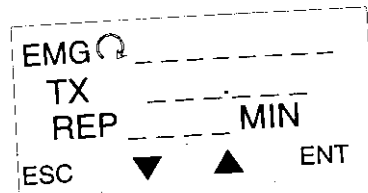


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⊙ = SELECT VIA ROTARY SELECTOR ON TOP PANEL

Figure 30. EMERGENCY Channel Designation Screen

2-2.5.1.5 Pre/De Emphasis, Transmit Inhibit, and Repeater Delay.
 The Pre/De Emphasis, Transmit Inhibit, and Repeater Delay Screen, shown at **Figure 31**, allows the user to enable or disable the Pre/De Emphasis capability in the radio, set the Transmit Inhibit feature, and set a Repeater Delay time. Pre/De Emphasis is a signal filtering method that reduces background noise and improves speech intelligibility. Transmit Inhibit is a feature used to keep users from talking over other radio conversations. The transmit inhibit options are CARR, CARR+O, TONE, TONE+O, and NONE. CARR (transmit inhibit on busy channel with carrier) prevents transmission if any activity is detected on the channel. CARR +O is the same as CARR with the addition of an override feature, which allows the user to override the transmit inhibit state by quick-keying the radio (i.e., two PTT presses within a short time frame - default value is 0.5 second). TONE (transmit inhibit on busy channel with wrong squelch code) prevents transmission on an active channel with a squelch code other than your own. TONE+O is the same as TONE with the addition of the quick-override feature. Transmit inhibit will lock the PTT switch. If the user tries to transmit (press the PTT switch) on an active channel, an alert tone will be generated, and transmission will be inhibited. The Repeater Delay is a time delay used to prevent the radio from receiving its own transmission from a tactical repeater. The screen begins with P/D EM highlighted. Press [ENTER] and use the [▲] or [▼] keys to turn Pre/De Emphasis on or off. Press [ENTER] again to lock in the value. Use the [▼] key to go to TX INH, press [ENTER] and use the [▲] or [▼] keys to choose CARR, CARR+O, TONE, TONE+O or NONE. Press [ENTER] again to lock in the value. Use the [▼] key to go to RPTR, press [ENTER] and use the [▲] or [▼] keys to scroll through

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the repeater delay values (None (0.0), 0.2, 0.4, 0.6, 0.8 or 1 second). Press [ENTER] again to lock in the value. Use the [▼] key to go to a Reset screen. Pressing ENT will reset any global parameters that had been changed back to the values before the current changes were made. Use the [▼] key to go the Backlight Control and Transmit Time Out screen (**Figure 27**). Press ESC to exit from the Global Programming Screens.

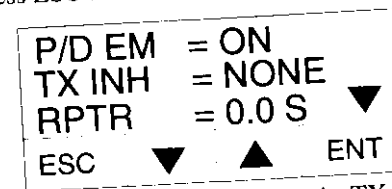


Figure 31. Pre/De Emphasis, TX Inhibit, and Repeater Delay Screen

2-2.5.2 Channel Programming Screen.
 The Channel Programming Screens, shown at **Figure 32** through **Figure 39**, opens with a screen showing the ID and alpha tag of the selected channel (**Figure 37**). To select a different channel for programming, the operator must first select the zone containing that channel. Then the operator uses the rotary select knob to scroll through the channels in that zone. The operator can not change the channel's ID and alpha tag on the screen.

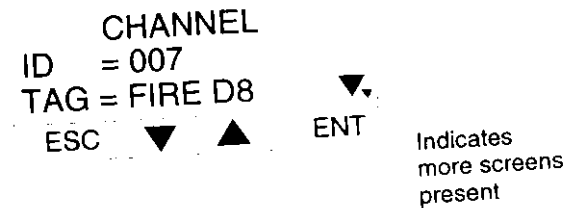


Figure 32. Channel Programming Screen (1 of 8)

Use the [▼] key to scroll to the mode and bandwidth select screen (**Figure 33**), where MODE will be outlined. To change mode press [ENTER] and use the [▲] and [▼] keys to choose the mode (Analog or Digital). If Analog is chosen, use the [▼] key to go to B/W (bandwidth) and press [ENTER]. The [▲] and [▼] keys can be used to choose the desired

bandwidth. If Digital is selected, the bandwidth is automatically set to 12.5 kHz, therefore B/W will not appear.

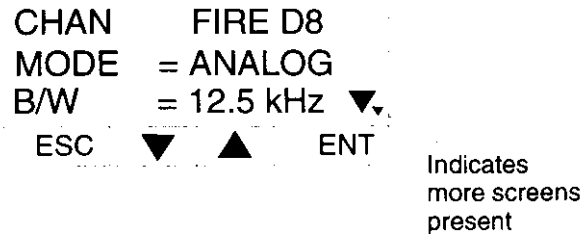


Figure 33. Channel Programming Screen (2 of 8)

Use the [▼] key to scroll to the encryption enable/disable screen (Figure 34), where ENCRPT will be outlined. Press [ENTER] and use the [▲] and [▼] keys to enable or disable encryption. If encryption is enabled the K= will appear to allow the operator to choose an encryption key. Use the [▼] key to go to K and press [ENTER], then use the [▲] and [▼] keys to scroll through the available keys. Press [ENTER] to select the desired encryption key.

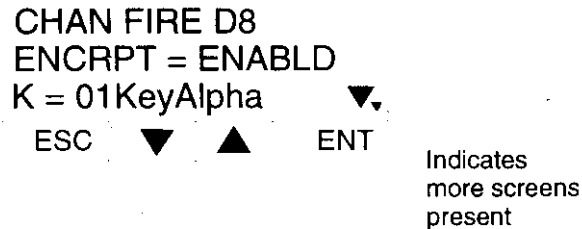
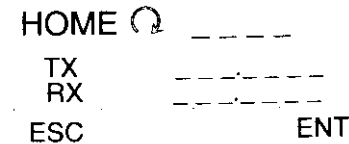


Figure 34. Channel Programming Screen (3 of 8)

Use the [▼] key to scroll to the receive frequency screen (Figure 35), where RX = will be outlined. Press [ENTER] to go to the first number of the receive frequency and use the number keys on the keypad to change the frequency, if desired. Press [ENTER] to lock in the new frequency. If the channel mode is digital RXNAC will appear below the frequency. Use the [▼] key to highlight RXNAC and press [ENTER]. Then use the [▲] and [▼] keys to scroll through the available NACs and press [ENTER] to select the desired code.

2-2.5.1.3 Home Channel.

The Home Channel Designation Screen, shown at Figure 29, allows the user to designate, using the rotary switch on top of the radio, which channel within the selected zone is to be considered the Home channel. The screen opens with Home outlined press [ENTER] and then use the rotary switch on the top of the radio to choose a home channel. As the user scrolls through the channels the channel's transmit and receive frequencies will be displayed, but cannot be changed on this screen. Press [ENTER] to choose a Home channel and use the [▼] key to go to the next Global parameters screen.



⊙ = SELECT VIA ROTARY SELECTOR ON TOP PANEL

Figure 29. HOME Channel Designation Screen

2-2.5.1.4 Emergency Channel.

The Emergency Channel Designation Screen, Shown at Figure 30, allows the user to designate, using the rotary switch on top of the radio, which channel within the selected zone is to be considered the Emergency channel. The screen opens with EMG outlined. Press [ENTER] and then use the rotary switch on the top of the radio to choose an emergency channel. As the user scrolls through the channels the channel's transmit and receive frequencies will be displayed, but cannot be changed on this screen. Press [ENTER] to choose a Home channel and use the [▼] key to go to the next Global parameters screen..

