

VHF/AM PORTABLE TRANSCEIVER MODEL TiL-91-DE/S

**15 WATT PORTABLE SYSTEM NO 910600
(TPS-250)**

Installation and Operating Instructions

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Rev. B**

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Technisonic Industries Limited

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WARNING

Do not make physical contact with antenna when transmitter is on. This unit can produce up to 20 watts of power when operated in high power mode.

WARNING

This unit contains two 12 VDC, 7.2 AMP HR batteries. Ensure terminals are covered in insulating material during installation or removal. Short circuit of battery terminals may cause damage to equipment and/or personnel

CAUTION

This unit contains static sensitive devices. Wear a grounded wrist strap and/or conductive gloves when handling printed circuit boards.

WARRANTY INFORMATION

! CAUTION !

ANTENNA *MUST* BE CONNECTED TO THE TRANSCEIVER BEFORE TURNING POWER ON

The Portable Transceiver Model 91-DE/S is under warranty for one year from date of purchase. Failed units caused by defective parts, or workmanship should be returned to:

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SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

The VHF/AM Portable Transceiver System P/N 910600-1, manufactured by Technisonic Industries Limited, is a portable, microprocessor controlled, simplex transceiver complete with battery, antenna and microphone operating over the frequency range of 117.975 MHz to 138.000 MHz. The Portable base station system is intended for temporary or backup base station operation in an airport environment. The system can operate from AC power, external DC power, or internal batteries in local and remote operating modes.

1.2 DESCRIPTION

The 91-DE/S Portable System consists of Portable Case P/N 911010-1, Transceiver Model TiL 91-DE P/N 901006-2, Microphone P/N 861902-1, Blade Antenna P/N 911017-1, and AC Power Cord P/N 927002-1. The front access cover houses the flexible blade antenna, microphone, AC power cord, 2.5 Amp SLO blow fuse (AC), 5 Amp fuse (DC) and 2 Allen Keys Refer to Figures 1-1 and 1-2 for details.

1.2.1 Portable Case P/N 911010-1

The Portable case consists of a Power Supply Module, RF Amplifier Module, Rechargeable Lead Acid Batteries, and Control Board.

1. POWER SUPPLY MODULE - The Power Supply Module provides the DC supply voltage to the Transceiver and Linear Amplifier, and Houses the Battery Charger which provides a combination constant current constant voltage charging and trickle charging to the two 12 VDC Lead Acid Batteries.
2. RF AMPLIFIER MODULE PA15 - Provides 15 Watt power output when the front panel switches are set to High. The RF Amplifier is fed by the 7 Watt RF output from the transceiver. A chassis mounted RF Relay bypasses the RF Amplifier in Receive and Low Power transmit modes.
3. CONTROL BOARD - provides all the switching functions necessary for hybrid operation and interfaces the lower half off the control panel to control charging, AC/DC and, battery operation. It also provides Battery Charged/Low indications.

1.2.2 Transceiver Model TiL-91-DE P/N 901006-2

The Transceiver is a microprocessor controlled VHF/AM transceiver operating over the entire band of 117.975 to 138.000 MHz in 25 kHz steps. The transceiver will store ten user selected frequency channels in addition to the resident emergency channel of 121.500 MHz. Frequency Selection, Storage, Recall, Channel Scan, Search, and Toggle modes are all selected by the 12 key keypad. Current operating frequency is displayed on a backlit liquid crystal display (LCD).

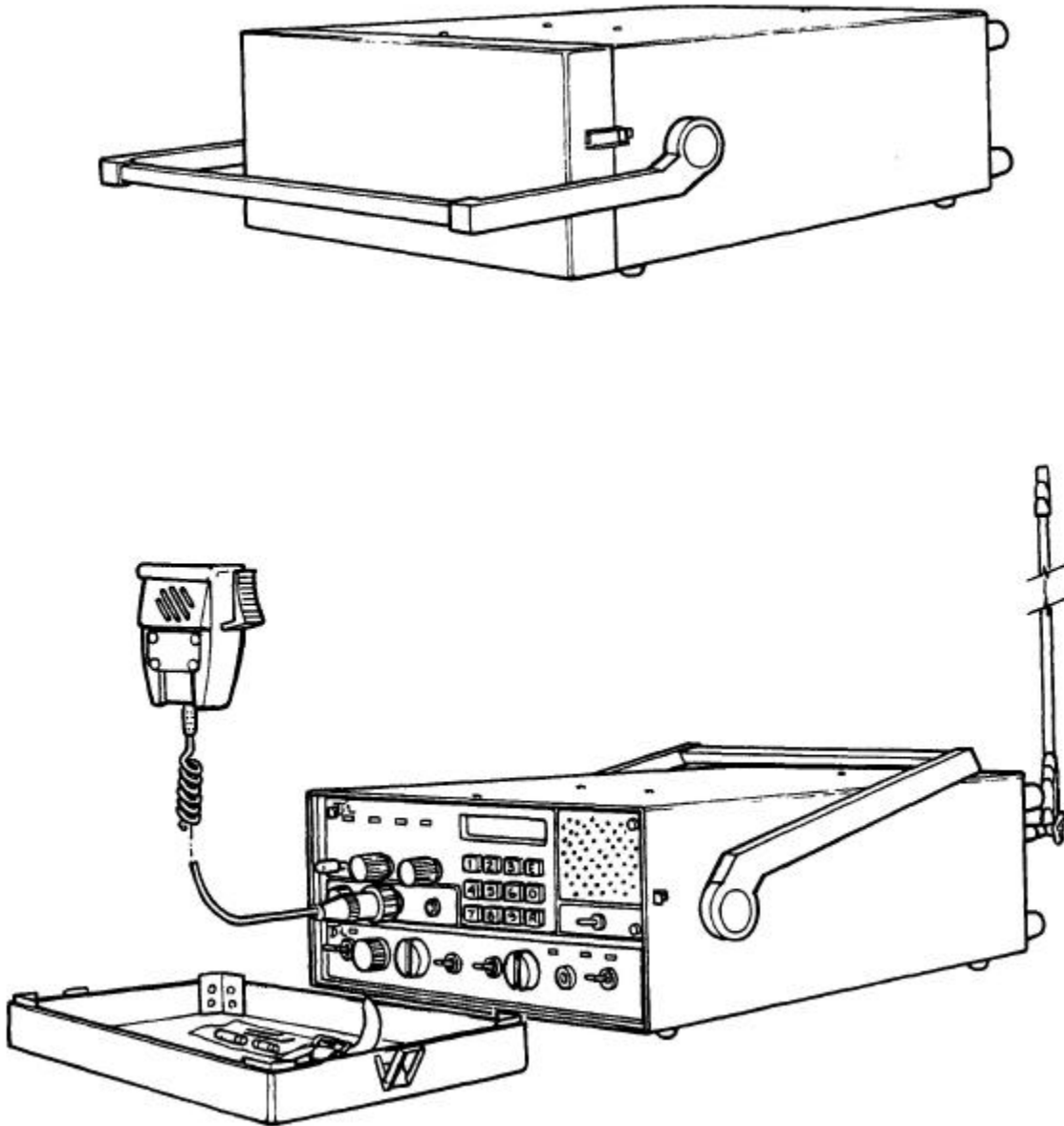


Figure 1-1 TPS-250 Portable Transceiver - General View (Closed & Open View)

