MICOR® Systems 90

VOICE PRIVACY ADAPTER

MODEL TLN1400A
## PERFORMANCE SPECIFICATIONS

<table>
<thead>
<tr>
<th>Model</th>
<th>TLN1400A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>Simple inversion method</td>
</tr>
<tr>
<td><strong>Current Drain:</strong></td>
<td></td>
</tr>
<tr>
<td>Clear Mode</td>
<td>100 ma @ 13.6V dc</td>
</tr>
<tr>
<td>Coded Mode</td>
<td>110 ma @ 13.6V dc</td>
</tr>
<tr>
<td><strong>Power Consumption (Coded Mode)</strong></td>
<td>1.5 watts</td>
</tr>
<tr>
<td><strong>Operating Temperature Range</strong></td>
<td>-30° to +60°C</td>
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<tr>
<td><strong>Audio Frequency Range</strong></td>
<td>300 to 3000 Hz</td>
</tr>
<tr>
<td><strong>Carrier Rejection</strong></td>
<td>More than 60 dB</td>
</tr>
<tr>
<td><strong>Input Signal Feedthrough</strong></td>
<td>Less than 40 dB</td>
</tr>
<tr>
<td><strong>Undesired Sideband Rejection</strong></td>
<td>More than 40 dB</td>
</tr>
<tr>
<td><strong>Oscillator Stability</strong></td>
<td>+0.6% to -0.2%</td>
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<tr>
<td><strong>Nominal Impedance:</strong></td>
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<tr>
<td><strong>Transmit</strong></td>
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</tr>
<tr>
<td>Microphone Input</td>
<td>600 ohms</td>
</tr>
<tr>
<td>Output to Transmitter</td>
<td>600 ohms</td>
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<tr>
<td><strong>Receive</strong></td>
<td></td>
</tr>
<tr>
<td>Input</td>
<td>10K ohms</td>
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<tr>
<td>Output</td>
<td>7K ohms</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>1/2 pound</td>
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<tr>
<td><strong>Mounting</strong></td>
<td>Under-dash housing</td>
</tr>
</tbody>
</table>
FOREWORD

SCOPE OF INSTRUCTION MANUAL

This manual offers descriptive and service information for the radios described in it. Service diagrams, parts lists, and printed circuit board details are also included.

NOMENCLATURE

Motorola radio equipment is specifically identified by the model number on the nameplate.

NOTE

Be sure to use the entire model number when making inquiries about your equipment.

Identifiers have been assigned to chassis and kits. Use these identifiers when requesting information or ordering replacements.

PRODUCTION CHANGES

When production and engineering changes are incorporated into the equipment, a revision numeral is assigned to the chassis or kit affected.

Typical Example:
The Model TRD1432AA becomes TRD1432AA-1 with the first revision.

This chassis number complete with revision numeral, if any, is stamped on the chassis at the time of production. The revision numeral becomes an integral part of the chassis identifier.

CAREFUL USE OF THE INSTRUCTION MANUAL AND THE MANY SUGGESTIONS CONTAINED IN IT WILL FURTHER INSURE PROPERLY INSTALLED AND MAINTAINED RADIO EQUIPMENT.

INSTRUCTION MANUAL REVISIONS

Changes which occur after an instruction manual is printed are described in the Instruction Manual Revision. These bulletins give the reader complete information on the change including pertinent parts listing data.

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The largest service organization specializing in mobile communications is Motorola's National Service Organization. Over 800 strategically located, adequately staffed and trained, independently owned and operated stations, manned with several thousand FCC licensed personnel constitute the sub-contracting force.

The administrative forces of area and district service managers and district service representatives are in the direct employ of Motorola.