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Press [ENTER] and use the [▲] or [▼] keys to scroll through the backlight values (Dim, Bright, or Off). Press [ENTER] again to lock in the value. Use the [▼] key to go to BL DLY, press [ENTER] and use the [▲] or [▼] keys to scroll through the backlight delay values (0 to 9 seconds). Press [ENTER] again to lock in the value. Use the [▼] key to go to TOT, press [ENTER] and use the [▲] or [▼] keys to scroll through the timeout timer values (30 to 300 seconds in 30 second increments or Off). Press [ENTER] again to lock in the value. Use the [▼] key to go to the next Global parameters screen.

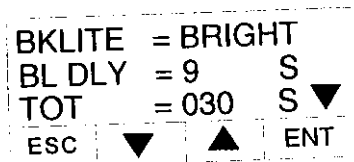


Figure 27. Backlight Control Screen

2-2.5.1.2 Display Appearance.

The Display Appearance Screen, shown at Figure 28, is used to set the display for either alpha names or numeric entries. The screen opens with DISPLY outlined. Press [ENTER] and use the [▲] or [▼] keys to choose either ALPHA or NUMBER. Press [ENTER] again to lock in the value. Use the [▼] key to go to the next Global parameters screen.

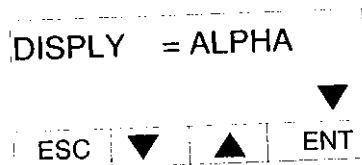


Figure 28. Display Appearance Screen

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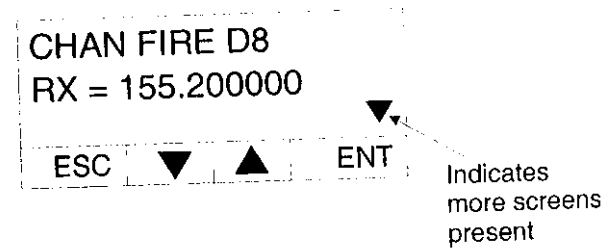


Figure 35. Channel Programming Screen (4 of 8)

Use the [▼] key to scroll to the receive squelch select screen, shown at Figure 36. If the channel is analog, the available receive squelch modes are NONE, NOISE, DCS, and CTCSS. For a digital channel, the only available squelch mode is P25. To change the analog squelch mode press [ENTER] when the RXSQMD is outlined, then use the [▲] and [▼] keys to scroll through the options, press [ENTER] again to lock in the desired option. If NOISE is chosen, a SQ (squelch) setting will appear below the RXSQMD. Press [ENTER] and then use the right and left arrows to increase or decrease the squelch level. If CTCSS is chosen, a TON (tone) setting will appear. Press [ENTER] and then use the [▲] and [▼] keys to scroll through CTCSS tones, and press [ENTER] again to lock in the chosen tone. If DCS is chosen, a CODE setting will appear. Press [ENTER] and then use the [▲] and [▼] keys to scroll through DCS codes, and press [ENTER] again to lock in the chosen code. For a digital channel, a TALKGP setting will appear. Press [ENTER] to advance to the first number of the Talkgroup ID code and use the number keys to enter a four-digit hexadecimal number (to enter the A, B, C, D, E, and F hexadecimal digits, keep pressing the number key with that digit above it (e.g. 3 for D, E, and F) until the letter appears. For example if E was required, pressing the "3" key three times to scroll from "3" through "D" to "E". Press the left and right arrow keys to scroll through the four digits of the code and press [ENTER] to lock in the selected Talkgroup ID code.

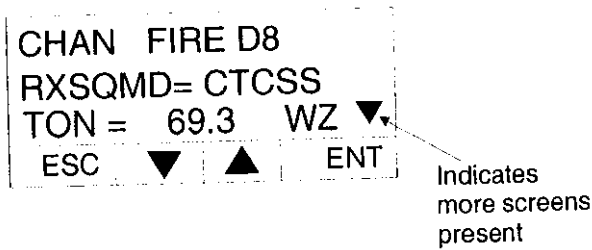


Figure 36. Channel Programming Screen (5 of 8)

Use the [▼] key to scroll to the transmit frequency screen (Figure 37), where TX = will be outlined. Press [ENTER] to go to the first number of the transmit frequency and use the number keys on the keypad to change the frequency, if desired. Press [ENTER] to lock in the new frequency. If the channel mode is digital TXNAC will appear below the frequency. Use the [▼] key to highlight TXNAC and press [ENTER]. Then use the [▲] and [▼] keys to scroll through the available NACs and press [ENTER] to select the desired code.

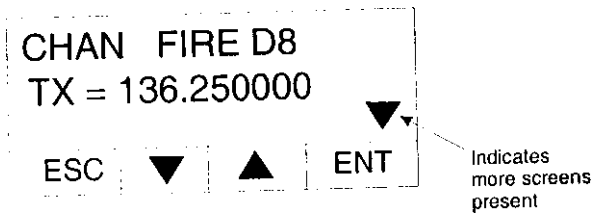


Figure 37. Channel Programming Screen (6 of 8)

Use the [▼] key to scroll to the transmit squelch select screen (Figure 38). The settings and method of changing them is the same as for the receive squelch, except NOISE is not a analog transmit squelch option.

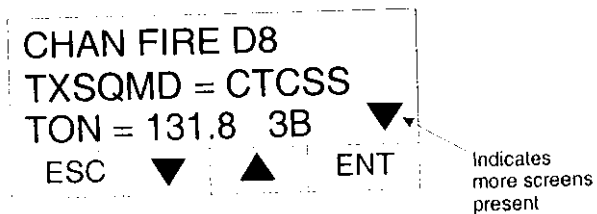


Figure 38. Channel Programming Screen (7 of 8)

2-2.5.1 Global Programming.

Global Programming Parameters are viewed and changed using five screens as described in the following paragraphs. Global programming options are shown in Table 3.

Table 3. Global Options

Parameter	Value
BKLITE (Backlight)	BRIGHT/DIM/OFF
BK DLY (Backlight Delay)	0 - 9 seconds
TOT (Time Out Timer)	30 to 300 seconds, in 30 second intervals, and OFF
DISPLY (Display)	ALPHA/NUMBER
HOME (Home Channel)	HOME Channel designation
EMERG (Emergency)	EMERGENCY Channel designation
REP	0 - ? minutes
P/D EM (Pre/De Emphasis)	ON/OFF
TX INH (Transmit Inhibit)	CARRIER, CARRIER+0, TONE, TONE+0, or NONE
REPEATER DELAY	0.2, 0.4, 0.6, 0.8, 1 sec., and NONE

2-2.5.1.1 Backlight Control and Transmit Timeout.

The Backlight Control and Transmit Timeout Screen, shown at Figure 27, is used to enable or disable display backlighting, set the backlight delay time, and set the Transmit Time Out timer. Backlight Control and Transmit Time Out are both potential energy saving options. Backlight Control allows an operator to set the backlight brightness and the backlight delay, which is the duration of time that the backlight will stay on after the last keypad activity. Transmit Time Out can be used to limit the duration of messages and reduce the possibility of the system being busied by an inadvertent or accidental PTT. The screen opens with BKLITE outlined.

