

# MIDLAND SYN-TECH™

VHF (WIDE BAND)

## SERVICE MANUAL

70-342XL / 442XL



**MIDLAND** LMR  
LAND MOBILE RADIO

1690 North Topping Avenue  
Kansas City, Missouri 64120

MANUAL NO. 70-342442  
09-342/442XL  
SM-8/86-1.5M

This service manual is intended to facilitate set-up and service of the 70-342XL and 70-442XL transceivers. In the first section of this manual, after transceiver description and specifications, instructions for transceiver preparation are found-- programming, calibration, installation, and summaries of available support equipment.

The second section of this service manual, entitled **SERVICING**, is dedicated to transceiver repair. Troubleshooting flow charts for locating likely problem areas are in the beginning of this section. General information follows, such as chip component identification and replacement instructions and realignment procedures.

Transceiver circuitry is contained on three PC boards and categorized herein respectively. Each PC board is detailed in text, charts, and diagrams; all of which can be viewed with their respective schematics. Each schematic page has a list of other applicable diagrams that can be viewed with it.

Because the PC boards have components and plating on both sides, layout diagrams show superimposed images of plating patterns and respective other-side-component maps. Any double-image layout of the three PC boards can be viewed with their respective schematic without turning pages.

Information in this book is focused on the basic transceiver. Because of the variety of readers' requirements, details of option add-ons are not included. A divider at the end of this book, entitled **OPTIONS**, is provided for allocating technical literature acquired with each add-on kit.

As necessary, service manual supplements will be published and distributed on the following forms:

- Manual Addition (MA).....For supplemental information useful in product alignment, service, or improvement. Printed on BLUE paper.
- Change Notice (CN).....For circuitry change details made during production by model and serial number. Printed on YELLOW paper.
- Manual Correction (MC)...For correcting literature errors not related to production changes. Printed on GREEN paper.
- Technical Bulletin (TB)..For solutions to field problems and tips for performance improvement. Printed on PINK paper.

Many useful facts and tips are provided in the text. If the reader intends to service several of the transceivers described herein, spending time to read applicable text will save time in the end.

# TABLE OF CONTENTS

70-342XL/442XL

	PAGE
Preface.....	ii
Table of Contents.....	1
Description.....	3
Specifications:	
General.....	4
Transmit.....	5
Receive.....	6
Scan and CTCSS.....	7
E/PROM Programming:	
Programmable Parameters.....	9
H1 Version Programmer Software.....	10
E/PROM Module Removal.....	10
Programming.....	11
Transceiver Calibration:	
Set-up.....	18
Error Codes.....	19
Procedure.....	20
Installation:	
Instructions.....	22
Under-Dash Configuration.....	24
Trunk-Mount Configuration.....	25
Under-Dash Power/Accessory Plug.....	26
Trunk-Mount Power and Accessory Plugs.....	28
Automotive Receiver Interference.....	31
Optional Accessories.....	35
Service Equipment.....	37
Service Tools.....	38
Optional Feature Add-on Kits.....	39

## SERVICING

Troubleshooting Charts:	
General.....	45
CPU/Phase-Lock-Loop.....	46
Transmitter.....	47
Modulator.....	47
Receiver.....	48
Component Replacement:	
Chip Component Identification.....	49
Replacing Components with Leads.....	50
Chip Capacitor and Resistor Replacement.....	51
Complete Alignment:	
Set Up.....	53
Error Codes.....	55
Realignment.....	55
Factory Presets.....	60

continued.....

# TABLE OF CONTENTS

70-342XL/442XL

## SERVICING continued:

Circuit Analysis:	
Transmitter Board.....	61
Microprocessor Pinouts Chart.....	63
RF Power Amplifier Board.....	69
Receiver Board.....	71
Simplified Squelch Circuit Schematic.....	75
Metering.....	76
Block Diagram.....	77
Under-Dash Circuitry:	
Under-Dash Interconnect Diagram.....	78
Front Panel Schematic Diagram.....	80
Front Panel PCB Layouts.....	81
70-342XL/442XL Receiver PCB Layouts.....	82
DC Voltages - Receiver Board.....	83
70-342XL Receiver Board Schematic Diagram.....	83
Trunk-Mount Circuitry:	
Trunk-Mount Interconnect Diagram.....	84
Control Head.....	85
Control-Cable Interface Board.....	86
DC Voltages - Receiver Board.....	87
70-442XL Receiver Board Schematic Diagram.....	87
Transmitter Board:	
DC Voltages - Transmitter Board.....	88
Microprocessor Pinouts (Duplicate Chart).....	89
RF Power Amplifier PCB Layout.....	90
E/PROM Module Layout.....	90
Transmitter PCB Layouts.....	91
Transmitter Board Schematic Diagram.....	93
Under-Dash Exploded Mechanical View.....	94
70-2301 Microphone Detail.....	95
70-2195 Hang Up Box Detail.....	95
Trunk-Mount Exploded Mechanical View.....	96
Parts List.....	97
Parts Ordering.....	109

OPTIONS.....

The MIDLAND SYN-TECH 70-342XL and 70-442XL VHF wide-band Land-Mobile transceivers are mobile two-way radios designed to operate on FM channels between 136 to 174 MHz. There are two varieties of the SYN-TECH 70-342XL and 70-442XL transceivers, each designed to operate on a different channel frequency range: the A-band radios (70-342AXL & 70-442AXL) on the 136-163 MHz range; the B-band radios (70-342BXL & 70-442BXL) on the 148-174 MHz range. SYN-TECH transceivers have the capacity to operate on up to eighty operator selectable channels, each of which can be programmed in the service shop.

The SYN-TECH 70-342XL transceiver is configured for under-dash mounting. It has a control knobs, push buttons, and display all on a front panel for easy access to the operator. The SYN-TECH 70-442XL transceiver is configured for mounting in a vehicle trunk or other remote location. It does not have front panel controls; instead it has a 34-pin receptacle in its face-piece. The receptacle accepts the 4-meter long Control Cable that interconnects the 70-442XL remote unit with its Control Head. The Control Head contains all the operator controls and is much smaller in size for mounting where accessible by the operator.

As the SYN-TECH 70-342 and 70-442 transceivers, the XL models are wide-band radios. Electronic tuning of critical stages is used to allow them to operate over a 24 MHz spread of channel frequencies.