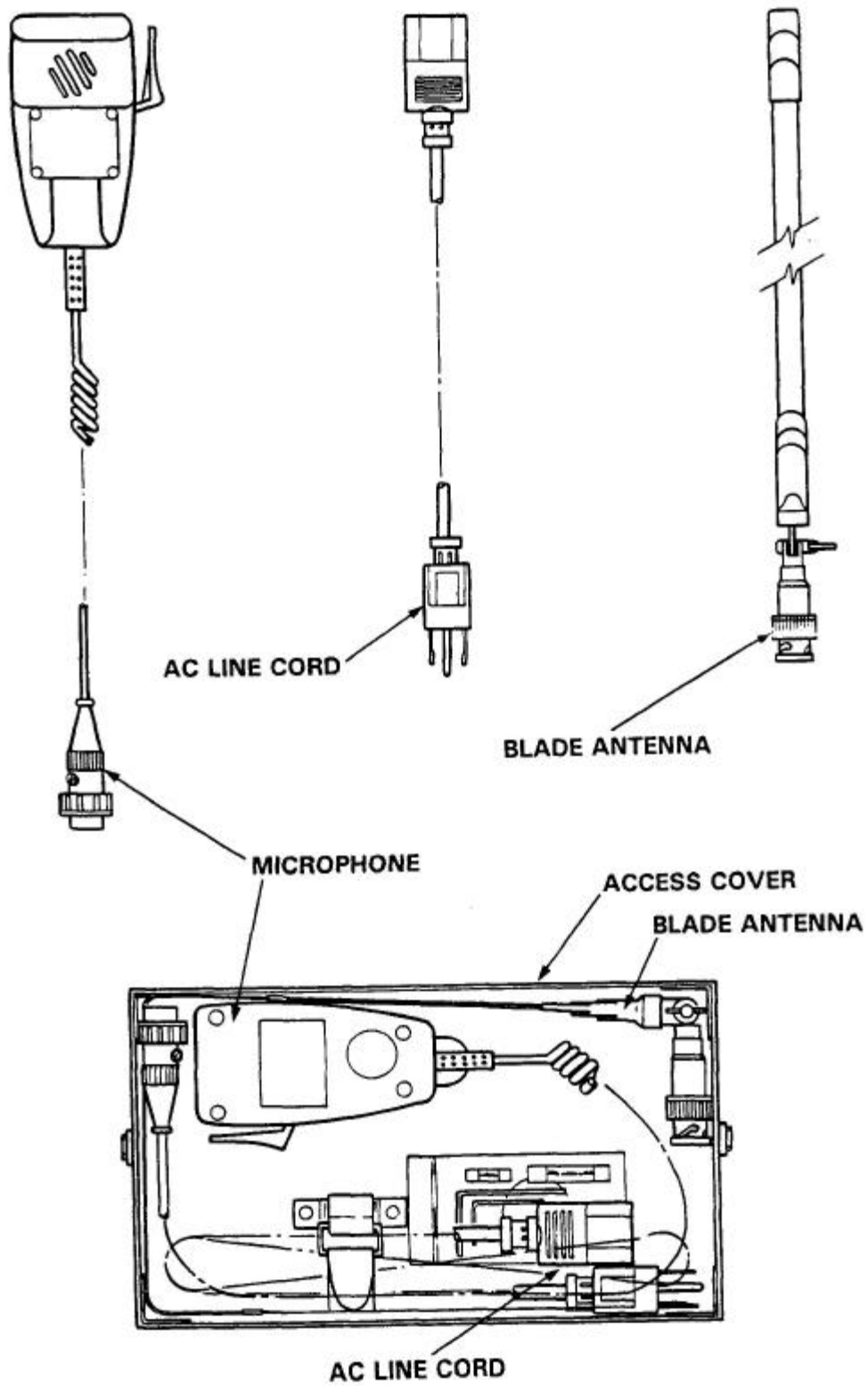


Figure 1-2 Transceiver Front Cover Assembly

1.2.2 Transceiver Model TiL-91-DE P/N 901006-2 (continued)

To improve the rejection of interfering signals, dual conversion receiver technology has been incorporated on the Transmitter/Receiver (Module A1) board used in Model 91-DE Transceiver. The second IF is 455kHz using a ceramic filter, which is immune to high energy ringing. The dual conversion module also has a second local oscillator, second mixer and ceramic filter. The first local oscillator is the original VCO.

The dual conversion receiver board, P/N 003494-1 was implemented into all Technisonic base stations starting in January 2001. An option label on the chassis will indicate OPTION 94 if the dual conversion board is installed. It is possible to retro-fit the dual conversion receiver/transmitter board into older TPS series base station employing the single conversion board. Please contact Technisonic for availability of an exchange board. Note: If a new A1 Module has been retrofitted the squelch circuit must be aligned for the receiver squelch to operate correctly.

The dual conversion receiver's squelch knob must be rotated significantly more clockwise (4 o'clock position) to obtain the same squelch setting (3uV) as a single conversion receiver's squelch knob set to the 12 o'clock (straight up) position.

If the dual conversion receiver's squelch knob is set to the 12 o'clock position, signals with a level greater than 0.5uV will open the squelch. At most airports this will not be an adequate level of squelch. Please be aware of this squelch knob adjustment variance when setting and/or comparing squelch levels of dual conversion vs. single conversion base stations.

1.2.3 Microphone P/N 861902-1

A general view of the Microphone Assembly Part Number 861902-1, Series 1, is given in Figure 1-2. The microphone is a rugged hand-held microphone housed in a high impact plastic case. The dynamic microphone is a noise cancelling type with a two-stage preamplifier, press-to-talk switch, and a retractable three-core cable terminated by a three-pin, male contacts, connector which mates with the MIC/PTT connector located on the front panel of the transceiver. The microphone dc supply for the microphone is supplied by the transceiver. The microphone is stored in the front access cover for transportation.

1.2.4 Blade Antenna P/N 911017-1

A General View of the blade antenna Part Number 911017-1 is given in Figure 1-2. The Blade Antenna is a broad band, flexible, whip antenna that operates over the entire frequency range of 117 Mhz to 138 Mhz. The antenna mounts on the rear panel RF BNC connector. A wing nut provides convenient angle adjustment. The antenna is stored in the front access panel.

1.3 MODES OF OPERATION

1.3.1 Transmit/Receive (Local Mode)

The transceiver may be operated in either of two modes; transmit or receive, as selected by the Press-to-Talk (PTT) switch on the microphone.

- (1) TRANSMIT MODE - When the PTT switch on the microphone is pressed, the transceiver operates in the transmit mode. The PTT signal line is grounded by the microphone PTT switch via the microphone lead and the MIC/PTT connector to the transceiver. The Tx ON amber LED will go ON, indicating that the transmitter is activated.

Transmission will occur on the channel frequency displayed on the Liquid Crystal Display (LCD). Frequency is determined by keypad entry of the operating frequency or by recalling a stored channel.

- (2) RECEIVE MODE - When the PTT switch on the microphone is released, the transceiver operates in the receive mode. The Tx ON amber LED will go OFF, indicating that the transmitter is inhibited. Reception of the frequency displayed on the LCD will occur.

The setting of the SQUELCH CONTROL determines the squelch threshold level. When the SQUELCH CONTROL is rotated in the counter-clockwise direction, the SQUELCH INDICATOR green LED will go ON, indicating that the squelch circuit is connecting the demodulated audio to the VOLUME CONTROL. The setting of the VOLUME CONTROL determines the audio level produced from the internal speaker. When the VOLUME CONTROL is adjusted in the clockwise direction, the audio level will increase.

NOTE

When the connector of the external loudspeaker or head phone is connected to the transceiver SPEAKER/PHONE jack, the internal loudspeaker is disconnected and the VOLUME CONTROL will control the audio level of the external loudspeaker or headphone.

1.3.2 Scan, Search, and Toggle Modes

1. SCAN MODE - In Scan Mode, the transceiver cycles through the preset Channel Frequencies and locks on to the first channel received in scan sequence. Audio is enabled for 5 seconds for operator identification. Pressing the Press-to-Talk switch exits the scan mode. If there is no operator action then the scan sequence continues in the scan sequence continuously.
2. SEARCH MODE - In Search mode the transceiver cycles through the preset Channel Frequencies and locks on to the first channel received in the scan sequence and normal operation is resumed.
3. TOGGLE MODE - In toggle mode the transceiver alternates between the current channel selection and the previous channel selected.

1.3.3 Local/Remote Operation

The Portable Transceiver can be operated in Local or Remote modes. An Independent record output is provided for communication monitoring and recording. Early 91-DE transceiver units employed a front panel switch to select local or remote operation. Later 91-DE units do not employ the switch and local/remote operation will occur simultaneously.

1. LOCAL OPERATION - In local operation, voice audio, and keying (PTT) functions are routed from the microphone to the transceiver. Receive audio is routed to the internal loudspeaker.
2. REMOTE OPERATION - In Remote operation, transmit audio, keying (PTT), and receive audio functions are routed over land lines to the 600 ohm remote input. Internal jumpers can be set for \pm DC or ground transmitter keying, and to provide a DC phantom squelch signal.

3. RECORD OPERATION - An independent 600 ohm audio output provides combined transmit and receive audio signals for recording of communication. An Internal jumper can be set to provide a floating output or ground referenced output.

1.3.4 AC/DC and Battery Operation

The unit can be operated by external 120 VAC, external 28 VDC, or internal battery power.

1. AC OPERATION - An AC power cord P/N 927002-1 (Refer to Figure 1-2) is supplied in the front access cover of the portable case assembly. During AC operation, the unit can be operated without batteries installed. With batteries present, the operator can elect to trickle charge the batteries during AC operation. The AC power supply can be set for 220 Vac operation via an internal jumper.
2. DC OPERATION - The unit can be operated from an external DC supply within the range of 21.6 Vdc to 30 Vdc. A DC connector is mounted on the rear of the Portable Case which mates with DC Power Cable P/N 863701-1 (Not Supplied) to facilitate external DC operation.

NOTE

Battery Charger does not operate during External DC Operation. Battery charger will only operate from an AC Power source.

3. BATTERY OPERATION - Battery operation can be selected from the front panel of the Portable Case. Two 12 Vdc, 7.2 Amp Hr lead batteries provide battery operation (Refer to Table 1-1 for Duty Cycle details).

1.4 TECHNICAL SUMMARY

A summary of electrical, operational, mechanical and physical characteristics of the transceiver, carrying case, microphone and blade antenna are indicated in Tables 1-1.

TABLE 1-1 PORTABLE SYSTEM LEADING PARTICULARS

GENERAL:

Power Requirements:

AC Input Voltage/Current 100 to 132 VAC @ 1.5 Amp
 DC Input Voltage/Current 21.6 VDC to 30 VDC @ 4.5 Amp

Temperature & Humidity:

Operating Temperature Range -25EC(-13EF) to + 55EC(+ 131EF)
 Storage Temperature Range -55EC(-67EF) to + 65EC(+ 149EF)
 Relative Humidity 100%

Microphone Compression Range 35 dB

Antenna:

Impedance 50 S
 Length (Overall) 603 mm (23.75 in) MAX
 VSWR 4:1 MAX

Dimensions & Weight (including Handle and Feet):

Width 270 mm (10.6 in) MAX
 Height 150 mm (5.9 in) MAX
 Depth 417 mm (16.4 in) MAX
 Weight (with Batteries) 11 Kg (24 lbs) MAX

TRANSMITTER:

Power Output (Low/High) 5-10/10-20 Watts
 Audio Input 0.05 Vrms to 2.0 Vrms
 Speech Processor Dynamic Range 35 dB
 Modulation 95% MAX
 Audio Distortion @ 90% mod (Low Power) 10% MAX
 Audio Distortion @ 90% mod (High Power) 15% MAX
 Audio Frequency Response 300 Hz to 2,500 Hz, + 1 -3 dB
 Spurious Emissions 60 dB below carrier
 Hum and Noise 45 dB below modulated carrier

RECEIVER:

