MOTOROLA

MITREK®

Two-Way FM Radio

29.7-50 MHz
60/110 Watts

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THIS MANUAL HAS BEEN
DISCONTINUED

Instruction Manual

68P81045E65-O

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 hangup 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.

MOTOROLA INC.
Communications Group

MITREK TWO-WAY FM RADIO

29.7-50 MHz
60/110 WATTS

CONTENTS

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

68P81045E65-O
6/30/80-PHI

MOTOROLA

MODEL CHART

FOR

"MITREK" MOBILE RADIO

1-4 FREQUENCY

60 AND 110 WATT RF POWER

29.7 - 50 MHz

CODE:

[X] = ONE ITEM SUPPLIED

[/] = ONE ITEM SUPPLIED DEPENDENT ON FREQUENCY RANGE

[2] = NUMBER INDICATES QUANTITY SUPPLIED

* INDICATES BREAKDOWN ON SEPARATE CHART

ITEM	DESCRIPTION	MODEL NUMBER	DESCRIPTION	RF OUTPUT (WATTS)	FREQS.
*HUB1001B	CHASSIS NON-EXTENDER (29.7-38.999 MHz) 60 WATT	T51JJA1000BK	CARRIER SQUELCH RADIO SET	60	1
*HUB1002B	CHASSIS NON-EXTENDER (39-50 MHz) 60 WATT	T51JJA1900BK	CARRIER SQUELCH RADIO SET	60	4
*HUB1021B	CHASSIS WITH EXTENDER (29.7-38.999 MHz) 60 WATT	T51JJA2000BK	CARRIER SQUELCH RADIO SET W/EXTENDER	60	1
*HUB1022B	CHASSIS WITH EXTENDER (39-50 MHz) 60 WATT	T51JJA2900BK	CARRIER SQUELCH RADIO SET W/EXTENDER	60	4
*HUB1011B	CHASSIS NON-EXTENDER (29.7-38.999 MHz) 110 WATT	T51JJA3000BK	"PRIVATE-LINE" RADIO SET	60	1
*HUB1012B	CHASSIS NON-EXTENDER (39-50 MHz) 110 WATT	T51JJA3900BK	"PRIVATE-LINE" RADIO SET	60	4
*HUB1031B	CHASSIS WITH EXTENDER (29.7-38.999 MHz) 110 WATT	T51JJA4000BK	"PRIVATE-LINE" RADIO SET W/EXTENDER	60	1
*HUB1032B	CHASSIS WITH EXTENDER (39-50 MHz) 110 WATT	T51JJA4900BK	"PRIVATE-LINE" RADIO SET W/EXTENDER	60	4
HLN4020A	TONE "PRIVATE-LINE" ENCODER/DECODER	T51JJA6000BK	DIGITAL "PRIVATE-LINE" RADIO SET	60	1
HLN4011A	DIGITAL "PRIVATE-LINE" ENCODER/DECODER	T51JJA6900BK	DIGITAL "PRIVATE-LINE" RADIO SET	60	4
KLN6209A	"VIBRASPONDER" RESONANT REED	T51JJA8000BK	DIGITAL "PRIVATE-LINE" RADIO SET W/EXTENDER	60	1
TRN6005A	CODED PLUG	T51JJA8900BK	DIGITAL "PRIVATE-LINE" RADIO SET W/EXTENDER	60	4
KXN1085A	CHANNEL ELEMENT, RECEIVER	T81JJA1000BK	CARRIER SQUELCH RADIO SET	110	1
KXN1087A	CHANNEL ELEMENT, TRANSMITTER	T81JJA1900BK	CARRIER SQUELCH RADIO SET	110	4
HHN4000A	HOUSING, TOP COVER, LOW POWER	T81JJA2000BK	CARRIER SQUELCH RADIO SET W/EXTENDER	110	1
HHN4001A	HOUSING, TOP COVER, HIGH POWER	T81JJA2900BK	CARRIER SQUELCH RADIO SET W/EXTENDER	110	4
HLN4034A	HOUSING, BOTTOM COVER	T81JJA3000BK	"PRIVATE-LINE" RADIO SET	110	1
HCN4000A	CONTROL HEAD, (1-FREQUENCY) CARRIER SQUELCH	T81JJA3900BK	"PRIVATE-LINE" RADIO SET	110	4
HCN4001A	CONTROL HEAD, (4-FREQUENCY) CARRIER SQUELCH	T81JJA4000BK	"PRIVATE-LINE" RADIO SET W/EXTENDER	110	1
HCN4002A	CONTROL HEAD, (1-FREQUENCY) "PRIVATE-LINE"	T81JJA4900BK	"PRIVATE-LINE" RADIO SET W/EXTENDER	110	4
HCN4003A	CONTROL HEAD, (4-FREQUENCY) "PRIVATE-LINE"	T81JJA6000BK	DIGITAL "PRIVATE-LINE" RADIO SET	110	1
HMN4000A	MICROPHONE	T81JJA6900BK	DIGITAL "PRIVATE-LINE" RADIO SET	110	4
HSN4000A	SPEAKER	T81JJA8000BK	DIGITAL "PRIVATE-LINE" RADIO SET W/EXTENDER	110	1
HKN4000A	CABLE, (17 FT) 1-FREQUENCY	T81JJA8900BK	DIGITAL "PRIVATE-LINE" RADIO SET W/EXTENDER	110	4
HKN4001A	CABLE, (17 FT) 4-FREQUENCY				
HKN4016A	CABLE, (17 FT) 1-FREQUENCY				
HKN4017A	CABLE, (17 FT) 4-FREQUENCY				
HLN4024A	MICROPHONE HANG-UP BOX				
TAB1001C	ANTENNA (25-30 MHz)				
TAB1002C	ANTENNA (30-54 MHz)				
HLN4022A	INSTALLATION KIT				
HLN4023A	TUNING TOOL KIT				
HKN4041A	FUSED LEAD				

EPS-27761-A

"MITREK" MOBILE RADIO
UNIFIED CHASSIS
29.7-50 MHz
60 AND 110 WATT
RF POWER

LEGEND:

- ● = ONE ITEM SUPPLIED
- ■ = SEE FURTHER BREAKDOWN IN THIS CHART
- ★ = SEE FURTHER BREAKDOWN IN SEPARATE CHART

MODEL	DESCRIPTION
■HUB1001B	UNIFIED CHASSIS 29.70-38.999 MHz (60 WATT) R1
■HUB1002B	UNIFIED CHASSIS 39.00-50.00 MHz (60 WATT) R2
■HUB1011B	UNIFIED CHASSIS 29.70-38.999 MHz (110 WATT) R1
■HUB1012B	UNIFIED CHASSIS 39.00-50.00 MHz (110 WATT) R2
■HUB1021B	UNIFIED CHASSIS WITH EXTENDER 29.70-38.999 MHz (60 WATT) R1
■HUB1022B	UNIFIED CHASSIS WITH EXTENDER 39.00-50.00 MHz (60 WATT) R2
■HUB1031B	UNIFIED CHASSIS WITH EXTENDER 29.70-38.999 MHz (110 WATT) R1
■HUB1032B	UNIFIED CHASSIS WITH EXTENDER 39.00-38.99 MHz (110 WATT) R2
HUB1003B	UNIFIED CHASSIS NON-EXTENDER (60 WATT) R1
HUB1004B	UNIFIED CHASSIS NON-EXTENDER (60 WATT) R2
HUB1013B	UNIFIED CHASSIS NON-EXTENDER (110 WATT) R1
HUB1014B	UNIFIED CHASSIS NON-EXTENDER (110 WATT) R2
HUB1023B	UNIFIED CHASSIS WITH EXTENDER (60 WATT) R1
HUB1024B	UNIFIED CHASSIS WITH EXTENDER (60 WATT) R2
HUB1033B	UNIFIED CHASSIS WITH EXTENDER (110 WATT) R1
HUB1034B	UNIFIED CHASSIS WITH EXTENDER (110 WATT) R2

ITEM	DESCRIPTION
■HUB1003B	UNIFIED CHASSIS NON-EXTENDER (60 WATT) R1
■HUB1004B	UNIFIED CHASSIS NON-EXTENDER (60 WATT) R2
■HUB1013B	UNIFIED CHASSIS NON-EXTENDER (110 WATT) R1
■HUB1014B	UNIFIED CHASSIS NON-EXTENDER (110 WATT) R2
■HUB1023B	UNIFIED CHASSIS WITH EXTENDER (60 WATT) R1
■HUB1024B	UNIFIED CHASSIS WITH EXTENDER (60 WATT) R2
■HUB1033B	UNIFIED CHASSIS WITH EXTENDER (110 WATT) R1
■HUB1034B	UNIFIED CHASSIS WITH EXTENDER (110 WATT) R2
HLN4189B	HARDWARE KIT LO-BAND
★HLB1001A	POWER AMPLIFIER (60 WATT) R1
★HLB1002A	POWER AMPLIFIER (60 WATT) R2
★HLB1011B	POWER AMPLIFIER (110 WATT) R1
★HLB1012B	POWER AMPLIFIER (110 WATT) R2
HLB4011B	MAIN BOARD NON-EXTENDER R1
HLB4012B	MAIN BOARD NON-EXTENDER R2
HLB4001B	MAIN BOARD WITH EXTENDER R1
HLB4002B	MAIN BOARD WITH EXTENDER R2
HLN4013A	HARDWARE KIT
HLN4039A	HARDWARE KIT HI-POWER
HLN4047A	HARDWARE WIRING KIT HI-POWER
HLN4019A	HARDWARE WIRING KIT
HLN4033A	BOTTOM COVER INTER AND GASKET
HLN4044A	INTERCONNECT BOARD

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"MITREK" MOBILE RADIO
POWER AMPLIFIER
29.7-50 MHz
60 AND 110 WATT
RF POWER

LEGEND:

● = ONE ITEM SUPPLIED

MODEL	HLB1001A	HLB1002A	HLB1011B	HLB1012B	ITEM	DESCRIPTION
DESCRIPTION	POWER AMPLIFIER (60 WATT) R1	POWER AMPLIFIER (60 WATT) R2	POWER AMPLIFIER (110 WATT) R1	POWER AMPLIFIER (110 WATT) R2		
	●				HLB4021A	POWER AMPLIFIER BOARD R1 (60 WATT)
		●			HLB4022A	POWER AMPLIFIER BOARD R2 (60 WATT)
			●		HLB4075A	POWER AMPLIFIER BOARD R1 (110 WATT)
				●	HLB4076A	POWER AMPLIFIER BOARD R2 (110 WATT)
	●	●			HLB4040A	POWER TRANSISTOR KIT (60 WATT)
			●	●	HLB4077A	POWER TRANSISTOR KIT (110 WATT)
	●	●			HLN4000A	HARDWARE POWER AMPL. (60 WATT)
			●	●	HLN4038A	HARDWARE POWER AMPL. (110 WATT)
	●	●	●	●	HLN4016A	ANTENNA SWITCH
	●	●			HLN4021A	FEED-THRU PLATE
			●	●	HLN4046A	FEED-THRU PLATE
			●	●	HLN4129A	TRANSFORMER AND HEATSINK

EPS-30273-O

OPTIONS

Time-Out Timer HLN4012A
Busy Light Adapter HLN4119A and Applicable Control Head

Handset TMN6057A and Handset Hangup Box TLN4698A
Microphone Hangup Box with Monitor Switch HLN4025A
Handset Hangup 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
SYSTEMS 90 Control Cables

SPECIFICATIONS

GENERAL

Dimensions	
(60 W)	6.35cm x 25.4cm x 30.48cm (2.5'' x 10'' x 12'')
(110 W)	6.35cm x 25.4cm x 36.9cm (2.5'' x 10'' x 14.5'')
Frequency Range	29.7-50 MHz
Weight (Less Acc.)	60 W: 4.76 kg (10.5 pounds) 110 W: 6.24 kg (13.75 pounds)
Temperature Range	-30 to +60°C
No. of Frequencies	1 to 4
Polarity	+/- Ground
Current Requirements:	
Standby	0.45A @ 13.8 V
Receive	2.0A @ 13.8 V
Transmit 60 W	14.0A @ 13.6 V
110 W	24A @ 13.4 V

TRANSMITTER

Power Out	60 Watts and 110 Watts
Stability	20 PPM (5 PPM optional)
Distortion	3%
FM Noise	70 dB
Spurs	85 dB
Frequency Separation	0.75 MHz (RGI) and 1.0 MHz (RGII)

RECEIVER

Sensitivity	0.3 uV
Intermodulation	85 dB
Selectivity	95 dB (20 kHz)
Stability	20 PPM (5 PPM optional)
Modulation Acceptance	±6.5 kHz
Spurs	100 dB
Audio Power	8 Watts
Distortion	5%
Frequency Separation	0.75 MHz (RGI) and 1.0 MHz (RGII)

(Pages vii and viii, and the safety info, have been deleted as irrelevant)

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.

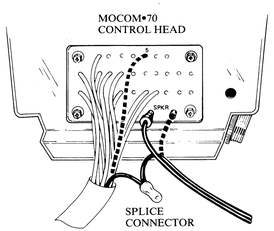
NOTE

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



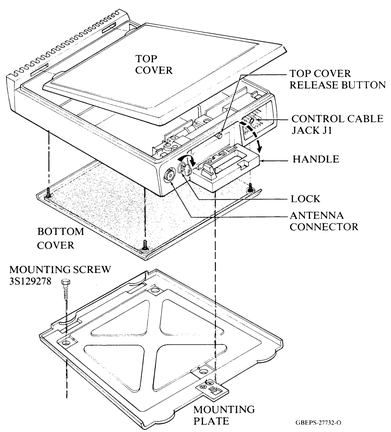
GAEPS-26441-O

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.



GBEPS-27732-O

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 distrub 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 on low band radio installation ONLY, 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.

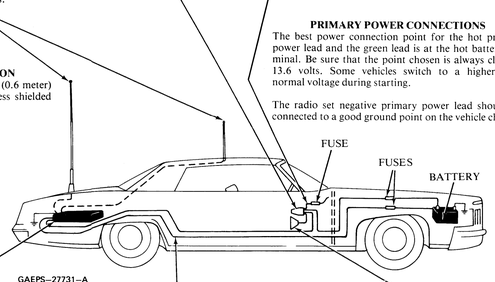
PRIMARY POWER CONNECTIONS

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.

GENERAL SAFETY INFORMATION

Antennas must be installed at least wo feet (0.6 meter) from vehicle operators and passengers unless shielded by a metallic surface.



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.

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.

MITREK

RADIO AND CONTROL HEAD
PREINSTALLATION CONSIDERATIONS

IMPORTANT

POWER OUTPUT

The Motorola **MITREK** fm two-way radio you are installing has been tested for proper transmitter power output before leaving the factory. Each radio is set to the proper output power level while connected to an accurate 50 ohm load impedance. Once the power level has been set, the internal power control/protection circuitry will reduce the power output whenever it senses a load impedance significantly different from 50 ohms. The operation of this circuitry may be different from that of other Motorola products you have installed.

When you check transmitter output power levels during installation, **be sure** you are using a good 50 ohm load impedance and test cables that are as short as possible. Any significant load variation from 50 ohms will cause an **apparent reduction** in output power due to the normal operation of the control/protection circuitry. These variations in power with degraded load impedance will be much more noticeable in the UHF band than in the VHF bands since cables, meters, connectors, etc. have larger effects at UHF. *If power seems to be unusually low* (greater than can be explained by the normal calibration differences you experience) check your test set-up. If power output goes up as you improve the quality of the load impedance (approach 50 ohms), the control/protection circuitry is performing normally.

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

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.

68P81109E32-E
(Sheet 1 of 2)
5/9/80-PHH

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. Install the 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 of flat washers. An assortment of additional screws and spacers are provided for installing the mounting plate over extremely irregular surfaces.

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

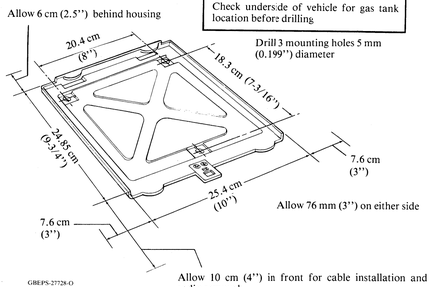
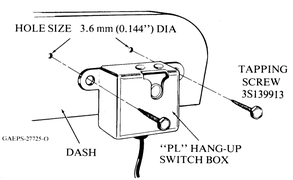


Table 1.
Contents of Installation Kit

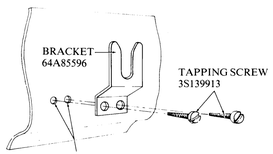
Qty.	Part No.	Description	Qty.	Part No.	Description
4	3-139965	Screw, tapping, 1/4-14 x 1/2	1	3-140075	screw, tapping, 1/4-14 x 7/8"
1	4-7688	Washer, locking, 1/4 internal	1	3-140076	screw, tapping, 1/4-14 x 1-1/8"
1	29-812980	Terminal, crimp, closed end	1	3-140077	screw, tapping, 1/4-14 x 1-1/2"
1	37-103890	Grommet, rubber	3	43-82292M01	BUSHING, spacer
6	42-10217A14	Strap, tie, 0.140 x 5.50, nylon			

C. MICROPHONE HANGUP BOX (PL OR DPL MODELS)



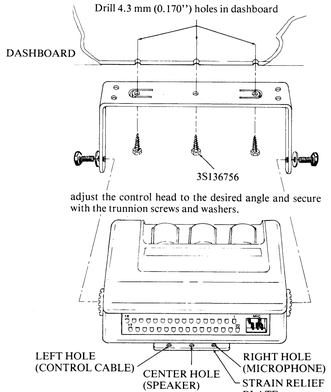
Install hangup box lead pins to correspondingly numbered slots at the rear of the control head; lead labeled 24/30 should be installed into slot 30 for busy light radios with busy light control heads, into slot 24 for all other systems.

D. MICROPHONE HANGUP CLIP (CARRIER SQUELCH MODELS)



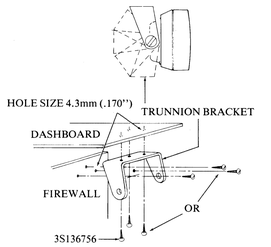
CONTROL HEAD, SPEAKER, AND ACCESSORIES

A. CONTROL HEAD

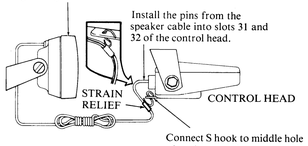


Install the pins from the control cable into correspondingly numbered slots on the radio cable connector at the rear of the control head; also the pin from the green (and orange if supplied) power lead. Connect the S hook on the control cable to the left hole in the strain relief plate.

B. SPEAKER



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



E. MICROPHONE

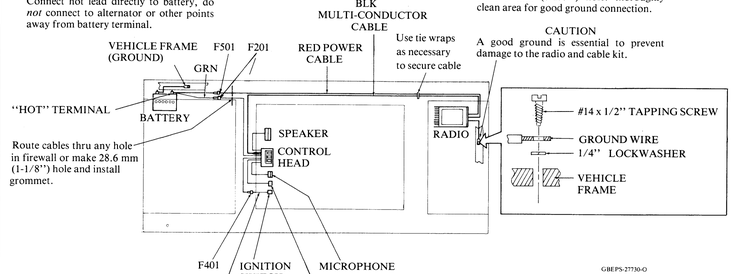
Step 1. Plug the microphone connector into the receptacle on the control head. Connect the S hook to the right hole of the strain relief plate.

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

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.



Step 1. Connect the fused power cable (red for — Gnd, black for + Gnd) from the trunk to the ungrounded battery terminal. NOTE: For positive ground installations remove jumper JU1 on interconnect board in the MITREK radios.

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. Remove jumper JU101 in the control head.

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.

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 element is on (indicates actual carrier frequency) and when the channel element is 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 Schmitt 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 two conditions when 9.5 V is applied: (1) during a transmission, and (2) 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 Q2 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 Hz. The phase relationships are such that Q1 always turns off when Q3 turns on.

2.2.5 Whenever Q1 turns off, the receive oscillator is disabled by the removal of the RX 9.5 volts. At the same time Q3 outputs a positive going pulse to Q4 via C2 and Q4 temporarily turns on. C3 starts charging through Q4 and R13 to the dc voltage at the output of the detector buffer. Remember 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. Q4 is also off at this time and C3 either charges or discharges to the dc voltage now at the detector buffer. This time the voltage is sampled when the oscillator and incoming carrier are enabled. With Q4 turned off any charging or discharging currents through R14 and C3 must flow through the meter movement which is in parallel with Q4. If the carrier developed voltage is higher than the idling voltage C3 will charge more causing the meter to deflect to one side of zero center. If the carrier developed voltage is lower than the idling voltage, C3 will discharge causing the meter to deflect to the other side of zero center. If the carrier developed voltage is identical to the idling voltage C3 will neither charge further nor discharge and the meter will read zero. With a carrier of known good frequency applied, the meter 4 circuit is activated and the channel element is warped until the meter reads zero center. At this point C3 is neither charging nor discharging and the receiver is right on frequency.

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 through 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.

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.

3.1.3 A third loop is provided on the 75 and 110 watt models. This loop protects the driver as well as the final amplifier by sensing and limiting the driver current.