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1301 E. Algonquin Road, Schaumburg, Ill. 60172
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| RE-24,815 | 2,834,879 | 3,059,184 | 3,204,202 | 3,306,990 | 3,387,270 |
| RE-26,079 | 2,883,521 | 3,061,785 | 3,205,455 | 3,307,051 | 3,400,219 |
| RE-26,361 | 2,888,652 | 3,070,737 | 3,218,587 | 3,307,121 | 3,409,841 |
| 2,626,384 | 2,899,547 | 3,070,748 | 3,223,953 | 3,323,065 | 3,414,881 |
| 2,637,782 | 2,901,601 | 3,083,332 | 3,233,243 | 3,324,408 | 3,416,032 |
| 2,650,333 | 2,912,573 | 3,087,117 | 3,234,469 | 3,327,215 | 3,424,854 |
| 2,688,059 | 2,918,571 | 3,087,998 | 3,247,475 | 3,328,695 | 3,424,983 |
| 2,691,094 | 2,924,705 | 3,087,999 | 3,250,997 | 3,328,727 | 3,430,171 |
| 2,691,560 | 2,925,562 | 3,091,736 | 3,250,999 | 3,333,151 | 3,431,486 |
| 2,699,425 | 2,938,082 | 3,094,293 | 3,256,497 | 3,333,911 | 3,437,838 |
| 2,705,281 | 2,963,577 | 3,101,441 | 3,263,172 | 3,334,293 | 3,437,934 |
| 2,731,555 | 2,966,585 | 3,119,093 | 3,273,083 | 3,335,405 | 3,441,854 |
| 2,738,466 | 2,974,221 | 3,126,514 | 3,275,938 | 3,336,533 | 3,447,133 |
| 2,740,891 | 2,984,740 | 3,128,431 | 3,281,697 | 3,341,777 | 3,448,342 |
| 2,743,361 | 2,994,844 | 3,129,396 | 3,284,714 | 3,345,568 | 3,449,680 |
| 2,759,052 | 3,009,115 | 3,131,354 | 3,289,098 | 3,345,569 | 3,453,521 |
| 2,759,103 | 3,014,127 | 3,149,317 | 3,292,085 | 3,345,573 | 3,454,927 |
| 2,777,950 | 3,027,454 | 3,175,183 | 3,293,644 | 3,348,148 | 3,458,664 |
| 2,799,010 | 3,027,455 | 3,175,187 | 3,300,723 | 3,355,533 | 3,465,294 |
| 2,808,507 | 3,039,081 | 3,175,193 | 3,304,501 | 3,355,709 | 3,469,191 |
| 2,809,236 | 3,041,550 | 3,183,382 | 3,304,503 | 3,369,597 | 3,471,796 |
| 2,830,200 | 3,048,659 | 3,191,123 | 3,305,779 | 3,370,236 | 3,471,805 |
| 2,833,994 | 3,048,747 |            |            | 3,373,379 | 3,473,152 |

Other U.S. Patents Pending
PARTS AND SERVICE
REPLACEMENT PARTS ORDERING

ORDERING INFORMATION

Motorola maintains parts depots strategically located throughout the country. These facilities are fully equipped to give the finest service. Orders for all parts except crystals, channel elements, and "Vibrasender" and "Vibrasponder" resonant reeds should be sent to the nearest parts depot. Orders for crystals, channel elements and reeds should be sent to the factory address listed. Orders for instruction manuals should also be sent to the parts depot.

When ordering replacement parts, the complete number identification of the item must be used whether it be a component, kit or complete chassis. This will fix proper identification and assure delivery of the desired item. Complete number identification should also be used when requesting equipment information.

Crystal and channel element orders should specify the crystal or channel element type number, crystal frequency, carrier frequency, and the chassis model number in which the part is used.

