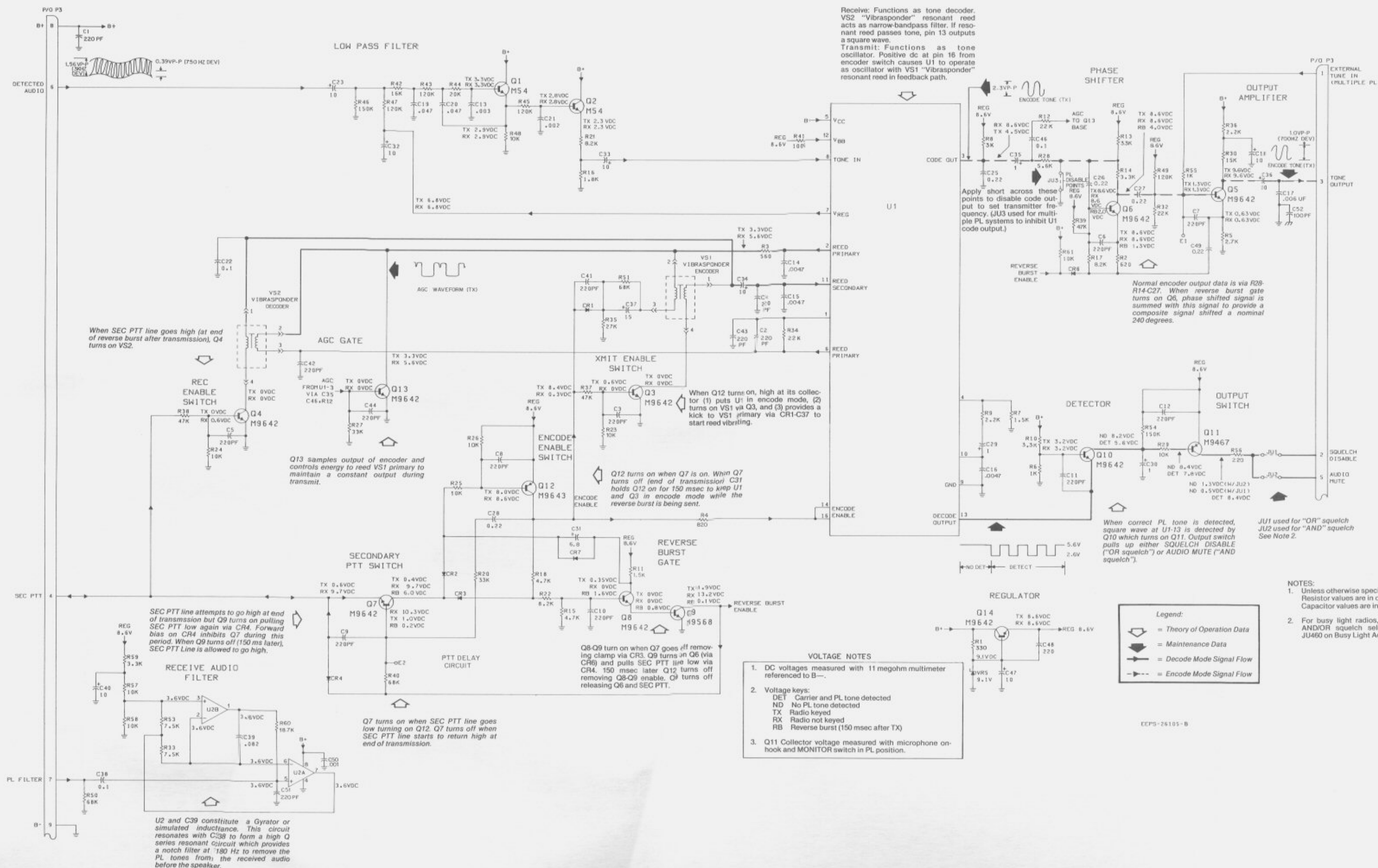
note: for optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TONE "PRIVATE-LINE" ENCODER/DECODER

MODEL HLN4020A

FUNCTION

Encodes and decodes sub-audible "Private-Line" tones. Encoder modules transmitter and delays transmitter turn-off 150 ms to allow transmission of turn-off reverse tone burst. Decoder detects received tone and unquelsches receiver when proper tone is received.



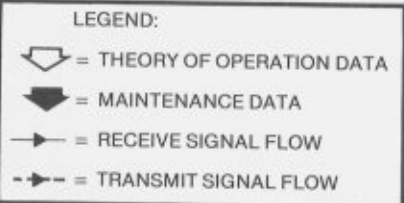
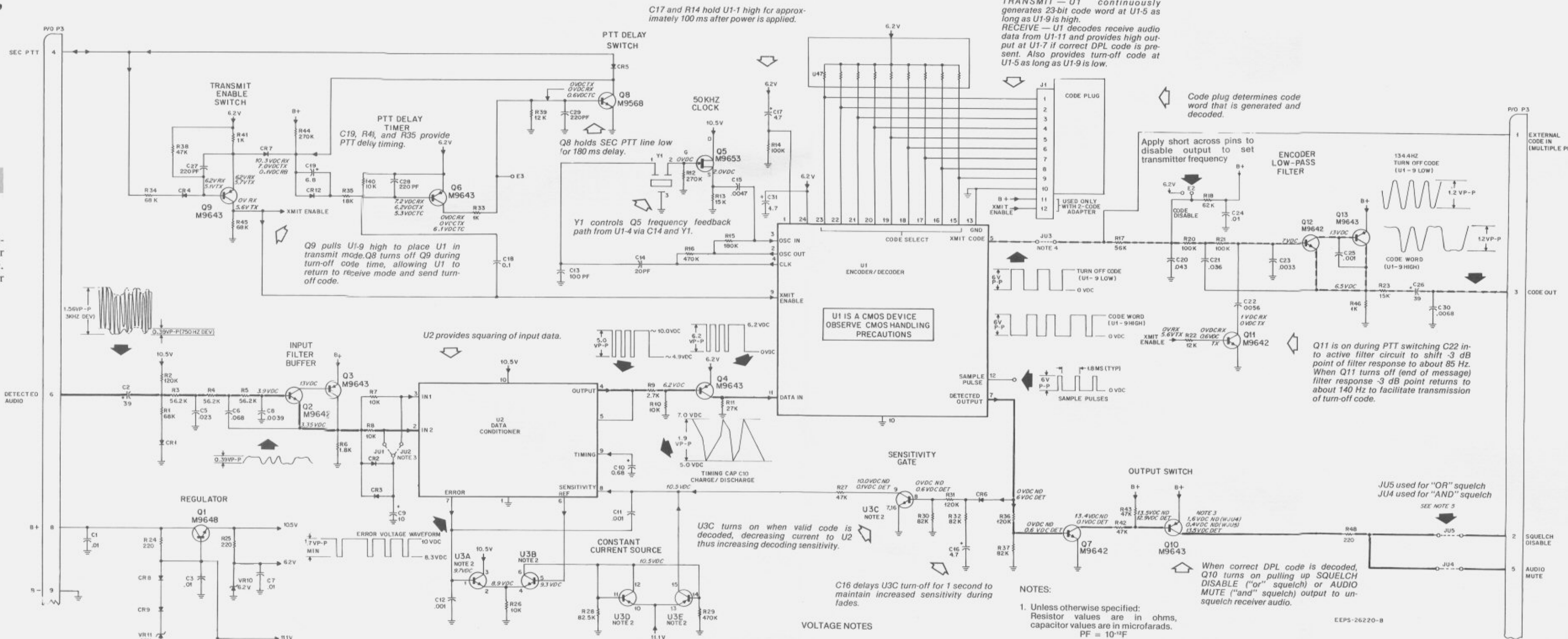
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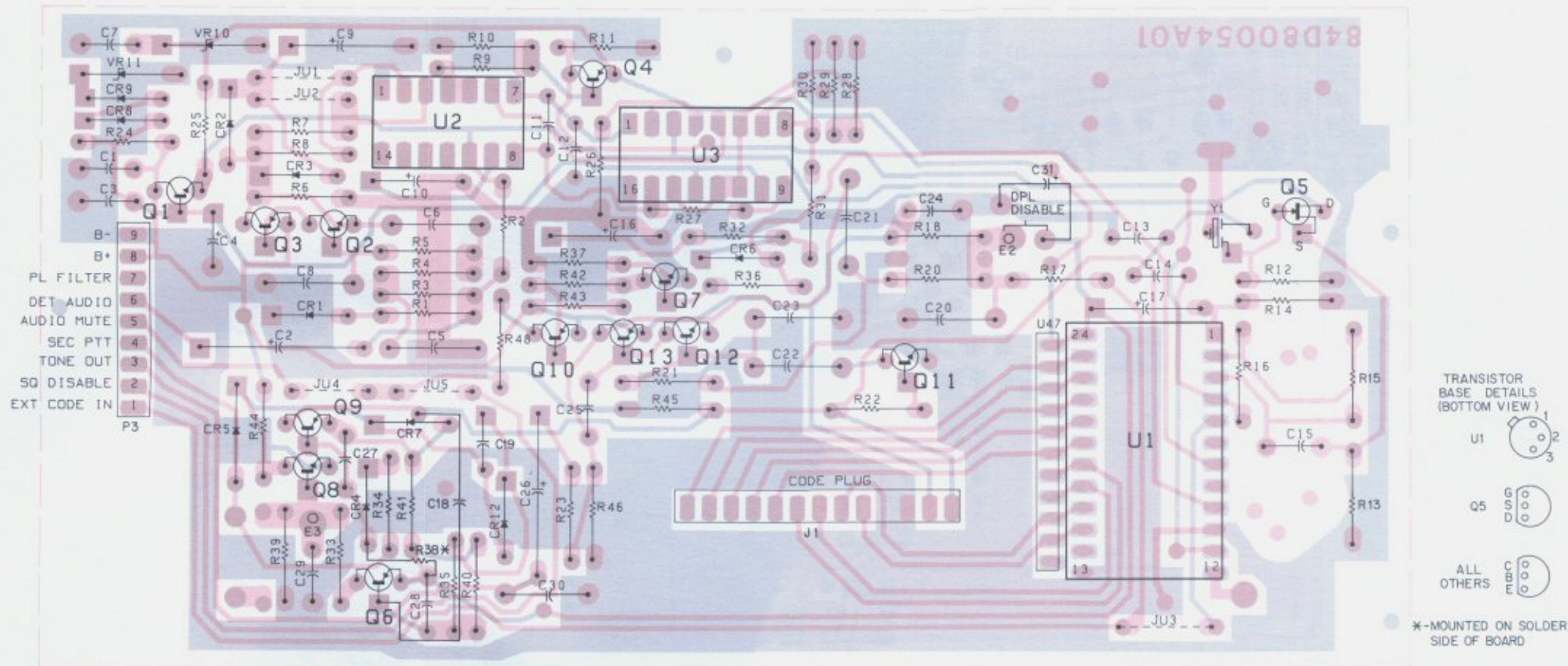
**“DIGITAL PRIVATE-LINE”
ENCODER/DECODER**
MODEL HLN4011A