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 feedback 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 FINAL AMPLIFIER REGULATION LOOP

3.3.1 The final amplifier 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 CR901. 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 CR901 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 felt at Q902 through R802. The second input to CR901 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 DRIVER REGULATION LOOP
(Included on 75 and 110 watt models only.)

3.4.1 The driver regulation loop provides protection for both the driver and the final amplifiers by limiting the driver current and power output. Transistor Q805 senses the driver current via R822 and CR803. The output from this stage is determined by the setting of potentiometer R826. This output is coupled through CR804 and is used to drive control amplifier U901 located on the main board. Potentiometer R826 is adjusted for a power output which is above the power level set by the final amplifier regulation loop.

3.4.2 Under normal conditions, the output of Q805 is too low to forward bias CR804 and the regulator loop controls the drive. When excess driver current is drawn, the input to Q805 decreases and the output increases. The inverted input to U901 increases and the control voltage output decreases, thus reducing the drive to the power amplifier.

3.5 OPERATION

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 curent to return to normal. If the PA 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.

3.6 INITIALIZATION

3.6.1 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.

3.6.2 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.

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/TROUBLESHOOTING

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 signal levels distributed at key points in the circuit. These levels are shown on the functional block diagram. The measurement points for the 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 TONE "PRIVATE-LINE"/ "DIGITAL PRIVATE-LINE" BOARD

To remove the board, remove three mounting screws, and unplug the board from J3 on the interconnect board. To replace the board reverse the removal procedure.

2.4 INTERCONNECT BOARD

To remove the interconnect board, remove the "PRIVATE-LINE"/"DIGITAL PRIVATE-LINE" board, and the time-out-timer board (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. To replace the interconnect board, reverse the removal procedure being careful to seat J2 into P2 on the main circuit board.

2.5 ANTENNA SWITCHING RELAY

To remove the antenna switching relay, unsolder two leads to the relay coil, and two coax cables from the receiver input, and harmonic filter output. Remove a locknut from the front of the chassis with a spanner wrench, and remove the relay (RSX4028A Spanner Nut Removal Tool available from Motorola National Parts). To replace the relay, reverse the removal procedure.

2.6 MAIN BOARD REMOVAL

To remove the main board, unsolder, and remove two coax cables, one on the component side, and one on the solder side, of the board. Unsolder the wiring to the five feedthru capacitors, and to the antenna relay.

Remove four transistor mounting screws from the chassis walls, and eleven hex head board mounting screws. Remove the board from the bottom of the chassis. To replace the board, reverse the removal procedure, taking care to replace the transistor insulations, and shoulder washers, to prevent the transistors from shorting to the chassis wall.

3. POWER AMPLIFIER

3.1 TRANSISTOR REPLACEMENT

3.1.1 To remove the power transistors, remove four transistor mounting screws and one nut, then unsolder and remove the transistors. (Special soldering iron tips ST1160 and ST1161 are available from the MOTOROLA Parts Department to aid in unsoldering the silver mica bypass capacitors, and the transistors.)

3.1.2 When replacing rf power transistors several precautions ***must*** be observed. First remove all thermal compound and residue from *both the chassis and the transistor* using a soft cloth or paper towel. Apply a thin film of Wakefield thermal compound to the bottom of the transistor mounting flange. Replace the transistor in the center of the printed circuit board cutout tightening the mounting hardware to 6-7 inch pounds ***maximum***. Solder leads using a low power (40-60 W) iron using enough solder to completely cover the lead and solder pad. ***Make sure*** that the solder is flowing freely both *over* and *under* the lead before removing the heat. If a lead tends to spring away from the printed circuit board, hold down the far end of the lead against the board (using the tip of pliers) until the solder hardens.

3.1.3 When removing components from the power amplifier printed circuit board it is ***essential*** that the solder by *completely molten* around the lead(s) to be removed ***before*** attempting to remove any component(s). Failure to exercise this precaution *could result* in removal of through-plating in component holes and/or top side metal on the printed circuit board which may necessitate removal of the printed circuit board for repair. To ensure proper performance of the rf power amplifier, it is ***essential*** (when replacing board-mounted parts) that the parts be mounted vertically with the bottom of the component(s) flush with the printed circuit board. However, the *proper mounting* of C805, C813, C814, C820-C828, R801, and Q804 is dictated by their lead configuration.

3.2 POWER AMPLIFIER BOARD REMOVAL

3.2.1 Under normal maintenance conditions, there should be no need to remove the PA board, since all components may be removed from the top of the board. If, however, it should become necessary, the following procedure should be used. Remove the input and output coax cables from the circuit board. Unsolder seven feed-thru capacitors. Remove eight hex head screws, four transistor mounting screws, and one transistor mounting nut. Lift the PA board out of the chassis.

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

4. FIELD REPAIR FAILURE ANALYSIS (110 WATT)

The following checks assume that the 13.4 V dc is applied to the radio set through a standard cable kit, that the radio is terminated in a resistive 50 ohm load, that all power control potentiometers (R826, R909, and R911) are positioned fully clockwise, and that alignment was performed with the radio set keyed on a defective channel (unless otherwise stated). All rf measurement should take into consideration the tolerance of the measuring equipment.

4.1 NO POWER OUTPUT OR POWER OUTPUT LESS THAN 40 WATTS

4.1.1 Exciter Checks

If MTR 3 is less than 20 uA, or MTR 5 is less than 5 uA on a problem channel, a defective channel element or misaligned exciter is the probable cause. The exciter is defective or misaligned if the exciter power output into a 50 ohm load is less than 2 watts. If the exciter output is less than 2 watts, realign the exciter as directed in the standard instruction manual. If the power amplifier output is still low, remeasure the exciter power output. If the exciter power out is still less than 2 watts, the exciter is defective.

4.1.2 Voltage and Overall Current Checks

With the radio unkeyed and the receiver audio at a minimum, check for +13.3 V dc on the Q801-Q803 collectors and for the power supply current drain.

Step 1. If one or more stages has zero voltage, check associated dc feed circuits for an open circuit.

Step 2. If more than 1 Ampere is being drawn from the power supply, check for A+ or A- shorts on the printed circuit board. Check *closely* under coil L804 (lifting it as necessary) for shorts due to punctured insulation on coil and printed circuit board.

4.1.3 Continuity Checks

Check the harmonic filter, output cable, and antenna switch for shorts, opens, or defective parts. Continuity checks (made with the radio keyed, but all transmit channel elements removed) can be used to isolate the fault.

4.1.3.1 No connection from the center pin of the UHF connector to the junction of L809 and C820 indicates an open antenna switch, cable or harmonic filter, or defective switching circuit.

Step 1. Check for at least 5 V dc across the antenna switch coil. If this voltage is low or absent, check for defects in the regulator/switching circuitry on the main board.

Step 2. Check back from L809 to the antenna cable center conductor in the harmonic filter to isolate the open section. If no connection is found at the antenna cable conductor, replace the antenna switch assembly.

4.1.3.2 A short from the center pin of the UHF connector to the chassis indicates a shorted antenna switch cable or harmonic filter.

Step 1. Check for the proper polarity of voltage on the antenna switch coil as indicated by the + and - markings on the coil bobbin.

Step 2. Remove the bottom covers from the radio and check for continuity from the center pin of the UHF connector to the center conductor of the receiver coax cable. If continuity is indicated, replace the antenna switch assembly.

Step 3. Visually check for shorts in the harmonic filter. If no shorts are visible, remove the output cable from the harmonic filter. If a short still exists at the UHF connector, replace the antenna switch assembly.

Step 4. Remove C820 and check to see if it is shorted. Continue removing remaining capacitors (C821-828) and check for a short until the short is isolated. If the short disappears upon removal of a capacitor, replace that capacitor and reassemble the radio.

4.1.4 Individual Stage Current Checks

Check the collector current drawn by all stages to determine if the normal value shown in Table 1 is drawn.

Step 1. If a stage is found with less than minimum Ic (see Table 1), check for shorts or defective components in that stage, then in the preceding and following stages.

Step 2. Where more than one stage indicates low current, check the earliest defective stage (toward the PA input) first.

Table 1. Minimum Normal Current Readings (all power control potentiometers set fully clockwise)

		29.7-38.999 MHz (RI)	39-50 MHz (RII)
Q801	Ic-direct	2A	2A
Q801	Ic-drop across R822	200 mV	200 mV
Q802, 3	Ic-direct	17A	15A
Q802, 3	Ic-drop across R801	170 mV	150 mV
Q802, 3	Ic-MTR 7	14 uA	12 uA

NOTE

"Direct" current measurements taken by inserting ammeter into transistor dc feed circuit *at the common A + connection.*

4.1.5 Transistor Checks

Unless absolutely necessary, transistors Q801-803 should ***not*** be replaced. If the final amplifiers are suspect, the defective device(s) can be isolated by lifting up one end of R812 and R813 and measuring their resistance. If R812 is open, replace R812 and Q803. If R813 is open, replace R813 and Q802.

4.2 POWER OUTPUT LESS THAN 135 W AT MAXIMUM POWER SETTINGS

4.2.1 Exciter Check

Perform the exciter check as outlined in paragraph 4.1.1.

4.2.2 Antenna Switch Check

Remove the bottom covers from the radio. With the channel elements removed and the radio keyed, check for continuity from the center pin of the UHF connector to the center conductor of the receiver coax cable on the printed circuit board. If continuity is indicated, replace the antenna switch assembly.

4.2.3 Voltage Checks

Check A+ and A- voltages at the Q801-Q803 collectors with the power amplifier operating. Use ***only*** a passive voltmeter or a VOM with 6.8 uH series chokes (Motorola Part No. 24-84250D02 or equivalent) at the probe tips. With the power supply accurately set for 13.4 V dc, voltages on the transistor collectors should exceed the following values (all voltages measured with respect to the A- plating on the power amplifier board):

Q801 — +11.9 V dc
Q802, 3 — +12.1 V dc

Step 1. If all voltages are low, recheck the power supply. If the power supply is satisfactory, check the feedthrough capacitors for poor solder connections.

Table 2. Minimum Power Output From Q802 or Q803
(12.5 V dc applied with a 1 watt drive signal)

RI (in MHz)			RII (in MHz)		
29.7-32.999	33.0-35.999	36.0-38.999	39.0-42.999	43.0-46.999	47.0-50.0
63 W	55 W	50 W	69 W	64 W	55 W

Step 2. If only one stage has low voltage, trace back through the dc-feeds of that stage, checking for bad connections or defective components. The maximum normal voltage drops are 0.3 V dc for R801, 0.5 V dc for R822, and less than 0.1 V dc for all other components in the dc-feed circuits.

4.2.4 Stage Current Check

Check the stage currents as outlined in paragraph 4.1.4.

4.2.5 Final Amplifier Check

If trouble in the final amplifier (Q802, Q803) is indicated, or other approaches have failed, check for defective parts. *If no obviously defective* passive components, misconnections, or shorts can be located, make the following tests.

NOTE

Remove all power from the radio set for the following tests.

Step 1. Check in-circuit base-emitter resistance on the suspect transistor(s). If *greater* than 1 ohm, coil L806 and L807 are bad.

NOTE

Place the *negative* potential lead from the ohmmeter on the transistor base for this test.

Step 2. If the resistance check shows that L806 and L807 are not defective, remove these coils and disconnect the base leads from the final amplifier transistors. Check the resistance across the pads where each coil connects in the circuit. If the resistance is not between 2 and 2.7 ohms, a defective R812 or R813, or a printed circuit board short is indicated.

Step 3. If no printed circuit board short is found, and R812 and R813 are good, replace coils L806 and L807 and resolder the transistor base leads. Unsolder the collector of Q802 and solder a 2500 pF (large body) silver mica capacitor (Motorola Part No. 21-859773 or equivalent) from the printed circuit board collector pad of Q802 to the emitter tab of Q802 which is closest to output transformer T802. Apply 12.5 V dc (measured at the A+/A- feed-thru capacitors) and a 1 watt drive signal. (This 1 watt drive source can be derived from the exciter by using R911 to control the exciter power output as measured by a thru-line wattmeter connected between the exciter and power amplifier board.) Peak C820 and C821 for maximum power output. If the power output is *less* than shown in Table 2, remove the 12.5 V dc and then replace Q803. Unsolder the 2050 pF capacitor from the printed circuit board collector pad of Q803 to the emitter tab of Q803 which is closest to T802. Reapply the 12.5 V dc, the 1 watt drive signal, and peak C820 and C821 for maximum power output. If the power output is *less* than the values shown in Table 2, remove the 12.5 V dc and 2500 pF capacitor and then replace Q802 and resolder the collector of Q803.

4.2.6 Driver Check

With all power removed from the radio set, check for open base return on Q801 by measuring in-circuit base-emitter resistance. A resistance *greater* than 1 ohm indicates that L803 is defective.

NOTE

Place *negative* potential lead of ohmmeter on transistor base(s) for this test.

5. 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 u problem, refer to Motorola publication 68P81109E33 "Reducing Noise Interference in Mobile Two-Way Radio Installation". 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 RADIO SERVICING

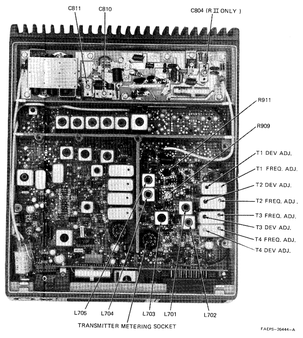
GENERAL TYPE	APPLICATION	RECOMMENDED MODEL	MINIMUM SPECIFICATIONS
AC-DC VOM	DC voltage measurements, general	Motorola T1009A	Measurement range: 0-15 V dc Sensitivity: 20,000 ohms/volt
DC Multimeter	DC voltage readings requiring a high input resistance meter.	Motorola S1063B	Measurement range: 0-15 V 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-50 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: 0-100 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: 29.7-50 MHz Frequency resolution: 10 Hz
Deviation Meter	Transmitter modulation deviation measurement	Motorola R1200A Service Monitor	Measurement range: 0-10 kHz deviation Frequency range: 25-50 MHz
RF Signal Generator	Receiver Alignment and troubleshooting	Motorola R1200A Service Monitor with attenuator	Frequency range: 25-50 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" Encoder-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 R1011A	1-20 V dc 0-40A
Pulse Generator	Extender measurements	TEK47A	

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

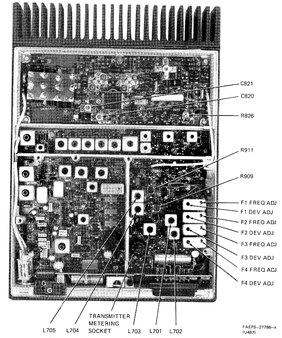
NOTE
Versions B-E of TEK5 Metering Panel must be modified with RPX4053A Conversion Kit before use with the radio.

TRANSMITTER PREALIGNMENT NOTES
RANGE I: 29.7-38999 MHz RANGE II: 39-50 MHz

1. Unnecessary tuning adjustments should be avoided. Usually, only a *touch-up* transmitter alignment is needed. Complete transmitter alignment is needed *only* in the following cases:
   a. after changing transmitter operating frequency.
   b. after replacing a component in a frequency-sensitive network.
2. The tune-up procedure has been written for use with the Motorola portable test set or the TEK-5 Meter Panel set to position A.
3. Before beginning a complete alignment, preset tuning adjustements as follows:
   a. Set C804 (Range II only), C810, and C811 to maximum clockwise (*60 W models*). Set C820 and C821 maximum clockwise (*110 W models*).
   b. Set R909 and R911 to maximum clockwise (*60 and 110 W models*). Set R826 to maximum clockwise (*110 W models*).
   c. Set L701, L702, L703, L704, and L705 according to the exciter preset chart. Preset positioning of the exciter coil slugs insures that the exciter is tuned to the correct harmonic of the oscillator.
   d. Set power supply voltage to 13.6 V (*60 W models*) or 13.4 V (*110 W models*).
4. Key transmitter for each step in alignment procedure and de-key as soon as alignment step is completed. Avoid keying an unaligned transmitter for prolonged periods.
5. Multi-frequency radios should be aligned on the lowest operating frequency.



Transmitter Adjustment Locations (60 Watt Models)



Transmitter Adjustment Locations (110 Watt Models)

TRANSMITTER ADJUSTMENT PROCEDURE

STEP	TEST SWITCH POSITION	ADJUSTMENT	PROCEDURE
1	M3	L701, L702, L703	Tune coils in order listed for a peak MTR 3 reading. Repeat procedure to ensure that a peak has been obtained.
2	M5	L704, L705	Tune coils in order listed for a peak MTR 5 reading. Repeat procedure to ensure that a peak has been obtained.
3 (Range II only)	M5	C804 (60 W models)	Tune for ***sharp dip*** on MTR 5.
4	Wattmeter	C810 (60 W models) C821 (110 W models)	Tune for peak power output.
5	Wattmeter	R911	Adjust for power output of 65 W (*60 W models*), 130 W (*110 W models*), or maximum clockwise, whichever is less.
6	Wattmeter	C811 (60 W models) C820 (110 W models)	Tune for peak power output.
7	Wattmeter	R911	Adjust for power output of 65 W (*60 W models*) or 130 W (*110 W models*).
8	Wattmeter	C810 (60 W models) C821 (110 W models)	Tune for peak power output.
9	Wattmeter	R911	Adjust for power output of 65 W (*60 W models*) or 130 W (*110 W models*).
10 (Range II only)	M7	C804 (60 W models)	Tune for a peak MTR 7 reading.
11 (Range II only)	Wattmeter	R911	Adjust for power output of 65 W (*60 W models*).
12	M5	L705, L704	Tune coils in order listed for a peak MTR 5 reading.
13	M3	L703, L702, L701	Tune coils in order listed for a peak MTR 3 reading.
14 (Range II only)	M7	C804 (60 W models)	Tune for a peak MTR 7 reading.
15	Wattmeter	R911	Adjust for power output of 65 W (*60 W models*) or 130 W (*110 W models*).
16	Wattmeter	C810, C811 (60 W models) C820, C821 (110 W models)	Tune in order listed for a peak power output. *On 60 W models*, if MTR 7 reading is ***greater*** than 15 uA, ***detune*** C810 until the reading is 14 uA.
17	M5 (110 W models) Wattmeter	R911	*On 60 W models*, adjust R911 for a power output of 70 W. *On 110 W models*, adjust R911 for a 130 W power output, note MTR 5 and then adjust R911 for a 2 uA increase on MTR 5.
18	Wattmeter	R909, R826 (110 W models)	*On 60 W models*, adjust R909 for a power output of 65 W. *On 110 W models*, adjust R826 for 130 W and then adjust R909 for a 120 W output.
	This completes the alignment for single frequency radios. For multi-frequency radios, perform the following steps. If the separation is greater than 400 kHz, the transmitter must be aligned on the lowest transmitter frequency before proceeding.		
19A	Wattmeter, M7	R909, R911, R826, C821	*On 110 W models with channel separation greater than 400 kHz*, set R909 and R826 to maximum clockwise. Then set R911 to 130 W on the *lowest* frequency, and turn C821 counterclockwise until M7 decreases 1 uA.
19B	—	R909, R911, R826 (110 W models)	Set to maximum clockwise.
20	M5	L704, L705	On the *highest* frequency, tune coils in order listed for a peak MTR 5 reading. Repeat procedure to ensure peak has been attained.
21	Wattmeter	R911	Adjust for power output of 50 W (*60 W models*) or 130 W (*110 W models*).
22	Wattmeter	L705	Adjust for equal power output on the *lowest* frequency and *highest* frequency (difference of 3 W or less).
23	Wattmeter	R911	On the *lowest* frequency, adjust for a power output of 70 W (*60 W models*) or 130 W (*110 W models*). Observe power output at all frequencies. On the channel having the *lowest* power output, adjust R911 for a power output of 70 W (*60 W models*) or 130 W (*110 W models*). *On 110 W models*, note MTR 5 and then adjust R911 for a 2 uA increase on MTR 5.
24A (60 W models only)	Wattmeter	R909	On the *lowest* frequency, adjust for a power output of 65 W. Observe power output at all frequencies. If power output on any frequency is *less* than 65 W, adjust R909 for a power output of 65 W. If the difference in power output between the *lowest* frequency and the *highest* frequency is greater than 4 W, ***return to Step 19.***
24B (110 W models only)	Wattmeter	R909, R826	Select the channel with the *lowest* power output. Adjust R826 for 130 W. Observe power on all channels. If any channel is less than 130 W, readjust R826 for 130 W. Adjust R909 for 120 W. If any channel is less than 120 W, readjust R909 for 120 W. If the difference in power output between any two channels is *greater* than 10 W, ***return to Step 19.***

The multi-frequency transmitter has now been completely aligned.

FINAL METER READINGS

1. Each time a transmitter is aligned or tested, final meter readings should be made and entered in a logbook.
2. All readings given in the following table are minimum (based on a nominal dc supply voltage of 13.6 volts (except M7 (PA current) which is a maximum reading.
3. The readings at M3 and M5 are purely relative and do not give actual current or voltage measurements.
4. Multiply the microampere scale reading obtained at M7 by 0.8 to determine the approximate final amplifier current in amperes.

TRANSMITTER METERING TABLE

S1056B-9B SERIES SWITCH POSITION	3	5	7
METER READING	20 uA (min)	5 uA (min)	15 uA max (60 W models) 18 uA max (110 W models)
FUNCTION METERED	Buffer Output	Exciter Output	PA Final 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 radios 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 Hz.

