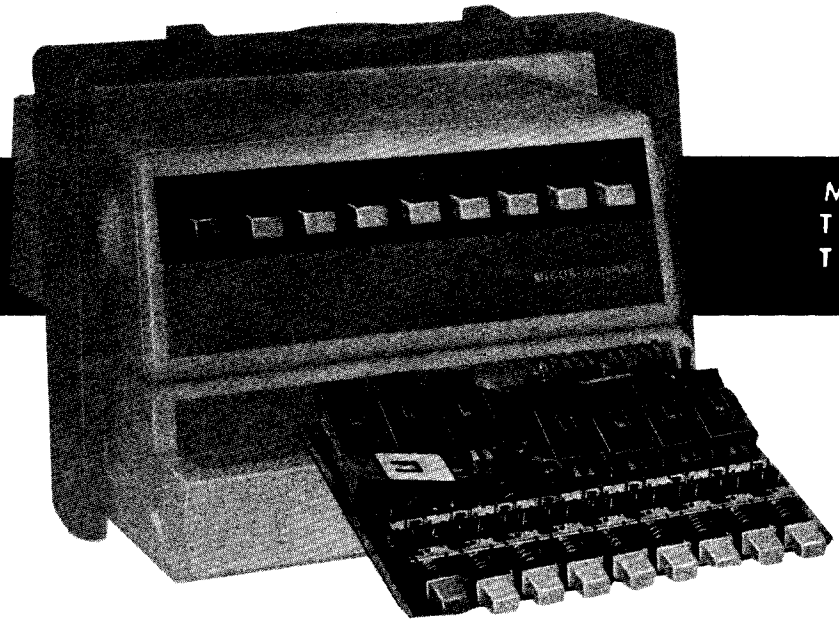
MICOR® | Systems 90

MOBILE MULTIPLE "PRIVATE-LINE" ENCODER



MODEL
TLN 1395A
TLN 1396A

MOTOROLA *Communications Division*

ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

Printed in U.S.A.
10/3/72-NPC

THIS MANUAL HAS BEEN
DISCONTINUED

68P81102E33
Issue - C

1. TECHNICAL CHARACTERISTICS

MODEL	FOR VHF RADIOS	TLN1395A,	TLN1396A,
	FOR UHF RADIOS	TLN1547A	TLN1548A
MAXIMUM NUMBER OF TONE FREQUENCIES		4	8
"PL" TONE FREQUENCIES		Selected from 67-210 Hz range	
FREQUENCY DETERMINING DEVICE		"Vibrasender" Resonant Reed	
FREQUENCY STABILITY		±0.15%	
NOMINAL LEVEL	FOR VHF RADIOS	350 mV rms @67 Hz, to 130 mV rms @ 210 Hz	
	FOR UHF RADIOS	780 mV rms, 67 to 210 Hz	
OUTPUT IMPEDANCE		4.7k ohms	
POWER REQUIREMENTS		±13.8V dc ±20% @200 mA	

Modulator characteristics differ between VHF MICOR (25-50 MHz and 132-174 MHz) and UHF MICOR (450-512 MHz) radio sets. Encoder models are not interchangeable.

2. DESCRIPTION

The mobile multiple "Private-Line" (PL) encoders equip Motorola "Micor" FM two-way mobile radios for use in several "Private-Line" networks. The Models TLN1395A and TLN1396A Multiple "Private-Line" Encoders are used with "Micor" VHF radio sets and the Models TLN1547A and TLN1548A are used with "Micor" UHF radio sets. The TLN1395A and TLN1547A generate up to four PL tones; the TLN1396A and TLN1547A generate up to eight PL tones. Each encoder is fully solid-state and constructed on two printed circuit boards. One board is a multiple PL conversion circuit board which mounts in the radio set. The second board is a multiple PL encoder circuit board card which slides into a Motorola "Systems 90" option housing. Switches and indicators of the operator's panel are an integral part of the board, as is the connector on the rear of the unit. All necessary related items, such as interconnecting cable with connector, are included. The housing is ordered separately, since numerous combinations of housings and options are possible.

3. "PRIVATE-LINE" NETWORK

The use of "Private-Line" tone-coded squelch models improves radio communications especially when operating under crowded channel conditions. Several "Private-Line" networks can use the same rf carrier frequency in the same area without hearing annoying transmissions of co-channel users. Receivers remain silent until a properly tone-modulated signal turns on the audio amplifiers so that messages transmitted by units in the same net can be heard. The speakers remain silent during all other transmissions; personnel do not have to listen to transmissions originating outside their "Private-Line" network.

Receivers accept only signals which are modulated with the correct tone and reject all others. "Private-Line" transmitters are modulated by a continuous sub-audible tone in addition to voice modulation. The receivers can also monitor all on-frequency signals by disabling the "Private-Line" tone-coded squelch circuit.

4. INSTALLATION

The encoder comes either as a factory equipped option, completely prewired, or as a field installed add-on to an existing "Micor" radio set. The conversion circuit board is installed in the "Micor" radio set. The PL encoder circuit board card is installed in the accessory housing, either alone or in combination with other radio accessory options. The installation instructions provided here are for the encoder used as the only accessory. For instructions pertaining to multiple option installations, refer to the installation instructions supplied with the housing assembly.

a. Field Installation of Multiple PL Encoder Board

(1) Remove the escutcheon backing and apply carefully to the housing assembly front panel. Use care to align the holes in the escutcheon with the holes in the panel.

(2) If the multiple PL encoder is used without a full complement of PL tones, the unused pushbutton switches must be pinned.

- Pull the applicable pushbutton plastic cover straight off. A screwdriver may be used to give added leverage.

- Install the supplied plastic pushbutton stop.

- Push the cover back on the pushbutton switch.

CAUTION

Be sure not to close the switch when replacing the pushbutton cover. Hold the little male slider pin that protrudes from the back of the switch with a small screwdriver and push the cover on. This slider pin is "in" when the switch is "open".

(3) Place the card into the two rails as shown in Figure 1 and slide the circuit card completely into the housing assembly.

(4) Determine which of the knockout panels in the rear housing cover must be removed to allow access to the 22-pin assembly on the board. Remove the panel by pushing it out toward the rear of the cover.

(5) Refer to Figure 1. Install the rear housing cover by (1) inserting the tabs on the top of the cover into the holes in the top of the housing assembly and (2) swinging the cover down against the bottom and (3) securing it with the two captive screws.

(6) Disconnect the black connector (P1101) from the control head.

(7) Use the contact removal tool to remove the following wires, with pins attached, from P1101.

- Yellow wire from position 1.
- Black-violet wire from position 9.
- Black-orange wire from position 22.

NOTE

Steps (8) and (9) are not necessary when the wires extend at least five inches beyond the sleeving on the multiconductor cable.

(8) Remove the "S" clamp from the end of the multiconductor cable and move the strain relief back about five inches from the ends of the wires.