FUNCTION

Encodes and decodes “Digital Private-Line” codes. Encoder modulates transmitter and delays transmitter turn-off 150 ms to allow transmission of turn-off code. Decoder detects received tone and unsquelches receiver when proper code is received.

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SHOWN FROM SOLDER SIDE

COMPONENT SIDE BD-DEPS-26100-A
SOLDER SIDE BD-DEPS-26099-A
OL-DEPS-26098-A

parts list

HLN4011A "Digital Private-Line" Encoder/Decoder Board PL-6050-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitors, fixed: uF, $\pm 5\%$, 50 V; unless otherwise stated		
C1	21-83596E36	.01 + 60-40%; 250 V
C2	23-82783B36	39 $\pm 10\%$; 10 V
C3	21-83596E36	.01 + 60-40%; 250 V
C4	23-84538G04	15 $\pm 20\%$; 20 V
C5	8-82905G39	.023
C6	8-83813H23	.068
C7	21-83596E36	.01 + 60-40%; 250 V
C8	8-83813H19	.0039
C9	23-84762H03	10 $\pm 10\%$; 20 V
C10	23-82783B48	.68; 35 V
C11, 12	21-82187B44	.001 $\pm 10\%$; 100 V
C13	21-80067A65	100 pF; 200 V
C14	21-80067A40	20 pF; 500 V
C15	21-83596E38	.0047 $\pm 10\%$; 100 V
C16, 17	23-84762H07	4.7 $\pm 20\%$; 10 V
C18	8-82096J18	.1 uF $\pm 10\%$; 250 V
C19	23-84538G22	6.8 $\pm 10\%$; 20 V
C20	8-83813H14	.043
C21	8-83813H24	.036
C22	8-83813H26	.0056
C23	8-83813H27	.0033; 100 V
C24	21-83596E36	.01 + 60-40%; 250 V
C25	21-82187B44	.001 $\pm 10\%$; 25 V
C26	23-82783B36	39 $\pm 10\%$; 10 V
C27, 28, 29	21-83596E10	220 pF $\pm 20\%$; 500 V
C30	8-84496D08	.0068 $\pm 10\%$; 400 V
C31	23-84538G02	4.7 uF $\pm 20\%$; 20 V
diode: (see note)		
CR1	48-83654H02	silicon
CR2, 3	48-84616A01	silicon, hot-carrier
CR4	48-83654H01	silicon
CR5	48-82178A01	germanium
CR6 thru 9, 12	48-83654H01	silicon
connector, receptacle:		
J1	9-82071K01	female, 12-contact
connector, plug:		
P1	28-80181B02	male, 9-contact

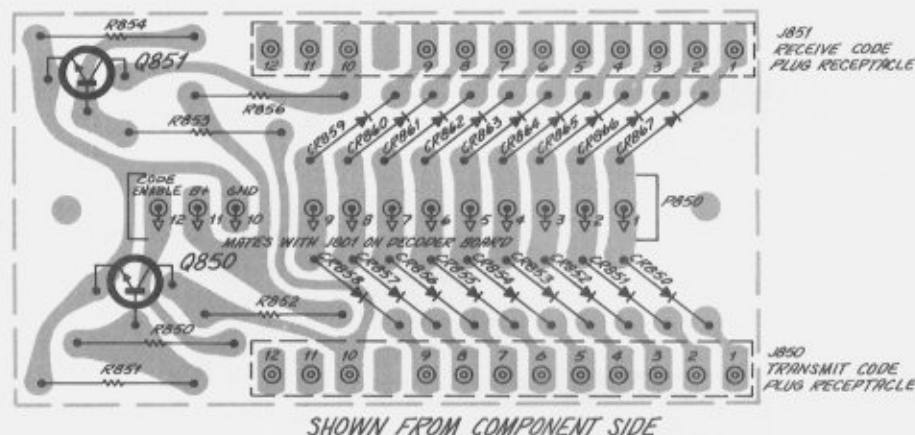
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
transistor: (see note)		
Q1	48-869648	NPN; type M9648
Q2	48-869642	NPN; type M9642
Q3, 4	48-869643	PNP; type M9643
Q5	48-869653	FET; type M9653
Q6	48-869643	PNP; type M9643
Q7	48-869642	NPN; type M9642
Q8	48-869568	NPN; type M9568
Q9, 10	48-869643	PNP; type M9643
Q11, 12	48-869642	NPN; type M9642
Q13	48-869643	PNP; type M9643
resistor, fixed: $\pm 5\%$; 1/4 W; unless otherwise stated		
R1	6-124A93	68k
R2	6-124A99	120k
R3, 4, 5	6-10621D64	56.2k $\pm 1\%$; 1/8 W
R6	6-124A55	1.8k
R7, 8	6-124A73	10k
R9	6-124C59	2.7k $\pm 10\%$
R10	6-124A73	10k
R11	6-124A83	27k
R12	6-124B08	270k
R13	6-124A77	15k
R14	6-124A97	100k
R15	6-124B04	180k
R16	6-124B14	470k
R17	6-124A91	56k
R18	6-124A92	62k
R20, 21	6-124A97	100k
R22	6-124C75	12k $\pm 10\%$
R23	6-124A77	15k
R24	6-124A33	220 ohms
R25	6-124A33	220 ohms
R26	6-124A73	10k
R27	6-124A89	47k
R28	6-10621D80	82.5k $\pm 1\%$; 1/8 W
R29	6-124B14	470k
R30	6-124C95	82k $\pm 10\%$
R31	6-124C99	120k $\pm 10\%$
R32	6-124C95	82k $\pm 10\%$
R33	6-124C49	1k $\pm 10\%$
R34	6-124A93	68k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R35	6-124A79	18k
R36	6-124C99	120k $\pm 10\%$
R37	6-124C95	82k $\pm 10\%$
R38	6-124A89	47k
R39	6-124C75	12k $\pm 10\%$
R40	6-124A73	10k
R41	6-124A49	1k
R42, 43	6-124C89	47k $\pm 10\%$
R44	6-124D08	270k $\pm 10\%$; 1/4 W
R45	6-124A93	68k
R46	6-124A49	1k
R48	6-124C33	220 ohms $\pm 10\%$
integrated circuit: (see note)		
U1	51-84267A82	type M6782
U2	51-84320A55	type LM565CN
U3	51-84320A79	type CA3096AE
U47	51-82142K02	resistor network
voltage regulator: (see note)		
VR10	48-83696E07	Zener, 6.2 V
VR11	48-82256C11	Zener, 10 V
crystal, resonator:		
Y1	48-82003K01	50 kHz
mechanical parts		
	14-861196	INSULATOR, transistor
	3-10904A02	SCREW, machine: M3.5 x 0.6 x 6
	3-10904A15	SCREW, machine: M3.5 x 0.6 x 13; 3 used
	4-80149A01	WASHER, captive; 4 used
	29-10271A15	TERMINAL, pin; 2 used