NOTE
Omit Steps 5 and 6 for single frequency units.

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, using the T3 and T4 FREQ ADJ controls, respectively.

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

DEVIATION ADJUSTMENTS

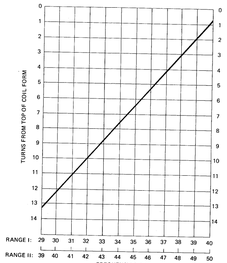
NOTE
The oscillator frequency adjustment *must* be made *prior* to this adjustment.

Step 1. Connect the output leads of the tone oscillator through a 0.33 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. Adjust 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.

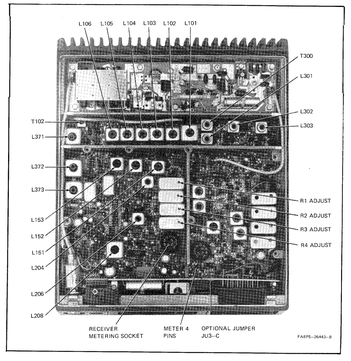
Step 4. "Private-Line" tone deviation should be between 0.5 and 1 kHz.



Exciter L701-5 Preset Chart

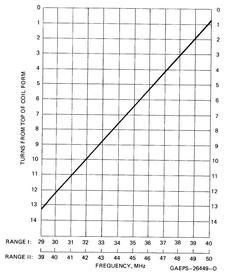
LOW BAND MITREK

RECEIVER ALIGNMENT

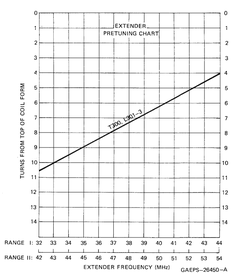


Receiver Adjustment Locations

RF Deck L101-6 and Injection Circuit L151-3 Preset Chart



Extender Preset Chart



RECEIVER PREALIGNMENT NOTES

1. The alignment procedure is written for use with the Motorola portable test set. 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 SELECTION SWITCH to the XMTR position. Switch polarity as necessary for proper M4 operation.
3. In some cases peak meter reading may occur at two points in the tuning range of a coil. Always tune to the peak where the slug is nearest the top of the coil form (away from the circuit board).
4. Receive Frequency Calculations:
   $F_{OSC} = F_C + 10.7$ MHz
   F_C = carrier frequency
   F_{OSC} = oscillator frequency
5. F_L is the lowest receive frequency.
   F_H is the highest receive 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.

RECEIVER ADJUSTMENT PROCEDURE

STEP	TEST SET METER POSITION	ADJUST	PROCEDURE
	Omit Steps 1-5 if receiver previously tuned.		
1		L101-L106 L151-L153	Preset rf deck and injection tuning slugs as shown in Preset Chart (read chart for F_L).
	Omit Step 2 on non-extender radios.		
2		T300, L301, L302, L303	Determine sampling channel frequency from EXTENDER tuning table. Preset EXTENDER tuning slugs as shown in EXTENDER Preset Chart.
3		T102	Preset the mixer drain transformer, T102, to approximately 2 turns below flush with the top of the coil form.
4		L204, L206	Preset the i-f matching network coils, L204 and L206, to 8 turns below flush with the top of the coil forms.
5	2	L208	Starting with the slug at the top of the coil form, adjust the detector coil L208, for 24 uA on meter 2 (no input signal is necessary).
	Omit Step 6 for non-extender radios.		
6	3	T300, L301, L302, L303	Set signal generator to extender frequency (see table) and set level to obtain a reading on meter 3. Tune in order for a peak on meter 3. Repeat until no further improvement is obtained.
	Perform Step 7A for all radios. Perform Steps 7B and 7C only for wide-space radios (F_H-F_L greater than 400 kHz).		
7A	6	L151, L152, L153	Set frequency switch to F_L. Adjust for peak reading on meter 6. Repeat until no further improvement is obtained.
7B	6	L151, L153	Set frequency switch to F_H. Tune L151 and L153 for a peak on meter 6. Repeat until no further improvement is obtained.
7C	6	L152	Set frequency switch to F_L. Tune L152 for a peak on meter 6. Repeat Step 7B then proceed to Step 8.
8	1 (Rev), 4	Receiver Oscillator Warp	*For each frequency:* Set the rf signal generator to the carrier frequency (± 30 Hz) and adjust the output level for a meter 1 reading of 35 uA. Activate the meter 4 circuit by shorting the meter 4 enable pins. Adjust the oscillator frequency (R1-R4 ADJUST) for a zero reading on meter 4.
9A	1 (Rev)	L101-L106	Connect an rf signal generator to the antenna connector and set to F_L. Adjust the generator level for an indication between 35 and 45 uA on meter 1. During tuning readjust the signal generator level as necessary to keep meter 1 between 35 uA and 45 uA. Tune L101-L106, in order, for a peak on meter 1. Repeat until no further improvement is obtained.
	Perform Step 9B only for wide-space radios (F_H-F_L greater than 400 kHz).		
9B	1	L101-L106	Repeat Step 9A using F_H.
	For a change of receiver frequency only, omit Steps 10 and 11.		
10	1 (Rev)	T102, L371, L372, L373, L204, L206	With any receiver frequency selected, apply standard test modulation (1 kHz modulation, ± 3 kHz deviation) to an on-channel signal generator and adjust the signal generator level for 35 uA on meter 1. Adjust T102, L371, L372, L373, L204 and L206 for a peak on meter 1, while adjusting the signal generator level to keep meter 1 between 35 uA and 45 uA (*L372 and L373 are preset only on extender radios*). Repeat until no further improvement is obtained.
11	AC voltmeter across speaker	L208	With the same conditions as in Step 10, adjust L208 slowly to produce maximum audio voltage across the speaker.
12	1 (Rev, 4)	Receiver Oscillator Warp	Repeat Step 8.

FINAL METER READINGS

In a properly tuned receiver the following meter readings should be obtained. All meter readings are purely relative and do not give actual current or voltage measurements.

RECEIVER METERING TABLE

S1056B-9B SERIES SWITCH POSITION	1	2	3	6
METER READING FOR NO INPUT SIGNAL	11 uA (min) 30 uA (max)	20 uA (min) 28 uA (max)	0 uA	10 uA (min)
METER READING FOR 200 uV INPUT AT F_{EXT}			5 uA (min)	
INPUT LEVEL ON F_{REC} FOR 35 uA METER READING	7 uV (max)			
FUNCTION METERED	Signal Strength	Detector D. C. Output	Extender RF Gain	Injection Level

EXTENDER FREQUENCY TABLE

F RECEIVE (MHz)	EXTENDER FREQUENCY
29.7-38.0	Tune the extender to F_H + 3.0 MHz.
39.0-46.0	
38.0-38.999 46.0-50.0	Tune the extender to F_L -3.0 MHz.

NOTE

In some instances, it may be necessary to retune the extender to avoid interference. If retuning is needed, the extender should ***never*** be tuned ***closer than 3 MHz*** to any receive frequency. Also, the extender should never be tuned more than ***4 MHz higher than F_H or 5 MHz lower than F_L.*** The extender may be tuned within the following bands of frequencies:

RANGE I: 32.7 MHz-44.0 MHz
RANGE II: 42.0 MHz-54.0 MHz

The national paging frequencies are approximately 35.5 MHz and 43.5 MHz. If there is a paging system in your area ***avoid*** tuning the extender near these frequencies.

EXTENDER PERFORMANCE TESTS

To check for proper extender channel operation, noise pulses must be coupled into the receiver along with the rf carrier. These pulses will degrade receiver sensitivity when the Extender is off. However, the noise pulses will have little effect when the Extender is working. The following tests may be made to verify that the Extender channel is operating properly.

Test Setup

Couple a TEK47A pulse generator modulated with an rf signal generator, to the receiver being tested. Monitor the receiver output with an ac voltmeter across the speaker.

NOTE

If another pulse generator must be used, connect it and the rf signal generator to the receiver being tested using a 3-way pad.

Continuous Pulse Blanking Effectiveness Test

This test applies high amplitude pulses to the Extender channel to verify proper noise attenuation during severe noise conditions.

Step 1. Disable the Extender by removing the option clip, (JU3), from the interconnect board.

Step 2. Apply a signal on the carrier frequency and adjust its amplitude to produce 25 dB quieting. The pulse generator should be off at this time.

Step 3. Increase the signal generator 50 dB above the 25 dB quieting level.

Step 4. Turn the pulse generator on, set it to the 10 kHz position, and increase its output level until 25 dBq is again obtained. This setting is known as a 50 dB max. pulse.

EXAMPLE

Normal 25 dB quieting	-115 dBm (0.4 uV)
25 dB quieting degraded 50 dB	-65 dBm (125 uV)

These are voltages into the radio; if the TEK47A is used, the voltages at the signal generator are typically 4 dB higher.

Step 5. Turn the pulse generator off, and enable the Extender by replacing the option clip, (JU3), at position C.

Step 6. Reset 25 dB quieting.

Step 7. When the pulse generator is turned back on, radio quieting should not be less than 20 dB.

Blanking Pulse Threshold Sensitivity Test

This test determines the amount of tolerable degradation to receiver sensitivity before blanking begins.

Step 1. Apply a signal on the carrier frequency and adjust its amplitude to produce 25 dB quieting. The pulse generator should be off at this time.

Step 2. Turn the pulse generator on, and set it to its lowest possible amplitude (at 10 kHz). Make sure that the option clip is in place (position C) so that the Extender is on.

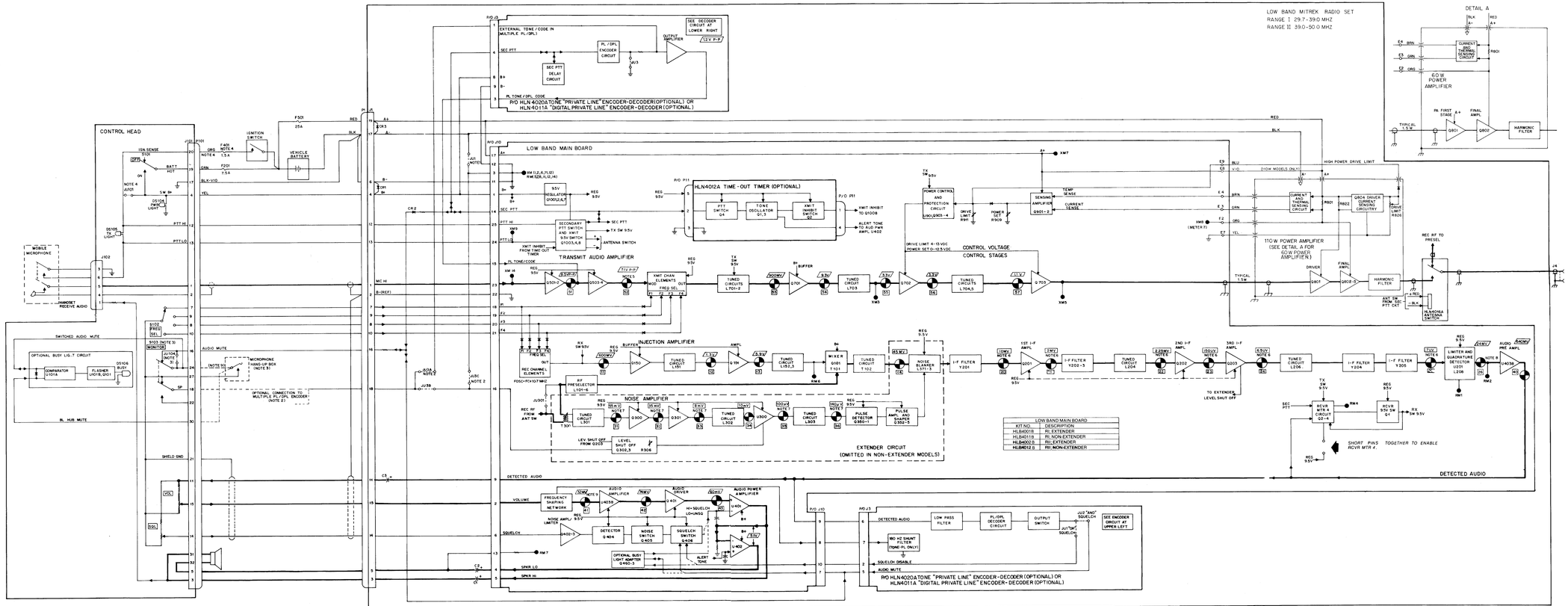
Step 3. Increase the pulse amplitude slowly until quieting no longer degrades, but begins to get better. Receiver performance should never be worse than 5 dB quieting during this test.

Level Shut-Off

This test checks for proper operation of the Extender level shut-off. It is used to disable the Extender under high level receive signal conditions.

Step 1. Perform Steps 1-6 in the Blanking Effectivenesss Test above to set 50 dB maximum pulse.

Step 2. After turning the pulse generator on, increase the rf signal generator slowly until a sharp increase in noise is heard in the speaker. At this point, the Extender circuitry is turned off. This should occur between 50 uV and 150 uV into the radio (80 uV and 240 uV on the generator when using the TEK47A).



NOTES:

1. JU1 ON INTERCONNECT BOARD IS REQUIRED ONLY IN INSTALLATIONS USING MOCOM-70 MOTRAC CABLE KITS. JU1 MUST BE OMITTED FROM INTERCONNECT BOARD IN POSITIVE GROUND INSTALLATIONS USING MITREK CABLE KIT; IT MAY BE OMITTED IN NEGATIVE GROUND INSTALLATIONS USING MITREK CABLE KIT.
2. JU3 NORMALLY OMITTED FROM INTERCONNECT BOARD. FOR EXTENDER MODELS JU3 IN POSITION C PROVIDES GROUND TO ENABLE EXTENDER. A SECOND JUMPER CLIP MAY BE INSTALLED IN POSITION A WHEN MULTIPLE PL/DPL ACCESSOREIS ARE USED.
3. JU104 IS INSTALLED, AND A HANG-UP BOX WITH MONITOR SWITCH IS USED IN PL/DPL SYSTEMS IF S103 IS USED FOR EXTENDER OR SP.
4. JU101 ***MUST*** BE OMITTED IF OPTIONAL ORANGE IGNITION SWITCH WIRE IS USED. WHEN THIS OPTION IS INSTALLED, TRANSMITTER USE REQUIRES IGNITION SWITCH TO BE ON. RADIO MAY BE USED IN RECEIVE ONLY MODE WITH IGNITION SWITCH OFF.
5. VOLTAGES IN TRANSMIT AUDIO CIRCUIT MEASURED WITH A 1 VOLT, 1000 HZ SIGNAL INJECTED AT MICROPHONE CONNECTOR.
6. VOLTAGES IN IF CIRCUIT ARE LEVEL OF ON-CHANNEL SIGNAL REQUIRED AT ANTENNA JACK TO PRODUCE 100 MV AT POINT INDICATED.
7. VOLTAGES IN EXTENDER CIRCUIT ARE LEVEL OF SIGNAL AT SAMPLING CHANNEL FREQUENCY REQUIRED AT ANTENNA JACK TO PRODUCE 100 MV AT POINT INDICATED.
8. VOLTAGES IN RECEIVE AUDIO CIRCUIT MEASURED WITH VOLUME CONTROL SET TO PRODUCE 32 MV AT POINT 41 WITH RECEIVED CARRIER DEVIATED 3 KHZ BY A 1000 HZ AUDIO TONE.
9. FOR BUSY LIGHT RADIOS, HUB CONNECTS TO TO 30 INSTEAD OF Z4.

LOW BAND 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
200-299	I-F
300-399	Extender Circuit
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

HLN4016A Antenna Switch is not field repairable and replacements should be ordered as a unit.

NOTE

The MITREK radio uses metric hardware; a hardware kit is available from Motorola National Parts. Order the RFX4062A MITREK Metric Hardware Kit.

68P81039E33-C
(Sheet 1 of 5)
6/30/80-PHI

parts list

LEGEND

L = RANGE I — 29.7 to 39 MHz
M = RANGE II — 39 to 50 MHz

PID HLB4001A, 4011A Main Board Transmitter Section (Range I)
PID HLB4002A, 4012A Main Board Transmitter Section (Range II) PL-6054-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF ±5%; 500 V; unless otherwise stated
C501	21-83596E36	.01 uF + 60-40%; 250 V
C502	21-83596E10	220 uF ±20%
C503, 504	8-84637L31	.047 uF ±10%; 250 V
C505, 506	21-83596E10	220 uF ±20%
C507	8-84496D03	.01 uF ±10%; 250 V
C508	8-82905G40	.02 uF; 50 V
C509	8-83813H44	.0012 uF; 100 V
C511	23-84685F03	100 uF + 100-10%; 25 V
C701L	21-80067A47	33; 100 V
C701M	21-83406D93	16
C702L	21-82450B32	2.7
C702M	21-82450B13	1.5
C703L	21-82610C02	43; 200 V
C703M	21-83406D56	24
C704L	21-84807K29	250
C704M	21-82204B54	150
C705	21-83596E36	.01 uF + 60-40%; 250 V
C706	21-83596E36	.01 uF + 60-40%; 250 V
C707L	21-80169A55	57; 200 V
C707M	21-80067A47	33; 100 V
C708L	21-82204B54	150; 200 V
C708M	21-80067A62	82; 200 V
C709	21-82187B44	.001 uF ± 10%; 100 V
C710L	21-80169A50	40; 200 V
C710M	21-83406D67	22
C711L	21-82450B32	2.7
C711M	21-82450B13	1.5
C712L	21-82610C02	43; 200 V
C712M	21-83406D67	22
C713L	21-80067A47	33; 100 V
C713M	21-84493B36	27
C714	21-82187B44	.001 uF ± 10%; 100 V
C715L	21-84493B36	27
C715M	21-84493B36	27
C716L	21-82610C09	120; 200 V
C716M	21-84493B33	100; 200 V
C717	21-82187B47	.0012 uF ± 10%
C718	21-82372C09	0.1 uF + 80-20%; 25 V
C719, 720	21-83596E36	.01 uF + 60-40%; 250 V
C721	21-82450B13	1.5
C722	21-83596E36	.01 uF + 60-40%; 250 V
C723	21-82450B13	1.5
C724	21-83596E36	.01 uF + 60-40%; 250 V
C759	21-82372C10	.05 uF + 20%; 25 V
C902	21-82187B44	.001 uF ± 10%; 100 V
C907	21-82187B44	.001 uF ± 10%; 100 V
C908	21-83596E37	.01 uF + 70-30%; 100 V
C909	21-82187B44	.001 uF ± 10%; 100 V
C910	23-84538G04	15 uF + 20%; 20 V
C914	21-82372C10	.05 uF + 20%; 25 V
C916	23-84538G02	4.7 uF + 20%; 20 V
C917	21-82187B44	.001 uF ± 10%; 100 V
C918, 919	21-82372C10	.05 uF + 20%; 25 V
C930L	21-83596E36	.0047
C930M	21-83596E24	.0033
C1004	21-83596E37	.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	.01 uF + 80-20%; 200 V
		diode: (see note)
CR601 thru 604	48-83654H01	silicon
CR701	48-82466H13	silicon
CR702, 703	48-82139G01	germanium
CR901	48-82466H13	silicon
CR902	48-82466H13	silicon
CR905	48-83654H01	silicon
CR907	48-82466H13	silicon
CR908	48-82466H13	silicon
CR1001	48-83654H02	silicon
CR1003	48-83654H01	silicon
CR1005	48-83654H01	silicon
CR1006	48-82466H13	silicon
		connector, receptacle:
J701	9-80028A01	female; 3 contact
J901	9-80028A01	female; 3 contact
J1002	9-80031C02	female; 12 contact
J1003	9-80028A01	female; 3 contact
		coil:
L515	24-80036A02	choke; ferrite, 1/2 turn
L701L	24-80068A09	variable; coded green
L701M	24-80068A08	variable; coded yellow
L702	24-80068A06	variable; coded white
L703	24-80068A10	variable; coded blue
L704L	24-80068A08	variable; coded yellow
L704M	24-80068A07	variable; coded orange
L705	24-80068A06	variable; coded white
L706	24-83961B01	choke; ferrite, 3-1/2 turns
L707	24-83884G05	choke;9 1/2 T coded white
L708	24-82835G13	choke; 0.82 uH
L710	24-82835G13	choke; 0.82 uH
L711, 712	24-82835G13	choke; 0.82 uH
L901	24-82835G23	choke; 33 uH
P601 thru 604	28-80096A02	**connector, plug:** male; 5 contact
		translator: (see note)
Q501	48-869643	PNP; type M9643
Q502, 503	48-869642	NPN; type M9642
Q504	48-869643	PNP; type M9643
Q701, 702	48-869932	NPN; type M9932
Q703	48-869953	NPN; type M9953
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	6-124A53	68k
R508, 509	6-124C73	10k
R510	6-124A69	6.8k ±5%
R511, 512	6-124A70	7.5k ±5%
R513	6-124C43	560
R514	6-124C01	10
R701	6-124A60	3k ±5%
R702	6-124A49	1k ±5%
R703	6-124D55	2.7 ±5%
R704	6-124A19	56 ±5%
R705	6-124A89	47k ±5%
R706	6-124A53	1.5k ±5%
R707	6-124A32	200 ±5%
R708	6-124A73	10k ±5%
R709	6-124B06	220k ±5%
R711	6-125A32	200 ±5%; 1/2 W
R907	6-124A81	22k ±5%
R908	6-124C55	1.8k
R909	18-83311K05	variable; 5k
R910	6-124C89	39k
R911	18-83311K08	variable; 50k
R912	6-124A79	18k ±5%
R913	6-124A73	10k ±5%
R914	6-124A97	100k ±5%
R915	6-124A27	120 ±5%
R916	6-124C65	4.7k
R917	6-124C65	4.7k
R918	6-124A39	390 ±5%
R919	6-125C29	150; 1/2 W
R920	6-124C25	100
R921	6-124C43	560
R922	6-124C49	1k
R924	6-124A29	150 ±5%
R926	6-124A33	220 ±5%
R927	6-124C57	2.2k
R940	6-124A90	51k ±5%
R941	6-124C49	1k
R942	6-124C25	100
R1001	6-124A53	1.5k ±5%
R1002	6-124A22	75 ±5%
R1003	6-124A19	56 ±5%
R1004	6-124A53	1.5k ±5%
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, 1016	6-124C67	5.6k
R1017	6-124A39	390 ±5%
		integrated circuit: (see note)
U901	51-846217K70	type M217
		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
		non-referenced item
	29-80020A01	CAN, coil, for L701 thru L705
	29-80014A01	CLIP, coax term