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

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Communications Division Parts Depot
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1170 Chess Drive, San Mateo, California 94404
Lake Mirror Road, Forest Park, Georgia 30050
1313 E. Algonquin Road, Schaumburg, Ill. 60172
85 Harristown Road, Glen Rock, New Jersey 07452
12955 Snow Rd., Parma, Ohio 44130
3220 Belt Line Road, Dallas, Texas 75234

FACTORY ADDRESS FOR CRYSTAL, CHANNEL ELEMENT AND RESONANT REED ORDERS

AIR MAIL ORDERS
Motorola, Inc.
Component Service Department
P. O. Box 66191
O'Hare International Airport
Chicago, Ill. 60666

REGULAR MAIL ORDERS
Motorola, Inc.
Component Service Department
4545 W. Augusta Blvd.
Chicago, Illinois 60651

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# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Application</td>
<td>1</td>
</tr>
<tr>
<td>Description</td>
<td>1</td>
</tr>
<tr>
<td>Model Complement</td>
<td>1</td>
</tr>
<tr>
<td>INSTALLATION AND OPERATION</td>
<td>1</td>
</tr>
<tr>
<td>Installation</td>
<td>1</td>
</tr>
<tr>
<td>Operation</td>
<td>3</td>
</tr>
<tr>
<td>THEORY OF OPERATION</td>
<td>3</td>
</tr>
<tr>
<td>Functional Description</td>
<td>3</td>
</tr>
<tr>
<td>Detailed Circuit Description</td>
<td>5</td>
</tr>
<tr>
<td>MAINTENANCE</td>
<td>8</td>
</tr>
<tr>
<td>Servicing</td>
<td>8</td>
</tr>
<tr>
<td>Troubleshooting</td>
<td>8</td>
</tr>
<tr>
<td>Adjustments</td>
<td>13</td>
</tr>
<tr>
<td>Printed Circuit Board Repair</td>
<td>13</td>
</tr>
</tbody>
</table>

REFERENCE DIAGRAM

TLN1400A "Micor" Voice Privacy Adapter Schematic .......................... 38C16
1. INTRODUCTION

1.1 APPLICATION

The TLN1400A "Micor" Voice Privacy Adapter (mobile speech scrambler) is designed for use with Motorola "Micor" FM two-way radios. The solid-state voice privacy adapter employs frequency-inversion audio scrambling to provide speech inversion on radio communications channels. The same adapter provides both scrambling and unscrambling of messages, minimizing casual eavesdropping and providing a deterrent to the more sophisticated, undesired listener.

1.2 DESCRIPTION

All circuitry of the voice privacy adapter is contained on a single printed circuit board. The circuit board plugs into an accessories unit, supplied with the radio set, and operates from the A+ (+13.6V) supply of the radio set. In the receive condition, the voice privacy adapter is electrically inserted between the discriminator buffer output and the volume control in the audio output stages of the receiver. In the transmit condition, it is inserted in the microphone audio line. A cable kit is supplied for making all required interconnections.

1.3 MODEL COMPLEMENT

The TLN1400A "Micor" Voice Privacy Adapter consists of the following items:

1 - TLN4571A "Micor" Voice Privacy Adapter Board
1 - TKN6520A Cable Kit
1 - TLN4572A Hardware and Escutcheon Kit

2. INSTALLATION AND OPERATION

2.1 INSTALLATION

2.1.1 Inspection

Inspect the equipment immediately after delivery and report any damaged or missing items to the transportation company making the delivery.

2.1.2 Control Head Modification

Minor modifications must be made to the control head before installing the voice privacy adapter. Modification consists of removing resistor R1103 from all control head printed circuit boards. For positive ground installations, also, remove jumper JU3 from printed circuit boards bearing part number 84E84571B03. If the control head has not been previously modified for use with the voice privacy adapter, perform the following procedure:

Step 1. Turn the radio off. Disconnect microphone, speaker, and radio set cables from the control head and remove the control head from its mounting trunion.

Step 2. Disengage two captive "Phillips" head screws located on the bottom outer edges of the control head housing and remove the upper half of the housing.

Step 3. Locate resistor R1103 on the control head circuit board and remove by cutting or unsoldering its leads. For positive ground installations, also remove jumper JU3 from the circuit board only if its part number is 84E84571B03.

Step 4. Replace the upper half of the control head housing and secure it with the two captive screws.

Step 5. Mount the control head on its mounting trunion. Reconnect microphone and speaker cables.