The XL models are revised 70-342 and 70-442 transceivers that used 5 KHz for their main VCO comparator frequency. The 70-342XL and 70-442XL models use 2.5 KHz, thus allowing channel frequency increments of 2.5 KHz for half-channels.

Many optional features, such as CTCSS, can be added at the factory. Complete add-on kits for field installation are readily available. A listing with brief kit descriptions can be found in later sections.

Operating parameters such as channel frequencies, CTCSS frequencies, and a variety of feature timing and codes are electronically contained in an alterable memory module for easy customizing. The plug-in memory module is reprogrammable in the service shop using the MIDLAND E/PROM Programmer.

The 70-342XL and 70-442XL transceivers contain three major printed circuit boards. The Transmitter Board contains transmitter, synthesizer, and microprocessor control circuitry. It lays horizontally, with components facing up, on the top side of the chassis center divider. The Receiver Board also lays horizontally, but on the underside of the chassis divider with components facing down. The third PC board is the RF Power Amplifier Board located inside the rear heat sink. It is accessible by removal of the heat sink top cover.

# SPECIFICATIONS

70-342XL/442XL

## G E N E R A L

OPERATING VOLTAGE: Nominal.....13.6 VDC, negative ground  
Range.....10.5 to 16 VDC

TEMPERATURE RANGE.....-30°C to +60°C

ANTENNA IMPEDANCE.....50 ohms, unbalanced

MICROPHONE.....Dynamic element (with amplifier)

FREQUENCY CONTROL.....Phase-Lock-Loop synthesized with  
EPROM Programming

### FREQUENCIES OF OPERATION:

Models 70-342AXL/442AXL.....136 to 162 MHz

Models 70-342BXL/442BXL.....148 to 174 MHz

CHANNEL CAPABILITY: Standard.....Up to 80 transmit and 80 receive

### CHANNEL FREQUENCY SPREAD without retuning:

Transmit.....24 MHz maximum

Receive.....24 MHz maximum

FREQUENCY TOLERANCE AND STABILITY..+/- 5 ppm both TX and RX (standard)  
+/- 2.5 ppm optional  
+/- 2.0 ppm optional

DUTY CYCLE.....Intermittent. 1 min TX, 4 min RX  
(Per EIA RS-152B)

HIGH HUMIDITY.....95% at 50°C per EIA RS-152B, sec.13

VIBRATION STABILITY.....Per EIA RS-152B, sec. 14

SHOCK STABILITY.....Per EIA RS-152B, sec. 15

### CURRENT DRAIN:

Standby.....0.35 ampere DC (max)

Receive.....1.00 ampere DC (max)

Transmit (40W @ 50ohms)....8.50 amperes DC (max)

### DIMENSIONS (H x W x D):

Transceiver (70-342XL/442XL)....65x188x270mm (2.6" x 7.4" x 10.6")

Control Head for 70-442XL.....50x88x80mm (2" x 3.5" x 3.2")

Speaker for 70-442XL.....100x100x77mm (4" x 4" x 3")

### WEIGHT:

Transceiver (70342XL/442XL)....3.15 Kg (6.96 lb)

Control Head for 70-442XL.....0.8 Kg (1.8 lb)

Speaker for 70-442XL.....0.71 Kg (1.58 lb)

--All specifications subject to change without notice.--

# SPECIFICATIONS

70-342XL/442XL

## T R A N S M I T T E R

Refer to EIA RS-152B and DOC RSS-119-Issue 3 for Method of Measurement and Standard of Performance.

CARRIER POWER OUTPUT.....	40 watts minimum, adjustable from 20 to 40 watts
MODULATION SYSTEM.....	Phase Modulation
AUDIO FREQUENCY RESPONSE.....	Per EIA and DOC specifications
AUDIO HARMONIC DISTORTION.....	3% THD (1 KHz tone at 3.0 KHz deviation)
SYSTEM DEVIATION.....	+/-5 KHz maximum
MODULATION LIMITING.....	Instantaneous peak clipping with low-pass audio filtering
HUM AND NOISE.....	50 dB
OCCUPIED BANDWIDTH.....	Less than -60 dB of carrier power 30 KHz outside carrier frequency
TRANSMIT CARRIER ATTACK TIME.....	100 ms max. for 50% rated power
CONDUCTED SPURIOUS EMISSIONS.....	Less than 25 uW from 1 to 1000 MHz
MICROPHONE INPUT LEVEL.....	-8 dBm +/-3 dB at 600 ohms
OUTPUT PROTECTION:	Shall withstand without damage, 5 minutes of operation into a 20:1 load mis-match with any standing wave variance.
OUTPUT STABILITY:	Shall not exceed spurious emission limits herein while operating into a 5:1 load mis-match with full standing-wave variance.

--All specifications subject to change without notice--

## R E C E I V E R

Refer to EIA RS-204C and DOC RSS-119 for Method of Measurement and Standard of Performance.

SENSITIVITY: 12 dB SINAD.....0.25 uV into 50 ohms

SQUELCH SENSITIVITY: Tight.....1.0 uV minimum, 2.0 uV maximum  
Threshold....0.2 uV maximum or 6 dB SINAD

SQUELCH BLOCKING.....13 dB

RECEIVER ATTACK TIME.....100 ms  
(squench release)

RECEIVER SQUELCH CLOSING TIME.....200 ms

ACCEPTABLE RF DISPLACEMENT.....+/- 3.5 KHz minimum

ADJACENT CHANNEL REJECTION.....80 dB at +/-30 KHz

SPURIOUS RESPONSE IMMUNITY.....85 dB

INTERMODULATION IMMUNITY.....75 dB

AUDIO POWER OUTPUT:  
Under-Dash Radio (70-342XL).....1 watt at 5% THD into its internal  
speaker, or  
5 watts 5% THD into a 3.2 ohm  
external speaker  
Trunk-Mount Radio (70-442XL).....5 watts at 5% THD into the 3.2 ohm  
external speaker

AUDIO FREQUENCY RESPONSE.....Per EIA and DOC specifications

HUM AND NOISE: Un-squelched.....40 dB  
Squelched.....50 dB

CONDUCTED SPURIOUS EMISSIONS.....200 uV across 50 ohms (800 pW)  
from DC to 1 GHz

INTERMEDIATE FREQUENCIES.....21.4 MHz (1st) and 455 KHz (2nd)

--All specifications subject to change without notice--



## S C A N O P T I O N

Several of these parameters are programmable by E/PROM programming.