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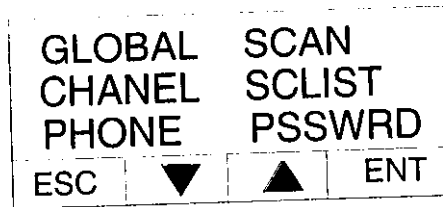


Figure 25. Main Programming Screen

To select any of the programming options, scroll the outline up or down with the [▲] and [▼] keys to the desired option and press [ENTER] to confirm the selection. The user can program Global parameters, Channel parameters, and Scan options, add/delete/change telephone numbers, add/delete/change scan zones, and change the password. If the wrong password, or no password, is entered, the radio will display the Invalid Password screen (Figure 26). If a wrong password is entered ten times consecutively, the radio keypad will lock so that no entries can be made. It will remain locked until it is reinitialized using the PC Programmer.

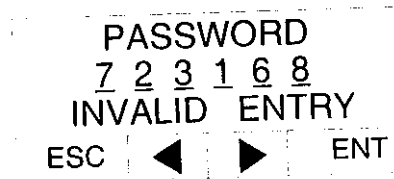


Figure 26. Invalid Password Screen

If the target data is always numeric (e.g., frequency, power level, Talk Group ID), each keystroke of a number key enters that number AND moves the cursor one space to the right. When the data is alphanumeric, the [▲] and [▼] keys change to [◀] and [▶], which move the cursor right or left on a line. To enter alphanumeric values, press one of the DTMF keypad keys, e.g., [2 ABC] and 2...A...B...C appear sequentially with each key press. Stop at the desired value and press [◀] or [▶] to navigate across the line. When a line entry is complete, pressing [ENTER] confirms the data entry and moves the cursor to the next line down.

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Use the [▼] key to scroll to the transmit high/low power screen, shown at Figure 39, where LO PWR will be outlined. Press [ENTER] and then use the [▲] and [▼] keys to scroll through the available power settings, and press [ENTER] again to lock in the chosen power level. Use the [▼] key to advance to HI PWR, and change the high power setting in the same way as the low power setting. If the [▼] key is pressed with HI PWR outlined the channel setting will cycle back to the original channel programming screen (Figure 36), so that the operator can use the rotary switch to select another channel and can then program that channel and so on until the operator has programmed all the required channels. To exit the channel programming, at any time, press [ESC].

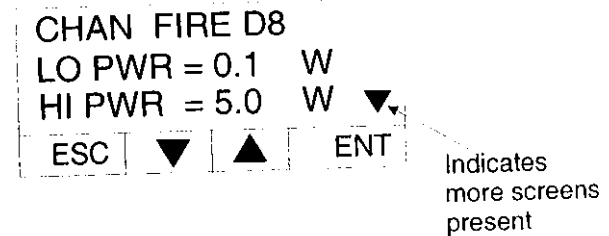


Figure 39. Channel Programming Screen -(8 of 8)

2-2.5.2.1 Channel Lock.

Individual channels can be selectively locked by the PC Programmer so that pre-programmed values cannot be changed from the radio keypad. If a locked channel is selected, the radio will display a "Channel Locked" screen as shown at Figure 40 when [ENTER] is pressed.

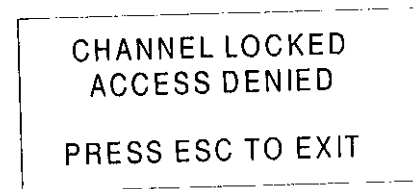


Figure 40. Channel Locked Screen

2-2.5.3 Phone.

The Phone Screen, shown at **Figure 41**, allows the user to add, delete, or change telephone numbers pre-programmed in to the radio. The screen opens with PHONE outlined. Use the numeric keypad to enter the number. Press the [▼] key to move to the NAME. After entering the name press the [▼] key to move to the first position of the NO. Enter the desired number and press [ENTER] to confirm the entry. Press [ESC] to return to the programming menu.

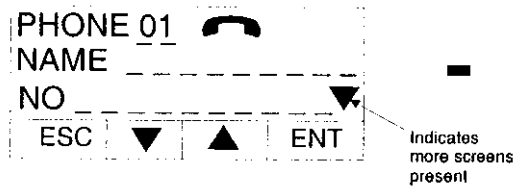


Figure 41. Phone Screen

2-2.5.4 Scan.

The Scan Screen, shown at **Figure 42**, allows the user to set the Scan Delay and the Revert Mode. The screen opens with DELAY highlighted. Press [ENTER] and use the keypad to enter a value of 1 to 7 seconds and press [ENTER] again to lock in the value. The Scan Delay time allows a user to reply to one received message before receiving another message. Use the [▼] key to highlight RVERT and press [ENTER]. Use the [▲] or [▼] keys to scroll through the revert mode choices (LASTRX, HOME, and SWITCH) and press [ENTER] to lock in the choice. The Revert Mode selections are SWITCH, the last channel selected by the rotary switch on top of the radio; LAST RX, the last received channel; and HOME, the Home channel.

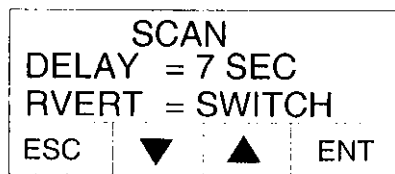


Figure 42. Scan Screen

2-2.4 HOME Operation Screen.

The HOME Screen has no additional lower-level screens. As shown at **Figure 23**, when HOME is highlighted, pressing [ENTER] switches the transceiver directly to the pre-programmed HOME channel, while pressing [ESC] reverts to the previous operating mode.

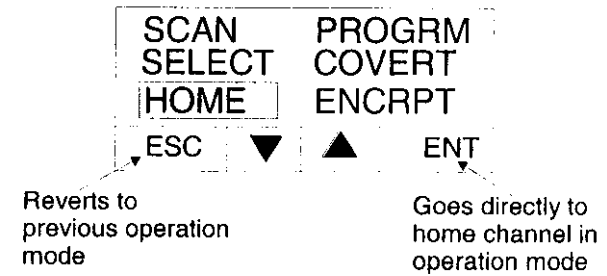


Figure 23. HOME Operation Screen

2-2.5 PROGRAM Screen.

To enter the radio program menu structure, select PROGRAM on the Main Programming screen and press [ENTER]. The display will change to the Password screen shown at **Figure 24**.

Use the keypad to enter password numbers



Figure 24. Password Screen

When the correct password is keyed in and the user presses [ENTER], the main radio program screen, shown at **Figure 25**, is displayed.

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to move the selection outline. Press [ENTER] to select the outlined tone or press [ESC] to return to the Select Operation Screen. The selected tone will be overlaid on the current active transmit channel and will be active for all future transmissions, until a different tone or no tone is selected. The radio will open only on receipt of a signal that includes the selected tone. To revert to the pre-programmed squelch value for the selected channel, move the outline to REVERT and press [ENTER].

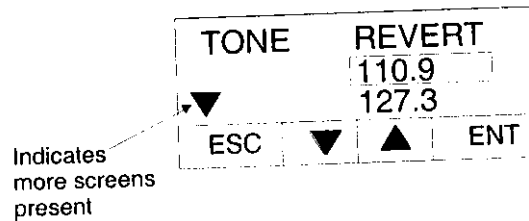


Figure 21. TONE Select Screen

2-2.3.7 Talkgroup ID (TKGP) Select Screen.