2.1.3 Installation of Voice Privacy Adapter

The voice privacy adapter board is installed in the accessory housing, either alone or in conjunction with other radio accessories. The installation instructions provided here apply to instances where the voice privacy adapter is used as the only accessory. (For instructions pertaining to multiple accessory installations, refer to the installation instructions supplied with the accessory housing assembly.) Refer to figure 1 or 2 and proceed as follows:

NOTE

The following procedure is for installation in negative ground systems, change connections as directed by the notes in figures 1 and 2.

Step 1. Modify the control head as described in paragraph 2.1.2 above.

Step 2. Slide the voice privacy adapter board completely into the accessory housing assembly.

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

Step 4. Disconnect the black connector (P1101) and the blue connector (P1102, if used) from the control head.

Step 5. Using the contact removal tool supplied, remove seven wires, with pins attached, from black (P1101) connector as follows:

(1) Yellow wire from position 1.

(2) Black-violet wire from position 9.

(3a) Shield of red shielded cable (brown center conductor) from position 10 on control heads using circuit board 84E84571B01 or B02 only.
Figure 1. "Micor" Voice Privacy Adapter, Interconnect Diagram (B01, B02 Control Head Circuit Boards)
(3b) Shield of triple shielded cable from position 21 on control heads using circuit board 84E84571B03 only.

(4) Brown center conductor of red shielded cable from position 17 on control heads using circuit board 84E84571B01 or B02 only.

(5) Black-yellow wire from position 11.

(6) Black-brown wire from position 16.

(7) Black-orange wire from position 22.

Step 6. Insert pins and wires (removed from black connector) into red connector of TKN6520A Cable Kit as follows:

   (1) Yellow wire into position 22.

   (2) Black-violet wire into position 14.

   (3a) Shield or red shielded cable (brown center conductor) into position 19 for control heads using circuit board 84E84571B01 or B02 only.

   (3b) Shield of triple shielded cable into position 19 for control heads using circuit board 84E84571B03 only.

   (4) Black-yellow wire into position 18.

   (5) Black-brown wire into position 3.

   (6) Black-orange wire into position 21.

   (7) Brown center conductor of red shielded cable into position 9 for control heads using circuit board 84E84571B01 or B02 only.

Step 7. Insert pins and wires of TKN6520A Cable Kit into black (P1101) connector as follows:

   (1) Yellow wire into position 1.

   (2) Black-brown wire into position 16.

   (3) Red-black wire into position 10 for control heads using circuit board 84E84571B01 or B02; or into position 2 for circuit board 84E84571B03.

   (4) Yellow-black wire into position 11.

   (5) Black-orange wire into position 22.

   (6) Violet-black wire into position 17 for control heads using circuit board 84E84571B01 or B02; or position 21 for circuit board 84E84571B03.

   (7) Black-violet wire into position 9.

Step 8. If the radio control cable has a blue (P1102) connector, insert pin of brown-black wire (of TKN6520A Cable Kit) into position 16. If the radio control cable does not have a blue connector, use the one supplied in the TLN4572A Hardware and Escutcheon Kit.

Step 9. Plug the black connector into J1101 and the blue connector into J1102 on the control head. Connect the red connector to the pins on the voice privacy adapter board through the access hole in the rear of the accessory housing.

Step 10. Remove the escutcheon backing and attach to the housing assembly front panel. Installation is complete.

2.2 OPERATION

Power is applied to the voice privacy adapter by turning the radio set on. To set for scrambled operation, depress the Clear-Coded switch (CODE lamp will light); for unscrambled operation depress to release the Clear-Coded switch (figure 3).

3. THEORY OF OPERATION

3.1 FUNCTIONAL DESCRIPTION

3.1.1 General

3.1.1.1 The voice privacy adapter is electrically inserted between the radio set discriminator output and the audio amplifier stages for reception; for transmission, it is inserted in the microphone audio line. The scrambling process affects the audio stages only.