CHANNEL CAPACITY.....2 scan groups of 64 each  
(duplicates allowed)

OPERATOR CONTROL OF SCAN.....Three modes selectable by  
push buttons

PRIORITY CHANNEL SELECTION.....Any channel selectable by the oper-  
ator using the channel push buttons

INDICATION OF PRIORITY DETECTION...Two-beep audible alert (elective)

KEY-UP CHANNEL REVERT.....Transceiver transmits on Priority  
channel or last stopped channel  
(depending on scan mode selected)

EXTRANEOUSLY BUSY CHANNEL SKIP.....Channels can be skipped in scan by  
DOWN channel selection

PRIORITY CHANNEL SAMPLING RATE.....Every 4 or 8 channels, or every 1  
or 2 seconds during scan hold

SIGNAL DETECTION.....of carrier presence or vacancy; or  
of correct CTCSS tone presence or  
vacancy with carrier

SCAN RESUME DELAY.....0.3, 2.5, or 5 seconds or  
lock & hold until reset

SCAN SPEED (with standard timing):  
Noise squelch busy detection.....20 idle channels per second  
CTCSS detection.....3 channels per second if all busy

## C T C S S O P T I O N

CODE FREQUENCIES.....All EIA standard from 67 to 241.8Hz

MODULATION LIMITS.....500 to 1000 Hz carrier deviation

DECODE SENSITIVITY.....Less than 5 dB SINAD

RECEIVER RESPONSE TIME.....200 ms maximum

ENCODER RESPONSE TIME.....50 ms maximum

TRANSMITTER TONE DISTORTION.....5% maximum

AUDIO DISTORTION WITH CTCSS TONE...10%

--All specifications subject to change without notice--



The 70-342XL and 70-442XL transceivers contain an Erasable/Programmable Read Only Memory (E/PROM) module. The module holds specific customer frequencies, feature selections, and other parameters that determine radio operation.

Before final alignment and check, the module must be reprogrammed with customer specifics. If any option add-on kits are to be installed, appropriate parameters may also need to be programmed as instructed in respective kit installation literature.

To change E/PROM electronic information, the plug-in module must first be erased by exposing it to ultraviolet light using the MIDLAND 70-1100/1101 E/PROM Eraser. Then, reprogramming is necessary using the MIDLAND 70-1000 E/PROM Programmer. Operation parameter information is entered into the Programmer through its keypad, converted into binary data useful to the transceiver, then written into the E/PROM.

The following are programmable operation parameters in the SYN-TECH mobile transceivers. See the 70-1000 E/PROM Programmer Operator's Manual (No. 70-999113) for details.

1. All eighty transmit and eighty receive channel frequencies
2. All standard CTCSS tones for each TX and RX channel (requires installation of the CTCSS module within the transceiver)
3. Time-out-timer time (maximum continuous transmission duration)
4. Scan parameters as follows:
  - a. Two scan groups, each containing up to sixty-four channels
  - b. A variety of priority/scan channel revert arrangements utilizing the two channel lists.
  - c. Either presence or absence of carrier or correct CTCSS tone to indicate a busy channel
  - d. Channel sampling rate (time spent looking for carrier presence on each channel)
  - e. CTCSS decode time (time allotted for decoding after carrier is detected)
  - f. Scan hold time (delay of scan resume after channel clears)
  - g. Post-transmit scan hold time (delay of scan resume after PTT release)
  - h. Retention of scan list channels deleted (skipped) by operator activation of the DOWN selector while in scan mode. Normally, these selections are erased by release of the SCAN and PRI push buttons and power-down. Programming limits erasure to power-down only.
5. Busy channel lockout with or without alert tone to the operator. Adding jumpers allows busy channel inhibit by CTCSS tone status. See "BCLO JUMPERING".
6. Transmit-to-receive changeover delay of up to 200ms for special options.
7. Last selected channel recall on power-up may be disabled.

## H1 VERSION UPGRADE

The E/PROM programmer, model 70-1000, must contain H1 or later version software to program all features and parameters into the Z-273 E/PROM modules that are used in the 70-342XL and 70-442XL transceivers. The version level of software installed in the programmer is identified for one second in the two far right digits displayed after power-up. If your programmer contains software that is older (lower letter) than the H1 version, upgrade is required. To date of this printing, the newer L3 version software is current and available (in its own E/PROM) in Update Kit No. 70-1411. The 70-1000 Operator's Manual also has been rewritten. The May, 1985 printing can be ordered as MIDLAND part number 70-999113.

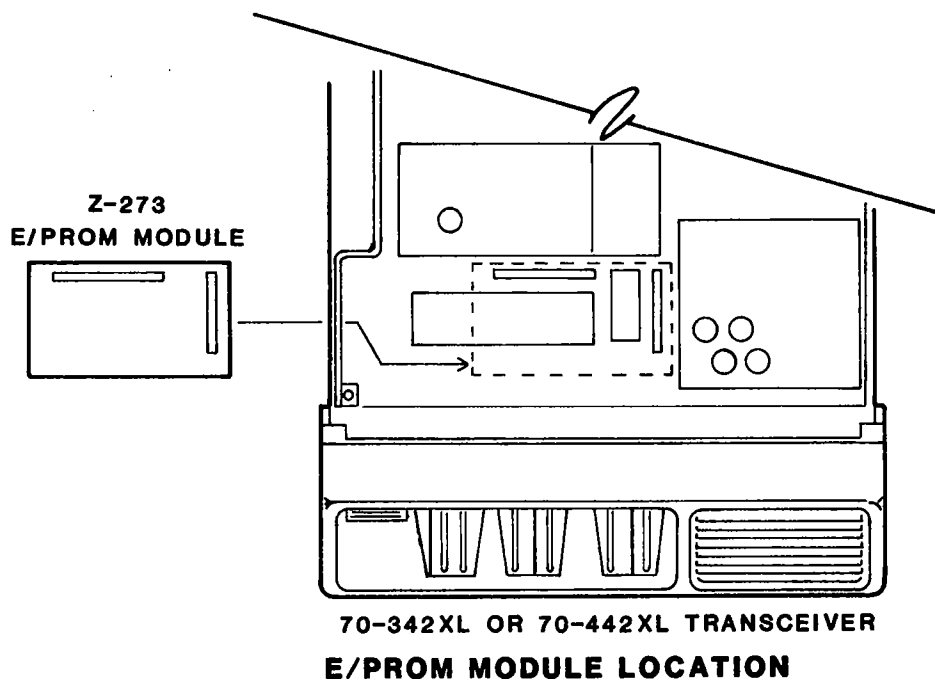
## CDCSS OPTION

If the Continuous Digital Coded Squelch System option is installed in the transceiver, the E/PROM Module is different. This Module, MIDLAND number 70-2402, is larger in size to accommodate an additional receptacle for connection to the CDCSS board. When programming, the E/PROM type selection entered into the Programmer is the same as for the standard E/PROM.