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

"DIGITAL PRIVATE-LINE" TWO-CODE ADAPTER

MODEL TLN5730A



APPLICATION —

Plugs into code plug receptacle on "Digital Private-Line" decoder or encoder-decoder to allow separate "Digital Private-Line" codes for transmit and receive. Code plugs for the two codes then plug into the receptacles on the two-code adapter board.

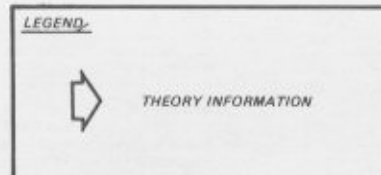
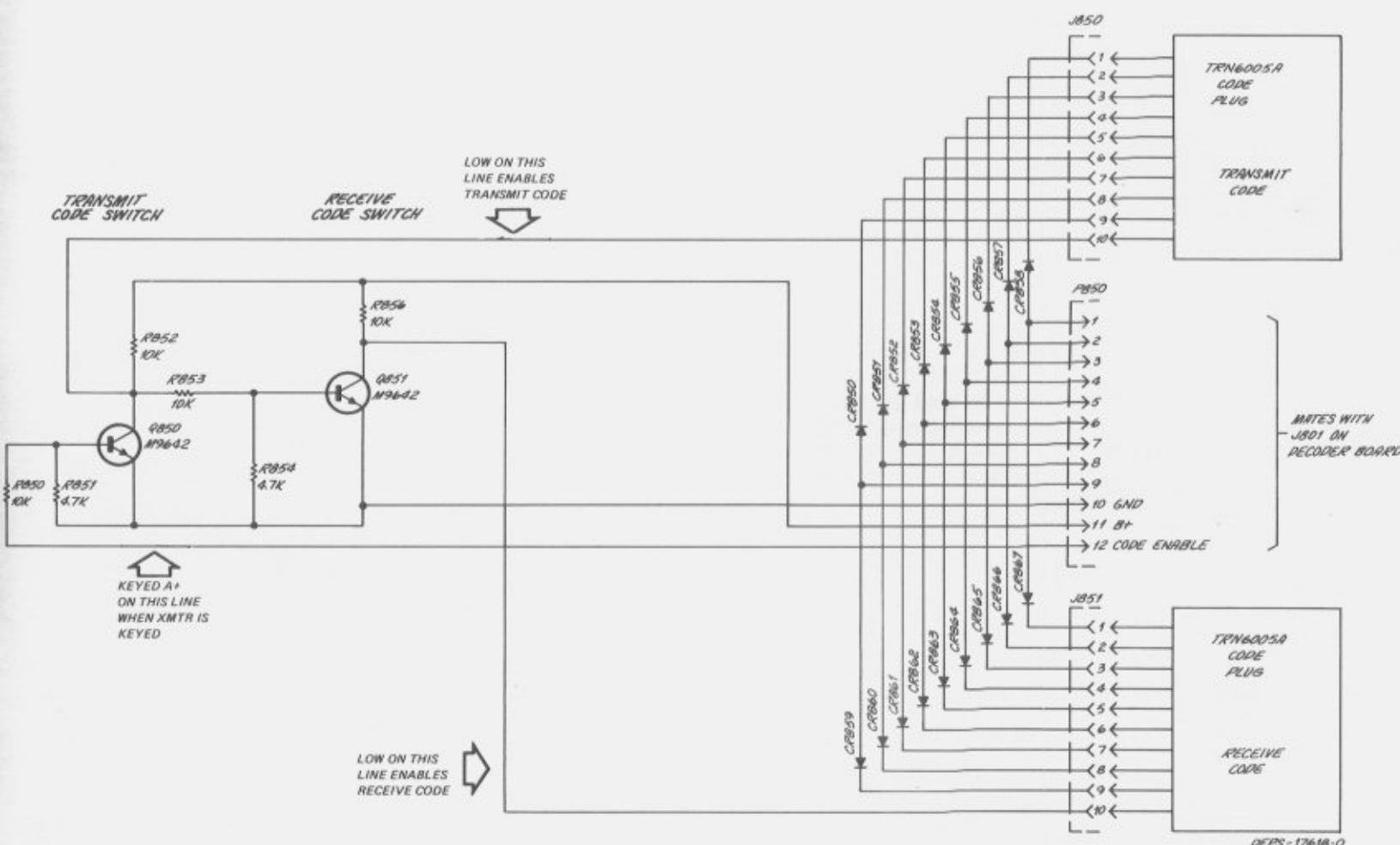
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
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PARTS LIST

TLN5730A 2-Code Adapter Board PL-3414-0

CR850 thru 867	48-83654H01	DIODE: (SEE NOTE) silicon
J850, 851	9-82071K01	CONNECTOR, receptacle: female; 12-contact
P850		CONNECTOR, plug: consists of: 28-82070K01 CONTACT, male; 13 req'd.
Q850, 851	48-869642	TRANSISTOR: (SEE NOTE) NPN; type M9642
R850, 852, 853, 856	6-124A73	RESISTOR, fixed: 10k ±5%; 1/4 W
R851, 854	6-124A65	4.7k ±5%; 1/4 W
NON-REFERENCED ITEMS		
	1V80769B88	CIRCUIT BOARD ASSY., incl. referenced item P850
	3-138804	SCREW, machine: 4-40 x 5/16"; 2 req'd.

NOTE: For optimum performance, diodes and transistors must be ordered by Motorola part number.