3.1.1.2 For transmission, the voice privacy adapter first converts the 300-3000 Hz audio signal into a double-sideband, suppressed carrier information in a balanced modulator circuit. A low pass filter removes the upper sideband, leaving only the lower sideband of 500-3200 Hz for transmission. Because the difference frequency is used, audio in the lower sideband is inverted. This is the result of using a 3500 Hz modulating frequency, producing difference frequencies as follows:

3500 Hz (modulating signal)
-300 Hz (low audio range)
3200 Hz (difference)

3500 Hz (modulating signal)
-3000 Hz (high audio range)
500 Hz (difference)

3.1.1.3 As shown, the audio frequencies are now reversed in the audio spectrum thus becoming inverted images of the original audio signals. These inverted signals are referred to as scrambled audio frequencies.

3.1.1.4 When the scrambled audio frequencies are applied to a radio set receiver equipped with a voice privacy adapter, similar inversion process takes place. This process unscrambles
Figure 2. "Micor" Voice Privacy Adapter, Interconnect Diagram (B03 Control Head Circuit Board)
3.1.3 Receive Signal Flow (Coded)

3.1.3.1 (See figure 4.) Received scrambled audio from the radio set discriminator is applied through the "PL" filter, de-emphasis circuits, and amplifier Q1 to the receive audio gate.

3.1.3.2 In the receive mode, since the P-T-T input is not present, the receive audio gate is turned on and the received scrambled audio is applied to the differential phase splitter. The differential phase splitter provides two out-of-phase signals to the balanced modulator, which mixes each of the two signals with a 3500 Hz signal from the bistable and sums the mixed signals.

3.1.3.3 The audio output from the modulator is applied through an amplifier to an active filter which passes only the frequencies within the 300-3200 Hz range. The filter audio is de-emphasized and applied to the volume control in the control head. Input and output de-emphasis capacitors C6 and C55 are switched in the circuit in the CODED mode only.

3.1.4 Normal Signal Flow (Clear)

When the radio is operated in the clear mode, the signal flow is identical to the previously described transmit and receive flow paths into the balanced modulator/chopper circuit. At this point, only the in-phase portion of the signal passes because the Clear position of the switch grounds the collector of Q14 in the bistable. This keeps the bistable from switching the outputs and prevents injection of the 3.5 kHz square wave into the balanced modulator for mixing.

3.2 DETAILED CIRCUIT DESCRIPTION (See schematic diagram.)

3.2.1 Receive Audio Input Circuit

3.2.1.1 The receive audio input circuit consists of a "PL" filter, input amplifier, de-emphasis, and mode equalization circuit.

3.2.1.2 The input from the radio set discriminator is applied to the "PL" filter through an impedance matching network consisting of R1, R2, R3, and C1. R1 provides proper load for the discriminator and R2 provides proper source impedance for the "PL" filter.

3.2.1.3 The "PL" filter, consisting of C2, C3, C4, L1, and L2, attenuates "Private-Line" tones used to selectively call Motorola "PL" equipped radios. Without this attenuation, the "PL" tones would be inverted and appear at the speaker as annoying tones in the upper portion of the audio spectrum. When the voice privacy adapter is in the clear mode, resistor R4 is switched into the circuit to equalize the output level between the two modes.
3.2.1.4 Input amplifier Q1 amplifies the audio signals to compensate for losses through the "PL" filter. In the coded mode, capacitor C6 is switched into the circuit to provide de-emphasis. The output of Q1 is applied to the receive audio gate.

3.2.2 Microphone Input Circuit

3.2.2.1 The microphone input circuit consists of a microphone bias circuit, a pre-emphasis network, and input amplifier Q3.

3.2.2.2 RC coupling network R10, R11, and C9 provides DC bias to the microphone.

3.2.2.3 Pre-emphasis is provided by C8 and R12. The impedance of C8 varies with frequency; that is, it presents a high impedance to the low frequencies in the audio signal, but emphasizes the high frequencies.