The Talkgroup ID Select screen, shown at Figure 22, allows the user to transmit a message coded for receipt only by a specific Talkgroup ID. Use the [▲] and [▼] keys to move the selection outline to one of the pre-programmed IDs. Press [ENTER] to automatically code the next transmission for the selected Talkgroup ID or press [ESC] to return to the Select Operation screen.

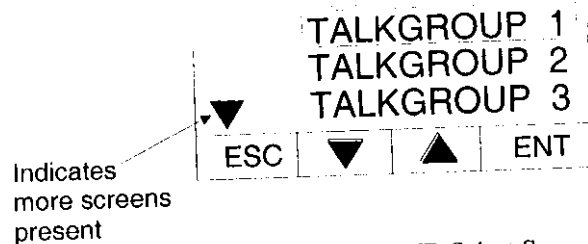


Figure 22. Talkgroup ID Select Screen

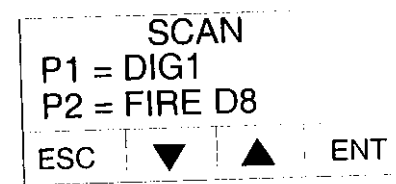
2-2.3.8 Talkaround (TKRD).

The last item in the Select menu is a feature that allows direct radio-to-radio communications without the use of a repeater. Use the [▲] and [▼] keys to turn Talkaround ON or OFF and press [ENTER].

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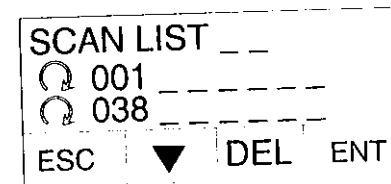
OPERATION

Use the [▼] key to scroll to the Scan Priority Channel screen, shown at Figure 43. This screen allows the operator to designate priority channels (PR1 and PR2). Highlight either PR1 or PR2 and press [ENTER], then use the rotary switch to select the proper channel and press [ENTER] again to lock in the selection.



2-2.5.5 Scan List.

The Scan List Screen, shown at Figure 44, allows the operator to edit Scan Lists from the radio channel switch.



2-2.5.6 Change Passwords.

To change the radio programming password, move the outline on the Programming Menu screen to PSSWRD and press [ENTER]. The display will change to the Old Password screen shown at Figure 45.

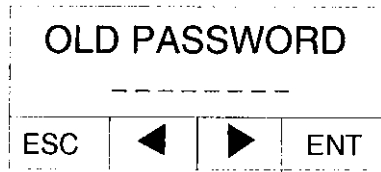


Figure 45. Old Password Screen

Enter the current password and press [ENTER]. The display will change to the New Password screen shown at Figure 46.

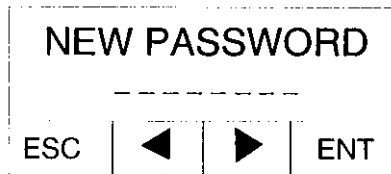


Figure 46. New Password Screen

Confirm the new password by pressing [ENTER] and entering the password again on the Confirm Password screen shown at Figure 47.

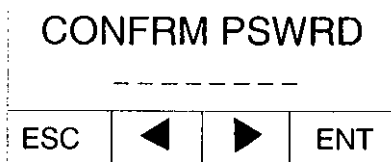


Figure 47. Confirm Password Screen

2-2.6 Covert

To program the radio's covert mode, select COVERT on the Main Programming menu screen and press [ENTER]. The display will change to the Password screen shown at Figure 48.

2-2.3.4 Message (MSG) Select Screen.

The Message Select Screen, shown at Figure 19, allows the user to select a message, from a pre-programmed list of messages., for transmission on the current transmit channel. Use the [▲] and [▼] keys to select a message. Press [ENTER] to send the message or [ESC] to return to the Select Operation screen.

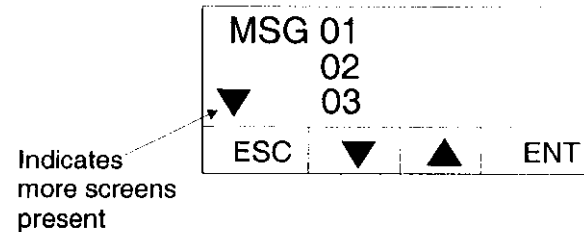


Figure 19. Message Select Screen

2-2.3.5 ID Call (IDCL) Select Screen.

The ID Call Select Screen, shown at Figure 20, allows the user to transmit a message coded for receipt by a specific user. Use the [▲] and [▼] keys to move the selection outline to one of the preprogrammed IDs or select 00 to enter a new ID using the radio keypad. Press [ENTER] to code the next transmission for the selected user ID or press [ESC] to return to the Select Operations Screen.

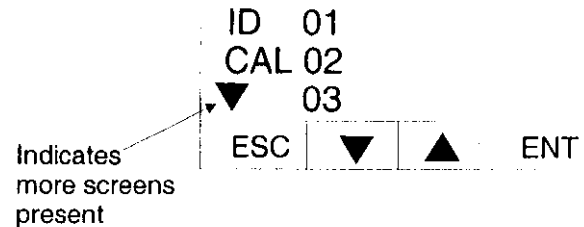


Figure 20. ID Call Select Screen

2-2.3.6 TONE Select Screen.

The Tone Select Screen, shown at Figure 21, allows the user to select a squelch tone (CTCSS or DCS) from the list of pre-programmed tones in the radio to be added to future transmissions. Use the [▲] and [▼] keys

2-2.3.1 ZONE Select Screen.

The Zone Select Screen, shown at Figure 16, allows the user to select another zone of channels, in addition to the three pre-programmed in the three position toggle switch.

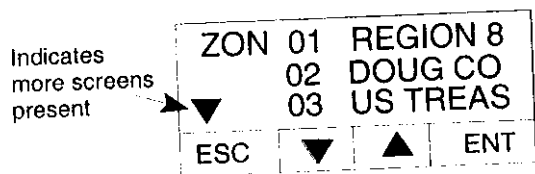


Figure 16. ZONE Select Screen

2-2.3.2 BANK Select Screen.

The Bank Select Screen, shown at Figure 17, allows the user to select a bank of zones different from the bank pre-programmed in Bank Scan.

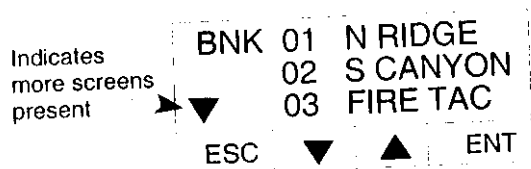


Figure 17. BANK Select Screen

2-2.3.3 Phone (PHON) Select Screen.

The Phone Select Screen, shown at Figure 18, allows the user to select a pre-programmed phone number for auto-dialing. Use the [▲] and [▼] keys to move the selection outline and press [ENTER] to autodial the selected number or press [ESC] to return to the Select Operation screen.

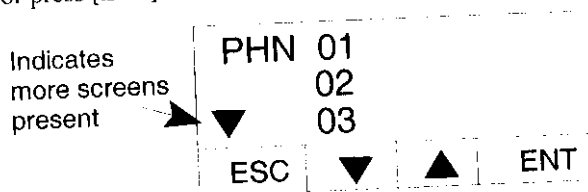


Figure 18. PHONE Select Screen.