## E/PROM MODULE REMOVAL

The E/PROM module is a small (1" x 2") plug-in printed circuit board that contains IC951 and IC952, and is labeled Z-273. It is located on the Transmitter Board, over the microprocessor IC901. For replacement purposes, the E/PROM module model number is 70-2401.

Always disconnect primary power to the transceiver before removing the E/PROM module. Loosen the four transceiver top cover screws and lift the cover off. Pull the E/PROM module straight upward to separate it from its two connectors (see below).



## PROGRAMMING

The following E/PROM programming procedure covers most programming for transceiver operation. Certain infrequently modified parameters are excluded (parameters listed as 4h, 6, and 7 on page nine). Complete programming procedures can be found in the Programmer Operator's Manual.

### Heed this precaution:

Do not apply or remove AC-line power to the Programmer while an E/PROM module is plugged into it. It is not necessary, nor advisable, to plug the module onto the Programmer until all parameter information is keystroke entered. Connect the module only when ready for the BLANK-WRITE-VERIFY operation (step 25).

### --E/PROM Erasure--

1. Erase the E/PROM module in the 70-1100/1101 Eraser. Assure the E/PROM window is clean, and set exposure time for 45 minutes. Refer to the Eraser instruction manual for details.

### --Heading Entry--

2. Turn the 70-1000 Programmer on. One of these self-test messages must appear in the FREQUENCY display for one second: "PASSOL3", "PASSIL3", "PASSOH1", or "PASSIH1". The last two digits indicate the required software revision level H1 or L3 is installed in the programmer. After two seconds, "TYP" should appear in the BAND display. If an earlier version software is installed, see H1 VERSION UPGRADE preceding.
3. Enter the heading (not necessary for transceiver operation, but recommended for organization) by pressing [MANUAL], then [ENTER], then the following:
  - a. The second part of the transceiver model number ('342A', for example). Then [ENTER].
  - b. Transceiver eight digit serial number (ex.: '12345678'). Then [ENTER].
  - c. First three digits of a ten digit customer number (ex.: '123'). Then [ENTER].
  - d. The last seven digits of the customer number (ex.: '9ABCDEF'). Then [ENTER].
  - e. The month numerically (ex.: March = '3'). Then [/].
  - f. The date ('1' through '31'). Then [/].
  - g. The last two digits of the year (ex.: '86'). Then [ENTER].
  - h. Press [RESET] to close heading sequence.

### --E/PROM Type Selection--

4. Press [1] to select the standard Z-273 E/PROM Module. "Z-273" should appear. (If the transceiver contains either Talk-Around option 70-2815 or 70-2816, select the Z-273TA E/PROM Module type by pressing [7] instead of [1]) Press [ENTER].

## --Band Code--

5. Select the VHF band and 2.5 KHz PLL reference code by pressing [2], then [D]. "15d" should appear in the BAND display (if the transceiver has been modified with 70-2178 or 70-2179 High-Side Injection Kits, use band code [E] instead of [D]). Press [ENTER]. The Programmer should now be ready for channel frequency entry.

## --Channel Frequency Programming--

The CHANNEL display indicates the numeric channel designator that will appear in the transceiver display. The STEP display indicates what entry is to be made for that channel--

- "1" = receive frequency
- "2" = receive CTCSS tone frequency or receive CDCSS code
- "3" = transmit frequency
- "4" = transmit CTCSS tone frequency or transmit CDCSS code

If an invalid frequency is entered in the following steps, the frequency display will flash. Press [CLEAR], then reenter the correct frequency.

6. CHANNEL "1" and STEP "1" should now be displayed. Key in the desired receive frequency for channel 1 including the decimal point. Then press [ENTER].
7. CHANNEL "1", STEP "2", should be displayed. If a coded squelch option is installed in the transceiver, the CTCSS tone frequency or CDCSS code can be entered as described below.

CTCSS Key in the desired CTCSS tone frequency to be decoded including the decimal point (only standard EIA frequencies are valid). The digits will appear in the FREQUENCY display. Press [ENTER]. If carrier squelch operation is desired or no coded squelch option is not installed, enter zero.

CDCSS Key in the desired three-digit standard decode code (only EIA standard codes are valid). The digits will appear in the FREQUENCY display. If signal is inverted, key [A] after digits. A "-" will appear. Press [ENTER]. If carrier squelch operation is desired or no coded squelch option is installed, enter zero.

The Programmer contains a table of EIA standard CTCSS tone frequencies and CDCSS codes, any of which each are accessible in this mode. Press [D] to call the CTCSS tone frequencies and again to increment through them one at a time. The CDCSS codes are stacked on top of the CTCSS tone list, and should appear when scrolling past the highest CTCSS tone. Press [C] to decrement through the lists. When the desired frequency or code is displayed, press [ENTER] to program.

8. CHANNEL "1", STEP "3", should be displayed. Key in the desired transmit frequency for channel 1 including the decimal point. Then press [ENTER]. If the transmitter is to be disabled in channel 1, enter zero.
9. CHANNEL "1", STEP "4", should be displayed. If the transceiver is equipped with a coded squelch option, key in the desired CTCSS tone frequency or CDCSS code to be transmitted, or nothing for no tone/code transmission. Then press [ENTER]. The tone/code table can be used in this mode also.
10. Repeat steps 6 through 10 to program the remaining seventy-nine channels. Channels may be skipped and left unprogrammed. Channels can be scrolled and re-accessed using the up and down arrows.