RF Input Impedance 50S, VSWR 2:1 MAX
 Sensitivity (12 dB SINAD) @ 1 KHz 30% Mod 1.5 µvolts
 Selectivity, 25 KHz Channel Spacing:
 6 dB Bandwidth Greater Than 15 KHz
 80 dB Bandwidth Less Than 50 KHz
 Adjacent Channel Selectivity Greater Than 80 dB
 Spurious Response Attenuation Greater than 90 dB
 Frequency Stability (-40EC to + 55EC) ± 1,000 Hz MAX
 RF AGC (5 µvolts to 1 volt) Audio Level 3 dB
 Intermodulation:
 Ultimate Sensitivity 70 dB
 30 µvolts 45 dB
 300 µvolts 30 dB

TABLE 1-1 PORTABLE SYSTEM LEADING PARTICULARS (Continued)

RECEIVER (Continued):

Unwanted Radiation	Less than 80 μ volts into 50 S
Hum & Noise @ 1mV RF 30% MOD	40 dB
Loudspeaker Output	3 W MAX
Phone Output	100 mW into 600 S
Audio Distortion 1mV RF Input, 30% MOD	5% MAX
Audio Distortion 1mV RF Input, 90% MOD	10% MAX
Audio Output Limiting	Less than 1 dB @30 to 100% MOD
Audio Frequency Response 300 Hz-2500 Hz	+ 1 -3 dB
Audio Acquisition Time	Less than 100 msec
Audio Squelch Characteristics:	
Squelch Type	Noise and Carrier Operated
Carrier Operated Squelch	Adjustable 2 to 15 μ volts

BATTERY AND BATTERY CHARGING:

Battery Operation:

Lo Power 50% Duty Cycle	5 Hrs MIN
Hi Power 50% Duty Cycle	2 Hrs MIN
Receive Only (Audio output less than 3 W)	12 Hrs MIN

Battery Charge Cycle:

95% Capacity	6 Hrs
100% Capacity	8 Hrs
Battery Charger Voltage	27.5 Vdc MAX
Battery Charger Current	3 Amps MAX
Battery Voltage	2x12 VDC @ 7.2 Amp Hrs

REMOTE CONTROL:

Remote TX:

Range	+ 10 dBm to -18 dBm
Impedance	600 S floating with respect to ground

Remote RX:

Range	+ 10 dBm to -15 dBm
Factory Setting	-8 dBm
Impedance	600 S floating with respect to ground
Phantom Squelch	15-17 Vdc, 2 Vdc for Mute

Remote Recorder:

Range	+ 10 dBm to -20 dBm
Factory Setting	-8 dBm
Impedance	600 S floating with respect to ground

SECTION 2

PREPARATION FOR USE AND STORAGE

2.1 INTRODUCTION

This section provides the information required for custom configuration of the system, removal and replacement of batteries, and storage. Custom system configuration includes customizing channel frequencies and remote control set up.

Channels 0 to 9 can be configured for fixed frequency operation including transmit inhibit on preselected channels.

Remote control functions can be tailored for ground or \pm DC, single line, or land line keying. Optional Phantom squelch signal can be enabled or disabled. Record transmit and receive audio signals can be floated or ground referenced.

2.1.1 Disassembly General (Refer Figure 2-1)

- (1) Remove front access cover (1) by releasing 2 clip fasteners.
- (2) Remove and retain 4 bottom screws (2) securing cover (5) to chassis (6).
- (3) Remove and retain 2 top screws (item 3) securing cover to chassis.
- (4) Remove and retain 2 screws (item 4) securing cover to heatsink (7).
- (5) Slide cover forward, lift clear of chassis.

2.1.2 Assembly General (Refer to Figure 2-1)

- (1) Position cover (5) on Chassis (6) by aligning cover screw holes with chassis threaded inserts.

CAUTION

The two center screws are secured to an aluminum heatsink. Care must be taken to avoid stripping heatsink threads. Install screws in the sequence indicated to finger tightness. Tighten screws in the same sequence.

- (2) Install 2 screws (4) securing cover to heatsink (7).
- (3) Install 2 top screws (3) securing cover to chassis.
- (4) Install 4 bottom screws (2) securing cover to chassis.

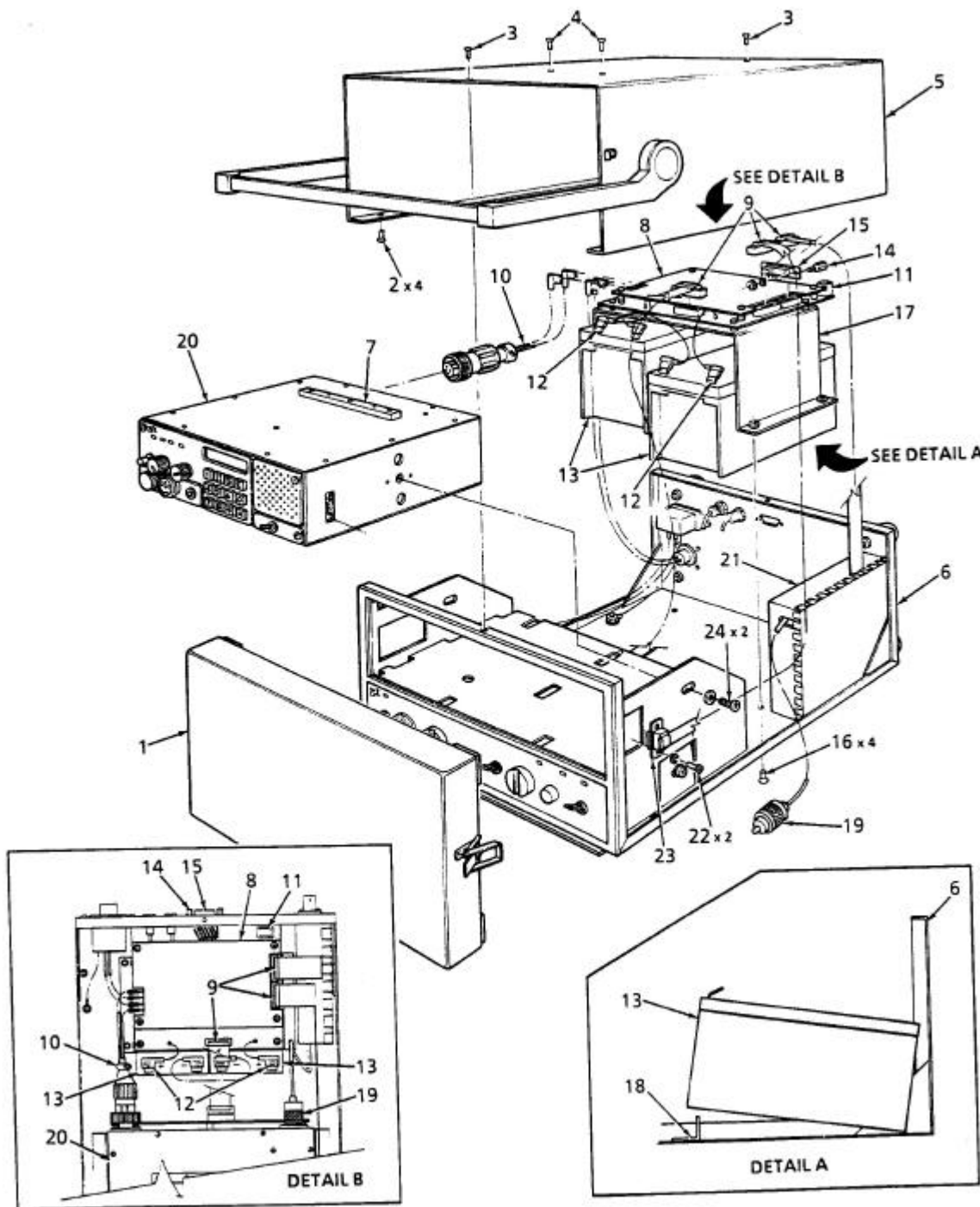


Figure 2-1 Battery Installation and Removal

2.2 BATTERY INSTALLATION & REMOVAL

2.2.1 Battery Removal

Remove Cover Assembly as described in paragraph 2.1.1. Refer to Figure 2-2 for location of items indicated below.

- (1) Disconnect (+) and (-) Terminal lugs (12) on Battery (13).
- (2) Disconnect 3 Ribbon Cable Connectors (9) on Control Board (8).
- (3) Disconnect External DC cable connection (10) on Control Board.
- (4) Disconnect TP1 Connector (11) on Control Board.
- (5) Remove and retain 2 screws, 2 lockwashers, and 2 nuts (14) securing D connector (15) to rear of chassis (6).
- (6) Remove and retain 4 screws (16) securing Control Board Bracket (17) to chassis (5).
- (7) Lift Control Board Bracket slightly, slide toward front of chassis, and lift clear of chassis lip (18).
- (8) Lift Bottom edge of Batteries and slide forward to clear chassis lip. Lift Batteries clear of chassis.

Replace Cover Assembly as described in paragraph 2.1.2.

2.2.2 Battery Installation

Remove Cover Assembly as described in paragraph 2.1.1. Refer to Figure (2-1) for location of items indicated below.

CAUTION

Batteries are shipped charged to 80% capacity. Damage to equipment and personnel may result if care is not taken to prevent accidental shorting of Battery terminals.

NOTE

Batteries are shipped with anti-corrosive agent on battery terminals. DO NOT remove agent when installing batteries.

- (1) Disconnect UHF connector (19) from transceiver (20).
- (2) Position Batteries (13) flush with chassis lip bracket (18).
- (3) Position Control Board Bracket Assembly (17) over Batteries and secure to chassis (6) with 4 screws (16).

- (4) Loop RF Cable (item 19) between Linear Amplifier (21) and Control Board Bracket. Reconnect to Transceiver.
- (5) Secure D-type Connector (15) to rear of chassis with 2 screws, 2 lock washers, and 2 nuts (13).