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MITREK ACCESSORIES

MOBILE MICROPHONE

The mobile microphone contains the microphone element and a push-to-talk switch. Model HMN4000A is packaged in a rugged weather-resistant housing; Model HMN4001A uses conventional packaging. Schematic details are shown on the control head schematic diagram in this manual.

parts list

HMN4000A Microhpne HMN4001A Microphone			PL-6059-O
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	
P102	1-84135C01	cable, assembly: includes: coil cord	
MK321	59-82933C02	cartridge: dynamic	
S318	40-82263G01 or 40-82263G02	switch: dpst (HMN4000A) dpst (HMN4001A)	
mechanical parts			
3-124693		SCREW, machine; 6-32 x 1/4"; 2 used	
3-129498		SCREW, machine; 6-32 x 5/16"	
3-132436		SCREW, machine; 6-32 x 13/16"; 3 used	
4-7666		LOCKWASHER, #6 external	
4-7669		LOCKWASHER, #6 split; 3 used	
4-114201		WASHER, flat; 3 used	
4-82705B01		WASHER, backup; 4 used	
4-82707B01		WASHER, flat (HMN4000A)	
13-83174B03		EMBLEM	
15-82701B24		HOUSING, microphone; front	
32-82703B01		GASKET, microphone	
35-82652K01		BAFFLE, microphone	
38-84559B01		BUTTON, microphone	
42-852710		STRAP	
42-82702B02		RETAINER	
43-82706B01		SLEEVE, switch (HMN4000A)	
15-82701B25		HOUSING, microphone; rear	
33-82599D01		NAMEPLATE (HMN4001A)	
54-84962K01		TAG, safety	

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6-10-81 GGI

SPEAKER

The HSN4000A Speaker provides the audio output from the radio. It is equipped with its own trunnion bracket and may be mounted on the firewall or dashboard near the radio. The speaker is mounted in a strong, weather-resistant housing.

parts list

HSN4000A Speaker			PL-6060-B
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	
LS301	50-84561B02	speaker: dia. 5" PM	
mechanical parts			
3-132436		SCREW, machine; 6-32 x 13/16"; 4 used	
3-84244C01		SCREW, trunnion; 2 used	
7-84568B01		BRACKET, trunnion	
13-84151C02		BEZEL, speaker	
15-84981B09		COVER, speaker base	
32-80195A01		GASKET, speaker	
38-84383D02		CAP, protective; 3 used	
29-82602D01		PIN, terminal; 2 used	
37-82603D31		SLEEVEING, coded 31	
37-82603D32		SLEEVEING, coded 32	
42-82018H05		RETAINER, cable	
42-84081A03		CLAMP, wire	
3-136756		SCREW, tapping; 10-16 x 5/8"; 3 used	
30-83155H01		CABLE, 2 cond	

MICROPHONE HANGUP BOX

The microphone hangup boxes are used with "Private-Line" and "Digital Private-Line" radios to automatically place the radios in the monitor (carrier-squelch) mode when the microphone is lifted off-hook. Model HLN4024A is used in most installations. Model TLN4025A also contains a slide switch to place the radio in the monitor mode with the microphone still on-hook; this model is used in situations where the normal MONITOR switch on the control head is used for special functions or when used in conjunction with a carrier squelch control head.

parts list

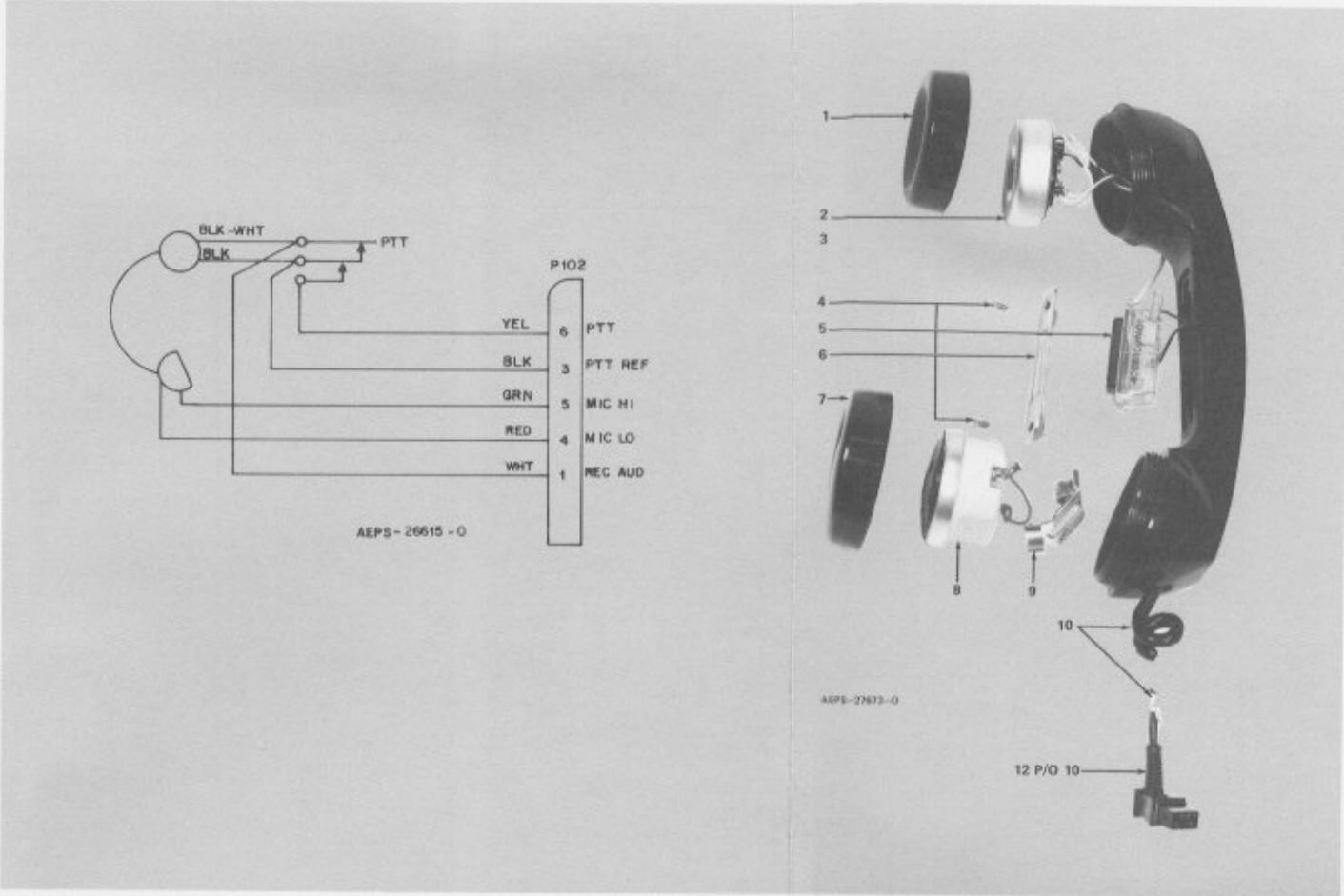
HLN4024A Microphone Hang-Up Box HLN4025A Microphone Hang-Up Box w/ Switch			PL-6061-B
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	
S101	40-82159D02 or 40-84198C01	switch: spst open leaf (HLN4025A)	
S301	40-84622B04	spst, slide (HLN4025A)	
mechanical parts			
3-139913		SCREW, tapping; 8-15 x 1/2"; 2 used	
3-129075		SCREW, machine; 2-56 x 1/2"; 2 used (HLN4024A)	
4-8406		LOCKWASHER, #2 internal; 2 used	
7-80268A01		BRACKET, switch (HLN4024A)	
14-80266A01		INSULATOR (HLN4024A)	
32-05719B01		BOOT, switch (HLN4024A)	
38-84383D01		CAP, protective; 2 used	
42-82018H07		RETAINER, cable	
64-80267A01		PLATE, nut (HLN4024A)	
15-80191A01		HOUSING, hang-up box	
4-400136		WASHER, flat; .196 x .312 x .067"	
41-867668		SPRING	
29-82602D01		PIN, terminal; 2 used	
37-80143B01		SLEEVEING, coded 24/30	
37-82603D27		SLEEVEING, coded 27	
3-135495		SCREW, tapping; 2-56 x 3/8"; 2 used (HLN4025A)	
64-84199C01		PLATE, mounting (HLN4025A)	
15-84626B02		HOUSING, hang-up box (HLN4025A)	

IGNITION SENSE LEAD

The optional ignition sense lead is used in systems where the green lead is connected to the battery (allowing receiver operation at all times) and it is desired to allow transmitter operation *only* when the ignition switch is on. This option includes the orange power lead and fuse; this lead supplies power to the radio PTT circuits when an optional jumper is altered in dc control head.