## --Center Frequency Programming--

To afford wideband capability, the self-tuned 70-342XL and 70-442XL transceivers switch the operating range of their VCO's when selected channel frequency crosses a range-center frequency. This switching is controlled by the microprocessor and must be programmed into the E/PROM. Center Frequency values entered into the E/PROM depend on the transceiver frequency band (A-band or B-band).

11. Scroll backward through the channel list with the appropriate arrow push button. Whenever the list is looped backwards from channel 0 to channel 79, the Center Frequency 'channel' is accessed and "CF" appears in the CHANNEL display. Stop on the CF channel.
12. STEP "1" will also appear, showing readiness for receive Center Frequency entry. Key in '148.12' if the transceiver is an A-band model (136-162 MHz range) or key in '160.92' if the transceiver is a B-band model (148-174 MHz range). Press [ENTER].
13. STEP "3" will appear, showing readiness for transmit Center Frequency entry (STEP 2 and 4 do not apply, therefore do not appear with the CF channel). Key in '147.20' if the transceiver is an A-band model (136-161 MHz range) or '160.00' if the transceiver is a B-band model (148-174 MHz range). Press [ENTER].

## --Scan Channel Entry--

14. Channel and tone frequency entry is complete. Press [SCAN] to begin scan channel programming sequence. The display will be blank except for the SCAN indicator.

There are two lists of scan channels available--A and B. Each list can be up to 64 channels long. The two lists are used by the transceiver during scan operation differently, depending on selection of the PRI and SCAN push buttons and Function Mode programming. Details of operation are found in both the transceiver and the Programmer operator's manuals.

15. Press [A] to program the A list. "A" will appear in the STEP display and the first list sequence designator "0" will appear in the BAND display.
16. Key in the channel number to be scanned first in the A list, then press [ENTER]. While it is keyed, the channel number will appear in the CHANNEL display.
17. After [ENTER] is pressed, the A list sequence designator (BAND display) will increment to 1. Key in the second A scan channel and press enter. If you make an error, press [CLEAR] and re-enter. If the channel entered was left blank in the channel frequency entry steps above, the CHANNEL display will flash to indicate the error. Press [CLEAR] and enter a valid channel.
18. Continue entry of the A scan list. A channel can be entered in several scan sequence spots to cause it to be sampled more often. To scroll through the A list, press the up and down arrows to see each sequence designator assignment. The highest designator is 63.
19. When the A list entry is complete, press [B]. "b" should appear in the STEP display and the lowest B list scan sequence designator (0) should appear in the BAND display. Enter B scan list channels in the same manner as A list entry. Again, the highest list sequence designator is 63.
20. Press [RESET] to exit the scan programming mode. The Channel frequency entry mode will resume displaying CHANNEL "0", STEP "1", and the appropriate frequency.

## --Function Entry--

The Busy Channel Lockout feature, Time-Out-Timer feature, and scan feature parameters are programmed in the Function Mode. Only four of these eight parameters need programming for most applications, therefore attention is given to only these four hereinafter. Procedures to program the others (timing adjustments, etc.) can be found in the Programmer Operator's Manual.

21. BCLO Press [FUNC.] then [ENTER]. "FnC" will appear in the BAND display and "1" in the STEP display. Function Code 1, for programming the Busy Channel Lockout (BCLO) feature, is now active. Key in one of the following values, then press [ENTER]. If no entry is made, the transceiver will operate per the default value of 3 --no BCLO. Also see "BCLO JUMPERING" in this section for jumper considerations.



21. continued...

BCL0 parameters:

- 0= BCL0 without alert. No audible indicating tone will be heard.
- 2= BCL0 with alert. When the PTT button is pressed while the transceiver is inhibited, a tone will be applied to the speaker.
- 3= BCL0 disabled. No transmit inhibiting per receive status.

Throughout Function Mode programming, the up and down arrows will sequentially select the Function Codes.

22. Time-Out-Timer "FnC" and "2" will be displayed. Key in the parameter value to set the Time-Out-Timer duration as listed below, then press [ENTER]. When the transmitter is continuously keyed for the programmed duration, the timer disables the transmitter and applies an audible alert tone to the speaker. The timer is reset upon PTT release. If no entry is made, the default value of 0 will be automatic, leaving the Time-Out-Timer inoperative.

- |                               |                |
|-------------------------------|----------------|
| 0= Disable the Time-Out-Timer | 4= 120 seconds |
| 1= 30 seconds                 | 5= 150 seconds |
| 2= 60 seconds                 | 6= 180 seconds |
| 3= 90 seconds                 | 7= 210 seconds |

23. Press the up arrow four times to skip to Function Code 7. Function Codes 3 through 6 will automatically be programmed with their default values. If a special application requires altering scan timing, refer to the Programmer Operator's Manual for procedure.

24. Priority Monitoring "FnC" and "7" should be displayed. Entering a value in this mode either disables priority channel (see Operator's manual) sampling or changes its rate. If this function is not programmed, the default is one Priority channel sampling every eight channels scanned, and one Priority sampling every second when scan is stopped on an active non-priority channel.

Key in a value listed below, then [ENTER], to program the desired sampling rates.

- 0= Sample the Priority channel once every four non-priority channels scanned, and sample it every second when scan is stopped.
- 1= Sample the Priority channel once every eight non-priority channels scanned, and sample it every second when scan is stopped.
- 2= Sample the Priority channel once every four non-priority channels scanned, and sample it every two seconds when scan is stopped.
- 3= Sample the Priority channel once every eight non-priority channels scanned, and sample it every two seconds when scan is stopped.
- 4= Disable Priority monitoring

25. Scan Format "FnC" and "8" should be displayed. The scan feature operates in three different mode formats--'Normal', 'Modified', and 'Secondary'. Each is described in the Operator's Manual.

While operating, scan is stopped by detection of received signal. Programming can set scan-stop by noise squelch carrier detection, CTCSS detection, absence of detected carrier, or absence of correct CTCSS tone with carrier presence. The latter two are used in in special applications.

The parameter value determines both scan format and scan stop aspects as listed below. Key in the desired value and press [ENTER]. The default value if no entry is made is 1, which is correct whether a coded squelch feature is installed in the transceiver or not. If no CTCSS frequency nor CDCSS code is programmed to a channel (steps 6-11), any odd value parameter programmed will be decreased by one when read by the transceiver (ex.: If 1 is programmed and CTCSS is disabled, the transceiver will subtract 1 and operate per parameter 0.).