NOTE

Screws are difficult to position in unit. Tilt entire unit and hold screws in position with tweezers or small needle nose pliers.

- (6) Connect 3 Ribbon Cable Connectors (9) on Control Board (8).
- (7) Connect External DC Cable connection (10) on Control Board.
- (8) Connect TP1 Connector (11) on Control Board.
- (9) Connect (+) and (-) Terminal lugs (12) on Battery (13).
- (10) Replace Cover Assembly as described in paragraph 2.1.2.
- (11) Refer to paragraph 3.7.1 for battery charging information.

2.3 FIXED CHANNEL FREQUENCY SET UP

The following procedure fixes preselected channel frequencies and inhibits transmit on receive only channels. After completion of this procedure the operator will be able select stored channels only for receive or transmit. Keypad entry of frequencies is disabled.

2.3.1 System Configuration

- (1) Configure channel frequencies as desired (Refer to Section 3.4.5).
- (2) Select channels for Rx only (transmit inhibit) operation (Refer to paragraph 3.4.7).

2.3.2 Transceiver Removal

- (1) Remove Case Assembly Cover. Refer to paragraph 2.1.1 and Figure 2-1.

CAUTION

Failure to disconnect batteries before removing UHF connector from transceiver may result a in short circuit.

Ensure that damage does not result from UHF connector coming in contact with exposed circuit card on rear of power supply by disconnecting battery terminal lugs first.

- (2) Disconnect (+) and (-) Terminal Lugs (12) on Battery (13).
- (3) Disconnect UHF connector (19) and External DC Cable (10) from rear of transceiver (20). Refer to Figure 2-1.
- (4) Remove and retain 2 screws, and 2 lockwashers (22) securing Ribbon Cable (23) to D connector on right side of transceiver (20). Remove connector from socket.
- (5) Remove and retain 2 screws, and 2 washers (24) securing Transceiver to chassis (6).
- (6) Slide Transceiver to rear of chassis. Lift Transceiver clear of chassis.

2.3.3 Transceiver Disassembly/Assembly and Jumper Installation

- (1) Remove and retain 12 flathead screws (1) and 3 Panhead screws (2) securing transceiver top cover (3) to chassis (4). Refer to Figure 2-2.
- (2) Position Jumper J6 on pin 1 and pin 2 to disable keyboard entry of frequency selection and lock operating configuration.
- (3) Position Jumper J6 on pin 2 and pin 3 to enable keypad frequency selection and unlock operating configuration.

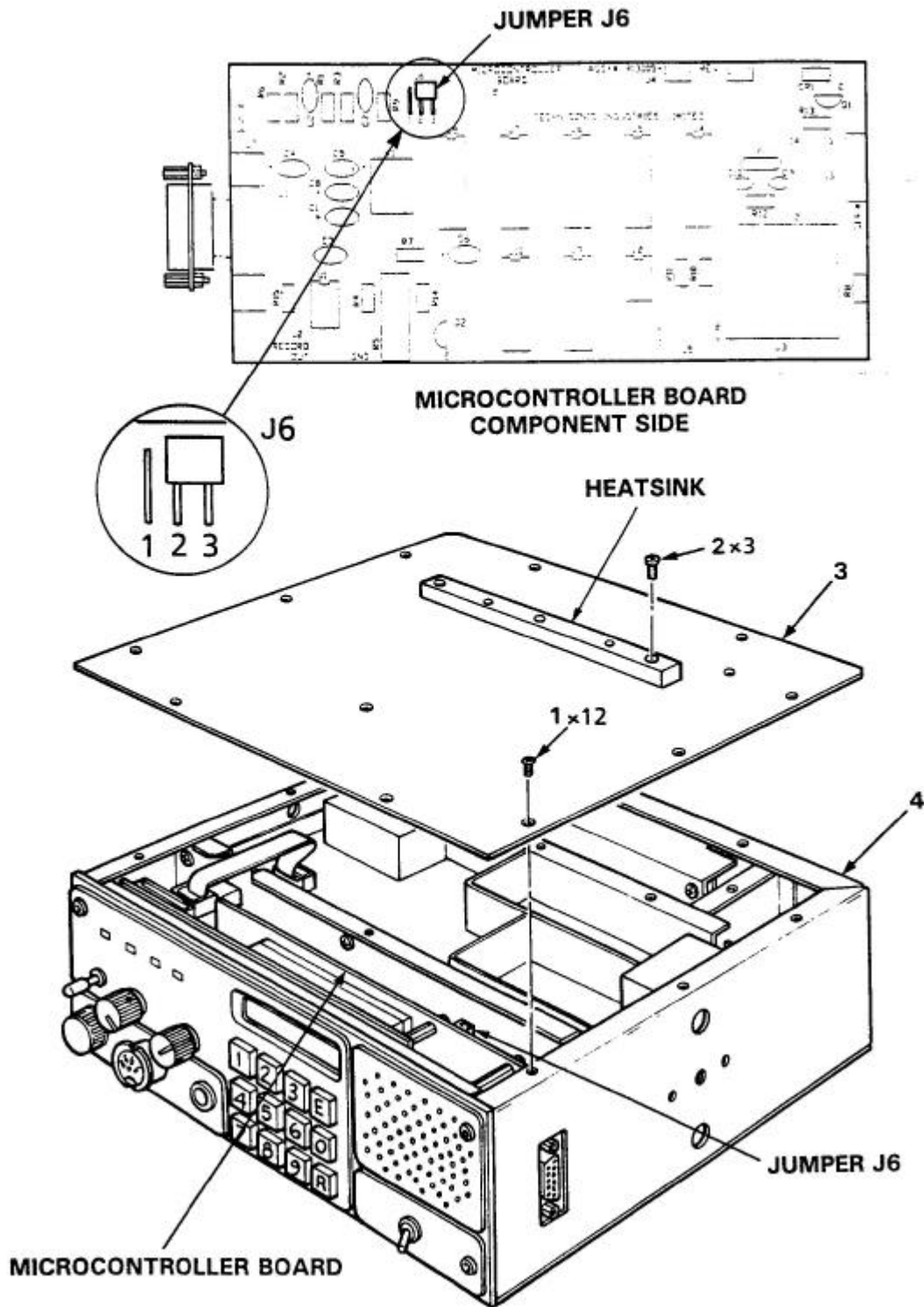


Figure 2-2 Fixed Channel Jumper Locations

- (4) Position Transceiver Cover (3) on Chassis (4). Ensure that cover holes are aligned with threaded inserts.
- (5) Position 12 flathead screws (1) and 3 Panhead screws (2) through cover (3) holes into chassis (4) threaded inserts. Tighten screws with fingers.
- (6) Tighten screws securing Transceiver Cover (3) to Chassis (4).

2.3.4 Transceiver Replacement

- (1) Position Transceiver (20) in Case Assembly. Refer to Figure 2-1. Slide transceiver to front of Case Assembly. Ensure that Transceiver Front Panel is flush with front of Case Assembly and Transceiver mounting holes align with chassis threads. Tighten screws.
- (2) Position 2 Panhead screws and 2 washers (24) in threaded holes. Secure Transceiver to Chassis (6).
- (3) Install 2 panhead screws and 2 lockwashers (22) securing Ribbon Cable (23) to D Connector.
- (4) Connect UHF Connector (19) and External DC Cable (10) to connectors at rear of Transceiver.
- (5) Replace Case Assembly Cover (Refer to paragraph 2.1.2).

2.3.5 Operational Check

- (1) Turn Unit On (Refer to paragraph 3.3).
- (2) Recall Channels "0" through "9" (Refer to paragraph 3.4.6). Ensure that the frequencies indicated for each channel displayed correspond to those selected.
- (3) Transmit on each channel. Observe that the TX Led (Refer to Figure 3-2, for location) does not light on channels selected to operate exclusively in receive mode.
- (4) Enter a valid frequency (within the frequency range of (117.975 MHz to 138 MHz) that differs from the frequency stored in channel "0".
- (5) Store the frequency in channel "0" (Refer to paragraph 3.4.5).
- (6) Recall Channel "0" frequency. Channel "0" frequency displayed shall be the same frequency entered before Locking the operating configuration (ie. different from the frequency entered in step 4).
- (7) Perform Steps 4 through 6 for each channel.