parts list

HKN4007A Cable Ignition Switch			PL-6058-A
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	
F401	65-890033	fuse: 1-1/2 amp; 250 V	
fuseholder:			
		includes:	
	14-82882A01	INSULATOR, fuse, body	
	14-82883A01	INSULATOR, fuse, cap	
	41-82885A01	SPRING	
	42-82884A01	CLIP, fuse; 2 used	
cable, power, orange, includes:			
	30-10310A82	WIRE, .18 ga. stranded, orange, 66-1/2"	
	37-82603D20	SLEEVEING, coded #20	
	29-82602D01	PIN TERMINAL	
	29-136968	LUG, soldering	
	29-824456	LUG, ring tongue	
	29-865065	LUG, ring tongue	



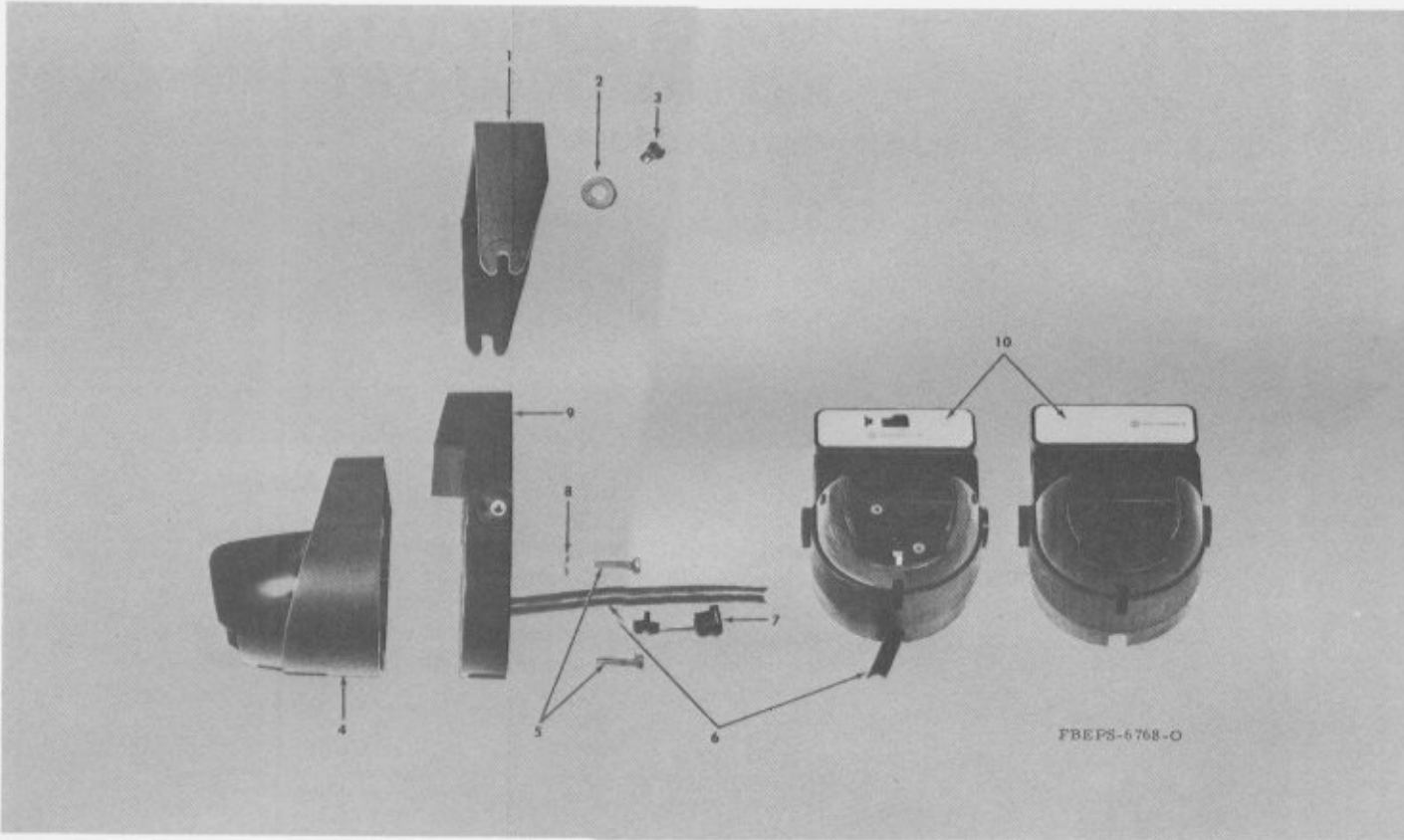
HANDSET

The TMN605'A Handset is used in installations where a telephone-style handset is preferred to the mobile microphone and speaker. The unit operates in the same manner as a telephone handset except that it has a PTT button which is used to key the radio.

parts list

TMN6057A HANDIET			PL-6064-A
CODE	MOTOROLA PART NO.	DESCRIPTION	
1	15B84054A01	CAP, receiver (see note)	
2	59C84058A01	CARTRIDGE, receiver	
3	15C84059A01	HANDLE (see note)	
4	3S124432	SCREW, machine: 4-40 x 1/4" "Phillips" flat head; 2 req'd.	
5	40C84087A01	SWITCH, push; includes pushbutton and dust cover	
6	15B84053A01	PLATE, switch cover	
7	15B84055A01	CAP, transmitter (see note)	
8	59B83272G01	MICROPHONE ELEMENT, telephone; dynamic type	
9	7B83352H01	BRACKET, cord retaining	
10	1D84519C01	CORD ASSEMBLY; includes a "molded-on" 5-contact female connector	
12		CONNECTOR, plug: 5-contact; "molded-on"	

note: A replacement handle, plus transmit and receiver caps, can be obtained by ordering Part No. 15C84107A01.



HANDSET HANGUP BOX

The handset hangup boxes are used (1) to automatically place "Private-Line" and "Digital Private-Line" radios in the monitor (carrier squelch) mode when the handset is lifted off-hook, and (2) transfer audio from the mobile speaker to the handset receiver when the handset is lifted off-hook. Model TLN4698A is used in most installations. Model TLN4507A also contains a slide switch to place the radio in the monitor mode with the handset still on-hook; this model is used in situations where the normal MONITOR switch on the control head is used for special functions. or when used in conjunction with a carrier squelch control head. The TLN4505A Hangup Cup is supplied with carrier squelch models.

parts list

Hang-Up Boxes			PL-6063-A
CODE	MOTOROLA PART NO.	DESCRIPTION	
1	7C84568B02	BRACKET, trunnion	
2	4S1724	WASHER, flat; 0.234" x 0.625" x .048"	
3	3S7302	SCREW, machine: 10-32 x 3/8" "Phillips" hex head	
4	15C84520C01 or 15C84520C02	HANG-UP CUP & SWITCH ASSEMBLY HANG-UP CUP (TLN4505A)	
5	3S135507	SCREW, machine: 6-32 x 3/4" "Phillips" hex head	
6	1V80717B42 or 1V80727B32	CABLE ASSEMBLY; includes attached insertable connector contacts (TLN4507A)	
7	42B82018H08	CABLE ASSEMBLY; includes attached insertable connector contacts (TLN4698A)	
8	4S1720	ANCHOR, cable strain relief	
9	1V80717B40 or 58D84514C01	WASHER, flat; 0.156" x 0.378" x .030" MOUNTING BASE & SWITCH ASSEMBLY (TLN4507A)	
10	13B84515C01 or 13B84515C02	MOUNTING BASE (TLN4698A and TLN4505A) ESCUTCHEON (TLN4507A) ESCUTCHEON (TLN4698A and TLN4505A)	
non-coded items			
42B82018H08		RETAINER, cable (TLN4698A)	
3S136756		SCREW, tapping; 20 x 5/8" (TLN4698A)	
38B84383D01		CAP, protective	