3.2.2.4 Input amplifier Q3 amplifies the audio signal to compensate for the losses in the pre-emphasis network.

3.2.3 Audio Gates

The audio gates utilize the low "on" resistance and high "off" resistance characteristics of field effect transistors Q2 and Q4 to connect the audio signals from the receive input circuit or microphone input circuit (transmit) to the input of the differential phase splitter. Q2 and Q4 are operated such that only one signal is connected at a time. In the receive state, the output of amplifier Q1 is connected to Q9 and the microphone audio is blocked by the high resistance of Q4. In the transmit state this condition reverses (Q2 has a high resistance) thus blocking the radio set audio and connecting the microphone audio through Q4 to Q3. The control voltage for switching Q2 and Q4 is provided by the gate switching circuit.

3.2.4 Push-to-Talk (P-T-T) Bridge Circuit

The bridge provides source current to the gate switching circuits through Q5 whenever the P-T-T button is pressed. Although this system operates with negative ground, the bridge circuit provides an interface to equipment using positive ground (if required).

3.2.5 Gate Switching Circuit

Gate switch Q6 and Q7 provides the bias voltages that control audio gates Q2 and Q4. When the P-T-T button is pressed, the P-T-T bridge provides currents to the gate switching circuits that bias transmit audio gate Q4 to the on condition and receive audio gate Q2 to the off condition. When the P-T-T button is released, the gates reverse condition. The CR5, R23, and C12 network provides a 300-millisecond time delay before the audio gates return to the receive mode after the P-T-T button is released. The time delay complements the reverse burst delay incorporated into "PL" tone coded transmitters and thereby prevents the receiver output from being coupled to the modulator input. The coupling would otherwise result in a short audible tone at the speaker during this period.

3.2.6 Differential Phase Splitter Circuit

Differential phase splitter Q9 (A and B) is a differential amplifier that provides two audio signals with a 180-degree phase difference. Bias for both halves of Q9 is provided from the same source, and, with equal base resistors, both base-emitter junctions are maintained at the same operating point. The two output signal levels are set equally by balance potentiometer R38. Both signals are then coupled to the balanced modulator/chopper circuit.

3.2.7 Balanced Modulator/Chopper

3.2.7.1 The balanced modulator/chopper circuit consists of three basic circuits - an oscillator, a bistable, and a chopper.

3.2.7.2 Oscillator Q8 is a Clapp series-tuned oscillator that provides a stable 7-kHz output. Frequency-determining components L4 and C17 have complementary temperature coefficients to maintain frequency stability over the operating temperature range. The output of Q8 is converted into square waves by Q10 to provide the fast fall time required to trigger bistable Q13, Q14.

3.2.7.3 Bistable multivibrator Q13, Q14 operates when the unit is in the coded mode (S1 set to Coded). The bistable divides the 7-kHz input by two and provides two 3500-Hz square wave outputs which control the chopper circuit. The bistable output alternately turns on either Q11 or Q12. When S1 is set to the Clear position, the collector of Q14 is clamped to circuit ground, holding Q13 collector at circuit supply potential.

3.2.7.4 The chopper circuit consists of NPN transistors Q11 and Q12 connected in a common collector configuration. The emitter of each transistor is connected to the junction of two series connected precision resistors. One end of each pair of resistors is connected to one of the two differential phase splitter outputs. The other end of each pair is tied together to provide a summing point. Transistors Q11 and Q12 are alternately switched from saturation to cutoff by the bistable circuit outputs at the 3500-Hz rate. The signal produced at the summing point is a double-sideband suppressed carrier.

3.2.8 Amplifier

Amplifiers Q15 and Q16 provide the necessary gain to drive the active filter circuit.

3.2.9 Active Filter Circuit

The active filter circuit, Q17 through Q26, is a five-stage filter that attenuates the upper sideband and bistable frequencies. The first and
fourth stages are band rejection stages. The remaining three are low pass filter stages. The combined response of the stages is flat from 300 Hz to 3000 Hz and frequencies above 3500 Hz are attenuated. The filter output consists of only the lower sideband output of the balanced modulator/chopper.