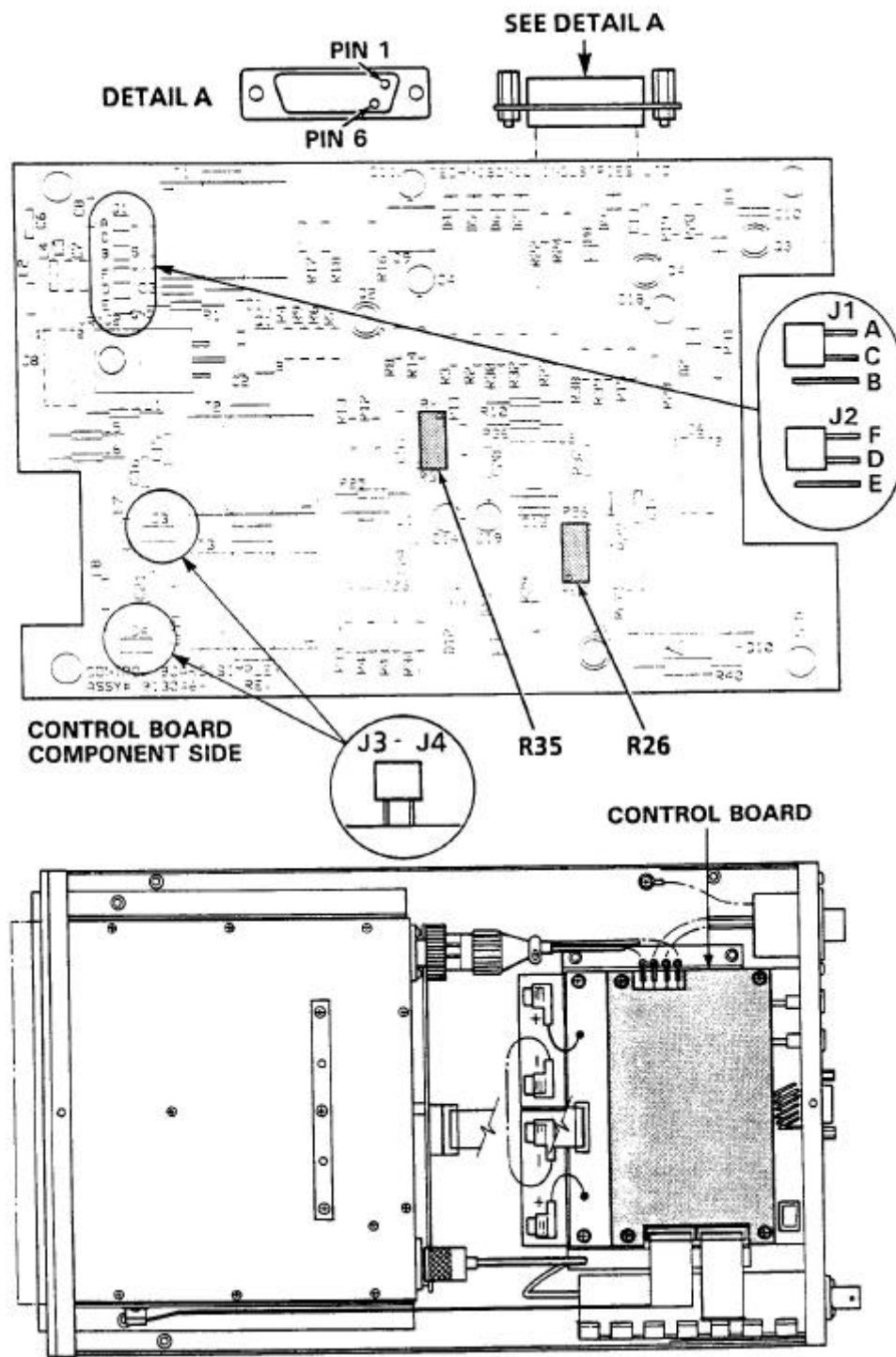


Figure 2-3 Remote Operation - Jumper Locations

2.4 REMOTE OPERATION SET UP

The Procedures listed below enable the user to custom configure the unit for external remote control hardware. Refer to Table 2-1 for connector pin details on Remote Control D Connector located at rear of Case Assembly and Table 2-2 for Jumper Functions.

The Record audio output and Remote audio line level is factory set for -8 dBm. Trimpot resistor R26 (Record) is adjustable over the range of + 10 dBm to -20 dBm. Trimpot resistor R35 (Remote Audio) adjusts levels over the range of + 10 dBm to -15 dBm.

Transmitter keying can be set for ground keying or \pm DC keying. In \pm DC keying, a positive voltage between + 10 Vdc and + 48 Vdc or negative voltage between -10 Vdc and -48 Vdc will key the transmitter. A DC voltage between -5 Vdc and + 5 Vdc will not key the transmitter.

- (1) Remove Cover from Case Assembly. Refer to paragraph 2.1.1.

CAUTION

This unit contains static sensitive devices. Wear a grounding strap and/or conductive gloves when handling printed circuit boards.

- (2) Position Jumpers on Control board as indicated in Table 2-2. Refer to Figure 2-3 for jumper locations.

NOTE

Jumpers J1, and J2 must be in one of the Locations shown in Table 2-2 for Press-To-Talk (PTT) Operation.

- (3) Replace Cover on Case Assembly. Refer to paragraph 2.1.2.
- (4) Verify Remote Control operation in accordance with manufacturers instructions.

TABLE 2-1 REMOTE CONTROL CONNECTOR FUNCTIONS	
PIN NO	FUNCTION
1	Remote TX Audio High
2	Remote Recorder Audio High
3	Remote Rx Audio High
4	+ 24 Vdc
5	Remote Rx Audio Low
6	Remote Tx Audio Low
7	Single Line Keying
8	Remote Recorder Audio Low
9	Ground

TABLE 2-2 REMOTE CONTROL JUMPER FUNCTIONS		
JUMPER	LOCATION	FUNCTION
J1	A,C	Enables Transceiver PTT function on Remote Tx audio line.
	B,C	Isolates PTT from Tx audio line. Connects PTT to Pin 7 of Remote connector.
J2	E,D	Selects Voltage operation of PTT (± 10 Vdc to ± 48 Vdc).
	F,D	Selects Ground operation of PTT (0 Vdc ± 0.5 Vdc).
J3	IN	Recorder Out is referenced to chassis ground (Can be used for remote PTT ground source).
	OUT	Recorder Out is floating.
J4	IN	Inserts phantom squelch into Rx audio line. 15 Vdc to 17 Vdc with RF signal present (47 KS impedance). Less than 2.0 Vdc mute.
	OUT	Removes phantom squelch from Rx audio line (floating).

2.5 OPTIONAL LOUDSPEAKER, HEADPHONE INSTALLATION

Provision is made for connection of either an external loudspeaker or headphone to the SPEAKER/PHONE jack of the transceiver, as shown in Figure 3-2.

2.5.1 External Loudspeaker

When an external loudspeaker is to be installed, an 8-ohm nominal impedance loudspeaker should be used. The loudspeaker cable should be terminated by a 1/4 in., 3-pole telephone plug (male), with the loudspeaker connected between tip and sleeve (ground). Insert the external loudspeaker connector into the SPEAKER/PHONE jack located on the front panel of the transceiver. When the external loudspeaker connector is connected to the transceiver SPEAKER/PHONE jack, the internal loudspeaker is automatically disconnected.

2.5.2 Headset

Headset impedance should be 150 to 600 ohms. The headset cable must terminate in a 1/4 in. 3-pole telephone plug (male), to mate with the SPEAKER/PHONE jack located on the front panel of the transceiver. The internal loudspeaker is automatically disconnected. Connect the headset as indicated below for receiver audio with or without transmit audio.

- (1) HEADSET WITHOUT TRANSMIT AUDIO - When receiver audio only without transmit audio is required, the headset should be connected between the tip and sleeve (ground) of the telephone plug.
- (2) HEADSET WITH TRANSMIT AUDIO - When receiver audio with transmit audio is required, the headset should be connected between the ring and sleeve (ground).

2.6 OPERATIONAL CHECK

Perform an operational check of the transceiver after all adjustments. Check each channel in use in both the transmit and receive modes of operation, using the Operating Instructions given in Section 3 of this document and the appropriate specified operating procedures during transmission.

2.7 STORAGE

To store for an extended period, Remove Batteries and store unit in a dry place, in the original shipping container. Store batteries in a well ventilated area.

NOTE

Batteries should be completely discharged and recharged at six month intervals when not in regular use.

SECTION 3

OPERATING INSTRUCTIONS

3.1 INTRODUCTION

This section includes a functional description of each switch, control, indicator and connector located on the front and rear panels of the portable transceiver, including the PRESS-TO-TALK switch located on the microphone. Operating instructions for transmit/receive and the special functions are also included.

3.2 OPERATOR'S SWITCHES, CONTROLS AND INDICATORS

A view of the front and rear panel is given in Figure 3-2. A functional description of each of the operator's switches, controls and indicators, and the microphone PRESS-TO-TALK switch, is given in Table 3-1, Operator's Switches, Controls and Indicators and Table 3-2, Channel/Function Selector Keypad.