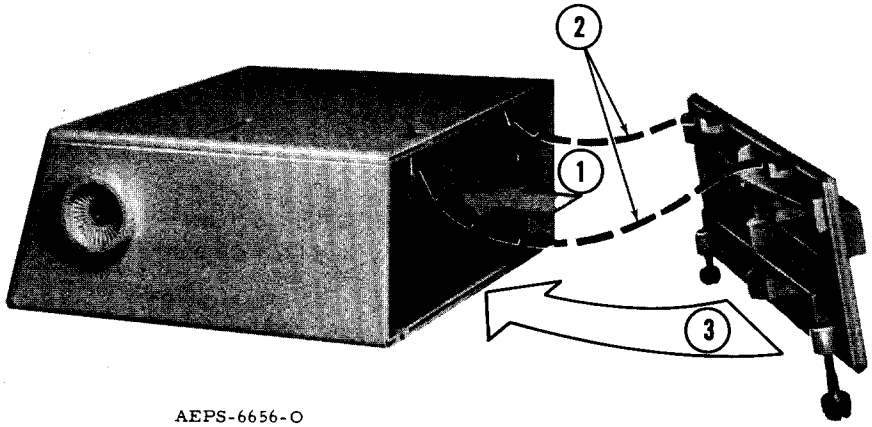
(9) Cut and remove the cable sleeving so that approximately five inches of the wires are exposed. Be careful not to cut the insulation of the wires. Hook the strain relief "S" hook to the bracket on the option housing.

(10) Insert the pins and wires which were removed from P1101 into the tan connector (P1) as follows:

- Yellow wire into position 13.
- Black-violet wire into position 12.
- Black-orange wire into position 22.
- Violet wire into position 18.

(11) Insert the pins and wires connected from P1 into P1101 as follows:

- Yellow wire into position 1.
- Black-violet wire into position 9.
- Black-orange wire into position 22.



AEPS-6656-O

Figure 1.
Circuit Board Card and Rear Cover
Installation Detail

(12) Reconnect P1101 to the control head and connect P1 to the 22-pin receptacle (J1) on the rear of the circuit card.

b. Field Installation of Multiple PL Conversion Board

(1) Unlock the "Micor" radio set and pull the handle forward.

(2) Disconnect the power/control connector (P1105) and antenna connector.

(3) Lift the radio set out of the vehicle. (The bottom cover will remain mounted in the vehicle.)

(4) If the radio set is presently a "Private-Line" model, loosen the two mounting screws holding the PL encoder board. (Refer to Figure 2.)

(5) Pull out the present PL encoder board.

(6) If the radio set is presently a carrier squelch only version, cut jumper JU401 on the "Micor" exciter board. Jumper JU401 has already been cut on PL versions.

(7) Install the multiple PL conversion board in the position where the normal PL encoder is mounted and tighten the mounting screws. (Refer to Figure 2.)

(8) Connect the lead attached to the PL conversion board to P901-27 (main power plug of the "MICOR" radio).

(9) Reinstall the radio set in the vehicle.

c. Factory Wired Option

When the encoder option is purchased as part of a radio system, the wiring changes will have been completed. The individual system components are shipped with all interconnecting cables attached, to permit a thorough system check out before unpacking. To install the radio system proceed as follows:

(1) Install the radio and cabling as directed in the radio installation instructions.

(2) Install the trunnion bracket and housing assembly as instructed.

(3) Connect the black (and blue, if used) connector(s) to the control head.

(4) Connect the tan connector (P1) to encoder jack (J1).

5. OPERATING PROCEDURE

Refer to Figure 2.

To select a "Private-Line" tone, press one of the PL buttons.

To change PL tones, press another PL tone button. The previously selected tone button will automatically disengage.

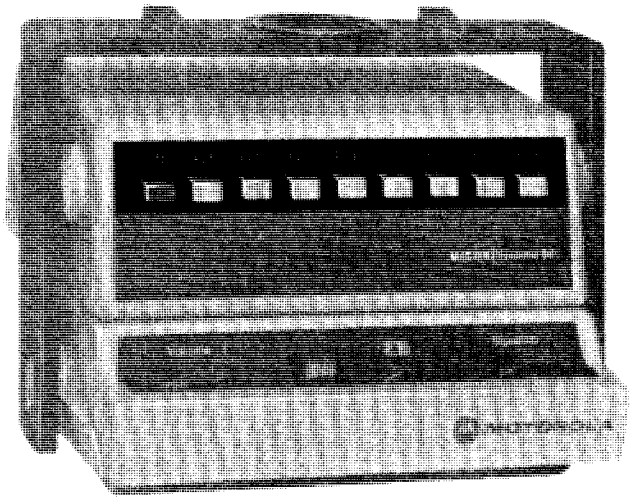
To turn the PL encoder off, press the OFF button.

6. FUNCTIONAL OPERATION

Refer to the multiple PL encoder block diagram Figure 3. The encoder may be divided into four major sections.

a. Tone Oscillator

The tone oscillator generates two equal amplitude tone signals 180° out-of-phase whenever power is applied to the radio. Differential amplifiers Q1 and Q2 provide the out-of-phase signals. Feedback amplifier Q3 provides negative feedback to limit the level of oscillation. The "Vibrasender" resonant reed determines the frequency of operation.



AEPS-5252-O

Figure 2.
Controls and Indicators

b. Rapid Turn-On Circuit

When a "Private-Line" tone is selected, the rapid turn-on circuit minimizes delay in reaching normal tone level output. The level detector Q5 senses the level of the tone output from the differential amplifier. At a low level, the level detector biases off the dc switch Q6 which in turn allows the audio switch Q4 to turn on. This provides very high positive feedback to the oscillator for a rapid increase in amplitude. When the amplitude of oscillation reaches a preset level, the entire rapid turn-on circuit is disabled until a change in "Private-Line" tone is made.

c. Reverse Burst Timing Circuit

The reverse burst timing generator provides a transmitter turn-off delay of approximately 150 milliseconds after the transmitter is unkeyed. During this period, an opposite phase tone (reverse burst) is developed in the tone output circuit which dampens the oscillations of the "Vibrasponder" resonant reed in listening receivers to eliminate "squelch tail" noise burst at the end of the message. When the keyed filtered A+ is applied, keying switch Q11 and delayed turn-off switch Q13 operate immediately to key the transmitter. Delay generator Q12 is also activated. When the transmitter is unkeyed, delay generator Q13 keeps delayed turn-off switch Q13 activated for approximately 150 milliseconds.