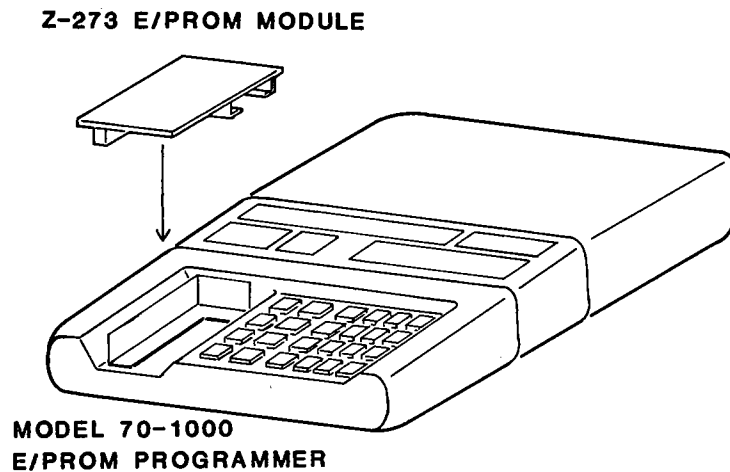
Function Code 8 --

- 0= 'NORMAL' Scan Mode with scan stopped by carrier presence
  - \* 1= 'NORMAL' Scan Mode with scan stopped by presence of correct CTCSS tone or CDCSS code
  - 2= 'NORMAL' Scan Mode with scan stopped by absence of carrier
  - \* 3= 'NORMAL' Scan Mode with scan stopped by presence of carrier without correct CTCSS tone or CDCSS code
  - 4= 'MODIFIED' Scan Mode with scan stopped by carrier presence
  - \* 5= 'MODIFIED' Scan Mode with scan stopped by presence of correct CTCSS tone or CDCSS code
  - 6= 'MODIFIED' Scan Mode with scan stopped by absence of carrier
  - \* 7= 'MODIFIED' Scan Mode with scan stopped by presence of carrier without correct CTCSS tone or CDCSS code
  - 8= 'SECONDARY' Scan Mode with scan stopped by carrier presence
  - \* 9= 'SECONDARY' Scan Mode with scan stopped by presence of correct CTCSS tone or CDCSS code
  - A= 'SECONDARY' Scan Mode with scan stopped by absence of carrier
  - \* b= 'SECONDARY' Scan Mode with scan stopped by presence of carrier without correct CTCSS tone or CDCSS code
- \* : If the selected channel does not have a CTCSS tone or CDCSS code programmed to it, the transceiver microprocessor will decrease this parameter value by one and operate accordingly.

26. This concludes the Function Mode programming sequence. Press [RESET] to exit.

Parameter entry is complete. If the last selected channel recall feature is to be disabled, or the operator-deleted scan channel recall feature is to be disabled, or scan timing needs modification; refer to the Programmer Operator's Manual for programming procedures.

27. Plug the erased Z-273 E/PROM module onto the 70-1000 Programmer as shown in Figure 2.



## PROGRAMING THE E/PROM MODULE

28. Press [FUNC.] key, then the [4/B.W.V.] key. The BLANK, WRITE, and VERIFY indicators will each illuminate in succession as the module is programmed. "PASS" will be displayed if the new content in the E/PROM is correct. If the readout displays flashing numbers or "ERR", the E/PROM must be erased again, and validity of the previously entered channel information is in question.
29. Install the E/PROM Module into the transceiver.

## BCLO JUMPERING

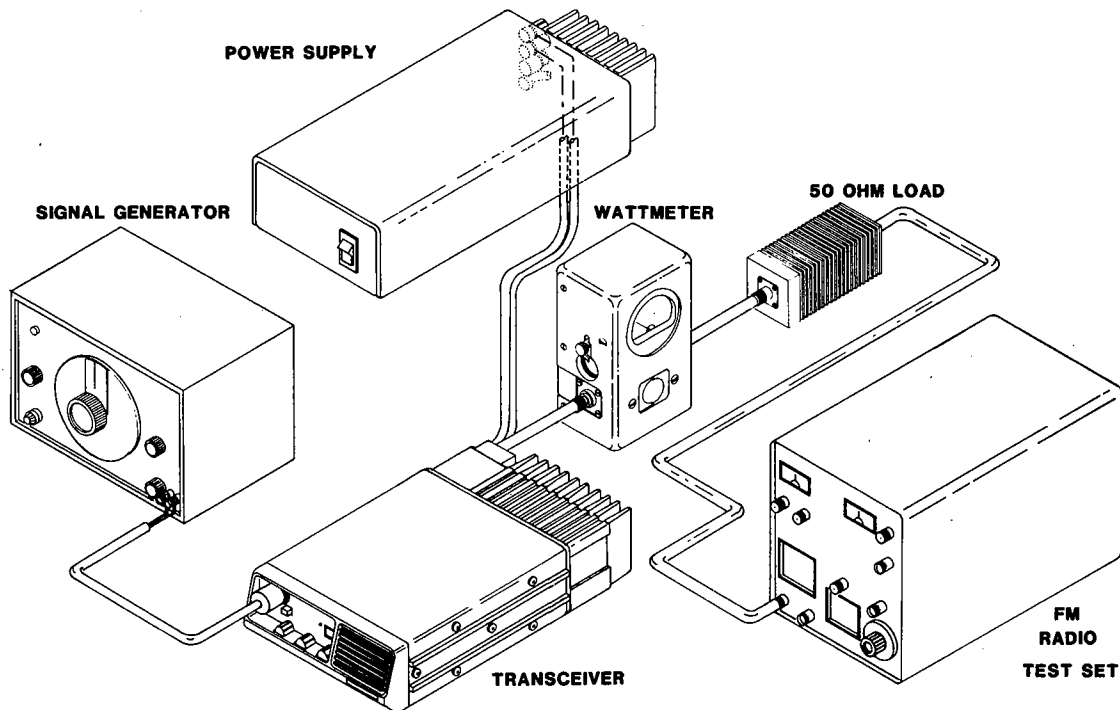
The Busy Channel Lock-out feature, if programmed as previously described, prevents transmission on a busy channel and can provide an audible alert when an attempt is made. The standard transceiver is configured for BCLO by carrier detection when enabled by programming. Therefore if neither CTCSS nor CDCSS are used, no jumpers change is necessary. If desired, and if CTCSS (or CDCSS) is installed in the transceiver, a jumper can be moved to an alternate location inside the transceiver to prevent transmission only when an appropriate CTCSS tone is received.