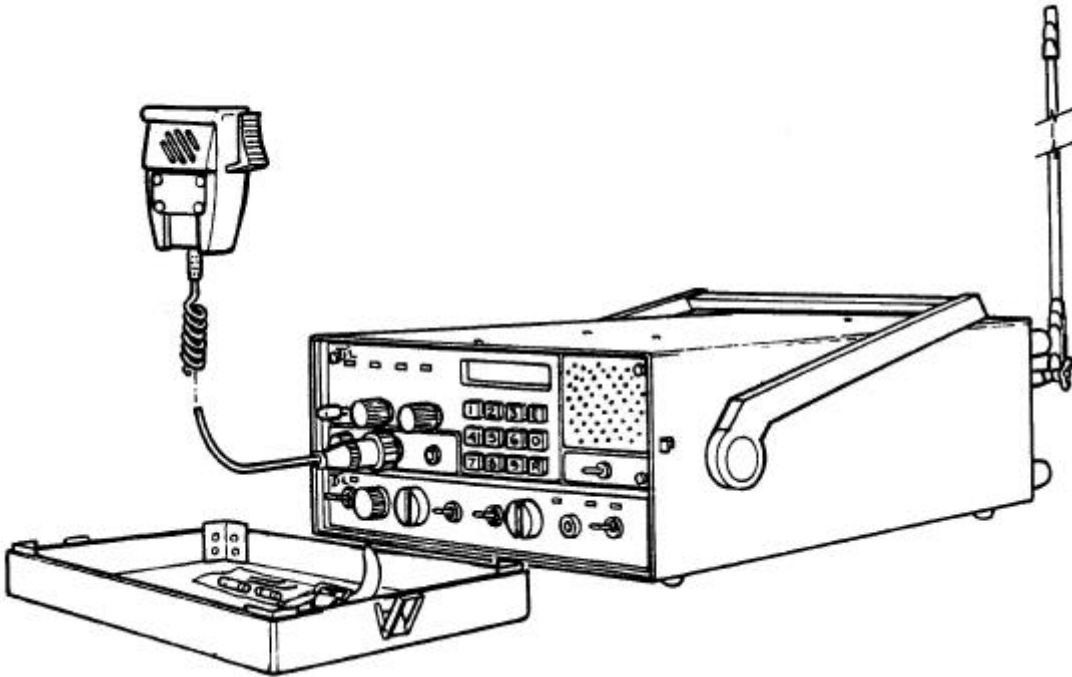
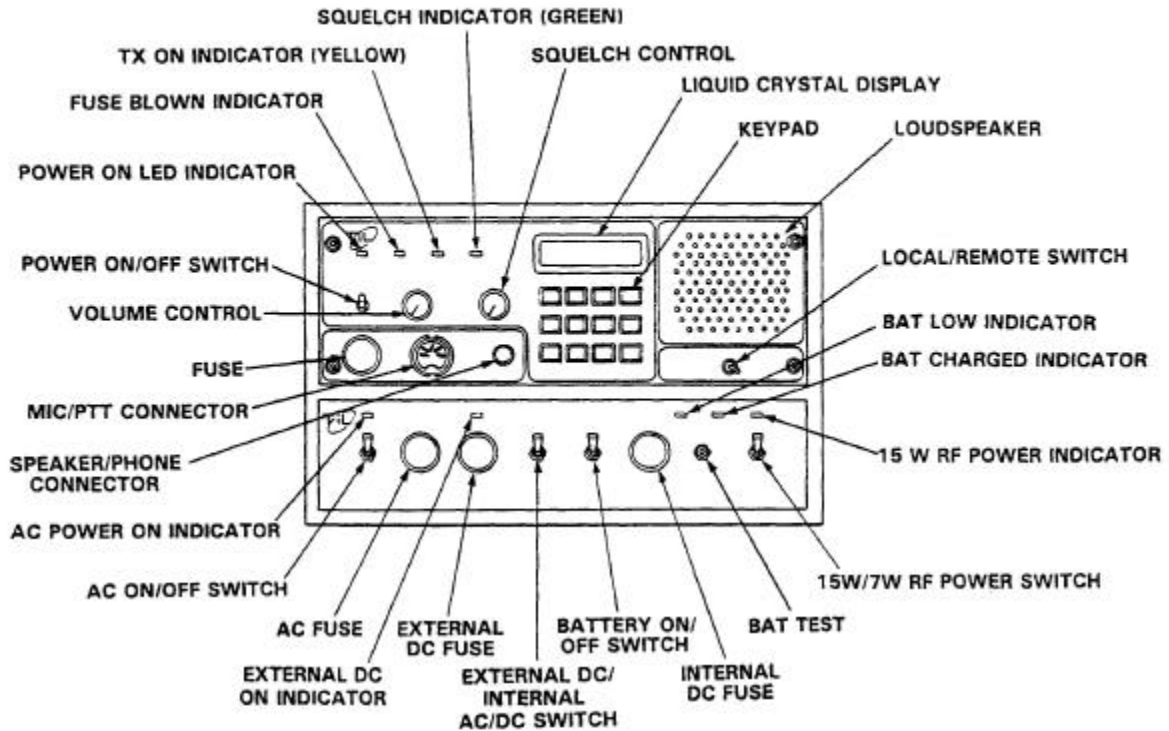
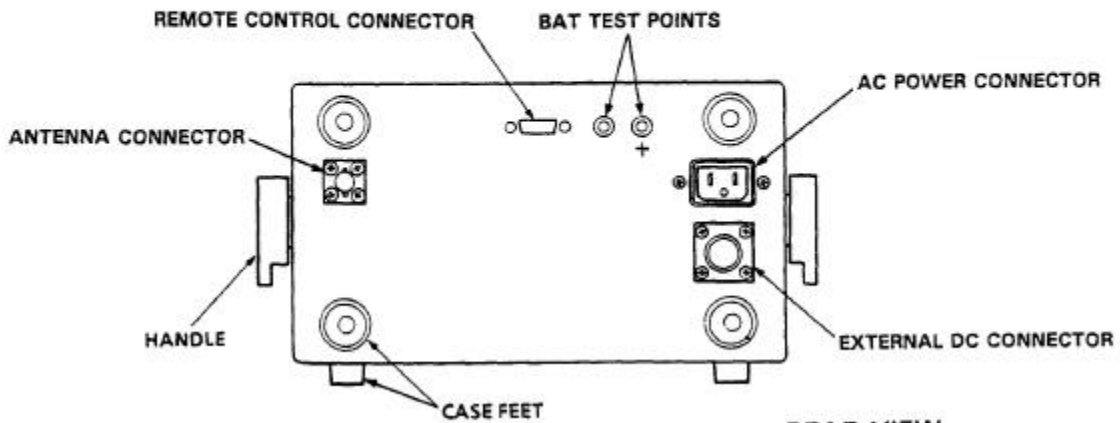


Figure 3-1 Transceiver Set Up



FRONT VIEW



REAR VIEW

Figure 3-2 Transceiver Front and Rear Panel Layout

TABLE 3-1 OPERATORS SWITCHES, CONTROLS AND INDICATORS		
No.	SWITCHES CONTROLS & INDICATORS	FUNCTIONAL DESCRIPTION
1	POWER ON/OFF SWITCH	A toggle switch applies the 27.5 volts nominal power supply to the transceiver. The transceiver is switched to ON in the toggle UP position the transceiver is switched OFF in the toggle DOWN position.
2	POWER ON LED INDICATOR	A GREEN LED Indicates when the POWER ON/OFF switch is set to ON and voltage is applied to the transceiver.
3	FUSE	A 5 Amp FUSE protects the 27.5 volts nominal power supply line.
4	FUSE BLOWN RED LED INDICATOR	A RED LED indicates when the 5-Amp fuse is "blown", and External DC, AC, Battery power is present.
5	SQUELCH CONTROL	A linear potentiometer determines the squelch threshold level. When the SQUELCH CONTROL is rotated in the counter-clockwise direction, the SQUELCH GREEN LED indicates that the squelch is connecting demodulated audio to the VOLUME control.
6	SQUELCH INDICATOR GREEN LED	A GREEN LED indicates the squelch circuit is connecting demodulated audio signal to the VOLUME control.
7	Tx ON AMBER LED INDICATOR	An AMBER LED indicates when the transceiver is keyed by the microphone PRESS-TO-TALK (PTT) switch or remote land line, and the transceiver is operated in the Tx mode. The Tx ON AMBER LED switches OFF, when the transceiver is operated in the receive mode.
8	VOLUME CONTROL	A logarithmic potentiometer determines the audio level applied to the internal speaker when the transceiver is operated in the receive mode. When the SPEAKER/PHONE connector is in use the internal loudspeaker is disconnected and the VOLUME CONTROL sets the audio level applied to the external speaker or headphone.
9	MIC/PTT CONNECTOR	A 5-pin connector functions as Microphone/PTT and Test Connector. Pin 1 - PTT Signal Line Pin 2 - Microphone Signal Ground Pin 3 - Microphone Signal and Microphone DC Supply Line Pin 4 - AGC test voltage Pin 5 - Squelch test voltage
10	MICROPHONE PTT	PRESS-TO-TALK (PTT) switch determines transceiver operating mode. When the PTT switch is pressed, the transceiver operates in Tx mode. When the PTT switch is released, the transceiver operates in Rx mode.
11	KEYPAD	Performs Chan/Freq and Special Feature Selection (Refer Table 3-2).

TABLE 3-1 OPERATORS SWITCHES, CONTROLS AND INDICATORS (Continued)		
FIG 3-1 No.	SWITCHES CONTROLS & INDICATORS	FUNCTIONAL DESCRIPTION
12	LIQUID CRYSTAL DISPLAY	A 5½ digit Liquid Crystal Display (LCD) displays the FREQUENCY/ CHANNEL that the transceiver is currently operating on. IN SCAN mode it displays the current frequency scanned if RF signal is present.
13	LOUDSPEAKER	An 8-ohm internal speaker reproduces the receiver audio output. The audio line is disconnected from the internal loudspeaker when the transceiver is operated in Tx mode or when the SPEAKER/PHONE connector is in use.
14	LOCAL/ REMOTE SWITCH	Selects Local or Remote operation (Refer paragraph 2.4) for remote set up details.
15	SPEAKER/ PHONE CONNECTOR	A 3-pole connector provides interconnection to either an external loudspeaker or headphone. When in use, the internal speaker is disconnected and the VOLUME control sets the audio level applied to the external speaker or headphone.
16	AC ON/OFF SWITCH	A 2-pole switch applies external AC power to the portable case power supply.
17	AC POWER ON LED INDICATOR	A RED LED indicates when AC power is applied to the unit and the AC POWER SWITCH is set to ON. Also indicates that the Portable Case power supply is functioning.
18	AC FUSE	A 2.5 Amp fuse protects Portable Case power supply from power supply internal short circuit or transceiver short circuit.
19	EXTERNAL DC FUSE	A 5 Amp fuse protects the 27.5 volt nominal power supply line. As part of reverse polarity protection, the fuse will "blow" when polarity of the External DC supply line is reversed.
20	EXT DC ON LED INDICATOR	A GREEN LED indicates when External DC is applied to the unit and the EXTERNAL DC SWITCH is set to ON.
21	EXTERNAL DC/ INTERNAL AC/DC SWITCH	Selects External DC when set to EXT DC isolating Batteries and AC Supply line. Selects AC or Battery operation in conjunction with Battery ON/OFF switch.
22	BATTERY ON/OFF SWITCH	Selects AC Operation when set to Battery OFF. When set to Battery ON provides Battery Power to transceiver. When AC Switch is set to ON and AC Power is connected, battery charging is enabled.
23	INTERNAL DC FUSE	A 5 Amp fuse provides battery isolation in the event of a short circuit.