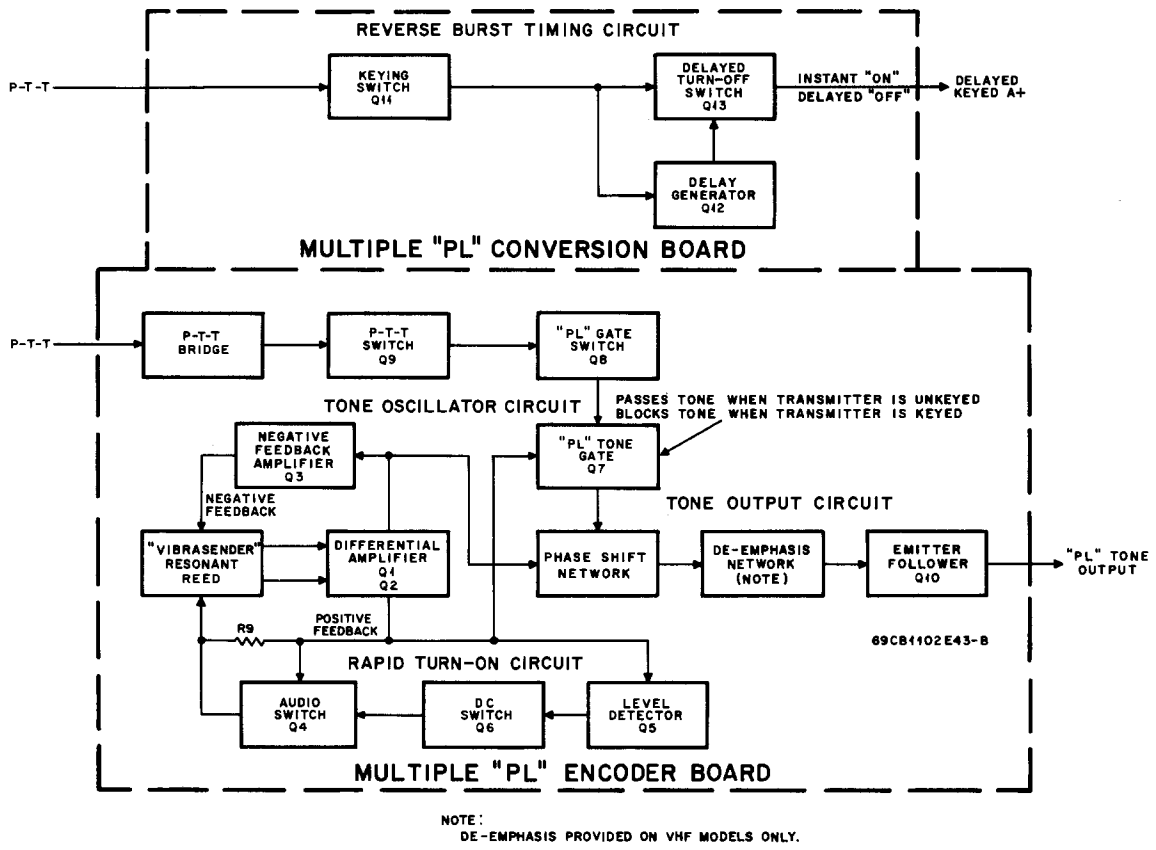


Figure 3.
Multiple "Private-Line" Encoder Block Diagram

d. Tone Output Circuit

The tone output circuit provides a fixed level tone output to the modulator of the transmitter. The phase of the tone is shifted during the reverse burst period. When the transmitter is keyed, PL tone gate Q7 is switched off. Therefore, a single input to the phase network produces a specific phase output signal through emitter follower Q10. When the transmitter is unkeyed, PL tone gate Q7 switches on which allows both tone signals to be applied to the phase network. With both signals applied, the phase network develops a signal 240° out of phase. This is the proper signal to rapidly dampen the "Vibrasponder" resonant reeds.

7. CIRCUIT DESCRIPTION

a. Tone Oscillator

The tone oscillator operates when a PL tone is selected. The outputs at the collectors of differential amplifiers Q1 and Q2 are identical but 180° out of phase. The amplitude of these collector signals are independent of frequency. A positive feedback signal is coupled through C5 and R9 to sustain oscillation. The output of Q1 is applied to feedback amplifier Q3 as negative feedback to limit the level of oscillation. When the signal level exceeds a fixed amount, Q3 is biased into operation. It provides a negative feedback signal which keeps the oscillator out of limiting, thus providing a sinusoidal wave output. Q3 operates as an emitter follower, providing current gain to drive the low impedance "Vibrasender" resonant reed. The "Vibrasender" resonant reed is the frequency determining device of the oscillator. It acts as a very high Q, narrow bandpass transformer, coupling only its resonant frequency and blocking all others. At its resonant frequency, the reed vibrates to couple energy from the primary to the secondary winding.

The "Vibrasender" resonant reed is a precision built device which maintains its frequency within ±0.15% of that specified. It consists of a tuned cantilever reed of special steel mounted on a rugged base with a coil and two permanent magnets.

The entire assembly is spring-mounted and hermetically sealed in a metal housing to insure long life at peak performance under all types of conditions. The design of the reed eliminates the need for servicing throughout its useful life. The reed is a plug-in device which may be easily removed and replaced for circuit testing or to change frequencies. Reeds are available in specific frequencies in the 67-210 Hz range. No circuit adjustments are required when changing reeds.

NOTE

"Private-Line" tone frequencies are assigned by Motorola Systems Engineering to prevent duplication or interference between tones in the same area. Consult them before changing frequencies.

b. Rapid Turn-On Circuit (Q5, Q6, Q7)

When level detector Q5, senses a tone output level of less than 6 dB of full output, it is biased off. This turns on DC switch Q6, which turns on the audio switch Q4. Positive feedback is provided through saturated Q4 for a rapid increase in amplitude of the selected tone. When the tone output reaches a level of approximately 6 dB below full output, level detector Q5 is biased on. This, in turn, turns off DC switch Q6 which biases off Q4 through R12 and CR2. This permits normal oscillator operation.

c. Tone Output Circuit (Q7 thru Q10)

When the P-T-T lead is grounded (transmitter keyed), the P-T-T switch Q9 turns on. The P-T-T bridge, together with the jumper connected to point B (positive ground systems) or point A (negative ground systems), permit Q9 to turn on with either negative or positive grounded systems. Q9, in turn, allows PL gate switch, Q8, to turn on. Q8 gates 10 volts to PL tone gate Q7, turning it off. Q7 remains off during transmission and permits only the tone output of Q1 to be coupled to emitter follower Q10.

When the P-T-T lead is ungrounded (transmitter unkeyed), P-T-T switch Q9 turns off. Q9, in turn, biases off PL gate switch Q8 and allows PL tone gate Q7 to conduct. The tone outputs of Q1 and Q2, 180 degrees out of phase, are combined through phase shift capacitors C8 and C9 to produce a signal 240 degrees out of phase. The signal is placed at the input of emitter follower Q10. Emitter follower Q10 provides impedance matching to a low impedance output and isolates the tone oscillator from the external circuit to which the tone output is applied.

The modulator of VHF radios has a +6 dB per octave per-emphasis characteristic. To maintain 0.5 to 1 kHz PL tone deviation of the transmitter signal, C10 (not used on UHF models) at the base of Q10 provides a compensating -6 dB per octave de-emphasis. The modulator of UHF Micor radios has a flat characteristic, so the -6 dB per octave de-emphasis is not required.

d. Reverse Burst Timing Circuit (Q11, Q12, Q13)

When the transmitter is keyed, keying switch Q11 is forward biased by the keyed filter A+ voltage on its base and it turns on. With Q11 acting as a short circuit:

-- A conduction path is established from A- through Q11, CR9 and R42 to A+. Most of the voltage drop is across R42, placing both the cathode and anode of CR9 at approximately A-.