HKN4000A, HKN4016A Control Cable (1-Freq.) 17'	
HKN4001A, HKN4017A Control Cable (4-Freq.) 17'	
HKN4002A, HKN4018A Control Cable, Negative Ground (4-Freq.) 22'	
HKN4003A, HKN4019A Control Cable, Positive Ground (4-Freq.) 22'	
HKN4004A, HKN4020A Control Cable, Negative Ground (4-Freq.) 10'	
HKN4005A, HKN4021A Control Cable, Positive Ground (4-Freq.) 10'	
HKN4006A, HKN4022A Control Cable, Positive Ground (4-Freq.) 17'	PL-6062-B

parts list

HCN4000A thru HCN4011A Mitrek Control Head

PL-6051-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C101	23-84665F01	capacitor, fixed:
C102	23-84665F04	10 μ F, + 100-10%; 25 V 1 μ F, + 150-10%; 50 V
DS104	65-83376K01	lamp, sub-miniature:
DS105	65-83376K01	.08A; 14 V
DS106	65-83376K01	.08A; 14 V .08A; 14 V (busy light models only)
J101	9-80120A01	connector, receptacle: female, 32-contact includes: J102 - male, 5-contact
R101	18-80126A02	resistor, fixed: $\pm 5\%$; 1/4 W;
R102	18-80126A01	unless otherwise stated
R103	6-124C35	var. 25k includes switch S101
R104	6-124C61	var. 25k
R105, 106	6-124C73	270 $\pm 10\%$
R107	6-125C19	3.3k $\pm 10\%$
R108	6-124A61	10k $\pm 10\%$
R109	6-124A97	56; $\pm 10\%$; 1/2 W
R110	6-124A81	3.3k
R111	6-124A49	100k
R112	6-124A81	22k
R113	6-124A90	51k
R114	6-124A46	750
R115	6-124A51	1.2k
R116	6-124A57	2.2k
R117, R118	6-124A73	10k
R119	6-124A71	8.2k
CR101	48-83654H02	diode (see note)
CR103	48-83654H02	silicon
CR104	48-83654H01	silicon
CR107	48-83654H01	silicon
VR102	48-82256C15	voltage regulator: (see note) Zener type: 5.1 V
Q101	48-869643	transistor: (see note) PNP; type M9643
U101	51-84621K76	integrated circuit: (see note) type M2176
S101		switch:
S102	40-80111A01	on-off, p/o R101
S103	40-80127A01	rotary, 4-position (4-freq. models only) pushbutton, dpdt

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

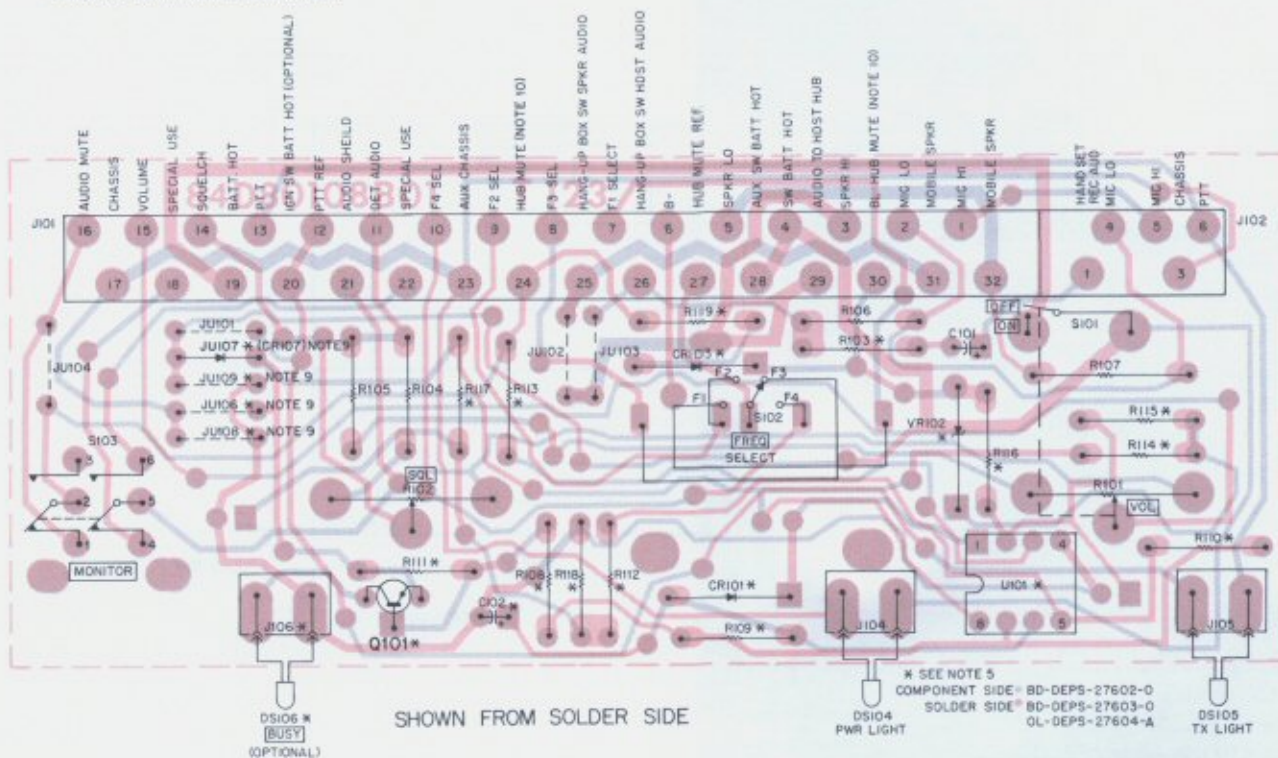


TABLE A COMPARISON OF THE TWO STUDIES

SQUELCH CONDITION		
FULL SQUELCH UNSQUELCHED		
JUMPER	NORMALLY	JUMPER
JU101	IN	ST
JU102	IN	IN
		O
		W
JU103	IN	IN
		O
		R
JU104	OUT	IN
		M
		S
		(N
JU106	OUT	M
JU107	CR107	JU
JU108	IN	CR
JU109	OUT	DI

CONTROL

MODEL	LENGTH (FEET)
HKN4000A	17
HKN4001A	17
HKN4002A	22
HKN4003A	22
HKN4004A	10
HKN4005A	10
HKN4005A	17

CONTROL

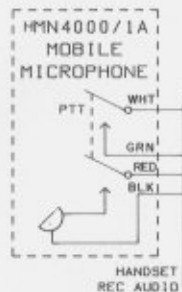
MODEL	SQUELCH TYPE (NOTE 3)
HCN4000A	CS
HCN4001A	CS
HCN4002A	PL/DPL
HCN4003A	PL/DPL
HCN4004A	PL/DPL
HCN4005A	PL/DPL
HCN4006A	PL/DPL
HCN4007A	PL/DPL
HCN4008A	CS
HCN4009A	CS
HCN4010A	PL/DPL
HCN4011A	PL/DPL

TABLE A COMPARATOR VOLTAGE (U101A-3)		
SQUELCH CONDITION	MICROPHONE	
	ON-HOOK	OFF-HOOK
FULL SQUELCH	1.2 V	1.5 V
UNSQUELCHED	4.9 V	8.4 V

JUMPER TABLE		
JUMPER	NORMALLY	FUNCTION
JU101	IN	SUPPLIES PTT CURRENT
JU102	IN	IN HANDSET APPLICATIONS MAY BE OMITTED TO DISABLE SPEAKER WITH HANDSET OFF-HOOK
JU103	IN	IN HANDSET APPLICATIONS MAY BE OMITTED TO DISABLE HANDSET RECEIVE AUDIO WHEN ON-HOOK
JU104	OUT	INSTALLED TO COMPLETE AUDIO MUTE PATH TO HANGUP BOX WHEN S103 NOT USED FOR MONITOR (NOTE 2)
JU106	OUT	MOVE CR107 TO THIS LOCATION FROM JU107 FOR POSITIVE GROUND
JU107	CR107	CR107 IN FOR NEGATIVE GROUND
JU108	IN	DELETED FOR POSITIVE GROUND
JU109	OUT	ADDED FOR POSITIVE GROUND