TABLE 3-1 OPERATORS SWITCHES, CONTROLS AND INDICATORS (Continued)		
FIG 3-1 No.	SWITCHES CONTROLS & INDICATORS	FUNCTIONAL DESCRIPTION
24	BAT TEST	Single pole pushbutton switch provides for manual battery charge level test. Results are indicated by the Batt Low LED indicator or BATT charged LED indicator.
25	BAT LOW LED INDICATOR	A RED LED Indicates that battery charge is less than 21.6 Vdc and that battery should be charged before using in battery mode.
26	BAT CHARGED LED INDICATOR	A GREEN LED Indicates that battery is charged to greater than 21.8 Vdc and is ready for use in battery mode.
27	15W/7W RF POWER SWITCH	Selects 7 Watt or 15 Watt Transmit Operation.
28	15 W RF POWER LED INDICATOR	An AMBER LED indicates that 15 Watt RF Power output has been selected and transceiver is operating in transmit mode. The LED is driven by sampled RF and indicates that RF is present.
29	*AC POWER CONNECTOR	3 Prong AC Connector for use with AC Power Cord P/N 927002-1.
30	*REMOTE CONTROL CONNECTOR	9 Pin "D" type connector provides connections required for remote operation. Refer to Table 2-1 for connector details.
31	*BATTERY TEST POINTS	Two Jacks are provided for exact measurement of internal battery voltage (Output Impedance is 20 KS).
32	*EXTERNAL DC CONNECTOR	Chassis mounted connector provides for Connection to External DC Supply Source. Mates with DC power cable P/N 863701-1.
* Denotes items located on rear panel.		

3.3 GENERAL OPERATING INSTRUCTIONS

3.3.1 Preparation for Use

To prepare the transceiver for use (Refer to Figures 1-2, 3-1 and Table 3-1).

- (1) Location for Transmit/Receive Operation.

The VHF frequency band is essentially line of site communication. When selecting a location there should be no obstacles between the communicating radio sites. Objects greater than two metres will reflect The RF signal and foliage greatly attenuates signal strength. The blade antenna should be positioned as vertical as space permits for optimum performance. A wing nut is provided on the Blade antenna for this adjustment.

WARNING

Do not make physical contact with antenna when transmitter is on. This unit can produce up to 20 Watts of power when operated in High Power Mode.

- (2) Open front access cover by levering the clip fasteners toward front of case. For Local Operation Remove Microphone and install in Microphone (PTT) connector.
- (3) Ensure that transceiver POWER ON/OFF switch is set to OFF.
- (4) Remove AC Cord from front access cover and install in AC chassis connector on rear panel or install External DC Cable in External DC chassis connector on rear panel as required.
- (5) Remove Blade Antenna from front access cover. Install antenna in rear panel chassis BNC connector. Adjust Antenna using wing nut for vertical polarization.
- (6) Select Local/Remote Operation (Applies only to older 91-DE units with a front panel Local/Remote switch). Newer units operate in local and remote modes simultaneously.
 - (a) For LOCAL operation set LOCAL/REMOTE switch to LOCAL.
 - (b) For Remote Operation Connect Land Line to D connector provided on rear of Portable Case. Set LOCAL/REMOTE switch to REMOTE.

NOTE

Refer to appropriate Operating Instructions for use with Remote Control Unit.

NOTE

The following operating procedures are intended specifically for Local Operation.

- (6) Select AC Power, External DC Power, or Battery Operation. Refer to Paragraphs 3.5 to 3.7).
- (7) Remove the microphone from front access panel, and ensure that the microphone connector is connected to the MIC/PTT connector of the transceiver.
- (8) Set the SQUELCH control in the fully counter-clockwise (CCW) position.
- (9) Set the VOLUME control in the 12 o'clock centre position.
- (10) Set the POWER ON/OFF switch to "ON".
- (11) Verify that the FUSE BLOWN red LED is OFF.
- (12) Verify that the POWER ON green LED is ON.
- (13) Set up Keypad "Beeps" as desired.
Refer to Keypad "Beeps" paragraph 3.4.1.
- (14) Set up Keypad and LCD Display Lighting as desired.
Refer to Keypad and LCD Display Lighting, paragraph 3.4.2.
- (15) Set up Transmitter Time-Out-Timer as desired.
Refer to Transmitter Time-Out-Timer, paragraph 3.4.3.
- (16) Select Frequency/Channel or operating mode as desired.
Refer to Front Panel Keypad Operation, paragraph 3.4.
- (17) Proceed to operate in the transmit mode, paragraph 3.3.2, or operate in the receive mode, paragraph 3.3.3, as required.

3.3.2 Transmitter Operation

To operate the transceiver in the transmit mode, proceed as follows:

- (1) Set 7W/15W RF POWER switch to desired operating level.

NOTE

**RF Power setting and duty cycle (ratio of Tx to Rx operation) seriously affects Battery Operating time.
Fully charged batteries will perform for:**

- 12 Hours minimum in Receive mode only.**
- 5 Hours minimum (50% duty cycle) @ 7 Watt**
- 2 Hours minimum (50% Duty Cycle) @ 15 Watt**

- (2) Hold the microphone in one hand, with the upper edge of the microphone as close as possible to the upper lip.

NOTE

This technique activates the noise cancelling feature of the microphone. The microphone is most effective when sound is ½ inch (12.7 mm) or more away from the microphone.

- (3) Press and hold the PRESS-TO-TALK switch of the microphone during transmission.
- (4) Ensure that the Tx ON amber LED is ON.
- (5) Speak slowly and distinctly into the microphone using specified operating procedures during transmission.
- (6) When message is ended, release the PRESS-TO-TALK switch of the microphone.
- (7) The transceiver is now operating in the receive mode.
- (8) Verify that the Tx ON amber LED is OFF.
- (9) Refer to paragraph 3.4 for Front Panel Keypad Operation and additional Operating modes.

3.3.3 Receiver Operation

To operate the transceiver in the receive mode, proceed as follows:

- (1) Ensure that the PRESS-TO-TALK switch on the microphone is NOT depressed, and verify that the Tx ON amber LED is OFF.
- (2) Verify that the correct operating frequency is displayed on the liquid crystal display (LCD). Refer to Front Panel Keypad Operation, paragraph 3.4 for Channel/Frequency selection.
- (3) Adjust the SQUELCH control to suit local reception conditions. When the SQUELCH control is rotated in the counter-clockwise direction, the SQUELCH indicator green LED will switch to ON, indicating that the squelch circuit is connecting the demodulated audio output to the VOLUME control.

Further adjustment of the SQUELCH control determines the squelch setting.

IMPORTANT NOTE

The dual conversion receiver's squelch knob must be rotated significantly more clockwise (4 o'clock position) to obtain the same squelch setting (3uV) as a single conversion receiver's squelch knob set to the 12 o'clock (straight up) position.

If the dual conversion receiver's squelch knob is set to the 12 o'clock position, signals with a level greater than 0.5uV will open the squelch. At most airports this will not be an adequate level of squelch.

Recommended procedure:

The squelch taper on a dual conversion receiver looks as follows:

Squelch knob position	Squelch setting
12 o'clock	0.5uV
3 o'clock	1.2uV
3:30 position	2.5uV
4 o'clock	3uV
Fully clockwise	9uV

It is recommended that the squelch be set to at least 2.5uV (3:30 knob position) at busy airport locations. If ACARS signals are present on adjacent or nearby channels the squelch level should be at least 3uV (4 o'clock) to prevent ACARS bleed through.

- (4) The VOLUME control can then be adjusted in a clockwise direction to increase the audio level, or in a counter-clockwise direction to decrease the audio level which can be heard on the internal loudspeaker.

NOTE

When an external loudspeaker or headset is connected to the SPEAKER/PHONE jack of the transceiver, the internal loudspeaker is automatically disconnected. The VOLUME control will now control the audio level applied to the external loudspeaker or headset, as applicable.

- (5) Refer to paragraph 3.4 for Front Panel Keypad Operation and additional Operating modes.

3.3.4 Switching OFF

To switch off the transceiver:

- (1) Set the POWER ON/OFF on transceiver to switch to OFF.
- (2) Verify that all indicator LED's on the front panel are OFF.

NOTE

When the transceiver is switched OFF there is no current drain in the External DC operating mode.

Unless unit is set to charge batteries there is no current drain in the AC operating mode (Refer to Paragraph 3.7.1).

There is no current drain if unit is left in battery mode and unit is not set to charge.

3.4 FRONT PANEL KEYPAD OPERATION

All frequencies within the range of 117.975 MHz to 138.000 MHz can be stored on channels 0 to 9 in 25 KHz steps. Channels and feature settings are stored in non-volatile memory. Removal of external power source or batteries will not erase stored channels, key "Beep" set up, Keypad and LCD display lighting set up, 90 second Tx time-out set up or Tx Inhibit selections. The SCAN and SEARCH features are NOT stored in memory when unit is turned off. Emergency channel 121.500 is permanently stored as an 11th Channel. Refer to paragraph 3.4.6 for details. Table 3-2 Provides a Quick Reference of the CHANNEL/FUNCTION SELECTOR KEYPAD Functions.