HLN4044A Interconnect Board PL-6030-E

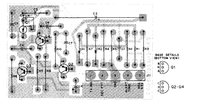
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C1, 2	23-83210A19	500 uF + 100-10%; 20 V
C3	23-82783B25	4.7 uF + 10%; 25 V
C11 thru 29	21-84874K01	470 pF ± 20%; 25 V (feed thru)
		diode: (see note)
CR1	48-82525G19	silicon
CR2	48-83654H01	silicon
CR3	1-80701T76	silicon
CR4	48-82466H18	silicon
		connector, receptacle:
J1	1-80701T74	connector, assembly; includes C11-C29
J3	9-80180B02	female; 9 contact
J10	9-80180B03	female; 25 contact
		resistor, fixed:
R2	6-124C55	1.8k ± 10%; 1/4 W
R4	6-124C33	220 ± 10%; 1/4 W
		mechanical parts
	42-80088A01	CLIP, option

HLN4012A Time-Out-Timer PL-6032-E

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	23-84539G01	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
C9	21-83406D81	20 pF ± 5%; 500 V
		diode: (see note)
CR1, 2	48-83654H01	silicon
		connector, receptacle:
P11	9-80098A01	female; 5 contact
		translator: (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%

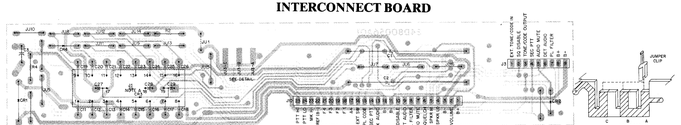
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TIME-OUT TIMER

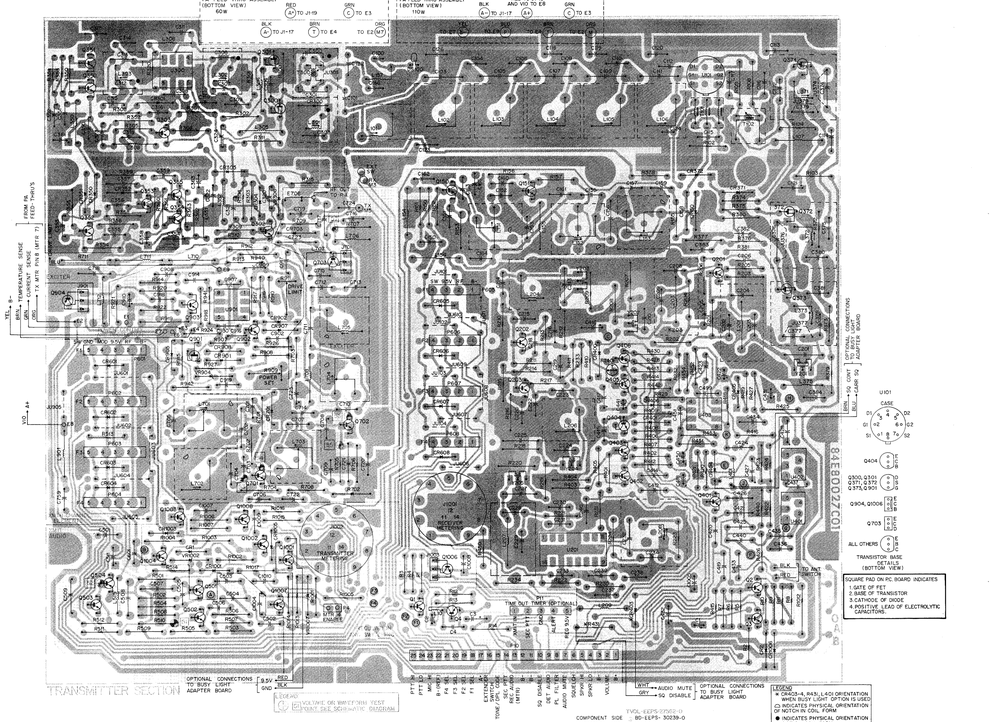


SHOWN FROM SOLDER SIDE

INTERCONNECT BOARD



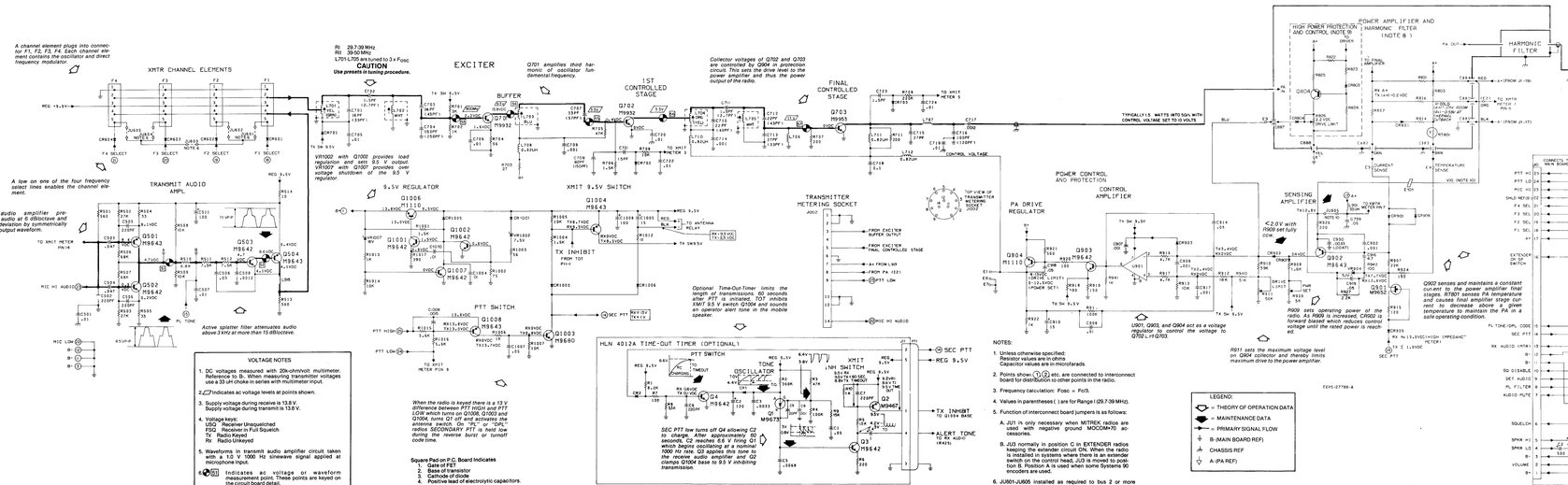
SHOWN FROM SOLDER SIDE



SHOWN FROM SOLDER SIDE

LOW BAND MITREK RADIO

TRANSMITTER SECTION



TRANSMITTER SECTION/RECEIVER SECTION BOARD DETAIL

68P81039E33-C
(Sheet 2 of 5)
6/30/80-PHI

LOW BAND MITREK RADIO

RECEIVER SECTION BOARD DETAIL

parts list

LEGEND
L = RANGE I — 29.7 to 39 MHz
M – RANGE II — 39 to 50 MHz

P/O HLB4001B, 4011B Main Board Receiver section (Range I)
P/O HLB4002B, 4012B Main Board Receiver section (Range II) PL-6057-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
All 300 series components except C372 and L371 are omitted on HLB4011B and HLB4012B		
		capacitor, fixed: ± 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 ± 20%; 20 V
C4	21-84493B41	100 pF ± 10%; 100 V
C100	21-84713A29	20 pF
C101L	21-83406D87	43 pF
C101M	21-83406D69	30 pF
C103L	21-82450B10	4.3 pF
C103M	21-82450B17	2.2 pF
C104L	21-83406D71	33 pF
C104M	21-83406D67	22 pF
C105L	21-82450B14	2.4 pF
C105M	21-82450B19	1.8 pF
C106L	21-83406D92	36 pF
C106M	21-83406D67	22 pF
C107L	21-82450B18	2 pF
C107M	21-82450B13	1.5 pF
C108L	21-83406D92	36 pF
C108M	21-83406D67	22 pF
C109L	21-82450B14	2.4 pF
C109M	21-82450B19	1.8 pF
C110L	21-83406D92	36 pF
C110M	21-83406D67	22 pF
C111L	21-82450B13	3 pF
C111M	21-82450B18	2 pF
C112L	21-83406D89	10 pF
C113	21-82372C10	.05 uF ± 20%; 25 V
C114	21-82372D08	.02 uF + 80-20%; 25 V
C118, 119, 120	21-82372C10	.05 uF ± 20%; 25 V
C115	21-83596E36	.01 uF + 80-40%; 250 V
C116, 117	21-82204B54	150 pF; 200 V
C121	23-84538G04	15 uF ± 20%; 20 V
C122, 123	21-82372C10	.05 uF ± 20%; 25 V
C124	21-82877B23	100 pF ± 10%; 75 V
C126	21-82372C10	.05 uF ± 20%; 25 V
C150	21-82877B46	390 pF ± 10%
C151L	21-82187B50	470 pF ± 10%
C151M	21-82187B46	390 pF ± 10%
C152L	21-83406D68	27 pF
C152M	21-83406D93	16 pF
C153L	21-82610C09	120 pF; 200 V
C153M	21-84493B14	68 pF; 200 V
C155L	21-83406D91	22 pF
C155M	21-82204B41	13 pF
C156L	21-82204B13	1.5 pF
C156M	21-82450B46	0.62 pF
C157L	21-83406D67	22 pF
C157M	21-83406D95	14 pF
C158	21-82450B18	2 pF
C159	21-83596E36	.01 uF + 60-40%; 250 V
C160	21-82187B46	390 pF ± 10%
C161, 162	21-83596E36	.01 uF + 60-40%; 250 V
C163	21-84493B58	560 pF; 100 V
C164	21-83596E36	.01 uF + 10%
C165	21-83596E13	.001 uF + 10%; 100 V
C166L	21-82877B15	120 pF
C166M	21-82336G12	100 pF; NOBO
C201	21-82450B35	0.2 pF ± 10%
C202	21-82372C10	.05 uF ± 20%; 25 V
C203	21-83406D87	43 pF
C204	21-83406D56	24 pF
C205, 206	21-82372C10	.05 uF ± 20%; 25 V
C208	21-83406D68	27 pF
C209	21-83406D56	24 pF
C210	21-83406D67	22 pF
C213	21-82450B33	0.56 pF
C214	21-80168A55	57 pF; 200 V
C215	21-80171A61	80 pF ± 10%; 250 V
C216	21-82372C10	.05 uF ± 20%; 25 V
C218	21-82187B44	.001 uF ± 10%; 100 V
C219	21-84538G02	4.7 uF ± 20%; 20 V
C220	21-82372C10	.05 uF ± 20%; 25 V
C222	21-80168A55	57 pF; 200 V
C223	21-84493B32	82 pF; 200 V
C224	21-83406D67	22 pF
C225	21-82450B50	0.15 uF ± 10%
C227	21-82450B46	0.62 pF
C228	21-84493B27	51 pF; 200 V
C229	21-83406D94	9 pF ± .5 pF
C230	21-82372C10	.05 uF ± 20%; 25 V
C231	21-83596E36	.01 uF + 60-40%; 250 V
C232	21-82450B46	0.62 pF
C233	21-83596E38	.0047 uF + 10%; 100 V
C234	21-80168A55	57 pF; 200 V
C237	21-83596E38	.0047 uF + 10%; 100 V
C238	21-82372C10	.05 uF ± 20%; 25 V
C239	8-84637L02	.033 uF; 250 V
C240	8-84637L29	.001 uF + 10%; 630 V
C300L	21-84493B47	270 pF; 200 V
C300M	21-83406D87	43 pF
C301L	21-82450B23	1.8 pF ± 10%
C301M	21-82450B22	1.6 pF ± 10%
C303L	21-80067A57	62 pF; 200 V
C303M	21-84493B59	39 pF
C304	21-83596E37	.01 uF + 70-30%; 100 V
C306L	21-80171A85	100 pF; 200 V
C306M	21-84493B14	68 pF; 200 V
C307L	21-82204B54	150 pF; 200 V
C307M	21-82204B68	90 pF; 100 V
C308, 309	21-83596E37	.01 uF + 70-30%; 100 V
C311	21-83596E37	.01 uF + 70-30%; 100 V
C312L	21-82204B54	150 pF; 200 V
C312M	21-84493B31	47 pF; 200 V
C313	21-82204B68	90 pF; 100 V
C314	21-82372C10	.05 uF ± 20%; 25 V
C315L	21-83406D95	14 pF
C315M	21-83406D64	5.6 pF ± .25 pF
C316 thru 319	21-83596E37	.01 uF + 70-30%; 100 V
C320	21-80067A12	4.25 pF ± 0.25 pF
C321, 322, 323	21-83596E37	.01 uF + 70-30%; 100 V
C324	21-84538G04	15 uF ± 20%; 20 V
C350	21-82372C10	.05 uF ± 20%; 25
C351	21-84493B41	100 pF ± 10%; 200 V
C352	21-83596E36	.01 uF + 60-40%; 250 V
C353	21-82610C03	47 pF; 200 V
C354	23-84538G04	15 uF ± 20%; 20 V
C355	21-82372C10	.05 uF ± 20%; 25 V
C356	21-83596E38	.0047 uF + 10%; 100 V
C357	21-82204B54	150 pF; 200 V
C358	21-83596E36	.01 uF + 80-40%; 250 V
C359	21-83406D79	18 pF
C361	23-84665F04	1 uF + 150-10%; 50 V
C363	23-84665F04	1 uF + 150-10%; 50 V
C372	21-84493B31	47 pF; 200 V
C374	21-82450B11	3 pF
C375	21-84493B31	47 pF; 200 V
C376	21-82450B19	1.8 pF
C377	21-82610C09	120 pF
C378	21-82204B68	90 pF; 100 V
C379, 380, 381	21-83596E36	.01 uF + 80-40%; 250 V
C382	21-83406D81	20 pF
C383	21-82610C03	47 pF; 200 V
C384	21-82372C10	.05 uF ± 20%; 25 V
C412	8-84637L37	0.1 uF ± 10%; 100 V
C414	8-84637L31	.047 uF ± 10%; 250 V
C414	21-84549B18	390 pF
C416	23-84538G04	15 uF ± 20%; 20 V
C417	23-84538G02	4.7 uF ± 20%; 20 V
C418	23-84665F01	10 uF + 100-10%; 25 V
C419	8-84637L28	.018 uF ± 10%; 250 V
C420	8-84637L27	.022 uF ± 10%; 250 V
C421	8-84637L02	.033 uF ± 5%; 250 V
C422	23-84665F01	10 uF + 100-10%; 25 V
C423	8-84637L32	.0068 uF ± 10%; 630 V
C424	8-84637L24	.068 uF ± 10%; 250 V
C425	8-84637L25	.01 uF ± 10%; 400 V
C426	8-84637L26	.0047 uF ± 10%; 630 V
C427, 428	23-84538G04	15 uF ± 20%; 20 V
C431	23-84665F04	1 uF + 150-10%; 50 V
C432	23-84665F06	220 uF + 150-10%; 25 V
C433, 434	8-84637L33	0.1 uF ± 10%; 100 V
C435, 436, 437	21-83596E10	220 pF ± 20%
C440	8-84637L27	.022 uF ± 10%; 250 V
C441	23-84665F01	10 uF + 150-10%; 25 V
C450	23-84665F01	10 uF + 150-10%; 25 V
C451	21-83596E10	220 pF ± 20%
C499	21-82187B44	.001 uF
		diode: (see note)
CR1, 2	48-83654H01	silicon
CR150	48-82139G01	germanium
CR300	48-83654H01	silicon
CR301	48-82139G01	germanium
CR304, 305	48-83654H01	silicon
CR350, 351	48-82139G01	germanium
CR352	48-83654H01	silicon
CR371, 372	48-83654H01	silicon
CR400, CR401, CR403 thru 406	48-83654H01	silicon
CR605 thru 608	48-83654H01	silicon
		lamp, glow:
DS100	65-82267D02	neon; type NE 2 V
		connector, receptacle:
J1001	9-82748G01	female; 12 contact
		coil:
L10	76-83960B01	ferrite bead; 1/2 turn
L101L	24-80068A06	9 1/2 turns; core coded RED
L101M	24-80068A07	9 1/2 turns; core coded GRN
L102L	24-80068A06	9 1/2 turns; core coded RED
L102M	24-80068A07	9 1/2 turns; core coded GRN
L103L	24-80068A06	9 1/2 turns; core coded RED
L103M	24-80068A07	9 1/2 turns; core coded GRN
L104L	24-80068A06	9 1/2 turns; core coded RED
L104M	24-80068A07	9 1/2 turns; core coded GRN
L105L	24-80068A06	9 1/2 turns; core coded RED
L105M	24-80068A07	9 1/2 turns; core coded GRN
L106L	24-80068A31	13 1/2 turns; core coded RED
L106M	24-80068A32	13 1/2 turns; core coded GRN
L107	24-82549D42	choke; 10 uH
L151L	24-80068B22	9 0.5 uF ± 10%
L151M	24-80068A25	9 1/2 turns; core coded RED
L152L	24-80068A27	9 1/2 turns; core coded RED
L152M	24-80068A27	9 1/2 turns; core coded RED
L153L	24-80068A27	9 1/2 turns;core coded RED
L153M	24-80068A28	9 1/2 turns; core coded RED
L154, 155, 156	24-82635G13	choke; 0.82 uH
L157	24-83804B68	90 pF; 100 V
L201	24-82549D51	choke; 10 uH
L203	24-82549D52	choke; 12 uH
L204	24-84419D03	33 1/2 turns; form coded GRN
L206	24-84419D31	33 1/2 turns form coded GRN
L207	24-82549D52	choke; 12 uH
L208	24-80133A07	26 1/2 turns
L209	24-82835G20	choke; 9.3 uH
L301, 302, 303	24-84216L02	6 1/2 turns
L304, 305, 306	24-82723H07	choke; 10 uH
L308	24-82723H07	choke; 10 uH
L350, 351, 352	24-82723H07	choke; 10 uH
L371, 372, 373	24-82723H07	choke; 10 uH
L375	24-82723H07	choke; 10 uH
L401	24-82723H05	choke; .41 uH
		connector, plug:
P4	28-80181B04	male; 2 contact
P10	28-80181B03	male; 25 contact
P11	28-80099E18	male; 5 contact
P605 thru 608	28-80096A01	male; 4 contact
		transistor: (see note)
Q1, 2, 3	48-869643	PNP; type M9643
Q4	48-869642	NPN; type M9642
Q150, 151	48-869643	PNP; type M9643
Q201, 202, 203	48-869494	NPN; type M9494
Q300, 301	48-869693	field-effect type M9653
Q302	48-869570	NPN; type M9570
Q303	48-869571	PNP; type M9571
Q350, 351	48-869570	NPN; type M9570
Q352	48-869571	PNP; type M9571
Q353	48-869570	NPN; type M9570
Q354, 355	48-869571	PNP; type M9571
Q371, 372, 373	48-869653	field-effect; type M9653
Q401, 402, 403	48-869642	NPN; type M9642
Q404	48-1346T41	NPN; type M54
Q405	48-869642	NPN; type M9642
Q406	48-869528	NPN; type M9528
		resistor, fixed ± 5%; 1/4 W: unless otherwise stated
R1	6-124AS9	2.7k
R2	6-124C91	56k ± 10%
R3	6-124AS3	1.5k
R4	6-124AS5	4.7k
R5	6-124C77	15k ± 10%
R6	6-124AS1	22k
R7	6-124A13	10
R8	6-124C73	10k ± 10%
R9	6-124C77	15k ± 10%
R10	6-124C83	27k ± 10%
R11	6-124A41	470
R12	6-124C77	15k ± 10%
R13	6-124C85	68k ± 10%
R14	6-124C65	4.7k ± 10%
R102	6-124A35	270
R103	6-124C17	47 ± 10%
R104	6-124A14	36
R106, 109	6-124B55	2.7
R150	6-124A29	150
R151	6-124A80	20k
R152	6-124AS8	43k
R153	6-124A39	390
R155	6-124C83	27k ± 10%
R156L	6-124A49	1k
R156M	6-124AS1	1.2k
R157L	6-124AS2	75
R157M	6-124A13	33
R201	6-124A49	1k
R202	6-124A79	18k
R203	6-124AS7	39k
R204	6-124A37	330
R205	6-124A09	22
R206	6-124AS9	2.7k
R207	6-124AS3	27k
R208	6-124AS5	680
R209	6-124AS3	27k
R210	6-124AS9	6.8k
R211	6-124AS3	27k
R212	6-124A47	820
R213	6-124AS1	3.3k
R214	6-124AS3	27k
R215	6-124AS9	6.8k
R216	6-124A47	820
R217	6-124AS1	3.3k
R218	6-124AS3	27k
R219	6-124AS5	680
R220	6-124AS3	27k
R221	6-124AS6	2k
R222	6-124C95	82k ± 10%
R223	6-124AS3	27k
R224	6-124C85	4.7k ± 10%
R230	6-124C49	1k ± 10%
R231	6-124A70	7.5k
R232	6-124AS1	68
R233	6-124A13	33
R300	6-124AB90	220k
R301	6-124AS1	22k
R301M	6-124AB9	6.8k
R302	6-124AC25	100 ± 10%
R303	6-124C57	2.2k ± 10%
R304	6-124C77	15k ± 10%
R305	6-124C49	1k ± 10%
R306	6-124A73	10k
R307	6-124C57	2.2k ± 10%
R308	6-124AS9	6.8k
R309	6-124D10	330k ± 10%
R310	6-124AS7	120
R311	6-124C85	4.7k ± 10%
R315	6-124A73	10k
R320L	6-124C57	2.2k ± 10%
R350	6-124C51	1.2k ± 10%
R351	6-124C73	10k ± 10%
R352	6-124A35	270
R353	6-124C57	2.2k ± 10%
R354	6-124C57	2.2k ± 10%
R355	6-124C79	18k ± 10%
R356	6-124A41	470
R357	6-124C65	4.7k ± 10%
R359	6-124C83	27k ± 10%
R360	6-124C65	4.7k ± 10%
R361	6-124AS8	6.2k
R362, 363	6-124C63	3.9k ± 10%
R372, 373	6-124C49	1k ± 10%
R374	6-124C65	4.7k ± 10%
R375	6-124C73	10k ± 10%
R376	6-124C57	2.2k ± 10%
R377	6-124C95	82k ± 10%
R378	6-124C55	1.8k ± 10%
R379	6-124C57	2.2k ± 10%
R380	6-124C67	5.6k ± 10%
R381	6-124C73	10k ± 10%
R401	6-124A94	75k
R402	6-124A69	6.8k
R403	6-124A45	680
R404	6-124A84	30k
R405	6-124A81	22k
R406	6-124A73	10k
R407	6-124A49	1k
R408	6-124AS7	2.2k
R409	6-124AS9	47k
R410	6-124C57	2.2k ± 10%
R411	6-124A73	10k
R412	6-124A72	9.1k
R413	6-124A79	18k
R414	6-124A29	150
R415	6-124C73	10k ± 10%
R416	6-124A73	10k
R418	6-124A97	100k
R419	6-124C73	10k ± 10%
R420, 421	6-124AS7	5.6k
R422	6-124A40	430
R423	6-124A09	22
R424	6-124A03	12
R425	6-124A45	680
R426, 427	6-124D55	2.7 ± 10%
R428	6-124AS2	24k
R429	6-124AS8	6.2k
R430	6-124A71	8.2k
R431	6-124C85	33k ± 10%
R440	6-124C49	1k ± 10%
R442	6-124C93	68k ± 10%
R450	6-124C73	10k ± 10%
R451	6-124AS7	5.6k
R452	6-124AS1	3.3k
R453	6-124B02	150k
R454	6-124C67	5.6k ± 10%