The BCLO jumper positions, JP107 and JP108, are located on the Transmitter Board between the modulator (L101, L102) shield and front PC board edge. Remove the jumper wire from JP107 position and install it into the JP108 position to set BCLO by CTCSS tone (or CDCSS code) detection. Do not install jumpers in both positions.

## SUGGESTED TEST EQUIPMENT FOR TRANSMITTER CALIBRATION

<u>Test Instrument</u>	<u>Instrument Capabilities</u>	<u>Instrument Type</u>
DC Power Supply	13.8 VDC, 10 amps	Power Mate BPA-20PF
Wattmeter	50 watts, 136-174 MHz	Bird model 43 with 50C element and 50 ohm load
Deviation Meter	136-174 MHz. +/-5KHz range	p/o Cushman CE-31A
Frequency Meter or Frequency Counter	136-174 MHz 2.0 ppm accuracy	p/o Cushman CE-31A or Heath SM-4120
Audio Generator	0-10 KHz sine-wave, 0-5 Vrms output	Heath SG-5218

## CALIBRATION SET-UP



The 70-342XL and 70-442XL wideband transceivers are capable of operating across a 24 MHz channel frequency spread. Therefore, receiver realignment is not needed, even when reprogrammed with new customer frequencies. Only transmit carrier calibration such as frequency, modulation, and output power may need adjustment. The transceivers are shipped from the factory programmed with test frequencies that must be changed to customer frequencies before installation.

REALIGNMENT MAY BE NECESSARY ONLY AFTER a component that affects transceiver tuning has been replaced. Realignment requires transceiver operation on special frequencies, therefore they must be programmed into the transceiver E/PROM specifically for alignment. The complete Alignment procedure can be found in the SERVICING SECTION of this manual.

\* \* \* \* ERROR CODES \* \* \* \*

Error code 90, 91, 92, 93, or 94 appearing in the channel display with continuous triple-beeps indicates the E/PROM module is missing, improperly inserted, or incorrectly programmed. Check the E/PROM module or refer to the E/PROM Programming section in this service manual.

Error code 95 appearing in the channel display with a triple-beep indicates the synthesizer phase-lock-loop cannot achieve lock. A defect exists and it must be corrected.

The following adjustments to calibrate transmit power output, transmit carrier frequency, and transmit modulation are all that should be necessary to prepare the wide-band 70-342XL or 70-442XL transceivers for end use.

1. Remove the 8 securing screws to remove the top and bottom covers.
2. Supply 13.6 volts DC power to transceiver J391. Connect [+] to pin 9 and [-] to pin 7. Connect a resistive, 50 ohm RF load (with a wattmeter) to antenna connector J392.

## --Carrier Frequency Adjustment--

3. Monitor the unmodulated transmitted frequency on any channel. Adjust REFERENCE OSCILLATOR CV701 for zero carrier frequency.

## --Modulation Adjustment--

4. Apply 0.15 Vrms of 2500 Hz signal to the Microphone Receptacle J393 pins 1 and 2 (J395 of the Control Head on trunk-mount transceivers). Pin 1 is signal high; pin 2 is ground.

Key the transmitter by grounding pin 4 of the Microphone Receptacle, and monitor carrier modulation. Readjust applied signal level for 2.5 KHz carrier deviation (50% modulation). Adjust L101 and L102 for maximum deviation.

5. If the transceiver is not equipped with a CTCSS option, skip this step. Select any channel that is programmed for a CTCSS tone. Remove the modulating signal and key the transmitter. While monitoring carrier modulation, adjust the TONE OUTPUT LEVEL adjustment (RV1 on the 70-2101 or 70-2102 CTCSS boards) for desired modulation level (typically 750 Hz carrier deviation).
6. Reapply the 2500 Hz modulating signal, but increase its level to 1 Vrms. Key the transmitter and adjust MODULATION LIMITING RV101 for 5 KHz carrier deviation. Vary the signal level to ensure modulation does not exceed 5 KHz.