TABLE 3-2 CHANNEL/FUNCTION SELECTOR KEYPAD	
KEYPAD	FUNCTIONAL DESCRIPTION
DIGIT 0 to DIGIT 9	Functions as a digits 0 - 9 for frequency entry and channel selection Recalls Channel when preceded by "R" key. * Stores Channel when preceded by "E" key. * Selects Special Function when preceded by "E" key.
"R"	Recalls stored channel frequency when followed by digits 0 to 9. Recalls last frequency displayed when preceded by the "E" key.
"E"	* Stores a frequency to channel when followed by digits 0 to 9. Enables Special Features (See Below).
"E", "0"	Recalls permanently stored emergency channel 121.500 MHz.
"E", "1"	Selects Automatic Lighting of Keypad and LCD Display.
"E", "2"	Selects Continuous Lighting of Keypad and LCD Display.
"E", "3"	Disables Keypad and LCD Display Lighting.
"E", "4"	Selects SEARCH mode.
"E", "5"	Selects SCAN mode.
"E", "6"	Enables 90 second Tx time-out protection.
"E", "7"	Disables 90 second Tx time-out protection.
"E", "8"	Toggles Key "Beeps" ON and OFF.
"E", "9"	Disables/Enables transmit on selected frequency.
"E", "R"	Toggles between currently displayed frequency and the previously displayed frequency.
<p>* If key "E" followed by a digit is pressed within 5 seconds of Keyboard entry of a frequency then the frequency is stored in the channel specified. IF 5 seconds has elapsed then key "E" followed by a digit selects the Special Function specified.</p>	

3.4.1 Keypad "Beeps"

Audible "Beeps" are generated when a key is pressed (default condition). Tones can be enabled/disabled by toggling the "E","8" keys.

+) , +) ,
Press *E* *8* to disable Key "Beeps".
.) - .) -
+) , +) ,
Press *E* *8* to enable Key "Beeps".
.) - .) -

3.4.2 Keypad and LCD Display Lighting

Three Display and keypad lighting modes are available to the operator. The default mode provides no keypad or LCD display backlighting. In Continuous mode, display backlight and keypad lighting is permanent until power is removed or until lighting mode exited. In automatic mode, display backlight and keypad lighting is off until a key on the keypad is pressed or until the lighting mode is exited.

+) , +) ,
Press *E* *1* to initiate automatic lighting.
.) - .) -
+) , +) ,
Press *E* *2* to initiate continuous lighting.
.) - .) -
+) , +) ,
Press *E* *3* to turn to lighting OFF.
.) - .) -

3.4.3 Transmitter Time-out

A 90 second time-out timer is provided to prevent accidental continuous transmission.

+) , +) ,
Press *E* *6* to initiate 90 second Tx time-out protection.
.) - .) -
+) , +) ,
Press *E* *7* to disable 90 second Tx time-out protection.
.) - .) -

3.4.4 Selecting a Frequency

To Select a frequency press the keypad digits in the sequence indicated (Refer to Fig 4-1, Operators Switches Controls and Indicators).

1st Digit - must be 1 for 100 Mhz, all other digits are ignored.
2nd Digit - must be 1,2 or 3, all other digits are ignored.
3rd Digit - must be any digit within the range of 117 Mhz to 138 MHz.

NOTE

**Entry of 117 MHz fills 975 in remaining digits.
Entry of 138 Mhz fills 000 in remaining digits.**

4th Digit - Can be any digit.
5th + 6th Digits are paired.

Entry of 5th digit 0 results in 00 displayed.
Entry of 2 results in 25.
Entry of 5 results in 50.
Entry of 7 results in 75.

Examples:

+) , +) , +) ,
Press *1* *1* *7*
.) - .) - .) -
117.975 is displayed on screen.

+) , +) , +) , +) , +) ,
Press *1* *1* *8* *0* *0*
.) - .) - .) - .) - .) -
118.000 is displayed on screen.

+) , +) , +) ,
Press *1* *3* *8*
.) - .) - .) -
138.000 is displayed on screen.

After keypad entry of a desired frequency, normal Tx/Rx operation can begin as described in paragraph 3.3 or the frequency can be stored as a channel as described in paragraph 3.4.2.

3.4.5 Storing a Frequency to a Channel

Up to 10 Frequencies can be stored and recalled in channels 0 to 9 as follows:

1. Enter the frequency to be stored as described in paragraph 3.4.1 followed immediately by pressing "E" and the desired Channel number "#".

NOTE

"E", "#" must be pressed within 5 seconds of entry or frequency will not be stored.

Examples:

+) , +) , +) , +) , +) ,
Press *1* *1* *7* *E* *0*
.) - .) - .) - .) - .) -
Frequency 117.975 MHz is stored as channel 0.

+) , +) , +) , +) , +) , +) , +) ,
 Press *1* *1* *9* *7* *5* *E* *1*
 .) - .) - .) - .) - .) - .) - .) -
 Frequency 119.750 MHz is stored as channel 1.

+) , +) , +) , +) , +) ,
 Press *1* *3* *8* *E* *2*
 .) - .) - .) - .) - .) -
 138.000 MHz as channel 2.

3.4.6 Recalling a Stored Channel

To recall the permanently stored emergency channel 121.500 MHz press "E","0". Press "R","#". The frequency stored as the channel indicated will be displayed on the screen.

Example:

+) , +) ,
 Press *R* *1*
 .) - .) -

Channel 1 frequency 119.750 MHz stored in the previous example will be displayed.

3.4.7 Transmit Inhibit

To Inhibit the transmit function on a desired channel press "E","9" immediately followed by the channel "#" to be inhibited. Subsequent pressing of "E","9","#" will enable the transmit function.

NOTE

After inhibiting the transmit function, the Tx inhibited channel must be recalled from memory for this function to take effect.

Example:

+) , +) ,
 Press *R* *1*
 .) - .) -

Channel 1 frequency 119.750 MHz stored in the previous example will be displayed. Press the PRESS-TO-TALK switch. Observe that the TX indicator LED lights.

+) , +) , +) ,	+) , +) ,
Press *E* *9* *1*	Press *R* *1*
.) - .) - .) -	.) - .) -

Press the PRESS-TO-TALK switch. Observe that the TX indicator LED does not light.

+) , +) , +) ,	+) , +) ,
Press *E* *9* *1*	Press *R* *1*
.) - .) - .) -	.) - .) -

Press the PRESS-TO-TALK switch. Observe that the TX indicator LED lights.

3.4.8 Toggling Between Two Channels

+) , +) ,
Press *R* *E* to recall previous channel.
.) - .) -

Example:

Recall Channel 0 as described in para 3.4.3
117.975 will be displayed.

Recall Channel 2
138.000 will be displayed.

+) , +) ,
Press *R* *E*
.) - .) -
117.975 will be displayed.

+) , +) ,
Press *R* *E*
.) - .) -
138.000 will be displayed.

3.4.9 Search Mode

In SEARCH MODE the receiver steps through each stored channel until a transmitted signal is found. The receiver will lock on to the first signal strong enough to quiet the squelch circuit. SEARCH mode is exited when a signal is found. Normal operation resumes as if the SEARCH frequency was selected from the keypad or recalled from memory.

+) , +) ,
Press *E* *4* to enter SEARCH mode.
.) - .) -
+) ,
Press *E* to exit SEARCH mode.
.) -

3.4.10 Scan Mode

In SCAN MODE the receiver steps through each stored channel until a transmitted signal is found. The receiver will lock on to the first signal strong enough to quiet the squelch circuit. When a signal is found, the frequency is displayed and the audio is enabled for 5 seconds. After the five second lock SCAN is resumed until the next frequency is found and the process is repeated. SCAN mode is continuous until the operator exits or the unit is switched off.

NOTE

**PTT is inhibited during SCAN mode.
Pressing PTT once exits SCAN mode.
Pressing PTT twice is required to Key the Transmitter.**

+) , +) ,
Press *E* *5* to enter SCAN mode.
.) - .) -
Press PTT to Lock on SCANned Frequency or
+) ,
Press *E* to exit SCAN.
.) -

3.5 AC OPERATION

- (1) Install AC Power Cord. Connect AC power source.
- (2) Set Ext DC/INT AC/DC switch to INT AC/DC.
- (3) Set BATTERY switch to ON for trickle charge.
- (4) Set BATTERY switch to OFF if batteries are not installed.
- (5) Set AC ON/OFF switch to ON.

AC ON/OFF Indicator shall light indicating that AC is present and Power supply is operating correctly.

3.6 EXTERNAL DC OPERATION

- (1) Set AC ON/OFF switch to OFF.
- (2) Set Ext DC/INT AC/DC switch to Ext DC.
- (3) Install External DC Power Cable P/N 863701-1 (Not Supplied) or equivalent to DC Connector on rear of Panel. Connect to External DC Source.

NOTE

Ensure that the DC source voltage does not exceed 30 Vdc. This Unit can operate within the range 21.6 Vdc to 30 Vdc.

NOTE

Batteries can not be charged in this mode. AC power must be present to charge batteries. Refer paragraph 3.7.1 Battery Charging.

3.7 BATTERY OPERATION

- (1) Set Ext DC/INT AC/DC switch to INT AC/DC.
- (2) Set BATTERY switch to ON.
- (3) Press BAT TEST switch. Battery CHG'D indicator shall light. If BAT LOW indicator lights, charge unit before using in Battery Mode.

3.7.1 Battery Charging

Completely discharged batteries will require 6 Hrs to charge to 95% capacity or 8 Hrs to charge to 100% capacity. Batteries should be completely discharged and recharged at six month intervals when not in regular use.

- (1) Install AC Power Cord.
- (2) Set Ext DC/INT AC/DC switch to INT AC/DC.
- (3) Set BATTERY switch to ON to charge Batteries.
- (4) Press BAT TEST.- Battery CHG'D indicator shall light. If BAT LOW indicator lights battery or charger may be defective. Replace batteries as indicated in paragraph 2-2 and repeat charging procedure. If batteries fail to charge return unit for repair (Refer to Warranty Information Page A).

NOTE

Test Points are provided on rear panel of the Portable Case for exact measurement of battery voltage. Output impedance is 20 KS.