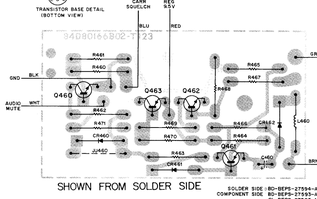
be ordered by Motorola part numbers.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
RT401	6-83600K08	**thermistors:** 20k ± 10% at 25 °C
		transformer:
T101	24-80095A01	balance mixer input
T102	24-80094A01	balance mixer output (tunable)
T300	24-84276L01	pri. 1 1/4 turns sec. 8 1/4 turns
		integrated circuit: (see note)
U101	48-84412L16	field-effect; dual match; type M1216
U201	51-84320A78	type M2078
U300	51-84320A62	type MC1350P
U401, 402	51-80065C01	type M2160
U403	51-84621K76	type M2176
		voltage regulator: (see note)
VR306	48-82256C12	Zener type; 5.6 V
		crystal:
Y201	48-84396K05	10.7 MHz
Y202 thru 205	48-84396K02	10.7 MHz
		non-referenced items
	26-80196A01	CAN, coil for L101
	26-80020A01	CAN, coil for L102 thru L106, L151 thru L153, and L701 thru L705
	26-80121A01	CAN, shield for L201 and L203
	26-80204A01	CAN, coil for L204 and L206
	26-80121A01	CAN, shield for L207
	1-80700T60	CAN, grommet assy. for L208
	26-80039A02	CAN, coil for L300 thru L303
	1-90070T55	CAN, grommet assy. for L371 thru L373
	26-80033A01	SHIELD, quadrature
	7-84264B01	BRACKET, lamp holder
	75-0529SB01	INSULATOR, circuit, (5 used)

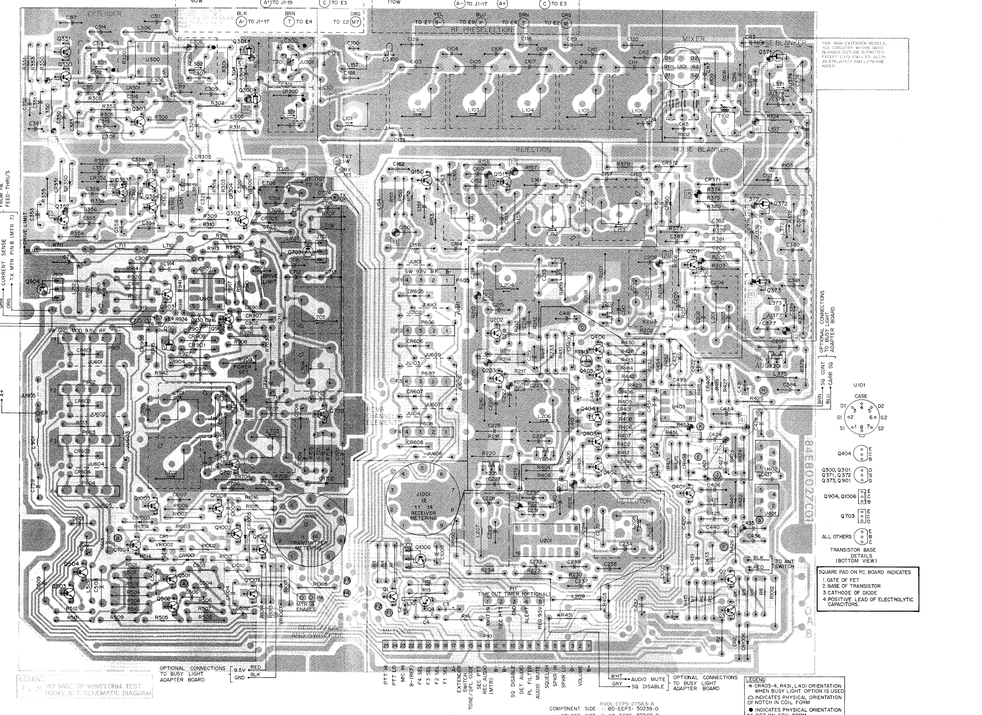
HLN4119A Busy Light Adapter Board PL-6323-A

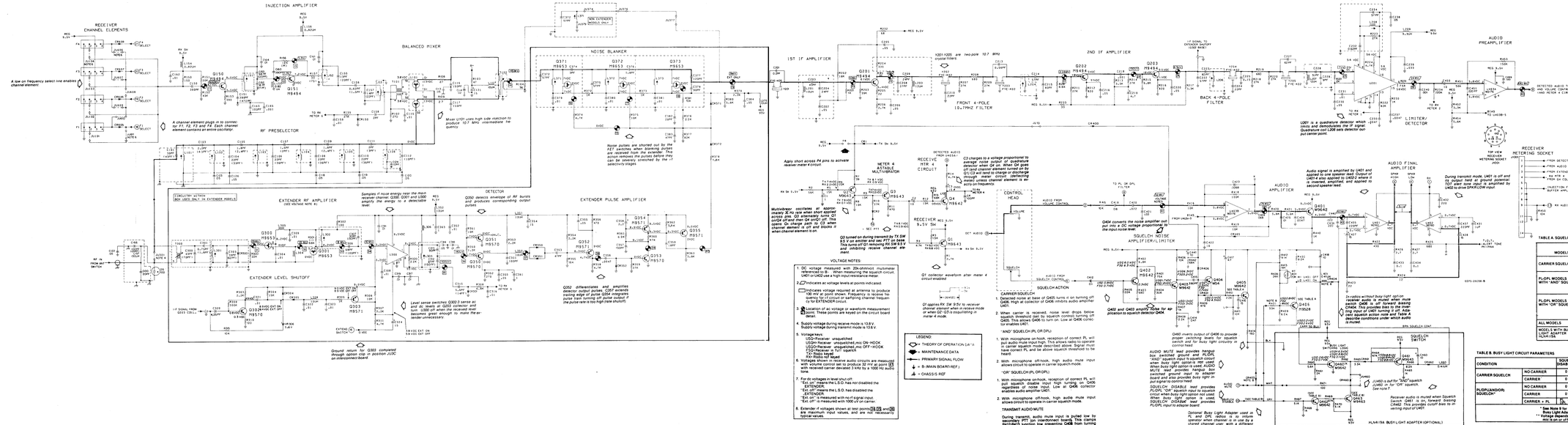
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C460	23-84665F01	**capacitor, fixed:** 10 uF
L460		**choke:** 0.41 uH
R460	6-124A67	**resistor, fixed: ± 5%; 1/4 W;** unless otherwise stated 5.6k
R461	6-124AS6	2k
R462	6-124A49	1k
R463	6-124A61	3.3k
R464	6-124AS5	4.7k
R465	6-124A49	1k
R466	6-124A71	8.2k
R467	6-124AS6	5.1k
R468	6-124A49	1k
R469	6-124AS5	4.7k
R470	6-124AS6	5.1k
R471	6-124AS5	100
CR460 thru 462	48-83654H02	**diode: (see note)** silicon
Q460	48-869642	**transistor: (see note)** NPN; type M9642
Q461	48-869643	PNP; type M9643
Q462	48-869642	NPN; type M9642
Q463	48-869643	PNP; type M9643

BUSY LIGHT ADAPTER



SHOWN FROM SOLDER SIDE





NOTES:
1. Unless otherwise specified: Resistor values are in ohms. Capacitor values are in microfarads (MF = 10-6)
2. Points shown (1) (2) etc. are connected to interconnect board.
3. Frequency calculation: $F_{OSC} = F_C + 10.7$ MHz
4. JU301 used only for non-extender models.
5. Component values shown in ( ) are for range 1 only. See parts list.
6. JU611 installed in single frequency radios to enable F1 bus for test elements. JU604-JU610 installed as required to bus 2 or more channel select lines to a single channel element. Multi-mode channels use the same receive frequency.
7. JU460 in for "AND" squelch, out for "OR" squelch. When busy light option is used: JU460 wire determines the type of squelch used by the radio. JU460 in for "AND" squelch, JU2 on PL board or JU4 on DPL board must be out.
8. CR403, CR404, R431, and L401 are omitted when busy light option is used and wires from Busy Light Adapter Board solder to holes normally occupied by these components.

TABLE A. SQUELCH CIRCUIT PARAMETERS

MODELS	CONDITION	AUDIO MUTE (7)	SQUELCH DISABLE (5)	SQUELCH SWITCH SWITCH Q405	MUTE SWITCH COLLECTOR Q406
CARRIER SQUELCH	NO CARRIER	0.8V	1.2	1.2–3.5V	1.5–5.0 V
	CARRIER PRESENT	0.6V	0.8 V	0.5 V	0.2 V
PL-DPL MODELS WITH "AND" SQUELCH	NO CARRIER	0.8V	0.4 V	1.2–3.5V	1.5–5.0 V
	CARRIER + PL OR DPL	0.6 V	0.4 V	0.5 V	0.2 V
	CARRIER W/O PL OR DPL	1.8 V	0.4 V	1.2–3.5 V	1.5–5.0 V
PL-DPL MODELS WITH "OR" SQUELCH	NO CARRIER	1.8 V	0.4 V	1.2–3.5 V	1.5–5.0 V
	CARRIER + PL OR DPL	1.6 V	PL 0.1 V, DPL 1.8 V	0.5 V	0.2 V
	CARRIER W/O PL OR DPL	1.8 V	0.4 V	1.2–3.5V	1.5–5.0 V
ALL MODELS	RADIO KEYED	1.1 V	0.3 V	0.5 V	3.5 V
MODELS WITH BUSY LIGHT ADAPTER HLN4159A	NO CARRIER	TABLE B	TABLE B	1.2–3.5V	4.5V
	CARRIER PRESENT	TABLE B	TABLE B	0.0V	0.2V

TABLE B. BUSY LIGHT CIRCUIT PARAMETERS

CONDITION		SQUELCH DISABLE (5)	Q403 COLLECTOR	Q402 COLLECTOR	AUDIO MUTE (7)
CARRIER SQUELCH	NO CARRIER	0V	1.4–2.5**	9.4 V	1.4–2**
	CARRIER	0V	5.5–8.6 V**	9.4 V	3.9–8.6 V**
PL/DPL(ANDOR) SQUELCH*	NO CARRIER	0V	1.4–2.5**	9.4 V	1.4–2**
	CARRIER	0V	5.5–8.6 V**	9.4 V	3.9–8.6 V**
	CARRIER + PL	PL 0.1V, DPL 1.8V	9.4 V	0.1 V	9.4 V

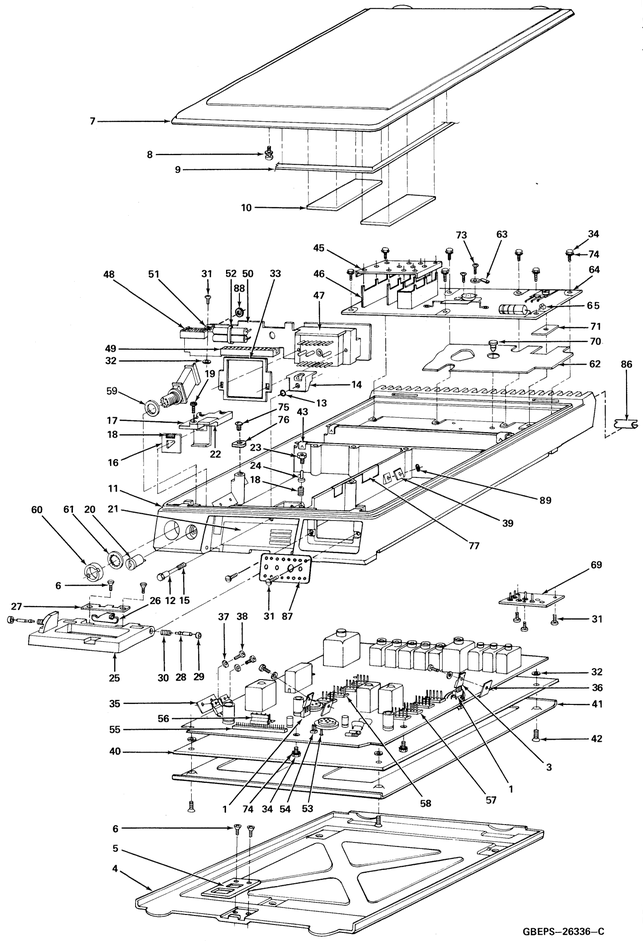
* See Note 9 for proper installation of PL/DPL jumpers when Busy Light Adapter HLN4159A is used.
** Voltage depends on whether or not JU460 is in or out, and if mic is on or off hook.

LOW BAND MITREK RADIO

MECHANICAL PARTS

68P81039E33-C
(Sheet 5 of 5)
6/30/80-PHI

60 WATT RADIO



GBEPS–26336–C

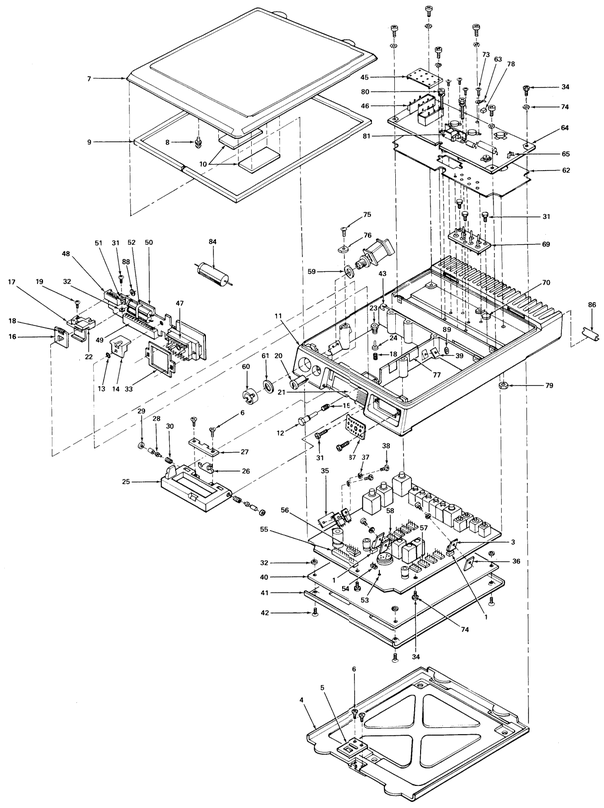
parts list

Mechanical Parts List for Low-Band Radio — PL-6066-C

ITEM NUMBER	MOTOROLA PART NO.	DESCRIPTION
1	—	SEE ELECTRICAL PARTS LIST
3	—	Q904, Q1006; SEE ELECTRICAL PARTS LIST
4	15-84677L01	COVER, bottom
5	64-80017A01	PLATE, latch
6	3-10906A05	SCREW, machine (M3.5 x 0.6 x 6); 4 used
7	15-84678L01	COVER, top (60 W models)
	or 15-80136A01	COVER, top (110 W models)
8	46-80026A01	STUD, latch
9	32-80075A01	GASKET, top cover(60 W models)
	or 32-80276A01	GASKET, top cover (110 W models)
10	75-80243B01	PAD, compression; 2 used
11	15-84676L01	HOUSING (60 W models)
	or 15-80135A01	HOUSING (110 W models)
12	47-80027A01	PUSH BUTTON
13	32-80148C01	GASKET, push button
14	7-80030A01	BRACKET, latch
15	41-80029A01	SPRING, latch
16	7-80016A01	BRACKET, lock slide
17	7-80015A01	SUPPORT, lock slide
18	41-80022A01	SPRING, lock; 2 used
19	3-10936B15	SCREW, tapping (B3.5 x 1.27 x 13)
20	55-80370A01	LOCK
21	13-80063A01	ESCUTCHEON
22	32-80081A01	GASKET, lock support
23	43-80150A01	SLEEVE, cover release
24	46-80151A01	STUD, cover release
25	55-80002A01	HANDLE
26	7-80113B01	BRACKET, latch
27	64-80019A01	PLATE, back-up
28	47-80021A01	PIN, pivot; 2 used
29	4-80125A01	WASHER, pivot; 2 used
30	41-80175A01	SPRING (3.05 MM OD) 2 used
31	3-10904A02	SCREW, machine (M3.5 x 0.6 x 6); 6 used
32	4-80149A01	WASHER, captivative; 5 used
33	32-80067A01	GASKET, cable plug
34	3-10936A06	SCREW, tapping (M3.5 x 1.27 x 8); 19 used
35	14-80090A01	INSULATOR, mica
36	14-84391F01	INSULATOR, mica; 2 used
37	4-84180C01	WASHER, shoulder; 5 used
38	3-10905A01	SCREW, machine (M3 x 0.5 x 6); 5 used
39	14-83572K01	INSULATOR, mica
40	32-80076A01	GASKET, bottom inner cover
41	15-80004A01	COVER, bottom inner
42	3-10906A19	SCREW, machine (M3.5 x 0.6 x 13); 4 used
43	42-80013A01	CLIP, coax (dress); 4 used
45	15-80205A01	COVER, RF shield (60 W models)
	or 15-80205A02	COVER, RF shield (110 W models)
46	26-80206A01	SHIELD, RF (60 W models)
	or 26-80206A02	SHIELD, RF (110 W models)
47	—	J1; SEE ELECTRICAL PARTS LIST
48	—	J3; SEE ELECTRICAL PARTS LIST
49	—	J2; SEE ELECTRICAL PARTS LIST
50	—	CIRCUIT BOARD, interconnect
51	7-80079A01	BRACKET, IC board support
52	42-10217A26	STRAP, cable harness; 3 used
53	29-10271A15	PIN, terminal; 8 used
54	—	P1004; SEE ELECTRICAL PARTS LIST
55	—	P10; SEE ELECTRICAL PARTS LIST
56	—	P11; SEE ELECTRICAL PARTS LIST
57	—	P601-4; SEE ELECTRICAL PARTS LIST
58	—	P605-8; SEE ELECTRICAL PARTS LIST
59	32-80080A01	GASKET, antenna connector
60	2-80006A01	NUT, spanner
61	4-114522	WASHER, lock
62	14-80077A01	INSULATOR, PA compartment (60 W models)
	or 14-80143A01	INSULATOR, PA compartment (110 W models)
63	7-80078A01	BRACKET, thermistor mounting
64	—	CIRCUIT BOARD, PA
65	29-80014A01	CLIP, coax terminal; 3 used
69	64-80005A01	PLATE, feed-thru
70	32-80084A01	GASKET, stud device
71	14-80179A01	INSULATOR, transistor TO220 (ceramic); 60 W models
73	3-10905A05	SCREW, machine (M3 x 0.5 x 8.0); 4 used
74	4-7666	WASHER, lock (#6); 19 used
75	3-10904A45	SCREW, machine (M3.5 x .6 x 13)
76	42-80366A01	CLAMP, cable
77	14-80061B01	INSULATOR, housing
78	75-80142B01	PAD, fracture
79	2-7003	NUT, hex head; 8-32 x 5/16 x 1/8
80	3-1093A18	SCREW, machine (M3.5 x 1.27 x 18); 2 used (110 W models)
81	HLN4129A	TRANSFORMER and heat sink assy. (110 W models)
84	23-83210A22	CAPACITOR (110 W models)
86	42-80282B01	CLIP, tray; retainer
87	32-90020C01	GASKET, cable connector
88	4-7607	WASHER, flat; .0125 x .281 x .027
89	4-80282B01	WASHER, compression (used on Q703)

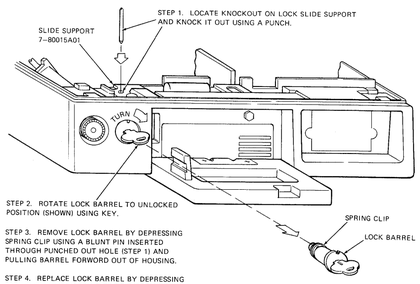
note: This radio uses metric hardware; a hardware kit is available from Motorola National Parts. Order the RFX-4062A Metric Hardware Kit.