-- The base voltage of delayed turn-off switch Q13 decreases and it is turned on.

-- Delayed keyed filtered A+ is developed to key the transmitter.

-- C14 charges.

-- A- is applied to the PL tone gating circuit to turn off the PL tone gate.

When the transmitter is unkeyed, keyed filtered A+ is removed from Q11 and it turns off. With Q11 turned off:

-- The PL tone gate Q7 is re-activated, allowing the reverse burst tone signal to pass.

-- C708 discharges and turns Q12 off for approximately 150 milliseconds.

-- Q13 remains on by receiving base drive through R39 and R40 for the 150 milliseconds that Q12 remains off.

-- After the delay period, Q12 turns on, Q13 turns off and the delayed keyed filtered A+ output is removed.

8. SERVICING

Maintenance of the mobile multiple PL encoder falls into two areas: testing and troubleshooting. Testing is performed either in-system or on the service bench.

NOTE

When checking PL tones, refer to the circuit board detail for location of the proper "Vibrasender" resonant reed.

a. Isolate Boards

The first step in testing the multiple "Private-Line" encoder is to determine whether the PL encoder board or the PL conversion board is defective. If the conversion board is believed to be defective, it is best to replace the board with an operational board. This is because it is difficult to take readings from the conversion board while mounted in the radio. For checkout, the conversion board can be replaced with either another conversion board or a single frequency PL encoder. If proper operation of the radio set is restored by replacing the conversion board, troubleshooting can be accomplished with the aid of an ohmmeter.

Removal and installation of the conversion board is accomplished as follows.

(1) Unlock the "Micor" radio set and pull the handle forward.

(2) Disconnect the power/control cable (P1105) and antenna connector.

(3) Lift the radio set out of the vehicle. (The bottom cover will remain mounted in the vehicle.)

(4) Disconnect the lead from P901-27. (This lead is connected to the PL conversion board and is terminated in a push-on type pin.)

(5) Loosen the two mounting screws holding the PL conversion board. (Refer to Figure 2.)

(6) Pull out the present PL conversion board.

(7) If checkout is being done with a single frequency PL encoder board, slide the board into the radio set and tighten the mounting screws.

(8) If checkout is being done with a PL conversion board, slide the conversion board into the radio set, tighten the mounting screws, and connect the lead attached to the conversion board to P901-27.

(9) Replace the radio set in the vehicle and test for proper operation.

b. In-System Testing of Encoder Board

Performing a checkout of the encoder board card while it is still connected to the radio system necessitates removing the circuit card from the "Systems 90" housing. This is accomplished as follows:

(1) Disconnect the tan connector from the circuit card.

(2) Loosen the two captive screws securing the rear housing cover and remove the cover.

(3) Slide the circuit card out of the housing assembly and place it atop the housing with the solder side up.

(4) Reconnect the tan connector to the circuit card.

CAUTION

Do not allow the circuit card to come into contact with any metallic object which may cause damage from an accidental short circuit.

(5) Apply power to the system and proceed to take the voltage measurements necessary to isolate the source of the problem.

c. Bench Testing

Bench testing allows the radio system to stay "in-service" by substituting an operational circuit card for a defective one, while the malfunction is corrected on the service bench. The following equipment is required for a thorough circuit checkout.

- DC power supply
- Service bench VTVM
- Service bench oscilloscope
- One short jumper wire terminated in alligator clips.

To perform the bench check proceed as follows:

(1) Remove the tan connector from the rear of the circuit card.

(2) Loosen the captive screws securing the rear housing cover and remove the cover.

(3) Remove the circuit card from the housing.

(4) Set up the circuit card as shown in Figure 4.

(5) Apply power to the system and proceed to take the voltage measurements necessary to isolate the source of the problem.

d. Troubleshooting

A troubleshooting chart is provided as an aid in isolating the cause of any malfunction attributed to the encoder circuits. This chart presents a logical sequence of steps which result in isolating a faulty component or circuit. Refer to this chart when attacking any problem caused by this unit.

e. Repair

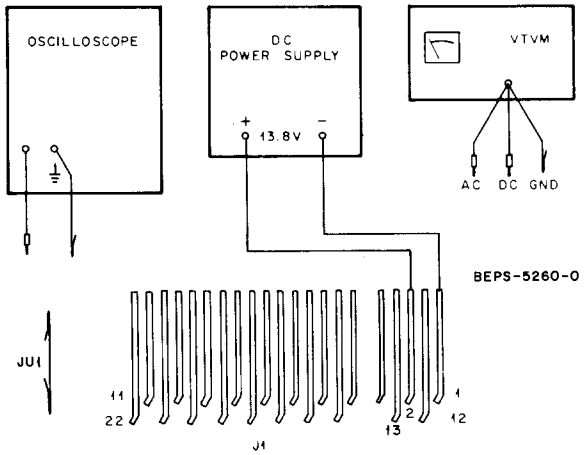
Any component on the circuit card can be replaced by following accepted repair procedures. Refer to the "Micor" radio instruction manual for information pertaining to ordering replacement parts. Upon completion of repairs, the circuit card is reinstalled as follows:

(1) Disconnect the tan connector from the circuit card.

(2) Slide the card completely into the housing.

(3) Install the rear housing cover and secure with two captive screws.

(4) Reconnect the tan connector to the circuit card.



CONNECTOR J1 VIEWED FROM FRONT OF CIRCUIT BOARD, THAT IS, FROM THE END WHERE THE PUSHBUTTONS ARE LOCATED.