Use the keypad to enter password numbers

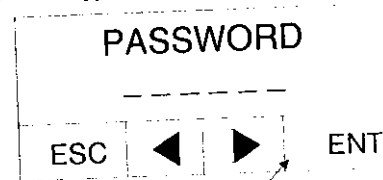


Figure 48. Password Screen

When the correct password is keyed in and the user presses [ENTER], the Covert Program Screens, shown at Figures 49 and 50, are displayed. The Covert operations screens allow the user to select operational parameters that can be disabled for covert operation. Use the [▲] and [▼] keys to move the selection outline to the different parameters, press [ENTER] and use the keys below the ON and OFF that will appear at the bottom of the screen. Covert operation parameters are listed in Table 4.

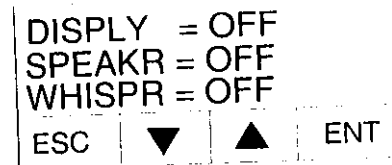


Figure 49. Covert Program Screen
(1 of 2)

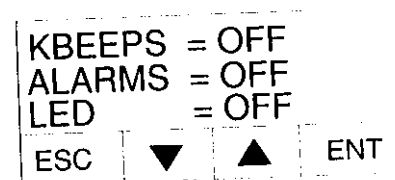


Figure 50. Covert Program Screen
(2 of 2)

Table 4. Covert Operation Parameters

Screen Label	Parameter	Description
KBEEPS	Audible Tones and DTMF Keypad Beeps	Enables/disables audible tones, including beeps when keys are pressed.
LED	LED Operation	Enables/disables LED.
DISPLY	Display	Enables/Disables display backlighting.
WHISPR	Whisper Mode	Enables/disables microphone whisper mode.
SPEAKR	Internal Speaker	Turns internal speaker on/off.
DEFAULT	Default	Resets all covert parameters to default (non-covert) settings.

NOTE: Covert operation controls over-ride all other programming.

2-2.7 Encryption.

2-2.7.1 Encrypted Operation.

The Racal 25 radio is capable of hosting up to 16 keys and hosts two algorithms: Single Bit Cipher Feedback (SBCF) DES (compatible with Motorola) 25 kHz channels and Project 25 output feedback DES 12.5 kHz channels. Channel mapping automatically selects the proper algorithm for each channel. It will not be possible to enact encryption on 12.5 kHz analog channels. Each of the 256 channels can be selected as an encrypted channel or non-encrypted channel using the PC Programmer. If the channel is designated as encrypted and the PTT is pressed when the radio is not in the encrypted mode, a warning tone will be heard. If the channel is designated as a clear channel and the PTT is pressed while the radio is in the encrypted mode, a warning tone will be heard. Each channel is linked to a default key which is associated with the transmit channel when the encryption switch is turned on. If the user selects a new key from the key select list it will replace the default key for that channel.

2-2.3 SELECT Operation Screen.

The SELECT Operation screen, shown at **Figures 13, 14, and 15** is accessed by moving the outline to SELECT on the Main Menu screen and pressing [ENTER].

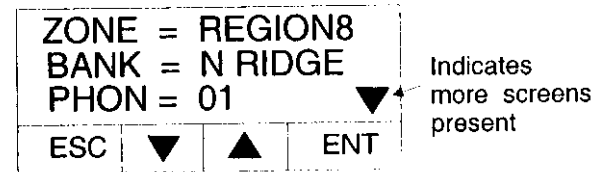


Figure 13. SELECT Operation Screen (1 of 3)

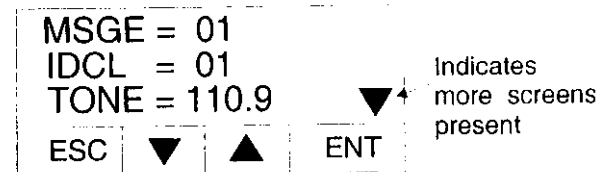


Figure 14. SELECT Operation Screen (2 of 3)

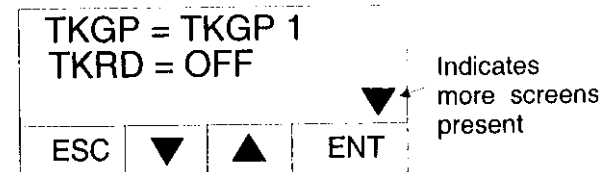


Figure 15. SELECT Operation Screen (3 of 3)

The Select Operation Screen allows the user to select from different sets of pre-programmed channels (zones or banks), lists of pre-programmed phone numbers, messages, or user ID numbers, operating parameters (CTCSS tones), or Talkgroup ID numbers; and enable or disable the Talkaround function.

shown at **Figure 11** will be displayed if that function is selected by pressing [ENTER].

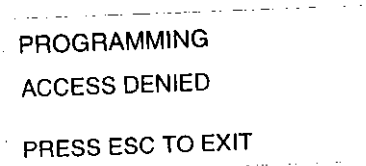


Figure 11. Menu Disabled Screen

2-2.2 SCAN Programming Menu.

The SCAN programming menu, shown at **Figure 12**, is accessed by selecting SCAN on the Main Menu screen and pressing [ENTER].

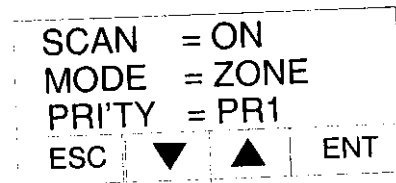


Figure 12. SCAN Programming Menu

The screen opens with SCAN outlined (selected). Press [ENTER] to be able to turn SCAN ON or OFF, using the [▲] or [▼] keys. Press [ENTER] again to lock the change into the radio. Press the [▲] or [▼] keys to go to MODE. Press [ENTER] to change the Scan Mode between SCAN, SEARCH, and ZONE using the [▲] or [▼] keys. SCAN enables the normal scan mode, SEARCH enables Global Search (scan of all frequencies programmed into the radio), and ZONE scans the zones that are in the zone scan list. Press [ENTER] to lock the change into place. Press the [▲] or [▼] keys to go to PRITY (Scan Priority). Press [ENTER] to change the Scan Priority between OFF, PR1, and PR2 using the [▲] or [▼] keys. PR 1 enables scanning with one priority channel, PR 2 enables scanning with two priority channels, Press [ESC] to return to the Main Menu.

2-2.7.2 Encryption Programming.

To program the radio's encryption mode, select ENCRPT from the programming menu and press [ENTER]. The display will change to the Password screen shown at **Figure 51**.

Use the keypad to enter password numbers



Opens ENCRPT screen when correct password is entered

Figure 51. Password Screen

When the correct password is keyed in and the user presses [ENTER], the main encryption program screen, shown at **Figure 52**, is displayed. The screen opens with the KEYSSEL highlighted. To change the active key, Press [ENTER] to go to the key selection screen shown at **Figure 57**, use the [▲] and [▼] keys and press [ENTER] when the desired key is outlined.

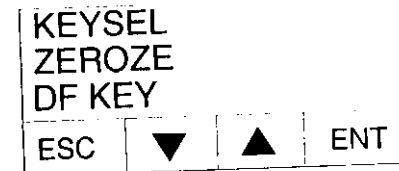


Figure 52. Encryption Programming Screen

To change the active key, Press [ENTER] to go to the key selection screen shown at **Figure 53**, use the [▲] and [▼] keys to highlight the desired key and press [ENTER].