110 WATT RADIO



GCEPS–27952–A

LOCK REMOVAL PROCEDURE



STEP 2. ROTATE LOCK BARREL TO UNLOCKED POSITION (SHOWN) USING KEY.

STEP 3. REMOVE LOCK BARREL BY DEPRESSING SPRING CLIP USING A BLUNT PIN INSERTED THROUGH PUNCHED OUT HOLE (STEP 1) AND PULLING BARREL FORWORD OUT OF HOUSING.

STEP 4. REPLACE LOCK BARREL BY DEPRESSING SPRING CLIP AND SLIDING BARREL BACK INTO HOUSING UNTIL SPRING CLIP SNAPS BACK INTO POSITION.

STEP 5. PLUG HOLE IN LOCK SLIDE SUPPORT (STEP 1) TO RESTORE WEATHER RESISTANT FEATURE OF RADIO.

GBEPS–27667–O

MITREK RADIO GASKET KITS

To ensure the continued weather resistance of the MITREK radio the gaskets must be maintained when servicing the radio and control head. The following are the gasket kits required for radio connector, lock, and control head servicing:

Front and Antenna Connector Kit (Kit No. RPX4128A)

Description	Qty. Supplied	Part Number
Front Connector, External	10	32-80020C01
Front Connector, Internal	10	32-80074A01
Antenna Connector	10	32-80080A01

Lock Gasket Kit (Kit No. RPX4130A)

Description	Qty. Supplied	Part Number
Lock Support Gasket	10	32-80081A01
Lock Support Slide	10	7-80015A01
Pushbutton	10	32-80148C01

Control Head Gasket Kit (Kit No. RPX4129A)

Description	Qty. Supplied	Part Number
Top Housing	10	32-80203B01
Rear Connector	10	32-80038C01
Control Shaft "0" Ring	10	42-10128A23
Pushbutton "0" Ring	10	42-10128A22

parts list

LEGEND
L = Range I — 29.7 to 39 MHz
M = Range II — 39 to 50 MHz

HLB4021A Power Amplifier Board (Range I)
HLB4022A Power Amplifier Board (Range II) PL-5990-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: ± 5%; 500 V; unless otherwise stated
C801L	21-850118	100 pF
C801M	21-865448	91 pF ± 3%
C802L	21-840812	200 pF
C802M	21-865448	91 pF ± 3%
C803M	21-865448	91 pF ± 3%
C804M	20-84218B03	variable 55-282 pF
C805L	21-868823	345 pF ± 3%
C805M	21-845214	510 pF; 300 V
C807L	21-84494B12	220 pF
C808	21-845214	510 pF; 300 V
C809L	21-84395B15	500 pF
C809M	21-84395B14	400 pF
C810L	20-84218B01	variable; 7-94 pF
C810M	20-84218B02	variable; 24-88 pF
C811	20-84218B03	variable; 55-282 pF
C812	8-82905G31	0.15 uF ± 10%; 50 V
C813	23-83210A15	183 uF + 150-10%; 25 V
C814 thru 817	21-83596E39	.005 uF ± 10%; 25 V
C818L	21-82372C09	0.1 uF + 80-20%; 25 V
C818M	21-8359BE39	.005 uF ± 10%; 25 V
C819L	21-82372C09	0.1 uF + 80-20%; 25 V
C819M,820M	21-83596E39	.005 uF ± 10%; 25 V
C820L	21-82372C07	.05 uF ± 10%; 25 V
C822L	21-84395B15	500 pF
C822M	21-84395B14	400 pF
C823L	21-865448	91 pF ± 3%
C823M	21-845214	510 pF; 300 V
C824	21-84395B15	500 pF
C825L	21-84395B13	300 pF
C826L	8-82905G11	0.22 uF ± 10%; 50 V
C827	8-82905G11	0.22 uF ± 10%; 50 V
C828L	21-84395B06	150 pF; 250 V
C828M	21-84395B02	100 pF; 250 V
C840,841	21-8359BE38	.0047 uF ± 10%; 100 V
C850L	21-847091	80 pF ± 2%; 300 V
C850M	21-83107B15	60 pF ± 2%
C851L	21-84395B26	160 pF ± 2%; 250 V
C851M	21-84395B21	123 pF ± 2%; 250 V
C853L	21-84395B26	160 pF ± 2%; 250 V
C853M	21-84395B21	123 pF ± 2%; 250 V
C855L	21-84395B26	160 pF ± 2%; 250 V
C855M	21-84395B21	123 pF ± 2%; 250 V
C857L	21-84395B26	160 pF ± 2%; 250 V
C857M	21-84395B21	123 pF ± 2%; 250 V
C859L	21-84395B26	160 pF ± 2%; 250 V
C859M	21-84395B21	123 pF ± 2%; 250 V
C861L	21-847091	80 pF ± 2%; 300 V
C861M	21-83107B15	60 pF ± 2%
CR801	48-82466H13	**diode: (see note)** silicon
		coil, choke:
L801L	24-83884G05	9-1/2 turns
L801M	24-83884G06	4-1/2 turns
L802L	24-83884G06	4-1/2 turns
L802M	24-83884G03	1-1/2 turns
L803M	24-84411B04	10-1/2 turns
L804	24-83977B02	2-1/2 turns (ferrite)
L805	24-84411B02	14-1/2 turns
L806L	24-83884G03	1-1/2 turns
L807	24-83977B02	ferrite; 2-1/2 turns
L808L	24-80041A05	9-1/2 turns
L808M	24-80041A04	7-1/2 turns
L809L	24-80271A01	wire loop
L809M	24-80271A02	wire loop
L810L	24-80041A01	6 turns
L810M	24-84614A02	4-1/2 turns
L811L	24-84614A01	3-1/2 turns
L811M	24-84614A03	2-1/2 turns
L812	24-83884G07	2-1/2 turns
L813L	24-83977B02	ferrite; 2-1/2 turns
L850L	24-80041A07	9 turns
L850M	24-80041A08	9 turns
L851L	24-80041A09	10 turns
L851M	24-80041A10	10 turns
L852L	24-80041A11	10 turns
L852M	24-80041A12	10 turns
L853L	24-80041A11	10 turns
L853M	24-80041A12	10 turns
L854L	24-80041A09	10 turns
L854M	24-80041A10	10 turns
L855L	24-80041A07	9 turns
L855M	24-80041A08	9 turns

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		resistor, fixed: ± 5%; 1/4 W: unless otherwise stated
R801	17-80233B01	.02; 5 W
R802	6-124A49	1k
R803	6-124A48	910
R804	6-124A49	1k
R806	6-124C33	220 ± 10%
R811M	6-125A32	200; 1/2 W
R812,813	6-125B67	8.2; 1/2 W
R814L	6-126D65	6.8 ± 10%; 1 W
R815L	6-126D65	6.8 ± 10%; 1 W
R817	6-125B67	8.2; 1/2 W
R818L,819L	6-125A11	27; 1/2 W
R820	1-80702T15	includes: R820, R825, R826, R827 in case in SHRINK SLEEVING
R821	1-80702T15	includes: R821, 822, 823, 824 in case in SHRINK SLEEVING
		NOTE: R820 thru 827 are all 6-125A25: 100; 1/2 W
RT801	6-83600K09	**thermistor:** 100k @25°C

		mechanical parts
	29-80014A01	CLIP, coax (2 used)
	26-80206A01	SHIELD (2 used)
	15-80205A01	COVER, rf shield **note:** Eyelets (part no. 5-135025) are not included in Power Amplifier Board Kits HLB4021A and HLB4022A and must be ordered separately)

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

HLB4040A Power Transistor Kit PL-6381-O

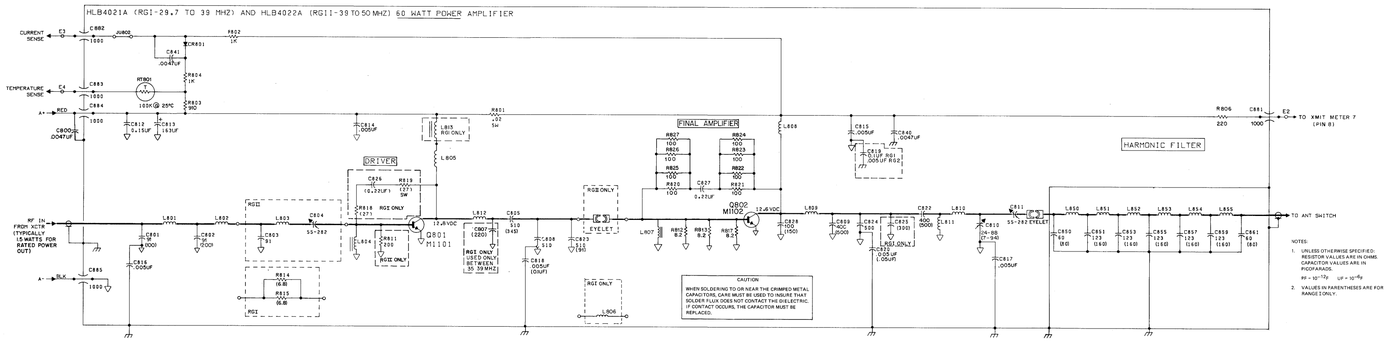
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		transistor: (see note)
Q801	48-84411L01	NPN; type M1101 (HLB4040A)
Q802	48-84411L02	NPN; type M1102 (HLB4040A)

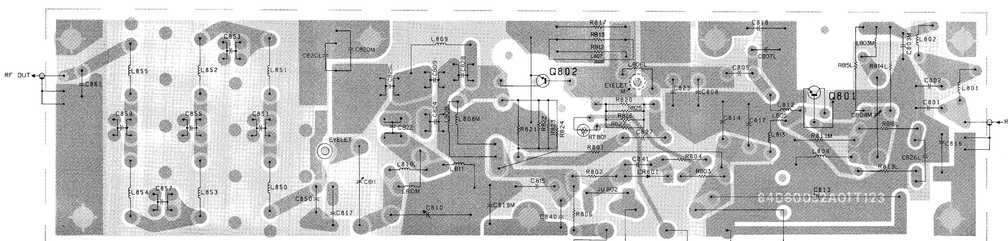
HLN4000A Hardware Kit (Low Band PA) PL-5991-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C800	21-82928B09	.0047 uF ± 5%; 500 V
		mechanical parts
	14-80077A01	INSULATOR, PA compartment
	32-80080A01	GASKET, antenna connector
	32-80084A01	GASKET, stud device
	7-80078A01	BRACKET, thermistor mounting
	3-10904A02	SCREW, machine (M3.5 x 0.6 x 6) 3 used
	2-80006A01	NUT, spanner
	4-114522	WASHER, lock
	3-10936A06	SCREW, tapping (B3.5 x 1.27 x 8) 7 used
	3-10905A01	SCREW, machine (M3 x 0.5 x 6) 3 used
	15-84676L01	HOUSING, radio
	4-84180C01	WASHER, shoulder
	14-80179A01	INSULATOR, transistor TO220 (ceramic)
	5-135025	EYELET (0.13 x 0.107) (RGI, 1 used; RGII, 2 used)

HLN4021A PA Feed-Thru Plate PL-5983-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C881 thru 885	21-82812H03	1000 pF + 100-0%; 500 V
		mechanical parts
	64-80005A01	PLATE, feed-thru
	4-837555H01	WASHER, solder





REF SYM SUFFIX CODE	MODEL USED ON
L	HLB4024A (RGI-29.7 TO 39MHZ)
M	HLB4022A (RGII-39 TO 50MHZ)

SHOWN FROM COMPONENT SIDE

MITREK POWER AMPLIFIER

60 WATTS
MODELS: HLB1001A (29.7-38.999 MHz)
HLB1002A (39-50 MHz)

FUNCTION

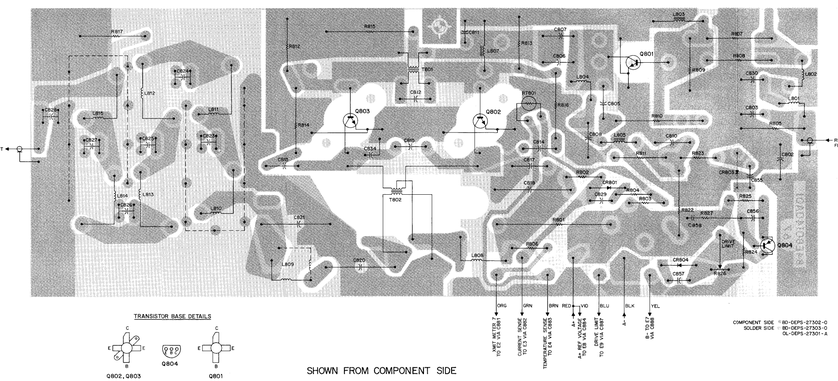
Increases power output of radio to 60 watts. Contains circuitry to sense temperature and current of final amplifier for application to power control and protection circuit in radio.

POWER AMPLIFIER

110 WATTS
MODELS HLB1011A (RANGE I)
HLB1012A (RANGE II)

FUNCTION

Increases power output of radio to 110 watts. Contains circuitry to sense temperature and current of final amplifier for application to power control and protection circuit in radio.



TRANSISTOR BASE DETAILS

SHOWN FROM COMPONENT SIDE

68P81041E62-A
6/30/80-PHI

parts list

HLN4129A Transformer Kit — PL-6999-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
T802	—	assembly (order HLN4129A Kit)

HLB4077A Power Transistor Kit — PL-7000-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		transistor: (see note)
Q801	48-869583	NPN; type M9583
Q802, 803	48-84411L02	NPN; type M1102

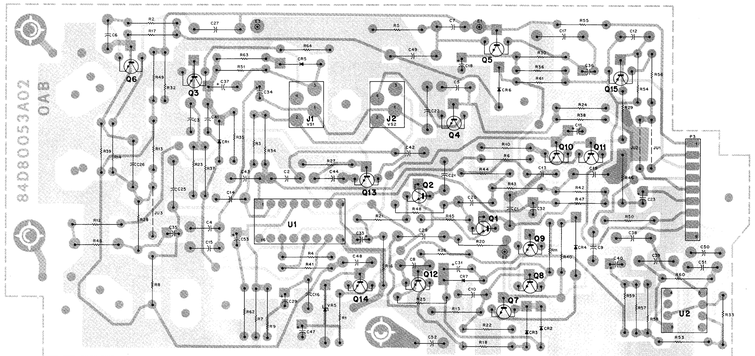
HLN4038A Hardware Kit — PL-6297-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		mechanical parts
	7-80078A01	BRACKET, thermistor mounting
	15-80135A01	HOUSING
	14-80143A01	INSULATOR
	3-10905A05	SCREW, machine M3 x 0.5 x 8; 4 used
	2-7002	NUT, hex 8-32 x 5/16 x 1/8"
	3-10936A18	SCREW, tapping: B3.5 x 1.27 x 16
	3-10936A06	SCREW, tapping: B3.5 x 1.27 x 8; 6 used
	2-80008A01	NUT, spanner
	4-7666	WASHER, lock: #6 ext.; 6 used
	4-114522	WASHER, lock: #5/8 int.
	14-80179A01	INSULATOR, transistor
	32-80080A01	GASKET, antenna connector
	32-80084A01	GASKET, stud device

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

HLB4075A Power Amplifier, Range I (L = 29.7 to 38.999 MHz)
HLB4076A Power Amplifier, Range II (H = 39 to 50 MHz) — PL-6998-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF ± 5%; 500 V; unless otherwise stated
C802	8-84637L04	.0033 uF ± 10%; 1000 V
C803L	21-84494B11	200
C803H	21-84494B85	140
C805	8-82905G21	.018 uF ± 10%; 100 V
C806	21-84857K35	330 ± 3%
C807L	21-84857K35	330 ± 3%
C807H	21-84395B25	350; 250 V
C809	8-84637L04	.0033 uF ± 10%; 1000 V
C810H	8-84637L21	.15 uF ± 10%; 100 V
C811L	21-84494B94	68 ± 2%
C812	21-84857K35	330 ± 3%
C813, 814	8-82905G21	.018 uF ± 10%; 100 V
C815H	21-84857K38	280
C817L	8-84637L22	.22 uF ± 10%; 100 V
C817H	8-84637L04	.0033 uF ± 10%; 1000 V
C818	23-82601A05	50 uF + 150-10%; 25 V
C820L	20-80102B02	var. 90-376; 250 V
C820H	20-80102B01	var. 68-282; 400 V
C821L	20-80102B02	var. 90-376; 250 V
C821H	20-80102B01	var. 68-282; 400 V
C823L, 824L	21-84395B06	150; 250 V
C823H, 824H	21-84395B20	100; 250 V
C825L	21-84395B26	160; 250 V
C825H	21-84395B20	110; 250 V
C826L, 827L	21-84395B06	150; 250 V
C826H, 827H	21-84395B02	100; 250 V
C828L	21-84395B22	66; 250 V
C828H	21-84395B19	43; 250 V
C829L	21-83596E38	.0047 uF ± 10%; 100 V
C829H	21-83596E24	.0033 uF ± 10%; 100 V
C830L	21-84494B22	750
C830H	21-84494B20	510
C855L, 856L, 857L	21-83596E38	.0047 uF ± 10%; 100 V
C856H, 856H, 857H	21-83596E24	.0033 uF ± 10%; 100 V
C858	23-84538G02	4.7 uF ± 20%; 20 V
		diode: (see note)
CR801, 803, 804	48-82466H13	silicon
		coil, choke, rf:
L801L	24-84411B04	10-1/2 turns
L801H	24-83884G12	8-1/2 turns
L802L	24-83884G07	2-1/2 turns
L802H	24-83884G03	1-1/2 turns
L803	24-83977B01	1-1/2 turns (ferrite)
L804	24-80178C01	2-1/2 turns
L805	24-80036A02	1/2 turn (ferrite)
L807	24-83977B01	1-1/2 turns (ferrite)
L808	24-80110B13	7-1/2 turns
L809L	24-80110B11	4-1/2 turns
L809H	24-80110B12	2-1/2 turns
L810L	24-80110B02	7-1/2 turns
L810H	24-80110B06	7-1/2 turns
L811L	24-80110B03	8-1/2 turns
L811H	24-80110B07	8-1/2 turns
L812L, 813L	24-80110B04	9-1/2 turns
L812H, 813H	24-80110B08	9-1/2 turns
L814L	24-80110B03	8-1/2 turns
L814H	24-80110B07	8-1/2 turns
L815L	24-80110B02	7-1/2 turns
L815H	24-80110B06	7-1/2 turns
		transistor: (see note)
Q804	48-869643	PNP; type M9643
		resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R801	17-80068B02	.01; 10 W
R802, 803	6-124C49	1k ± 10%
R804	6-124C67	5.6k ± 10%
R805L	17-82036G01	68 ± 10%; 2 W
R806	6-124A33	220
R807, 808	6-126B70	1.8; 1 W
R809L	6-125A01	10; 1/2 W
R809H	6-125C05	15 ± 10%; 1/2 W
R810L	6-127C19	56 ± 10%; 2 W
R810H	6-127C21	68 ± 10%; 2 W
R811, 812, 813	6-125B61	4.7; 1/2 W
R814L, 816L	17-80236B01	100; 2 W
R814H, 816H	17-82036G27	18; 2 W
R815L	6-127C25	100 ± 10%; 2 W
R817	6-125C97	100k ± 10%; 1/2 W
R822	17-82291B24	0.1; 3 W
R823L	6-124A46	910
R823H	6-124C53	1.5k ± 10%
R824	6-124A91	56k
R825	6-124A37	330
R826	18-83311K06	var. 10k
R827	6-124C25	100
		thermistor:
RT801	6-83600K09	100k @ 25°C
		transformer:
T801	24-80099B01	input