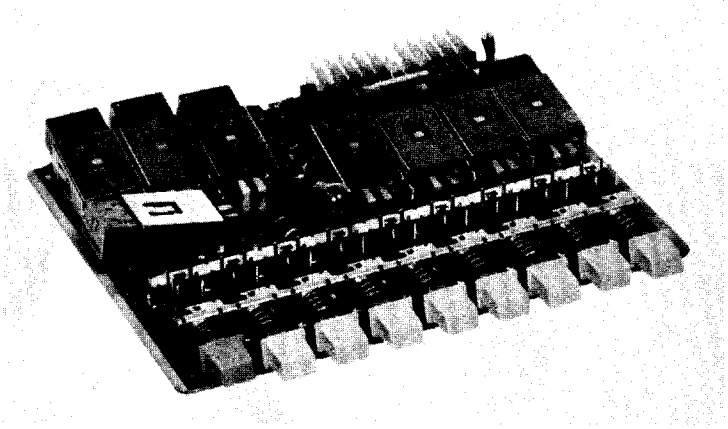
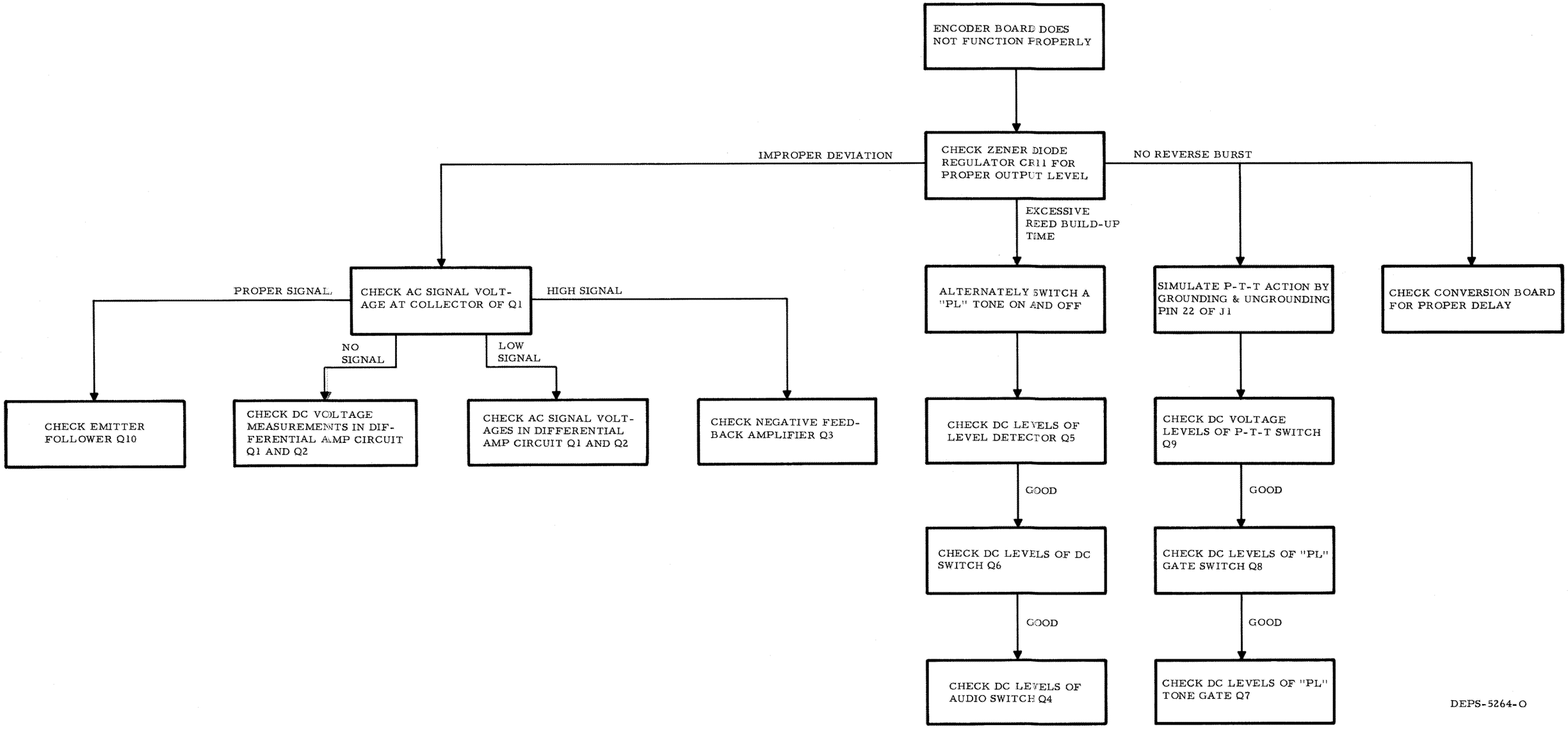


Figure 4.
Bench Test Set-Up

(Page 10 is blank)