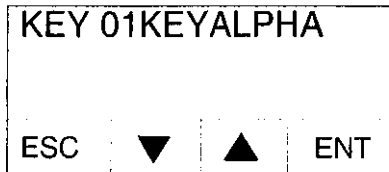


Figure 53. Key Selection Screen

To zeroize either all the keys in the radio or just the active key, Press [ENTER] to go to the zeroize key screen shown at Figure 54.

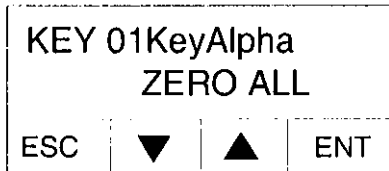


Figure 54. Zeroize Keys Screen

2-3 RADIO CLONING

The cloning function enables one radio to transfer its channel parameters into another radio. To clone from one radio to another, connect one end of the cloning cable (P/N 3500395-501) to the side connector of the SEND radio set (the radio set with the information to be cloned) and the other end of the cloning cable to the side connector of the RECEIVE radio set (the radio set to receive the information). After the cloning is over, the cable can be removed from the cloned (receive) radio and attached to another radio already powered on, and that radio can then also be cloned. Turn on power to both radio sets. The radio can clone either all of the parameters for all channels or can selectively clone only the channel parameters in one zone. After the initial power-up screen (see page 2-3), The Screen shown at Figure 55 will appear on the SEND radio: USE the [▲] or [▼] keys to select either Radio or Zone cloning and press [ENTER].

2-1.3.3 SQUELCH ADJUST Screen.

To adjust the squelch level, press the Monitor button for a few seconds. The Squelch Adjust screen, shown at Figure 9, will be displayed. To increase or decrease the squelch level, use the left and right arrow keys. The radio stays at the new squelch setting.



Figure 9. Squelch Adjust Screen

2-2 RADIO PROGRAMMING.

The Programming menu screen, shown at Figure 10, and subsequent lower level programming screens, are accessed by pressing [ENTER] on the keypad. Highlighting (outlining) one of the submenus is done by scrolling with the [▲] and [▼] keys. Any highlighted selection is accepted/selected by pressing the [ENTER] key. The “ENCRPT” menu item is only available in radios with encryption enabled at the factory. If encryption is not enabled, “ENCRPT” will not appear in the menu.

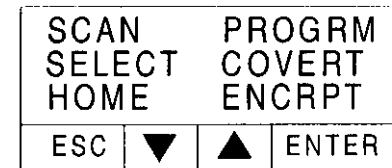


Figure 10. Main Menu Screen

2-2.1 MENU Enable/Disable.

The ability to modify radio parameters through the menu can be selectively enabled or disabled through the PC Programmer. Details of the PC Programmer operation are available in the MA6941C PC Programmer manual. Menu functions of “PROGRM”, “COVERT”, and “ENCRPT” can be disabled. If any of these functions has been disabled, the screen

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2-1.3.2 RECEIVE Screen.

When a signal is being received, the standby screen changes to the Receive screen shown at **Figure 7**.

If squelch breaks, display shows alpha-numeric label of received channel. If none assigned, channel index number is shown.

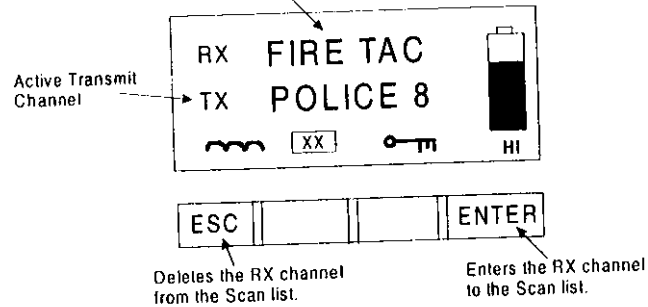


Figure 7. Receive Screen

If an alpha label has not been programmed for a channel, the display will automatically show either the channel number or the receive and transmit frequencies of the current channel as shown at **Figure 8**. Alternatives can be set by the PC Programmer or can be a soft key selection.

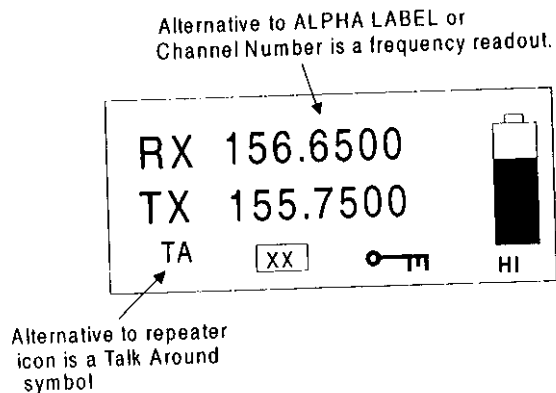


Figure 8. Alternate Receive Screen (Frequency Display)

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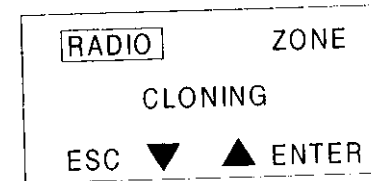


Figure 55. Send Radio Screen

Use the [▲] and [▼] keys to select either RADIO or ZONE cloning on the SEND radio and press [ENTER].

2-3.1 Radio Cloning.

If RADIO is selected, the Send radio screen, shown at **Figure 56** will appear:

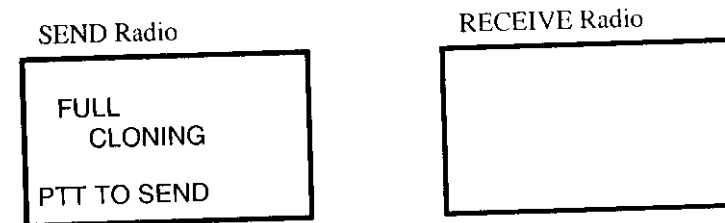


Figure 56. Send and Receive Radio Screens

The FULL CLONING message on the SEND radio indicates the setting that has been programmed using the PC Programmer. Available settings are FULL, LIMITED, DISABLED, and NO CHANGE. The FULL setting permits the radio to clone to any other Racal 25 Portable and set the cloned radio to FULL; LIMITED permits the radio to clone to another Racal 25 Portable, but the receiving radio will be set to DISABLED, which means the radio cannot clone to another Racal 25 Portable. NO CHANGE allows the radio to clone to another Racal 25 Portable, but does not change the clone setting of the receiving radio. The SEND radio has a timeout period of approximately 20 seconds during which it attempts to establish the connection to the RECEIVE radio. At the end of the timeout

period, if connection is not made, the SEND radio will display an error message. Press PTT on the SEND radio; the screens shown at **Figure 57**.

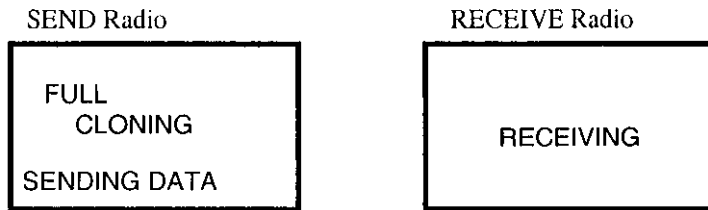


Figure 57. Cloning in Progress Screens

When cloning is successfully completed, the screens on both radios will revert to the default standby screen and resume normal operation. If cloning is unsuccessful, or if the connection with the receiving radio is not made within the timeout period, the SEND radio will display the error message shown at **Figure 58**. After a timeout it will revert back to the "PRESS PTT TO SEND" screen (**Figure 56**).