SHOWN FROM SOLDER SIDE

COMPONENT SIDE – 80-28PS-21895-0
SOLDER SIDE – 80-28PS-21896-0
84-28PS-21895-0

parts list

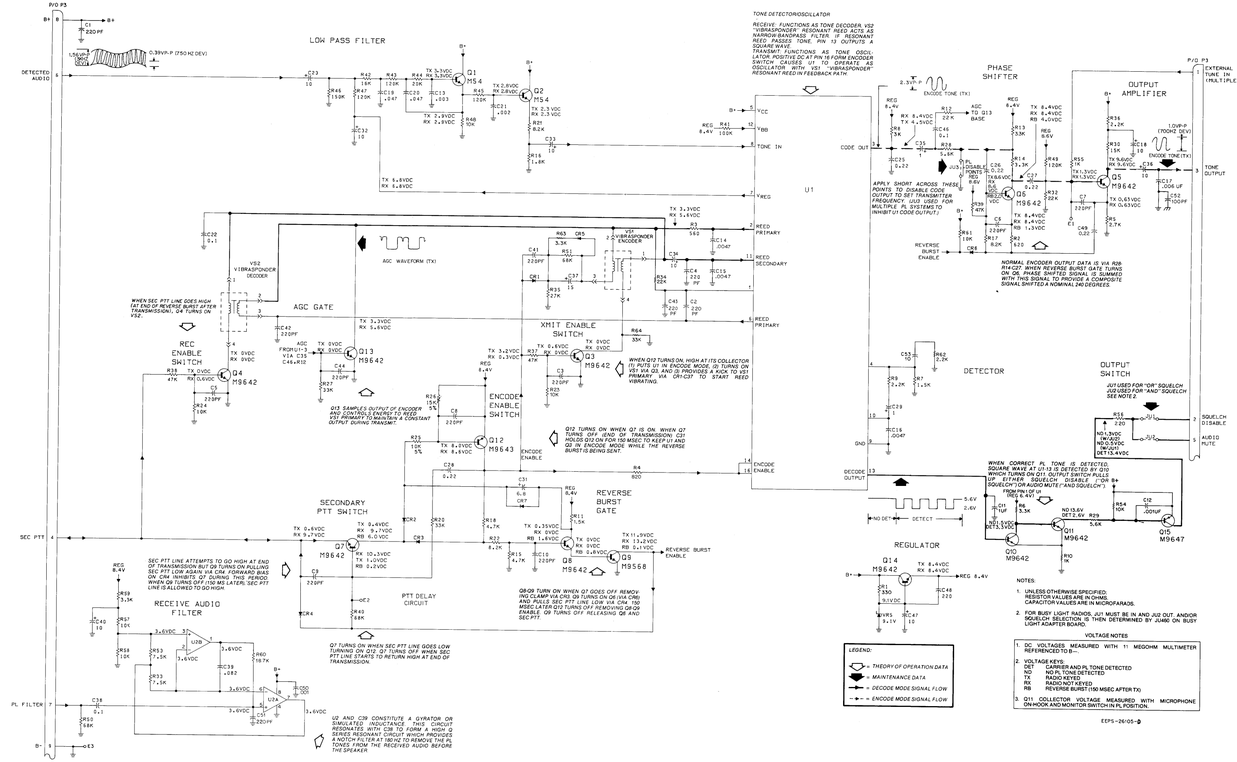
HLN4020A Tone "Private-Line" Encoder Decoder Board PL-6029-F

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C1 thru 10	21-83596E10	220 pF ± 20%; 500 V
C11	23-84536G01	1 uF ± 20%; 35 V
C12	21-82187B44	.001 uF ± 10%; 100 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	8-846371L91	.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	8-846371J22	0.22 uF ± 10%; 100 V
C29	23-84665F04	1 uF + 150-10%; 50 V
C31	23-84536Q22	6.8 uF ± 10%; 20 V
C32 thru 36	23-84665F01	10 uF + 100-10%; 25 V
C35	23-84536G01	1 uF ± 20%; 20 V
C37	23-84536G04	15 uF ± 20%; 20 V
C38	8-846371J37	0.1 uF ± 5%; 100 V
C39	8-846371L36	.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	8-846371J22	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
C53	23-84665F01	10 uF + 100-10%; 25 V
		diode: (see note)
CR1, 2, 3	48-83654H01	silicon
CR4	48-82178A01	germanium
CR5, 6, 7	48-83654H01	silicon
		connector, receptacle:
J1, 2	9-80132A01	JU1 & JU2 each consist of four 9-80132A01 parts
		connector, plug:
P3	28-80181B02	male: 9 contact

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		transistor: (see note)
Q1, 2	48-134674	NPN; type MS4
Q3 thru 8	48-869642	NPN; type M9642
Q9	48-869568	NPN; type M9568
Q10, 11	48-869642	NPN; type M9642
Q12	48-869643	PNP; type M9643
Q13, 14	48-869642	NPN; type M9642
Q15	48-869467	PNP; type M9467
		resistor, fixed ± 10%; 1/4 W; unless otherwise stated
R1	6-124A37	330
R2	6-124A44	820 ± 5%
R3	6-124C43	560
R4	6-124C47	820
R5	6-124A59	2.7k ± 5%
R6	6-124C61	3.3k
R7	6-124C63	5k
R8	6-124A60	3k ± 5%
R9	6-124C57	2.2k
R10	6-124C49	1k
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 24	6-124C73	10k
R25	6-124A73	10k ± 5%;
R26	6-124A77	15k ± 5%
R27	6-124C85	33k
R28, 29	6-124A67	5.6k ± 5%
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	6-124A73	10k ± 5%
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	6-124C73	10k
R55	6-124A49	1k ± 5%
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
R62	6-124C57	2.2k
R63	6-124C61	3.3k
R64	6-124C85	33k
		integrated circuit: (see note)
U1	51-84768F76	type M6876
U2	51-84621K76	type M2176
		voltage regulator:
VR5	48-82256C38	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, captivative; 4 used
7-80023A01		BRACKET, reed hold-down
29-10271A15		TERMINAL, pin; 3 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 unsquelches receiver when proper tone is received.

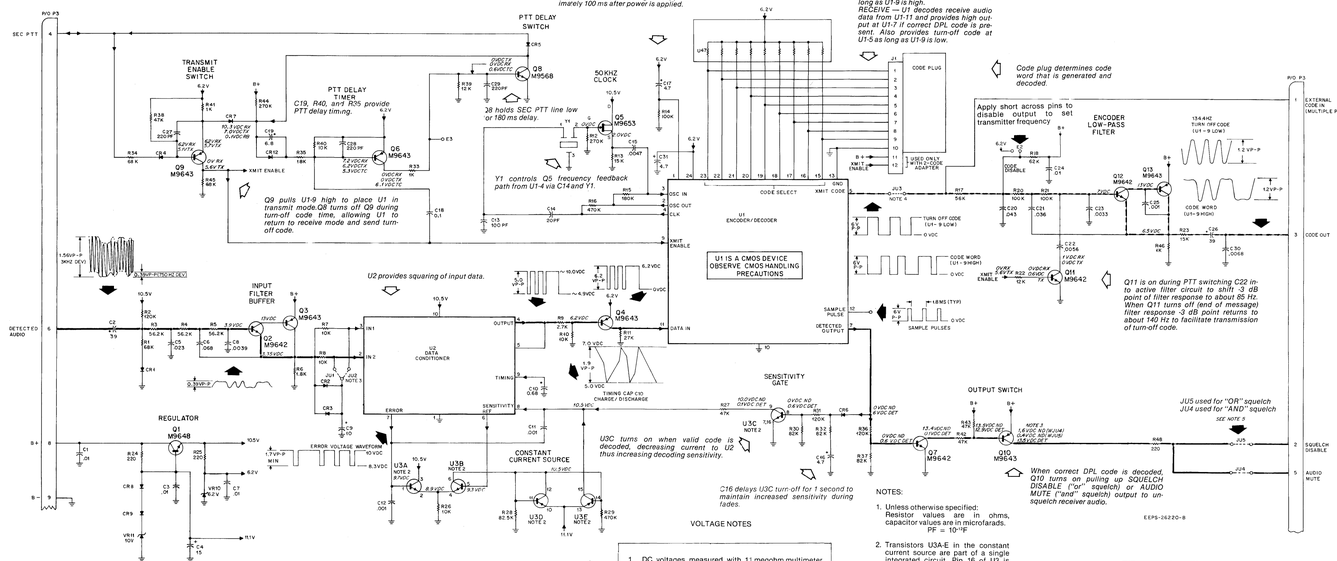
68P81039E22-D
6/5/80-PHI

"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.

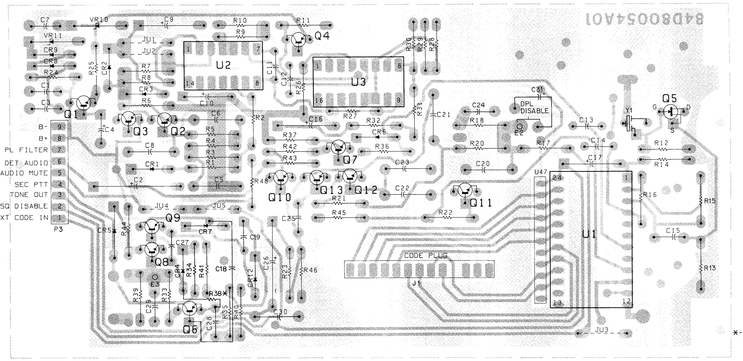


VOLTAGE NOTES

1. DC voltages measured with 11 megohm multimeter referenced to B—.
2. Voltage keys:
   TX Radio keyed
   RX Radio not keyed
   TC Turn-off code interval (180 ms after completion of TX)
   DET Correct DPL code detected
   ND Correct DPL code not detected
3. Q10 collector voltage measured with microphone on-hook and MONITOR switch in DPL enable position.
4. Waveforms measured with an on-channel rf input signal of 1000 uV modulated with 1000 Hz at ±4.25 kHz deviation and a digitally coded squelch signal at 750 Hz deviat`on total deviation ±5 kHz).

NOTES:

1. Unless otherwise specified:
   Resistor values are in ohms, capacitor values are in microfarads. PF = 10^{-12}F
2. Transistors U3A-E in the constant current source are part of a single integrated circuit. Pin 16 of U3 is grounded.
3. JU1 and JU2 determine code polarity. JU1 is used in UHF and VHF applications (low side injection). JU2 is used in low band applications (high side injection).
4. JU3 is removed in multiple DPL applications.
5. For busy light radios, JU4 must be in and JU5 out. AND/OR squelch selection is then determined by JU460 on Busy Light Adapter Board (see receiver schematic).



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-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitors, fixed: uF, ± 5%, 50 V; unless otherwise stated
C1	21-83596E36	.01 + 60-40%; 250 V
C2	23-82783B36	39 ± 10%; 10 V
C3	21-83596E36	.01 + 60-40%; 250 V
C4	23-84538G04	15 ± 20%; 20 V
C5	8-82905G39	.023
C6	8-83813H23	.066
C7	21-83596E36	.01 + 60-40%; 250 V
C8	8-83813H19	.0039
C9	23-84782H03	10 ± 10%; 20 V
C10	23-82783B48	.68; 35 V
C11, 12	21-82187B44	.001 ± 10%; 100 V
C13	21-80067A65	100 pF; 200 V
C14	21-80067A40	20 pF; 500 V
C15	21-83596E38	.0047 ± 10%; 100 V
C16, 17	23-84782H07	4.7 + 20%; 10 V
C18	8-82096J18	.1 uF ± 10%; 250 V
C19	23-84538G22	6.8 ± 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 ± 10%; 25 V
C26	23-82783B36	39 ± 10%; 10 V
C27, 28, 29	21-83596E10	220 pF ± 20%; 500 V
C30	8-84496D08	.0068 ± 10%; 400 V
C31	23-84538G02	4.7 uF ± 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:
P3	28-80181B02	male, 9-contact

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		transistor: (see note)
Q1	48-869648	NPN; type M9646
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: ± 5%; 1/4 W; unless otherwise stated
R1	6-124A93	68k
R2	6-124A99	120k
R3, 4, 5	6-10621D64	56.2k ± 1%; 1/8 W
R6	6-124A55	1.8k
R7, 8	6-124A73	10k
R9	6-124C69	2.7k ± 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 ± 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 ± 1%; 1/8 W
R29	6-124B14	470k
R30	6-124C95	82k ± 10%
R31	6-124C99	120k ± 10%
R32	6-124C95	82k ± 10%
R33	6-124C91	1k ± 10%
R34	6-124A93	68k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R35	6-124A79	18k
R36	6-124C99	120k ± 10%
R37	6-124C85	82k ± 10%
R38	6-124A89	47k
R39	6-124C75	12k ± 10%
R40	6-124A73	10k
R41	6-124A49	1k
R42, 43	6-124C89	47k ± 10%
R44	6-124D08	270k ± 10%; 1/4 W
R45	6-124A93	68k
R46	6-124A49	1k
R48	6-124C33	220 ohms ± 10%
		resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R1	6-124A93	68k
R2	6-124A99	120k
R3, 4, 5	6-10621D64	56.2k ± 1%; 1/8 W
R6	6-124A55	1.8k
R7, 8	6-124A73	10k
R9	6-124C69	2.7k ± 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 ± 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 ± 1%; 1/8 W
R29	6-124B14	470k
R30	6-124C95	82k ± 10%
R31	6-124C99	120k ± 10%
R32	6-124C95	82k ± 10%
R33	6-124C91	1k ± 10%
R34	6-124A93	68k

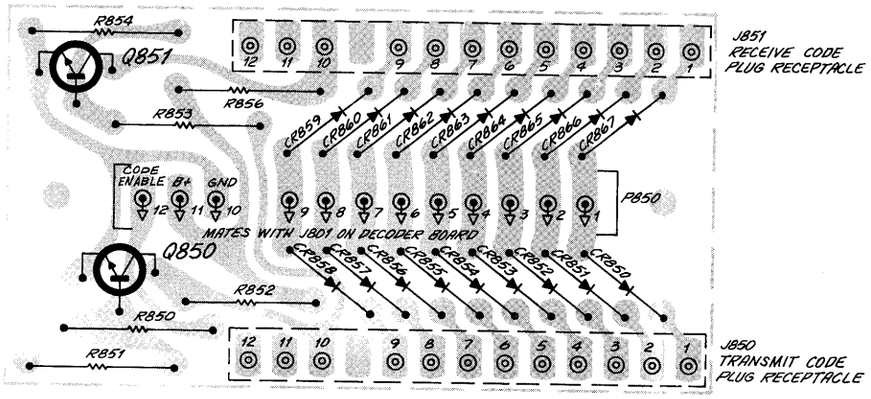
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		integrated circuit: (see note)
U1	51-84267A82	type M6782
U2	51-84320A55	type LM565CN
U3	51-84320A79	type CA3086
U47	51-82142K02	resistor network
		voltage regulator: (see note)
VR10	48-83696E07	Zener, 6.2 V
VR11	48-82256C11	Zener, 10 V
		crystal, resonator:
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.

68P81039E23-C
5/9/80-PHI

"DIGITAL PRIVATE-LINE" TWO-CODE ADAPTER

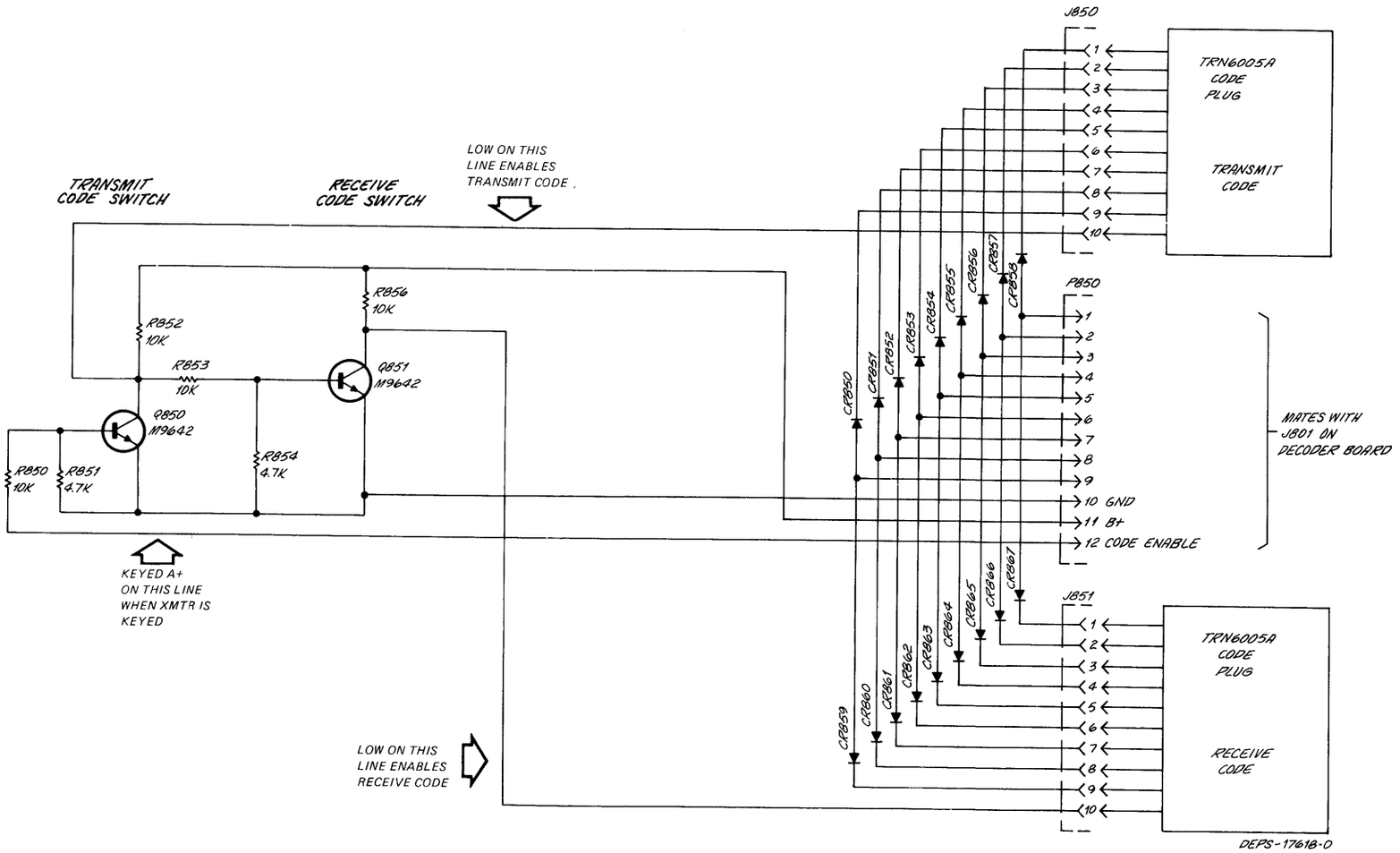
MODEL TLN5730A



SHOWN FROM COMPONENT SIDE

COMPONENT SIDE

OL-CEPS-17621-O



LEGEND

THEORY INFORMATION

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.

PARTS LIST

TLN5730A 2-Code Adapter Board — PL-3414-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
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.

DPL TWO-CODE ADAPTER/MITREK ACCESSORIES

68P81106E97-B
5/9/80-PHI

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-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		cable, assembly:
P102	1-84135C01	includes: coil cord
		cartridge:
MK321	59-82933C02	dynamic
		switch:
S318	40-82263G01	dpst (HMN4000A)
	or 40-82263G02	dpst (HMN4001A)
		mechanical parts
	3-13999	SCREW, tapping; 6-32 x 3/8"; 3 used
	3-14000	SCREW, tapping; 6-32 x 3/4"; 3 used
	13-83174B03	EMBLEM
	15-82701M24	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
	1-80701T27	HOUSING, microphone; rear; includes hang-up button
	33-82599D01	NAMEPLATE (HMN4001A)
	54-84962K01	TAG, safety

note: Replacement parts for rear housing assembly should be ordered as Motorola part number 1-80701T27. This assembly includes the hang-up button.