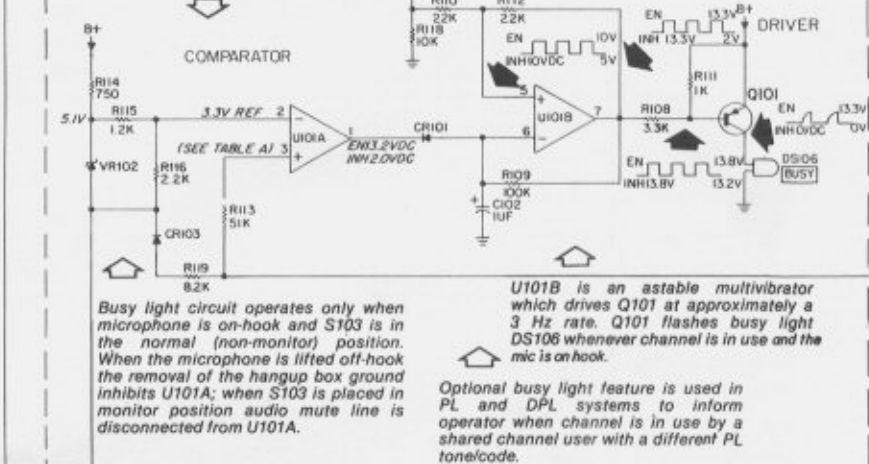
CONTROL CABLE MODEL CHART				
MODEL	LENGTH (FEET)	NO. OF CHANNELS (NOTE 6)	GROUND POLARITY (NOTE 7)	POWER
HKN4000A	17	1	-	LOW
HKN4001A	17	4	-	LOW
HKN4002A	22	4	-	LOW
HKN4003A	22	4	+	LOW
HKN4004A	10	4	-	LOW
HKN4005A	10	4	+	LOW
HKN4005A	17	4	+	LOW

CONTROL HEAD MODEL CHART				
MODEL	SQUELCH TYPE (NOTE 3)	NO. OF CHANS. (NOTE 6)	WEATHER RESISTANT (NOTE 7)	BUSY LIGHT (NOTE 9)
HCN4000A	CS	1	YES	NO
HCN4001A	CS	4	YES	NO
HCN4002A	PL/DPL	1	YES	NO
HCN4003A	PL/DPL	4	YES	NO
HCN4004A	PL/DPL	1	NO	YES
HCN4005A	PL/DPL	4	NO	YES
HCN4006A	PL/DPL	1	YES	YES
HCN4007A	PL/DPL	4	YES	YES
HCN4008A	CS	1	NO	NO
HCN4009A	CS	4	NO	NO
HCN4010A	PL/DPL	1	NO	NO
HCN4011A	PL/DPL	4	NO	NO



OPTIONAL BUSY LIGHT CIRCUIT

U101A compares voltage level on pin 3 (audio mute line) with a 3.3V reference and enables U101B (via CR101) whenever voltage at U101-3 exceeds 3.3 volts.



MITREK CONTROL HEAD

MECHANICAL PARTS

parts list

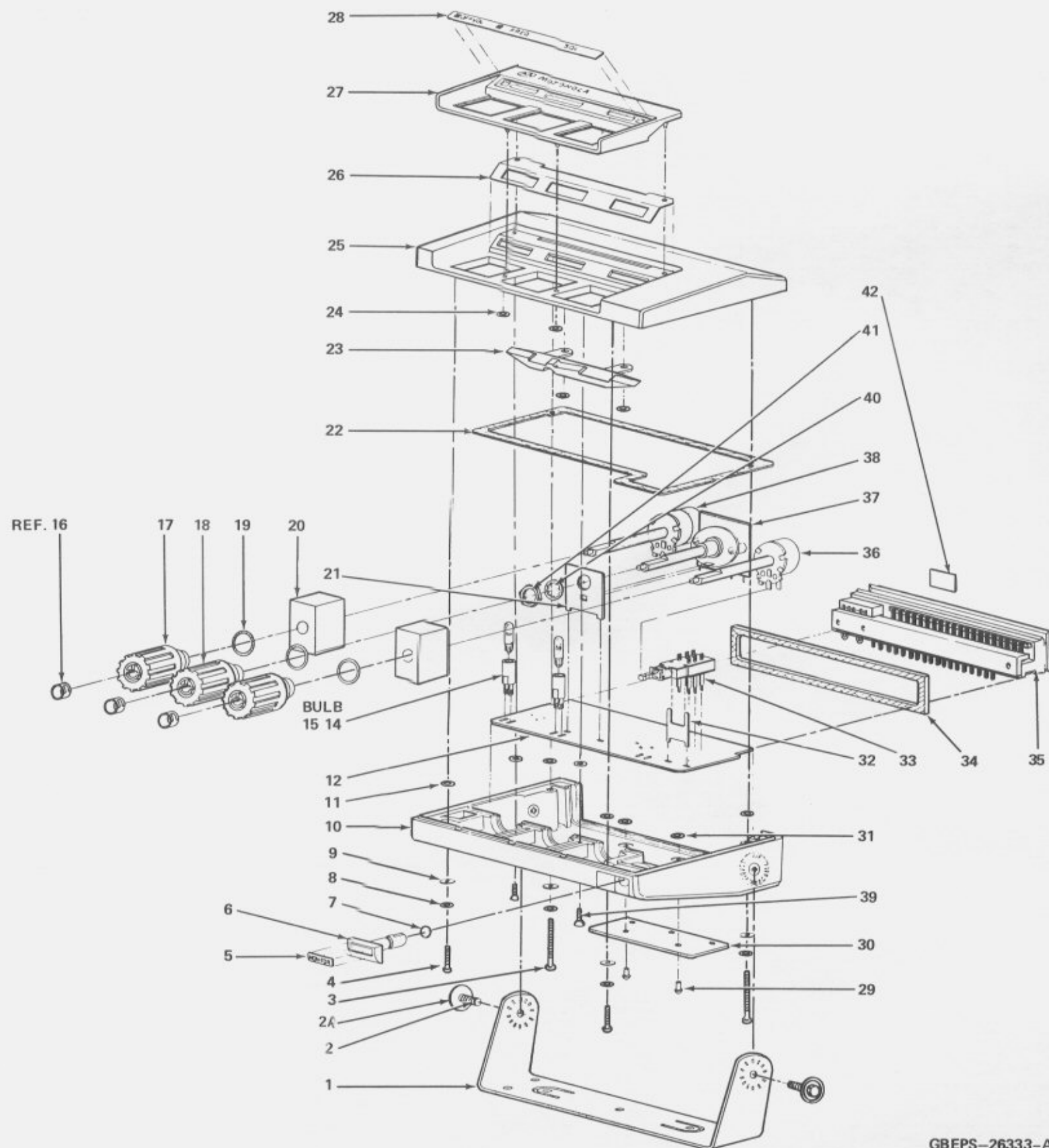
Control Head Mechanical Parts List

PL-6068-C

ITEM	PART NO.	DESCRIPTION	REMARKS
1	7-80101A01	bracket, trunnion	
2	3-135726	screw	for trunnion (two used)
2A	4-135784	washer	for trunnion (two used)
3	3-10903B62	screw, machine	for housing, rear (two used)
		(M3.5 x 0.6 x 30)	
4	3-10903B58	screw, machine	for housing, front (two used)
		(M3.5 x 0.6 x 13)	
5	33-80117A01	nameplate (decals)	"MONITOR"
6	36-80102A01	pushbutton	"PL" models only
7	36-80102A02	pushbutton	CS models only
7	42-10128A22	"O" ring	for pushbutton
8	4-7669	washer, lock	for housing screws (four used)
9	4-139390	washer, flat	for housing screws (four used)
10	13-80109A01	housing, bottom	
11	4-80149A01	washer, captive	for housing screws (six used)
12	84-80112A01	printed circuit board	
14	9-80051B01	light socket	w/o busy light option (2 used)
15	65-83376K01	light bulb	w/o busy light option; 2 used w/ busy light option; 3 used installed by vendor (three used)
16	42-10082A14	retainer, knob	
17	36-80107A01	knob, vol., sql.	
18	36-80160A01	knob, freq.	
19	42-10128A23	"O" ring	for knobs (three used)
20	32-80208A01	gasket	to isolate light (two used)
21	7-80158A01	bracket, freq. switch	
22	32-80103A01	gasket, housing	
23	61-80119A01	lens	
24	42-10113A31	retainer ring	for bezel and lens (six used)
25	15-80108A01	housing, top	
26	32-80165A01	adhesive strip	for bezel
27	13-80180A01	bezel	
28	33-80116A02	nameplate (overlay)	for bezel (1-freq. models)
28	33-80116A01	nameplate (overlay)	for bezel (4-freq. models)
29	5-7703	rivet	for strain relief bracket (two used)
30	7-80100A01	bracket, strain relief	
31	4-7555	washer, flat	for strain relief bracket (two used)
32	7-80159A01	bracket, p.b. switch	
33		switch, pushbutton	S103, see electrical parts list
34	32-80105A01	gasket, connector	
35		connector	J101, see electrical parts list
36		potentiometer, rotary	R102, sql.; see electrical parts list
37		switch, rotary	S102, freq.; see electrical parts list
38		potentiometer, rotary	R101 (p/o S101); see electrical parts list
39	3-10906B04	screw, machine, flat head	for housing, front (two used) (M3.5 x 0.6 x 13)
40	4-7855	washer, lock	for frequency switch bracket
41	2-1376	nut	for frequency switch bracket
42	32-80131B01	gasket, mic	for weather resistant models only