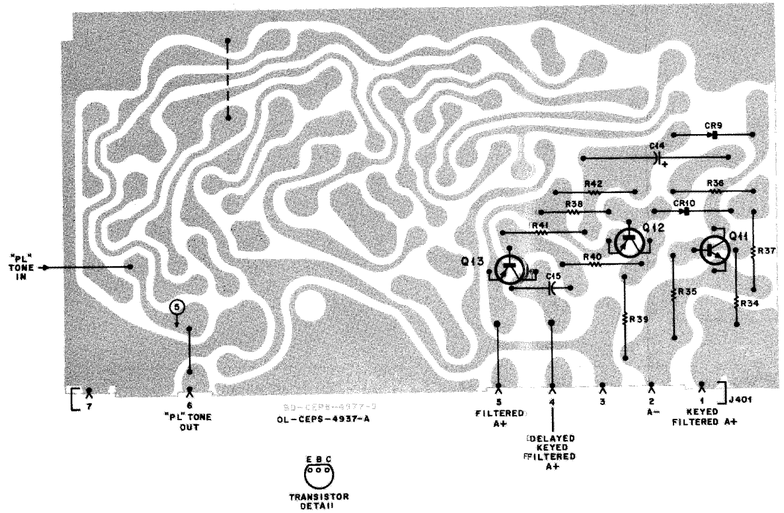
MULTIPLE "PRIVATE-LINE" ENCODER BOARD

TROUBLESHOOTING CHART

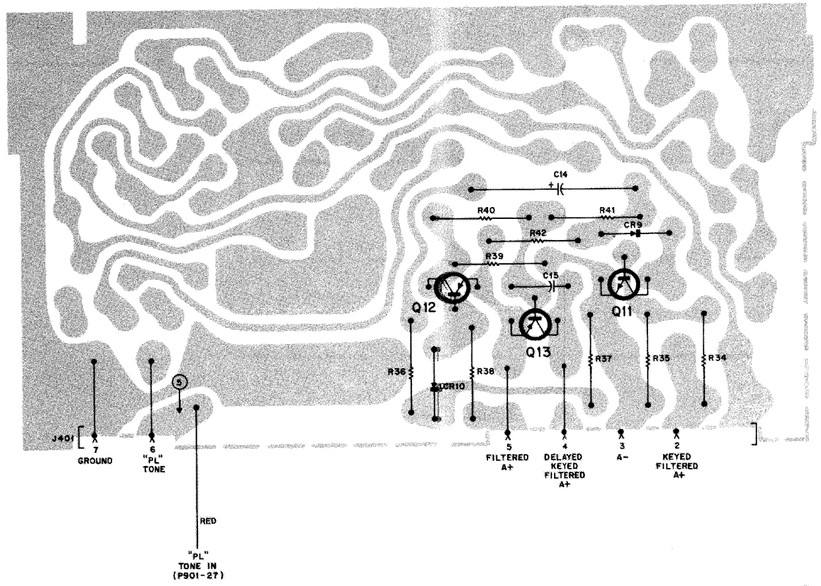


DEPS-5264-O

TLN4532A FOR LOW BAND AND HIGH BAND RADIOS

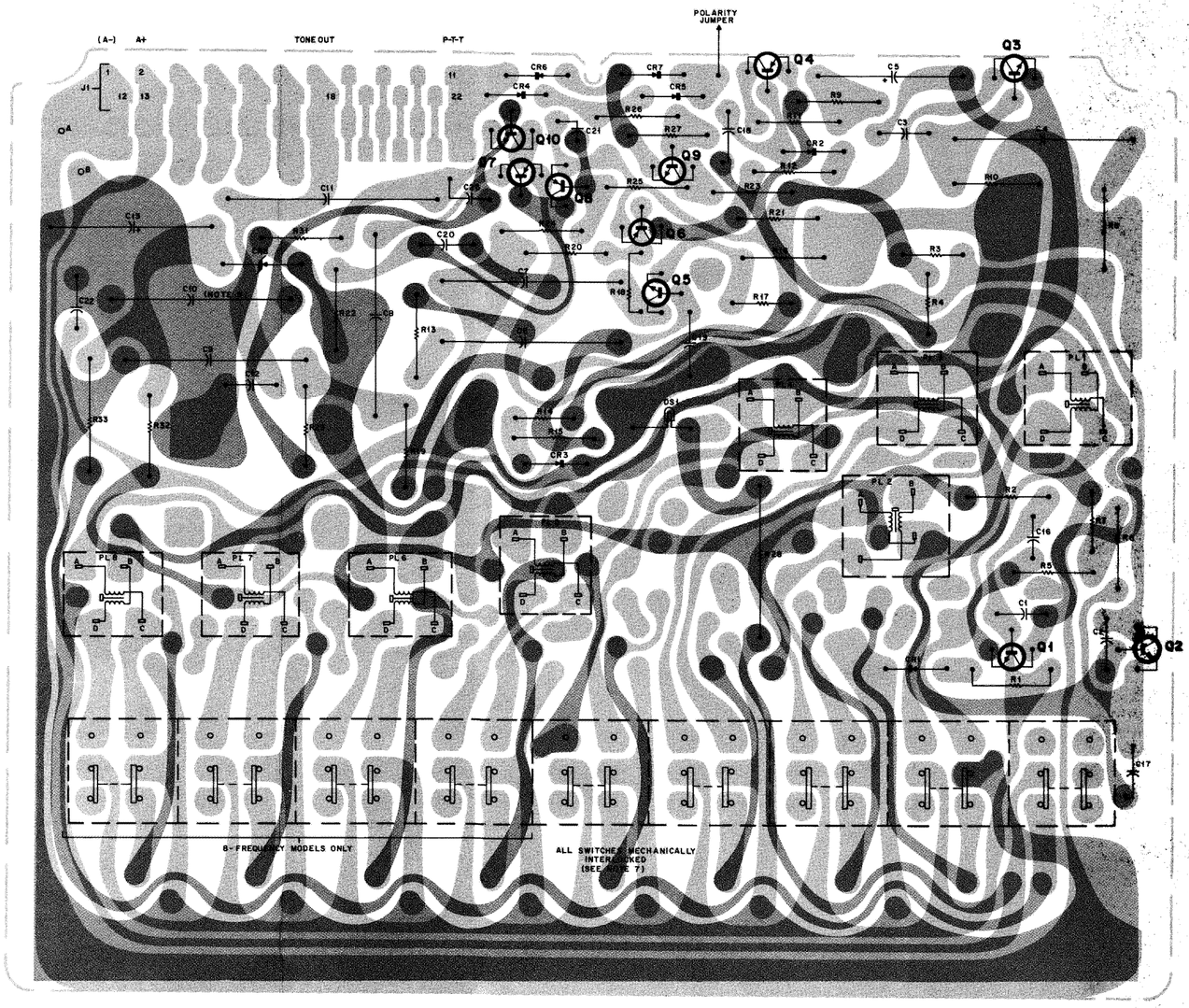


TLN5156A FOR UHF RADIOS



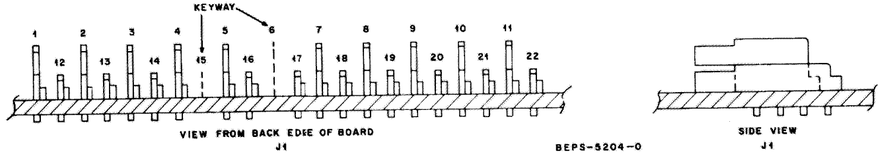
SOLDER SIDE OL-DEPS-10291-O

Multiple "Private-Line" Encoder
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81102E34-D
(Sheet 1 of 2)
10/3/72-NPC

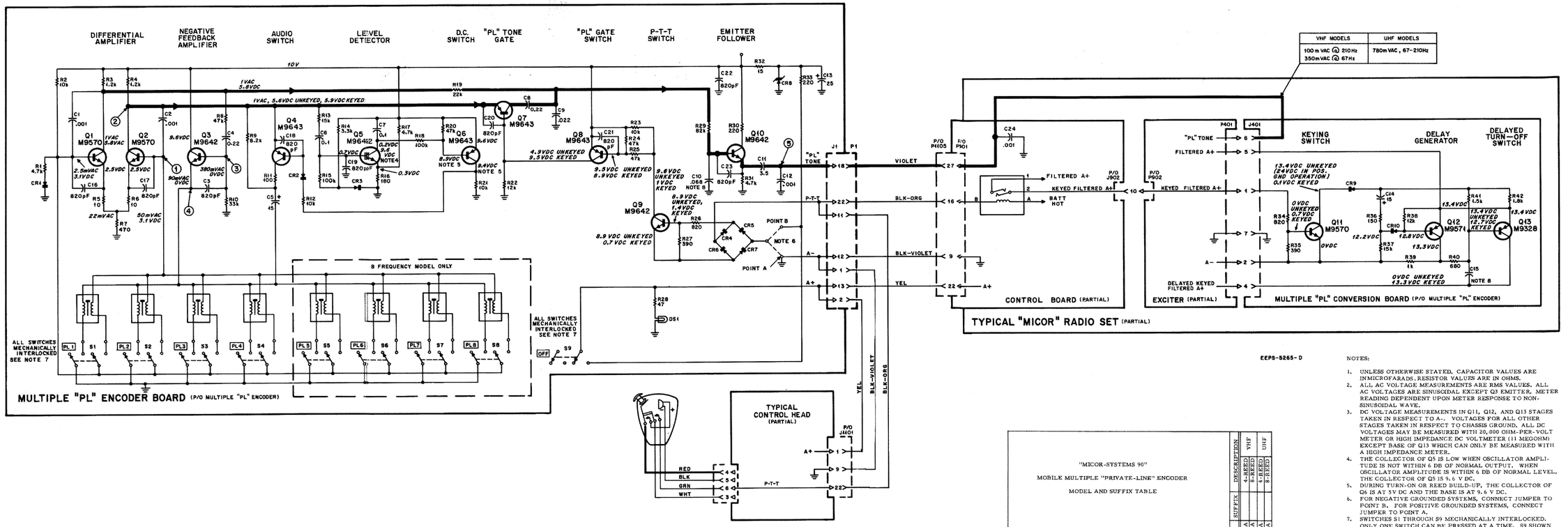


VERSION 2 CIRCUIT BOARD

SOLDER SIDE OL-DEPS-9737-O
COMPONENT SIDE OL-DEPS-9738-O
OL-DEPS-9739-A



BEPS-5204-O



EEPS-5265-D

NOTES:

1. UNLESS OTHERWISE STATED, CAPACITOR VALUES ARE IN MICROFARADS. RESISTOR VALUES ARE IN OHMS.
2. ALL AC VOLTAGE MEASUREMENTS ARE RMS VALUES. ALL AC VOLTAGES ARE SINUSOIDAL EXCEPT Q3 EMITTER. METER READING DEPENDENT UPON METER RESPONSE TO NON-SINUSOIDAL WAVE.
3. DC VOLTAGE MEASUREMENTS IN Q11, Q12, AND Q13 STAGES TAKEN IN RESPECT TO A-. VOLTAGES FOR ALL OTHER STAGES TAKEN IN RESPECT TO CHASSIS GROUND. ALL DC VOLTAGES MAY BE MEASURED WITH 20,000 OHM-PER-VOLT METER OR HIGH IMPEDANCE DC VOLTMETER (11 MEGOHM) EXCEPT BASE OF Q13 WHICH CAN ONLY BE MEASURED WITH A HIGH IMPEDANCE METER.
4. THE COLLECTOR OF Q5 IS LOW WHEN OSCILLATOR AMPLITUDE IS NOT WITHIN 6 DB OF NORMAL OUTPUT. WHEN OSCILLATOR AMPLITUDE IS WITHIN 6 DB OF NORMAL LEVEL, THE COLLECTOR OF Q5 IS 9.6 V DC.
5. DURING TURN-ON OR REED BUILD-UP, THE COLLECTOR OF Q6 IS AT 5V DC AND THE BASE IS AT 9.6 V DC.
6. FOR NEGATIVE GROUNDED SYSTEMS, CONNECT JUMPER TO POINT B. FOR POSITIVE GROUNDED SYSTEMS, CONNECT JUMPER TO POINT A.
7. SWITCHES S1 THROUGH S9 MECHANICALLY INTERLOCKED. ONLY ONE SWITCH CAN BE PRESSED AT A TIME. S9 SHOWN IN OFF POSITION (PRESSED). S1 THROUGH S8 SHOWN NOT ACTUATED.
8. C10 IS USED ON VHF MODELS ONLY. C15 IS 820 pF ON VHF MODELS AND .05 uF ON UHF MODELS.
9. PIN NOS. IN PARENTHESIS FOR P401 AND J401 APPLY TO UHF MODELS.

EPS-5205-A

"MICOR-SYSTEMS 90"

MOBILE MULTIPLE "PRIVATE-LINE" ENCODER

MODEL AND SUFFIX TABLE

SUB-UNIT	SUFFIX	DESCRIPTION	MODEL SUFFIX	DESCRIPTION	VHF	UHF
				4-REED		
				8-REED		
				4-REED		
				8-REED		
TLN4527A		ENCODER BOARD (4-REED)			X	
TLN4528A		ENCODER BOARD (8-REED)				X
TLN4532A		CONVERSION BOARD			X	X
TKN6507A		CABLE ASSEMBLY			X	X
TLN4514A		HARDWARE AND ESCUTCHEON KIT(4-REED)			X	X
TLN4515A		HARDWARE AND ESCUTCHEON KIT (8-REED)			X	X
TLN6824A		"VIBRASENDER" RESONANT REED	TLN1539A		*	*
			TLN1539B		*	*
TLN5154A		ENCODER BOARD (4-REED)	TLN1547A			X
TLN5155A		ENCODER BOARD (8-REED)	TLN1548A			X
TLN5156A		CONVERSION BOARD			X	X

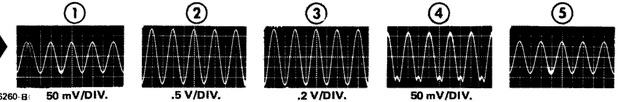
*NOTE: QUANTITY OF RESONANT REED UNITS REQUIRED DEPENDS UPON MODEL.

EPS-8870-A

"PL" ENCODER WAVEFORMS

OSCILLOSCOPE WAVEFORMS MEASURED UNDER FOLLOWING CONDITIONS:

1. WAVEFORMS SHOWN USING 100-Hz "VIBRASENDER" RESONANT REED.
2. VERTICAL SENSITIVITY SHOWN UNDER EACH WAVEFORM.
3. HORIZONTAL DEFLECTION = 5 msec/DIV.
4. ALL WAVEFORMS MEASURED IN RESPECT TO CHASSIS GROUND.



EPS-6260-B

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Multiple "Private-Line" Encoder
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81102E34-D
(Sheet 2 of 2)
10/3/72-NPC

REVISIONS 63P81762E34-D

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN1395A TLN1396A	-	EARLY VERSION	VERSION 1 CIRCUIT BOARD
TLN1395A TLN1396A	C16 THRU C23	ADDED, 21D82187B23, 820 pF	SCHEMATIC PARTS LIST, &
	C24	ADDED, 21D82187B14, .001 uF	VERSION 2 CIRCUIT BOARD
	CR4 THRU CR7	WERE 48C83654H01	PARTS LIST
TLN1547A TLN1548A	-	MODELS ADDED	

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

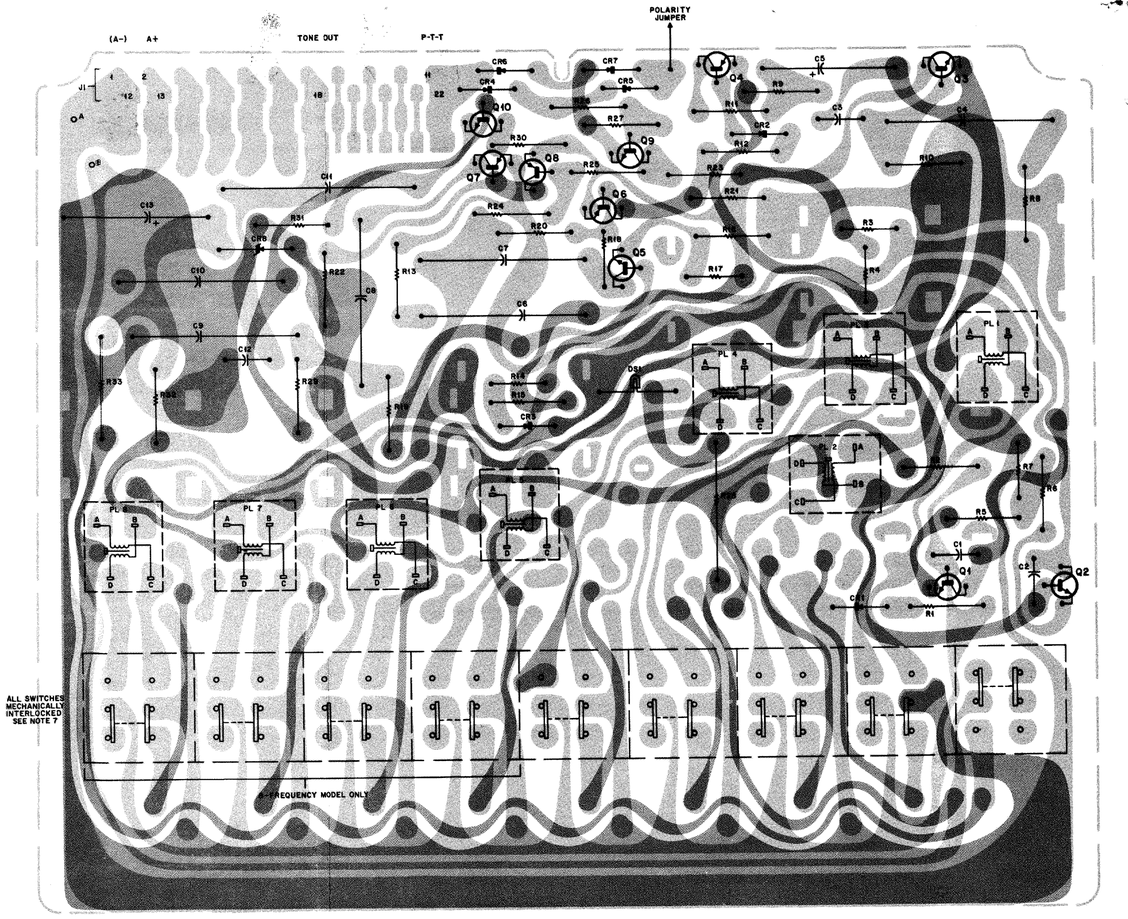
TLN1395A Multiple PL Encoder (4-tone) } Low Band and
TLN1396A Multiple PL Encoder (8-tone) } High Band PL-1216-C