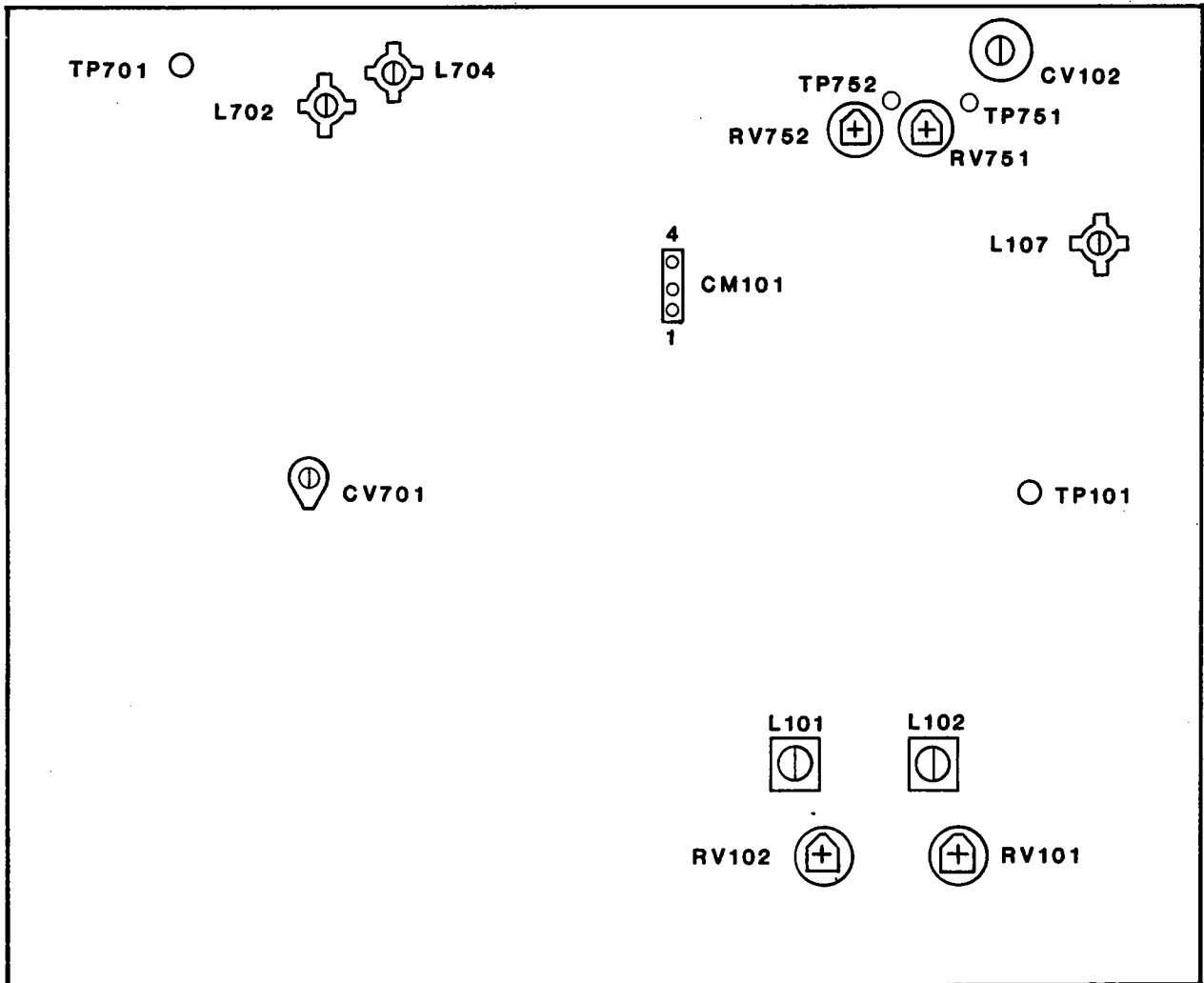
## --RF Power Output Adjustment--

7. Set POWER SET RV502 for maximum (fully clockwise).
8. Select the channel that transmits the center-most TX frequency. Key the transmitter and adjust CV501 and CV504 for maximum RF power into 50 ohms at the Antenna Connector.
9. Readjust POWER SET RV501 for 40 watts RF output into 50 ohms at the Antenna Connector.

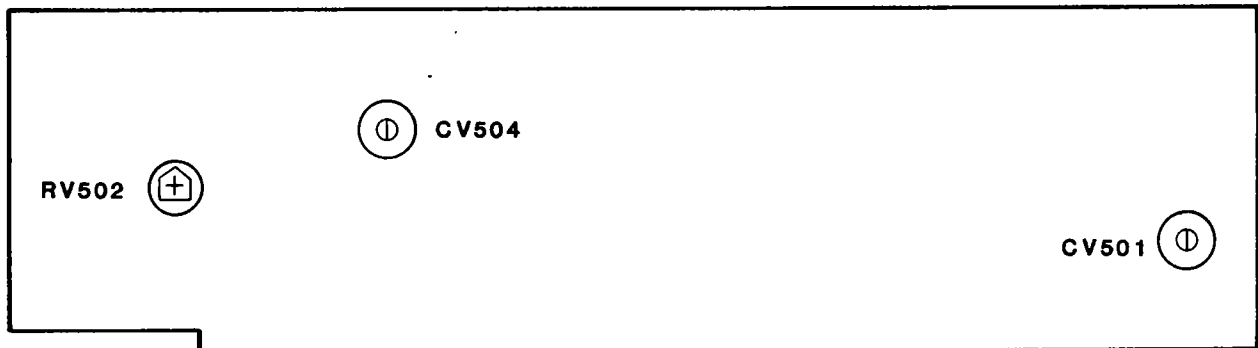
Calibration is complete. Normally, receiver realignment is not necessary.

## TRANSMITTER AND SYNTHESIZER ADJUSTMENTS

### TRANSMITTER BOARD



### RF POWER AMPLIFIER BOARD



## UNDER-DASH MOUNTING (Model 70-342XL only)

The 70-342XL transceiver is designed for use in automobiles, trucks, or other vehicles with 12 volt electrical systems. Where in the vehicle the transceiver is mounted does not affect its performance, provided its front panel controls are accessible to the operator. Typical mounting locations are under the dashboard or next to the driver's seat.

The transceiver is housed in a slim, small package to best conform to mounting locations. The mounting bracket slides into the transceiver siderails and provides a 3.25 x 7.75 inch flat surface across the transceiver top with holes for bolting to a flat surface in the vehicle. 5/32" holes must be drilled in the mounting surface to accept the four 3/8" screws and washers provided.

## TRUNK MOUNTING (Model 70-442XL only)

The 70-442XL trunk mount transceiver is designed for remote mounting such as a vehicle trunk or under a seat. The operator controls are in a compact control head for operator access. The bulk of the transceiver is within the separate remotely mounted unit. Because of this design, it does not have an internal speaker. Instead, a separate 3.2-ohm external speaker (included with the 70-442XL package) must be installed and connected to the Control Head.

The cable that interconnects the control head to the trunk unit is four meters long and flat for laying under carpeting. The cable must not lay near hot areas (above the catalytic converter, for example) nor against sharp edges.

A trunk unit mounting tray is provided with each transceiver. The flat tray is 7.5 inches square and must be bolted to the surface where the trunk unit will mount. 5/32" holes must be drilled in the mounting surface to accept the four 3/8" screws and washers provided. The 13 x 8 x 3 inch trunk unit then clips onto the tray.

A Control Head mounting bracket is provided with each transceiver. Its surface is 3/4 inch wide and 4 inches long with two screw holes 2 inches apart. 5/32" holes must be drilled in the mounting surface of the vehicle to accept the the 3/8" screws and washers provided. The Control Head and bracket assembly is 2 1/2 inches high, 4 1/4 inches wide, and 3 1/2 inches deep. At least 3/4 inch of additional depth is needed for the connectors that attach to the rear of the Control Head.

## REMOTE SPEAKER (required and included with the 70-442XL)

As part of the standard trunk-mount transceiver configuration (model 70-442XL), the model 70-2353 5-watt speaker connects to the Control Head Accessory Plug. It also can be used optionally with the 70-342XL under-dash transceiver to substitute the transceiver internal speaker. Its 5 1/2 ft. cable is terminated with appropriate Molex pins for