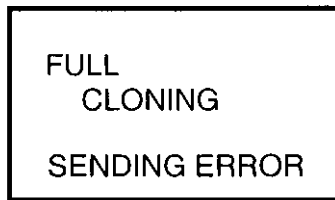


Figure 58. Cloning Error Screen

2-1.2.2 Zones.

A zone is a list of channels. The programmed channels can be assigned to zones. Each zone can be assigned up to 16 channels. The radio can store up to sixteen (16) zones, or groups of channels. Three zones can be selected by the toggle switch or 16 zones by the front panel keyboard. The zones may be assigned names of up to eight characters. The zones can be assigned to banks during programming.

2-1.2.3 Banks.

A Bank is a list of zones. The radio can store up to four banks. Any or all of the 16 zones can be included in each bank. Banks may also be assigned names of up to eight characters.

2-1.3 Operation Screens.

Operation screens are required for basic operation of the radio. These include Scan Operation, Receive, and Squelch Adjust screens. These screens are displayed in response to reception of a signal or Squelch switch operation on the radio and not from a previous menu screen. These screens are primarily for status display.

2-1.3.1 SCAN Operation Screen.

In normal operation, the user enables scan operation by using one of the programmable controls or the display menu. The radio will sequentially check each channel on the Scan List for activity. During Scan operation, the screen shown at **Figure 6** is displayed.

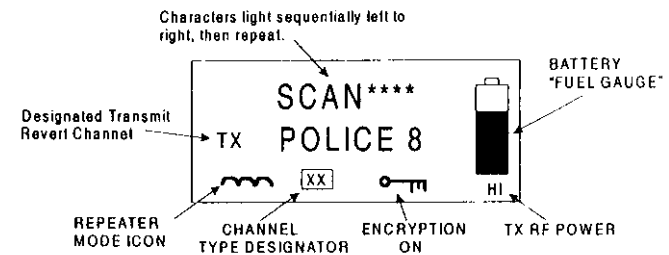


Figure 6. SCAN Operation Screen

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
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The prefix letter in the 2 line operation display is an icon or letter identifying the channel, zone, data channel, phone patch, priority channel etc. If there is a box around the letter this means it is included in the scan list. If there is no box it is not. To include a channel in the scan list quickly, press the key next to the ENTER key on the keypad (diamond icon on the key); to remove a channel, press the next key to the left (circle icon on the key) Alternative Identification icons are listed in **Table 2**.

NOTE

The Priority 1 (PR1) Channel is always included in the scan list and cannot be deleted.

Table 2. Alternative Identification Icons

B	Bank
Z	Zone
C	Channel
H	Home
TX	Transmit
RX	Receive
	Telephone Channel
	Data Channel

2-1.2 Channels, Zones, and Banks.

2-1.2.1 Channels.

The Racal 25 Portable has a total of 256 selectable channels. Each channel may be programmed for receive and transmit frequencies, squelch modes and values, analog and Project 25 digital modulation, encryption, and power. Each channel is identified by an eight character alpha-numeric label.

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2-3.2 Zone Cloning.

If ZONE is selected, the SEND radio screen shown at **Figure 59** will appear.

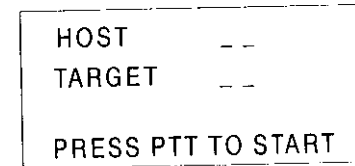


Figure 59. Zone Cloning Screen

Use the keypad and the [▲] and [▼] keys to enter the zone to be cloned FROM (HOST) and the zone to be cloned TO (TARGET). When the PTT is pressed, the SEND radio screen shown at **Figure 60** will appear.

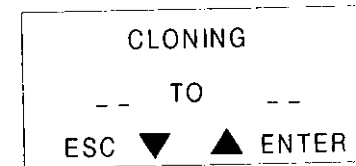


Figure 60. Send Radio Screen

The display shows the HOST and TARGET zones. The RECEIVE radio displays are the same as for RADIO cloning.

After cloning, to put the SEND radio back into normal operation, the cloning cable needs to be removed and the radio turned off, and then back on again.

2-4 KVL KEY LOADING OPERATIONS.

The KVL key loading function allows a user to overwrite keys (load a new key into an existing slot) in the radio using a Motorola ® DES/DES-XL Key Variable Loader (KVL) and a KVL cable (see paragraph 1-4.1).

2-4.1 Key Fill.

To load a key to the radio attach the kvl cable to the radio side connector and the KVL device. When the KVL cable is connected, the Key Tag Screen shown at **Figure 61** will appear, with "K>"selection highlighted.



Figure 61. Key Tag Screen

In this example, 01 is the key position (01-16) in the radio, KEY1 is an alphanumeric tag (of up to 8 characters) for the key. Use the [▲] or [▼] keys to scroll through the available lists of keys. Press [ENT] to select the slot to load the new key or press [ID] to advance to the Key ID screen shown at **Figure 62**.

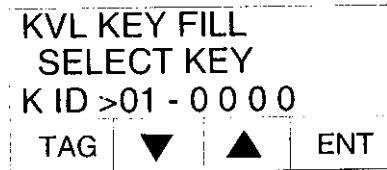


Figure 62. Key ID Screen

In this example, 01 is the key position in the radio, 0000 is a four-digit hexadecimal key Identification code. Press [TAG] to return to the Key Tag Screen. Pressing [ENT] at either screen will advance the user to the key transfer screen shown at **Figure 63**.

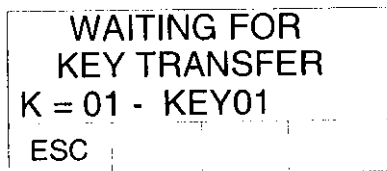


Figure 63. Key Transfer Screen

The key transfer will not occur until the PTT switch on the KVL device is pressed (see paragraph 2-4.2). Press [ESC] to return to the Key Tag or

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OPERATION**

2-1 RADIO OPERATIONS.

2-1.1 Standby Default Display Screen.

On initial power-up, the radio momentarily displays the radio title, the software version number, and the DSP version number. After a few seconds, this display is replaced by the default standby display screen shown at **Figure 5**. The display includes a battery "fuel gauge" indicator, a transmit power indicator, an encryption mode indicator, a channel type designator, a Repeater or Talk around mode icon, and two different display labels and alternative identification icons for the two labels.

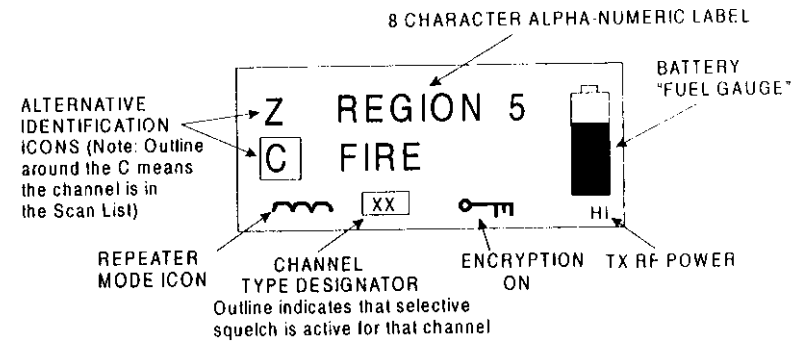


Figure 5. Default Display Screen

The available Channel Type Designators are:

- Aw - Analog wide channel spacing
- An - Analog narrow channel spacing
- DG - Digital

If the Channel Type Designator is outlined, some form of selective squelch is active for that channel.