		CAPACITOR, fixed:
C1	21D82187B20	.001 uF ±10%; 100 V
C2	21D82187B20	.001 uF ±10%; 100 V
C3	21D82187B21	820 pF
C4	8D83813H11	0.22 uF ±10%; 75 V
C5	23D83214C02	15 uF ±20%; 25 V
C6	8C82317B01	0.1 uF ±10%; 100 V
C7	8C82317B01	0.1 uF ±10%; 100 V
C8	8K868594	0.22 ±10%; 100 V
C9	8K852472	.022 ±10%; 200 V
C10	8K868588	.068 ±10%; 100 V (not used on UHF)
C11	23D82645A04	3.5 uF +100-10%; 20 V
C12	21D82187B20	.001 uF ±10%; 100 V
C13	23D82601A26	25 uF +150-10%; 25 V
C14	23D83214C26	15 uF ±20%; 25 V
C15	21D82187B23 or 21C82372C04	820 pF, ±10%; 500 V (low band and high band) .05 uF, +80-20%; 25 V (UHF)
C16 thru C23	21D82187B23	820 pF, ±10%; 500 V
C24	21D82187B14	.001 uF ±10%; 100 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 3	48C83654H01	silicon
CR4 thru 7	48D82420C01	silicon
CR8	48D82256C11	silicon; Zener type; 10 V
CR9	48C83654H01	silicon
CR10	48C83654H01	silicon
		LAMP, incandescent:
DS1	65B83554G01	12 V; 0.19 A; 1 c.p.; wedge base; type No. 161
		CONNECTOR, receptacle:
J1		(for reference only)
J401		(for reference only)
J902		(for reference only)
J1101		(for reference only)
		LEAD, electrical:
JU1	1V80718B31	"jumper"; includes 39S101184A07 CONNECTOR, plug: female; single-contact
		CONNECTOR plug:
P401		(for reference only)
P901		(for reference only)
P902		(for reference only)
P1105		(for reference only)
		TRANSISTOR: (SEE NOTE)
Q1	48R869570	N-P-N; type M9570
Q2	48R869570	N-P-N; type M9570
Q3	48R869642	N-P-N; type M9642
Q4	48R869643	P-N-P; type M9643
Q5	48R869642	N-P-N; type M9642
Q6	48R869643	P-N-P; type M9643
Q7	48R869643	P-N-P; type M9643
Q8	48R869643	P-N-P; type M9643
Q9	48R869642	N-P-N; type M9642
Q10	48R869642	N-P-N; type M9642
Q11	48R869570	N-P-N; type M9570
Q12	48R869571	P-N-P; type M9571
Q13	48R869328	P-N-P; type M9328
		RESISTOR, fixed: ±10%, 1/4 W; unl stated
R1	6S129669	4.7k ±5%
R2	6S129668	10k ±5%
R3	6S185A51	1.2k ±5%; 1/8 W
R4	6S185A51	1.2k ±5%; 1/8 W
R5	6S124A01	10 ±5%
R6	6S124A01	10 ±5%
R7	6S185A41	470 ±5%; 1/8 W
R8	6S131527	47k ±5%
R9	6S129983	8.2k ±5%
R10	6S129526	33k ±5%
R11	6S131524	100 ±5%
R12	6S129668	10k ±5%
R13	6S129236	15k ±5%
R14	6S185A61	3.3k ±5%; 1/8 W
R15	6S124A97	100k ±5%
R16	6R129431	180 ±5%
R17	6S185A65	4.7k ±5%; 1/8 W
R18	6S185A97	100k ±5%; 1/8 W
R19	6S129667	22k ±5%
R20	6S131527	47k ±5%
R21	6S129668	10k ±5%
R22	6S129887	12k ±5%
R23	6S129668	10k ±5%
R24	6S131527	47k ±5%
R25	6S131527	47k ±5%
R26	6S129432	820
R27	6S129863	390
R28	6S5583	47; 1 W
R29	6S124A95	82k ±5%
R30	6S131275	220 ±5%
R31	6S129669	4.7k ±5%
R32	6S124A05	15 ±5%
R33	6S2002	220 ±5%; 1/2 W
R34	6S129432	820
R35	6S129863	390
R36	6S129862	150
R37	6S129236	15k ±5%
R38	6S129887	12k ±5%
R39	6S129805	1k ±5%
R40	6S129984	680 ±5%
R41	6S129681	1.5k ±5%
R42	6S129269	1.8k
		SWITCH ASSEMBLY, push: interlocking action; lockout type:
S1	40D84324C06	5-section; each section dpdt; does not include 14C84360C01 INSULATOR, switch terminal: 5 req'd (4-tone encoder)
	or40D84324C07	9-section; each section dpdt; does not include 14C84360C01 INSULATOR, switch terminal: 9 req'd (8-tone encoder)
XDS1	9C84285C01	LIGHT, indicator: 2-contact; white opaque screen; for wedge-base lamps
		NON-REFERENCED ITEMS
	9C84910C01	SOCKET, "Vibrasender" Resonant Reed; includes integral mounting bracket
	66C84699B01	CONTACT REMOVAL TOOL
	13D84319C16	ESCUTCHEON (4-tone encoder)
	13D84319C06	ESCUTCHEON (8-tone encoder)
	38C84321C01	PUSHBUTTON (white)
	38C84321C02	PUSHBUTTON (orange)
	38B84617C01	STOP, switch pushbutton lockout

NOTE:

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

END OF DOCUMENT



SOLDER SIDE 80-DEPS-5204-0
COMPONENT SIDE 80-DEPS-5202-0
0L-DEPS-5203-B

VERSION 1 CIRCUIT BOARD