68P81039E26-C
5/9/80-PHI

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-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		speaker:
LS301	50-84561B02	dia. 5" PM
		mechanical parts
	3-140001	SCREW, tapping; 6-7/8"
	3-84244C01	SCREW, trunnion; 2 used
	7-84568B01	BRACKET, trunnion
	13-82671M02	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	SLEEVING, coded 31
	37-82603D32	SLEEVING, 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 HLN4025A 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-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		switch:
S101	40-82159D02	spst
	or 40-84198C01	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
	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	SLEEVING, coded 24/30
	37-82603D27	SLEEVING, 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)
	2-7041	NUT, 2-56 x 3/16"; 2 used (HLN4024A)

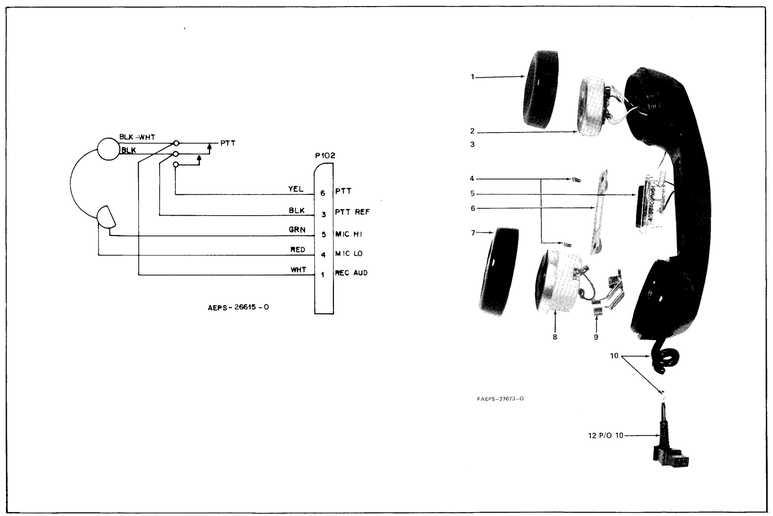
IGNITION SENSE LEAD

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 Ignition Switch Cable — PL-6058-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		fuse:
F401	65-890033	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:
	30-10310A62	WIRE, .18 ga. stranded, orange, 66-1/2"
	37-82603D20	SLEEVING, coded #20
	29-82602D01	PIN TERMINAL
	29-136968	LUG, soldering
	29-824456	LUG, ring tongue
	29-865065	LUG, ring tongue



HANDSET

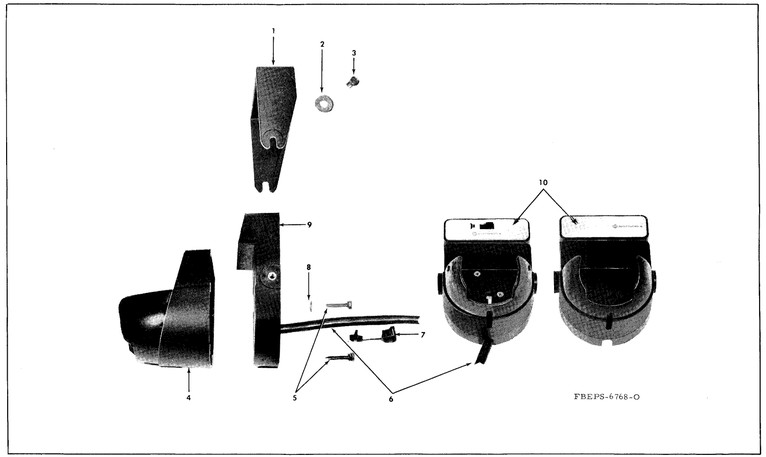
The TMN6057A Handset is used in installations where a telephone-style handset is preferred to the mobile microphone and speaker. The unit operates in the same manner as a telephone handset except that it has a PTT button which is used to key the radio.

parts list

TMN6057A HANDSET — 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	HANG-UP CUP & SWITCH ASSEMBLY
	or 15C84520C02	HANG-UP CUP (TLN4505A)
5	3S135507	SCREW, machine; 6-32 x 3/4" "Phillips" hex head
6	1V80717B42	CABLE ASSEMBLY; includes attached insertable connector contacts (TLN4507A)
	or 1V80727B32	CABLE ASSEMBLY; includes attached insertable connector cotacts (TLN4698A)
7	42B82018H08	ANCHOR, cable strain relief
8	4S1720	WASHER, flat; 0.156" x 0.378" x .030"
9	1V80717B40	MOUNTING BASE & SWITCH ASSEMBLY (TLN4507A)
	or 58D84514C01	MOUNTING BASE (TLN4698A and TLN4505A)
10	13B84515C01	ESCUTCHEON (TLN4507A)
	or 13B84515C02	ESCUTCHEON (TLN4698A and TLN4505A)
		non-coded items
	42B82018H08	RETAINER, cable (TLN4698A)
	3S136756	SCREW, tapping; 20 x 5/8" (TLN4698A)
	38B84383D01	CAP, protective

parts list

Low Power High Power

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-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
F201	65-86099	**fuse:** 7.5A; 32 V
F501	65-61682	25A; 32 V (HKN4000A-4006A)
	or 65-61683	40A;32 V (HKN4016-4022A)
P1		**connector, plug:** consists of:
	9-801050	CONNECTOR, female; 19-contact
	15-82075D04	HOUSING, connector; left half
	15-82075D05	HOUSING, connector; right half
	2-7019	NUT, hex; 4-40 x 3/32"; 2 used
	3-135198	SCREW, machine; 4-40 x 1-1/8"; 2 used
	3-132127 or 3-140048	SCREW, tapping; 6-20 x 3/4"; 2 used
	4-11722	WASHER, "C"
	4-800671	WASHER, flat
	4-82113D01	WASHER, flat
	1-80701752	SCREW and KNOB, assembly
	42-80168A02	CLIP, strain relief
P101	29-82602D01	consists of: PIN, terminal female; 15 used
W1		**wire assembly:** multi-conductor cable consists of:
	30-858513	CABLE, 13-conductor; 17" used (HKN4000A, 4016A)
	30-864650	CABLE, 17-conductor; 17" used (HKN4001A, 4006A, 4017A, 4022A)
	30-864650	CABLE, 17-conductor; 22' used (HKN4002A, 4003A, 4018A, 4019A)
	30-864650	CABLE, 17-conductor; 10' used (HKN4004A, 4005A, 4020A, 4021A)
W2	1-80701728	LEAD and FUSE ASSEMBLY (green) includes ref. item F201 and:
	29-82602D01	TERMINAL, pin
	37-82603D19	SLEEVING, coded no. 19
	37-132562	TUBING, heat shrink
	29-136968	LUG, solder
	29-824456	LUG, ring tongue
	29-865056	LUG, ring tongue
	14-82883A01	INSULATOR, fuseholder cap
	14-82882A01	INSULATOR, fuseholder body
	42-82884A01	CLIP, fuse; 2 used
	41-82885A01	SPRING, fuse compression
W3		CABLE: includes ref. items F501 and W5 (on HKN4000A-4006A) and:
	14-82883A01	INSULATOR, fuseholder cap
	14-82882A01	INSULATOR, fuseholder body
	42-82884A01	CLIP, fuse; 2 used
	41-82885H01	SPRING, fuse compression
	29-84528B02	LUG, ring tongue
	30-858553	CABLE, battery: red; 24" (HKN4000A, 4001A)
	or 30-858553	CABLE, battery; red; 27" (HKN4002A)
	or 30-858553	CABLE, battery; red; 13" (HKN4004A)
	or 30-858552	CABLE, battery; blk; 20" (HKN4006A)
	or 30-858552	CABLE, battery; blk; 27" (HKN4003A)
	or 30-858552	CABLE, battery; blk; 13" (HKN4005A)
	30-812505	CABLE, battery; red; 18" (HKN4016A, 17A)
	or 30-812505	CABLE, battery; red; 24-1/2" (HKN4018A)
	or 30-851875	CABLE, battery; red; 34-1/2" (HKN4019A)
	or 30-812505	CABLE, battery; red; 10-1/2" (HKN4020A)
	or 30-851875	CABLE, battery blk; 10-1/2" (HKN4021A)
	or 30-851875	GROUND LEAD consists of:
W4	30-858552	GROUND LEAD consists of: CABLE, battery; blk; 5-1/2" (HKN4000A, 4001A, 4002A, 4004A)
	or 30-851875	CABLE, battery; blk; 5-1/2" (HKN4016A, 4017A, 4018A, 4020A)
	or 30-858553	CABLE, battery; red; 5-1/2" (HKN4003A, 4005A, 4006A)
	30-812505	CABLE, battery; red; 5-1/2" (HKN4019A, 4021A, 4022A)
	29-84528B02	LUG, ring tongue (HKN4000A-4006A)
W5		Part of W3 for low power radios; HKN4000A-4006A) HKN4041A for high power negative ground HKN4040A for high power positive ground

HCN4000A thru HCN4011A Mitrek Control Head PL-6051-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C101	23-84665F01	10 uF, + 100-10%; 25 V
C102	23-84665F04	1 uF, + 150-10%; 50 V
		lamp, sub-miniature:
DS104	65-83376K01	.08A; 14 V
DS105	65-83376K01	.08A; 14 V
DS106	65-83376K01	.08A; 14 V (busy light models only)
		connector, receptacle:
J101	1-80703T51	female, 32-contact includes: J102 - male, 5-contact
		resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R101	18-80126A02	var. 25k includes switch S101
R102	18-80126A01	var. 25k
R103	6-124C35	270 ± 10%
R104	6-124C61	3.3k ± 10%
R105, 106	6-124C73	10k ± 10%
R107	6-125C19	56; ± 10%; 1/2 W
R108	6-124A51	3.3k
R109	6-124A97	100k
R110	6-124A81	22k
R111	6-124A49	1k
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
		diode: (see note)
CR101	48-83654H02	silicon
CR103	48-83654H02	silicon
CR104	48-83654H01	silicon
CR107	48-83654H01	silicon
		voltage regulator: (see note)
VR102	48-82256C15	Zener type; 5.1 V
		transistor: (see note)
Q101	48-869643	PNP; type W9643
		integrated circuit: (see note)
U101	51-84621K76	type MC2176
		switch:
S101		on-off, p/o R101
S102	40-80111A01	rotary, 4-position (4-freq. models only)
S103	40-80127A01	pushbutton, dpdt

TABLE A. COMPARATOR VOLTAGE (U101A(3))

	MICROPHONE	
SQUELCH CONDITION	ON-HOOK	OFF-HOOK
PULL SQUELCH	1.2 V	1.5 V
UNSQUELCHED	4.9 V	8.4 V

JUMPER TABLE

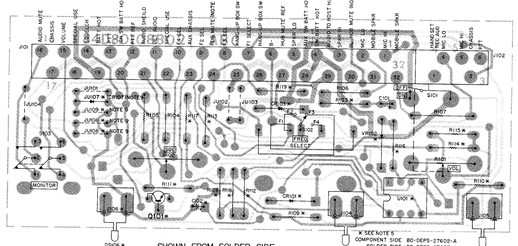
JUMPER	NORMALLY	FUNCTION
JU101	IN	SUPPLIES PTT CURRENT
JU102	IN	IN HANDSET APPLICATIONS MAY BE OMITTED TO DISABLE SPEAKER
JU103	IN	WITH HANDSET OFF-HOOK IN HANDSET APPLICATIONS MAY BE OMITTED TO DISABLE HANDSET RECEIVE AUDIO WHEN ON-HOOK
JU104	OUT	INSTALLED TO COMPLETE AUDIO PATH FROM TO HANGUP BOX WHEN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

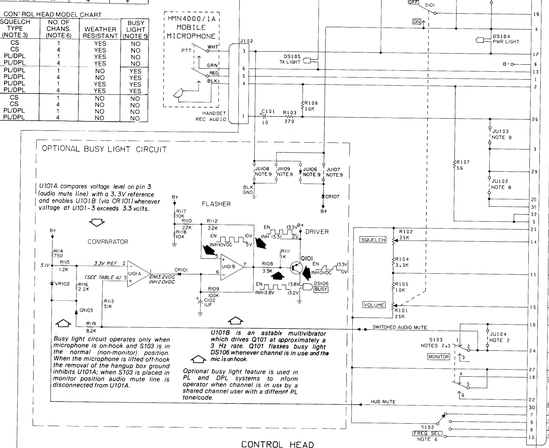
CONTROL CABLE MODEL CHART

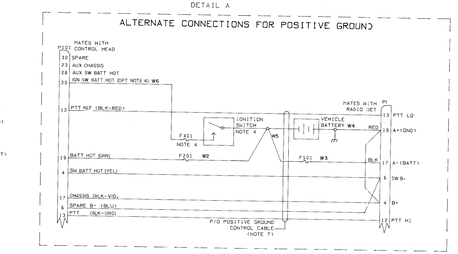
MODEL		LENGTH (FEET)	NO. OF CHANNELS (NOTE 6)	GROUND POLARITY (NOTE 7)
HIGH POWER	LOW POWER			
HKN4016A	HKN4000A	17	1	—
HKN4017A	HKN4001A	17	4	—
HKN4018A	HKN4002A	22	4	—
HKN4019A	HKN4003A	22	4	+
HKN4020A	HKN4004A	10	4	—
HKN4021A	HKN4005A	10	4	+
HKN4022A	HKN4006A	17	4	+

CON: ROL HEAD MODEL CHART

MODEL	SQUELCH TYPE (NOTE 3)	NO. OF CHANS (NOTE 6)	WEATHER RESISTANT	BUSY LIGHT (NOTE 5)
HCN4000A	CS	1	YES	NO
HCN4001A	CS	4	YES	NO
HCN4002A	PL/DPL	4	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







NOTES:

1. Unless otherwise specified: Resistor values are in ohms. Capacitor values are in microfarads.
2. S103 is normally used for PL monitor. However, it may be used as a spare switch for special purpose. In this case JU104 is installed to complete audio mute path to handgun box.
3. Mic hangup box used for PL/DPL radios: Hangup box shown off-hook. If S103 is omitted or used for special purpose, a HLN4025A Hangup Box is used. This hangup box includes a slide switch for PL monitor.
4. Orange ignition switch wire is optional. When this option is installed, transmitter use requires ignition switch to be on; radio may be used in receive only mode with ignition switch off. JU101 must be omitted.
5. Components within dotted box on schematic and indicated ✱ on circuit board detail are used only on busy light models.
6. S102 omitted for single frequency control heads: WHT, GRY, BLU, and BLK wires omitted in single frequency cables.
7. Detail A shows connection differences for positive ground cables. All other connections are identical to those shown for negative ground control cables at left.
8. When TLN4698A Handset Hang-Up Box is used JU102 and JU103 are omitted to provide audio reverting from speaker to handset earpiece. A TLN4507A Handset Hang-Up Box is used when S103 is not used for MONITOR.
9. Busy light circuit shown wired for negative ground systems; for positive ground systems JU108 is omitted and JU109 is added, CR107 is moved to location JU106 from JU107.
10. When optional busy light circuit is used, hangup box mute lead lgmi is connected to pin 30 instead of pin 24.
11. See parts list for fuse rating.

VOLTAGE NOTES

1. DC voltages measured with 20 K-ohm/volt multimeter referenced to B-.
2. Supply voltage during receive mode is 13.8 V. Supply voltage during transmit mode is 13.6 V in Low Power Radios and 13.4 V in High Power Radios.

EEPS-2595-C

LEGEND
AUDIO SIGNAL FLOW
CONTROL SIGNAL FLOW
CHASSIS GROUND
LOGIC GROUND

MITREK CONTROL HEADS
MODELS HCN4000-11A
MITREK RADIO CABLES
MODELS HKN4000-6A
HKN4016-22A

FUNCTION

The control head provides control of the trunk-mounted radio from the vehicle passenger compartment. It controls frequency selection, volume, and squelch. A PL MONITOR switch is provided for "Private-Line" radios. The radio cable interconnects the control head and radio and includes primary power connections.

parts list

HKN4040A Fused Lead, Positive Ground
HKN4041A Fused Lead, Negative Ground PL-6245-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
W5		LEAD, fused consists of:
	30-812505	CABLE, battery, red;2-1/2' (used on HKN4041A only)
	or 30-851875	CABLE, battery, black; 2-1/2' (used on HKN4040A only)
	29-84528B05	LUG, ring tongue
	9-84277B01	RECEPTACLE, fuse
	3-400465	SCREW, tapping
	42-84275B01	RETAINER, fuse
	38-84383D01	CAP, protection
F501	65-61683	FUSE, 5AG-40 Ampere

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

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MITREK CONTROL HEAD

MECHANICAL PARTS

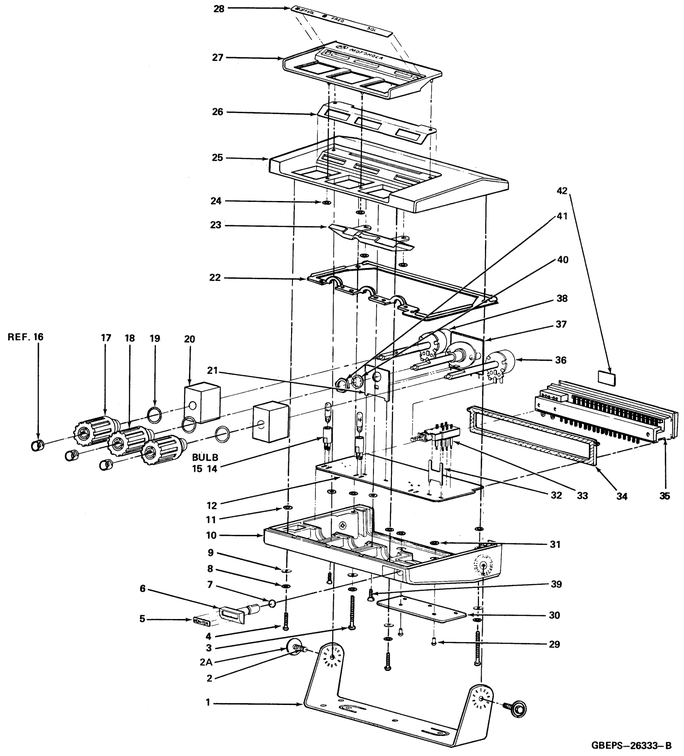
parts list

Control Head Mechanical Parts List PL-6068-D

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 (M3.5 x 0.6 x 30)	for housing, rear (two used)
4	3-10903B58	screw, machine (M3.5 x 0.6 x 13)	for housing, front (two used)
5	33-80117A01	nameplate (decal)	"MONITOR"
6	36-80102A01	pushbutton	"PL" models only
	36-80102A02	pushbutton	CS models only
7	42-10128A22	"O" ring	weather resistant models only
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
16	42-10082A14	retainer, knob	installed by vendor (three used)
17	36-80107A01	knob, vol., sql.	
18	36-80107A02	knob, freq.	
19	42-10128A23	"O" ring	weather resistant models only (3 used for multiple freq; 2 used for single freq.)
20	32-80208A01	gasket	to isolate light (two used)
21	7-80158A01	bracket, freq. switch	
22	32-80203B01	gasket, housing	
23	61-80119A01	lens	
24	42-10113A31	retainer ring	for bezel and lens (six used)
25	15-80108A01	housing, top	
26	32-80140B01	adhesive strip	for bezel, non weather resistant models only
27	13-80180A01	bezel	multi-freq., weather resistant models
	13-80180A02	bezel	single-freq., weather resistant models
	13-80114A01	bezel	multi-freq., non-weather resistant models
	13-80114A02	bezel	single-freq., non-weather resistant models
28	33-80116A02	nameplate (overlay)	for bezel (1-freq. models)w/o busy light option
	33-80116A01	nameplate (overlay)	for bezel (4-freq. models) w/o busy light option
	33-80116A05		4-freq., with busy light
	33-80116A06		1-freq., with busy light
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	32-80038C01	gasket, connector	weather resistant models only
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 (multiple freq. models only)
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	4-7655	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



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FIELD CONVERSION OF RADIO CABLES

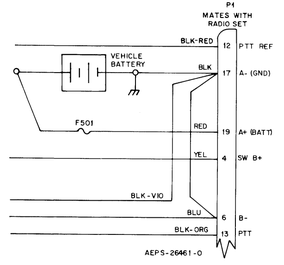
In some instances, it may be necessary or desirable to make field conversion of cables to facilitate a particular installation. Two examples of this would be to install a new MITREK radio in a positive ground vehicle when only a negative ground cable was available or to retrofit a MITREK radio into an 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.

NOTE

When converting to positive ground, JU1 on the interconnect board in the radio must be cut.

END OF DOCUMENT

NEGATIVE GROUND MITREK CABLE



CONVERSION PROCEDURE

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

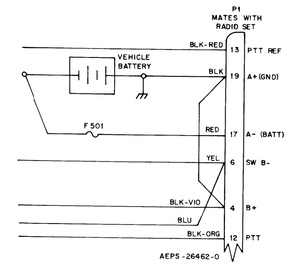
Wire Color	*Pin*
Blk-Red	12
Blk, Blk-Vio, Jumper	17
Red	19
Yel	4
Blu, Jumper	6
Blk-Org	13

Step 2. Resolder the wires to the following pins:

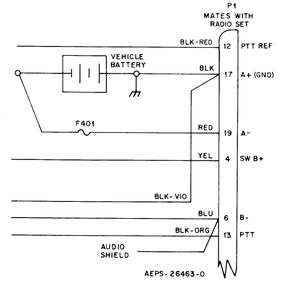
Wire Color	*Pin*
Blk-Red	13
Blk, Jumper	19
Red	17
Yel, Blu	6
Blk-Vio, Jumper	4
Blk-Org	12

Step 3. Attach a tag to the cable near the radio connector documenting the changes thatg 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