non-referenced items

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-139913	SCREW, tapping: 8-15 x 1/2"; 2 used
	3-136756	SCREW, tapping: 10-16 x 5/8"; 3 used
	37-80118A01	GROMMET
	38-84383D02	CAP, protective
	42-10113A32	RETAINER, ring



68P81039E24-B

(Sheet 2 of 2)

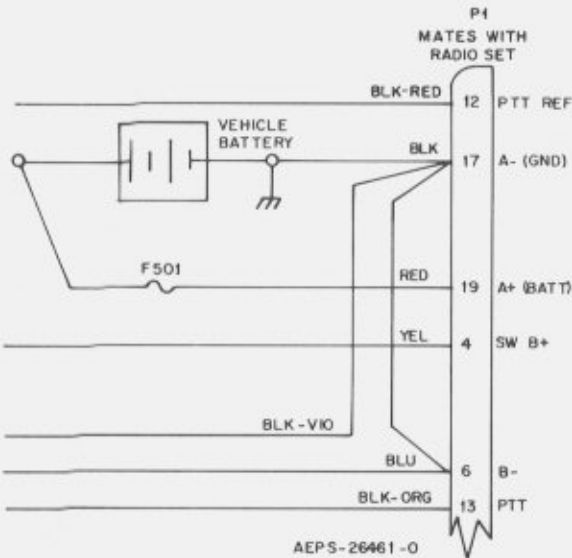
6-10-81 GGI

GBEPS-26333-A

FIELD CONVERSION OF RADIO CABLES

In some instances, it may be necessary or desirable to make field conversion of cables to facilitate a particular installation. Two examples of this would be to install a new MITREK radio in a positive ground vehicle when only a negative ground cable was available or to retrofit a MITREK radio into an existing positive ground MOCOM•70 installation. In both of these the resulting cable should be clearly tagged as its wire colors will not match any existing documentation.

NEGATIVE GROUND MITREK CABLE



CONVERSION PROCEDURE

Step 1. Unsolder the wires from the following pins at the connector to the radio set:

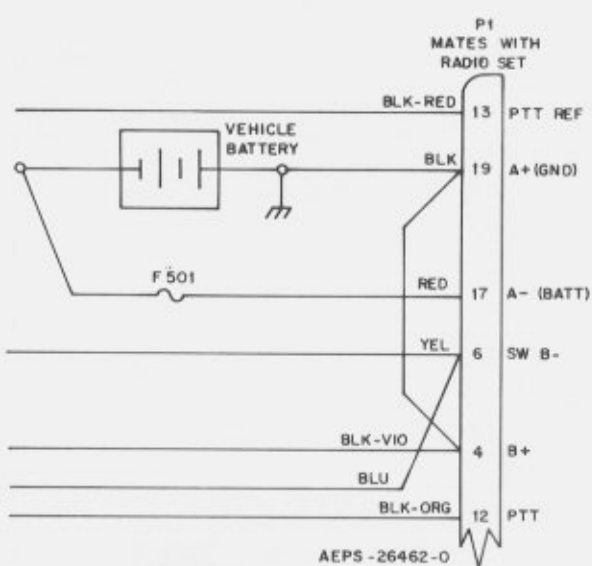
Wire Color	Pin
Blk-Red	12
Blk, Blk-Vio, Jumper	17
Red	19
Yel	4
Blu, Jumper	6
Blk-Org	13

Step 2. Resolder the wires to the following pins:

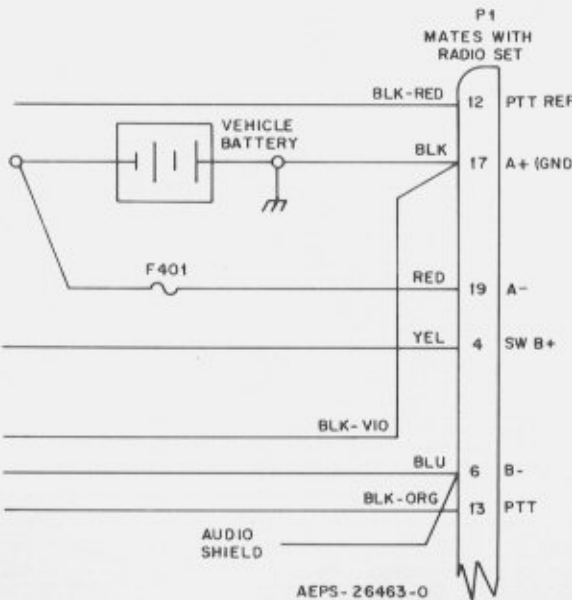
Wire Color	Pin
Blk-Red	13
Blk, Jumper	19
Red	17
Yel, Blu	6
Blk-Vio, Jumper	4
Blk-Org	12

Step 3. Attach a tag to the cable near the radio connector documenting the changes that have been made.

NEGATIVE GROUND MITREK CABLE MODIFIED FOR POSITIVE GROUND INSTALLATION



POSITIVE GROUND MOCOM•70 CABLE



CONVERSION PROCEDURE

Step 1. Unsolder the wires from the following pins at the connector to the radio set:

Wire Color	Pin
Blk-Red	12
Blk, Blk-Vio,	17
Red	19
Yel	4
*Blu, Audio Shield	6
Blk-Org	13

*Blu lead may be omitted on single frequency models.

Step 2. Resolder the wires to the following pins

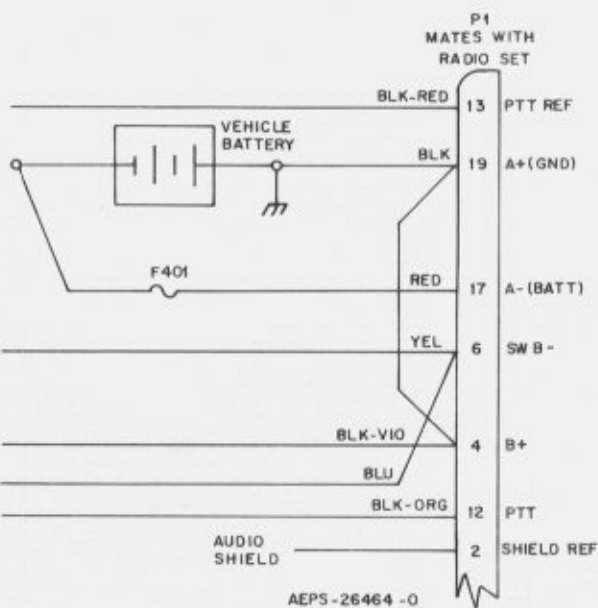
Wire Color	Pin
Blk-Red	13
Blk	19
Red	17
Yel, Blu*	6
Blk-Vio	4
Blk-Org	12
Audio Shield	2

*Blu lead may be omitted on single frequency models.

Step 3. Solder a short jumper (insulated #24 or larger wire) between pin 4 and pin 19.

Step 4. Attach a tag to the cable near the radio connector documenting the changes that have been made.

POSITIVE GROUND MOCOM•70 CABLE MODIFIED FOR POSITIVE GROUND MITREK INSTALLATION



MITREK

Two-Way FM Radio

403-420 MHz and 450-512 MHz
30/50 Watts

68P81037E75-B