3.2.10 Output Circuits

3.2.10.1 Receive Audio Output Circuit

Receive audio output from the filter is coupled through C54, R105, and R106 to the volume control in the radio set control head. In the coded mode only, capacitor C55 is switched into the circuit to provide de-emphasis.

3.2.10.2 Transmit Audio Output Circuit

Transmit audio output from the filter is coupled through C49, R97, and C50 to output amplifier Q27. R98 is switched into or out of Q27 input circuit to provide level equalization between modes. The output of Q27 is direct coupled to buffer stage Q28. Capacitor C51 provides de-emphasis of the transmit audio signals. Q28, an emitter follower, provides a low impedance output to transformer T1, which presents a balanced output to the transmitter modulator.

3.2.11 Power Supply Decoupling Circuit

The power supply decoupling circuit removes high frequency noise components from the dc input. Further decoupling is used to prevent undesired interstage coupling of high-level signals from some parts of the circuit to other low-level, high sensitivity portions of the circuit.

4. MAINTENANCE

4.1 SERVICING

4.1.1 Removal and Replacement of Voice Privacy Adapter

4.1.1.1 Removal

Step 1. Turn the radio set off and disconnect connectors from rear of accessory housing in which the voice privacy adapter is installed.

Step 2. Remove the accessory housing from its mounting trunion.

Step 3. Loosen two captive screws on bottom of accessory housing and remove accessory housing rear panel.

Step 4. Slide voice privacy adapter out of the accessory housing.

4.1.1.2 Replacement

Step 1. Slide voice privacy adapter into guide slots and into accessory housing.

Step 2. Replace accessory housing rear panel and secure by tightening the two captive screws.

Step 3. Reinstall accessory housing on its mounting trunion.

Step 4. Connect red connector to voice privacy adapter. If another accessory equipment is installed in the accessory housing, reconnect its connector.

4.1.2 CODE Lamp Replacement

Step 1. Remove voice privacy adapter from accessories case (paragraph 4.1.1.1 above).

Step 2. Note position of lamp over the coded-clear switch.

Step 3. Unsolder the two lamp assembly pin connections from the circuit board and remove lamp assembly. Remove all solder from holes in connection pads on circuit board.

Step 4. Place replacement lamp over coded-clear switch and insert connection pins of lamp in holes of the connection pads on circuit board. Solder the connections.

Step 5. Replace voice privacy adapter in accessory housing (paragraph 4.1.1.2 above).

4.2 TROUBLESHOOTING

Troubleshooting data for the voice privacy adapter is contained in the accompanying Troubleshooting Charts (figures 5, 6, and 7). The charts are designed to locate defective stages using signal tracing techniques. The defective components can then be located using voltage readings, waveforms and stage gain measurements shown on the schematic diagram. Filter stage responses are shown on Filter Frequency Response curves (figures 8 and 9).

NOTE

The filter should be checked in the clear mode.

4.2.1 Test Equipment

The following Motorola test equipment, or equivalent, is recommended for troubleshooting the unit.

- TEK-23 Dc Power Supply
- S1067A Solid-State Audio Oscillator
- T1038A General Purpose Oscilloscope
- S1051C Solid-State Ac Voltmeter
- S1052B Solid-State Dc Multimeter

4.2.2 Initial Procedure

4.2.2.1 The first step in troubleshooting is to check the interconnections for obvious faults. The coded-clear switch should be checked for proper operation. Then the procedures on the Troubleshooting Chart should be followed.
Figure 5. Overall Troubleshooting Chart
Figure 6. Receive Path Troubleshooting Chart
Figure 7. Transmit Path Troubleshooting Chart
Figure 8. Filter Response Curves Stage 1 (Q18), Stage 2 (Q20), and Stage 3 (Q22)

Figure 9. Filter Response Curves Stage 4 (Q24) and Stage 5 (Q26)
NOTE

Circuits or stages may operate normally even if measured dc voltages vary considerably from the typical values shown on the schematic diagram. Proper operation can usually be presumed if there is a distinct difference in the readings between the "clear" and "coded" state of the stage.

4.2.2.2 The troubleshooting charts provide setup information for both in-vehicle testing and bench testing. Test setup for bench testing is shown in figure 10.

4.3 ADJUSTMENTS

4.3.1 Oscillator Drift

The oscillator requires adjustment if it deviates from the +0.6, -0.2% limits listed in the Performance Specifications. Oscillator drift is usually detected when a change in pitch is heard in the coded mode. To adjust, remove the potting compound from the adjustment slug hole in L4 and adjust the oscillator to the correct frequency.

NOTE

Use General Electric RTV-102 silicon rubber or equivalent for potting L4.

4.3.2 Balance Adjust (coded mode)

The adjustment of balance adjust R38 is accomplished by inserting a 0.35V rms, 1000 Hz audio tone to connector pin 2 and adjusting for the sharpest sinewave (i.e., single waveform, see figure 11) at the filter output (collector of Q26). R38 has a knurled wheel that allows fingertip adjustment of the control.

4.4 PRINTED CIRCUIT BOARD REPAIR

4.4.1 General

4.4.1.1 The voice privacy adapter circuit is contained on a printed circuit board with special eyelets in all component mounting holes. The eyelets act as mechanical strain relief members.

Figure 10. "Micor" Voice Privacy Adapter, Bench Test Setup
Figure 11. Active Filter Output Waveforms thereby removing strain from the actual printed circuit.

4.4.1.2 In the past, servicemen have been led to believe that a low wattage soldering iron should be used to prevent damage to the printed circuit board. This is a misconception. Experience has shown that using a low heat iron has, in many cases, caused the damage the serviceman was trying to prevent. The temperature of the connection must be raised until the solder flows freely around the board eyelet. This usually takes a considerable length of time with a low wattage soldering iron. During this period, heat is conducted away from the eyelet by the printed wiring causing them, in some instances, to break away from the board. Therefore, it is preferable that a high-heat iron be used which will heat the connection rapidly to the point where the solder flows freely. Obviously, an iron this hot should not be held on the connection longer than necessary. The solder-

4.4.1.3 Breaks in the printed circuit wiring can be repaired by bridging the gap with solder. Remove the residual coating covering the printed wiring with solvent before soldering. Areas of damaged cuitry that cannot be practically re-

4.4.2 Component Removal

4.4.2.1 Special care should be taken during troubleshooting to be as certain as possible that the suspected component is the faulty one. This special care will eliminate unnecessary unsoldering and removal of parts which may weaken or damage the eyelet board.

4.4.2.2 When removing resistors, capacitors, and similar components, heat the connection to be loosened until the solder is molten. Then brush away, or shake off as much of the molten solder as possible. If the leads are bent over, use a soldering aid tool or a knife to straighten them. It may be necessary to apply the soldering iron while doing this. While applying the soldering iron, wig-

14
## REVISIONS

<table>
<thead>
<tr>
<th>BOARD AND SUFFIX NO.</th>
<th>REF. SYMBOL</th>
<th>CHANGE</th>
<th>LOCATION</th>
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<tr>
<td>TLN4571A-1</td>
<td></td>
<td>PLATED CIRCUITRY REVISED AND MISC. COMPONENTS R.E. LOCATED (NO CIRCUIT CHANGE)</td>
<td>CR15 ZENER DIODE ADDED</td>
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<tr>
<td>TLN4571A-2</td>
<td>C8</td>
<td>FROM .001 TO .022</td>
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<td>R16</td>
<td>FROM 270 TO 3.9K</td>
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<td>R79</td>
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TLN4571A "Micor" Voice Privacy Adapter Board
Component Location Detail
Motorola No. EMPD-5049-B
3/12/73-'UP

END OF DOCUMENT