1-5.4 Initializing the radio.

After connecting the battery and the antenna, turn the On/Off/Volume switch to ON. The radio performs a Power-On Self Test (POST) and gives a short medium-pitched tone to indicate PASS. Then use the switch to set the volume to a comfortable level. Verify and change programming as described in Chapter 2 "OPERATION".

1-5.4.1 Choosing a Channel.

The Default Display Screen, shown at **Figure 5**, shows the current zone and channel. To quickly select a different channel in the selected zone, rotate the channel selector knob to one of the other 16 pre-programmed channels. To change zones, either program one of the side keys or the three-position toggle switch or use the SELECT menu.

1-5.4.2 Transmitting a Voice Message.

Press the PTT on the side of the radio. Hold the unit approximately six inches from your mouth and speak in a clear voice.

1-5.4.3 Receiving a Voice Message.

Release the PTT to listen. Use the PC Programmer or the radio Program menu (see Section 2.2) to set/adjust the squelch level and set CTCSS tones, DCS variables, NACs, Talkgroup IDs, and/or Unit IDs, as required.

Key ID screen without loading the key. If the key is loaded successfully the Key Data Updated Screen shown at **Figure 64** will appear.

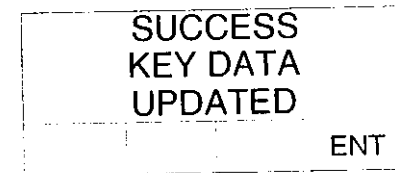


Figure 64. Key Data Updated Screen

If the key transfer does not work (key data seems to be corrupted or the key is invalid), the Key Load Failure Screen, shown at **Figure 65**, will appear. Press [ENT] to go back to the Key Tag or Key ID screen.

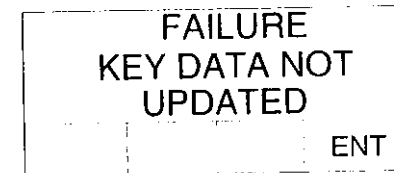


Figure 65. Key Load Failure Screen

2-4.2 KVL Device Operation.

To transfer a key to the radio from a KVL device the device must be turned on and have key data loaded into the key positions. Select a key position using the keypad (key positions are 0-9 and A-F). After pressing the key position (i.e., "9"), ensure that "READY" appears on the KVL Device LCD. If "ERASED" appears, that key position is empty and cannot be used. To transfer a key to the radio, press the PTT switch on the side of the KVL device. If the KVL can communicate with the radio the term "PASSED" should appear in the LCD. If "FAILED" appears, check the cable connections to both the radio and the KVL device and ensure that the radio is expecting a key transfer. If the connections are correct, the keyfill cable may be defective. Try using another keyfill cable to discover if that is the problem. The KVL device will show "PASSED" even if the key passed to the radio is found to be defective and cannot be loaded into the radio. To exit from the KVL Key Fill screens and return to normal operations, disconnect the keyfill cable from the radio.

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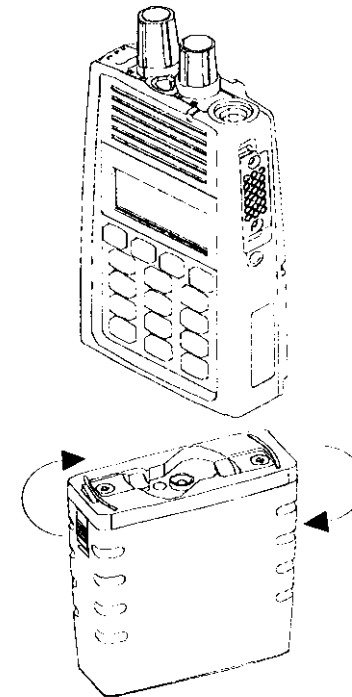


Figure 4. Battery Connection

1-5.3 Connecting the (optional) audio accessory.

The audio accessory is connected to the radio through a 6-pin male connector that clips on to radio side connector. To attach, align the keyway on the cable connector (female) with the tab on the radio connector and push the cable connector straight onto the radio connector.

1-4.1 Key fill.

Key fill is accomplished through the radio side connector using the PC Programmer or a Motorola @ DES/DES-XL Key Variable Loader (KVL). The PC Programming cable or DES Encryption Keyfill cable is used to load the keys. The radio can store up to 16 cryptographic encryption keys. The secure radio can retain encryption keys a minimum of 45 seconds after battery removal. If there is a loss of battery power for more than seven (7) minutes all keys will be zeroized.

1-4.2 Algorithms.

The radio is capable of hosting two algorithms: Single-Bit Cipher Feedback (SBCF) DES (compatible with Motorola) 25 kHz channels and Project 25 output feedback DES 12.5 kHz channels. These algorithms are selectable on a channel-by-channel basis.

1-4.3 Zeroization.

The radio can immediately zeroize all encryption keys through the manual panic zeroize control. Panic-zeroization can be accomplished by first pressing and holding the side panel top soft-key and then pressing the emergency push button. The radio can also zeroize all encryption keys, or can selectively zeroize individual encryption keys, through the programming menu. The emergency key can also be programmed, using the PC Programmer, to panic zeroize all encryption keys.

1-5 PREPARATION FOR USE.

1-5.1 Connecting the battery.

The battery is connected to the radio by a simple twist-lock mechanism that mates the top of the battery to the bottom of the radio, as shown at **Figure 4**.

1.5.2 Connecting the antenna.

The antenna is connected to the radio through an SMA connector on top of the radio (see **Figure 2**). To attach, screw the antenna clockwise onto the connector.

**CHAPTER 3
MAINTENANCE**

3-1 GENERAL.

This chapter provides operator maintenance instructions for the Racal 25 Portable radio. This includes troubleshooting, and removal/replacement procedures.

3-2 OPERATOR TROUBLESHOOTING GUIDE.

Table 5 contains the Operator Troubleshooting Guide.

Table 5. Operator Troubleshooting Guide

Symptom	Probable Cause	Corrective Action
Radio does not operate	<ul style="list-style-type: none"> Battery not properly connected Battery dead 	<ul style="list-style-type: none"> Remove and re-install battery Replace battery
Radio cannot communicate with other radio users in clear mode	<ul style="list-style-type: none"> Radios set to different frequencies Radios have different DCS/ CTCSS/NAC/ TALKGROUP ID codes 	<ul style="list-style-type: none"> Set radios to the same RX/TX frequencies (can clone from a master radio). Program the same receive and transmit DCS/CTCSS/NAC/ TALKGROUP ID codes in all radios
Background noise or other traffic on radio	<ul style="list-style-type: none"> Other users are using the same frequency 	<ul style="list-style-type: none"> Program receive and transmit CTCSS/ DCS/ NAC codes in all radios

Symptom	Probable Cause	Corrective Action
Limited talk range	<ul style="list-style-type: none"> Obstacles (heavy foliage or buildings) are obstructing the signal Battery power is low 	<ul style="list-style-type: none"> Move away from the obstructions; increase radio/antenna height, if possible. Check battery "fuel gauge" while pressing PTT; replace battery if low.
Radio display flashes ERROR message	<ul style="list-style-type: none"> Operational error in the radio 	<ul style="list-style-type: none"> Check for low battery power - see above. Turn the radio off, then back on
Radio display flashes ALARM message	<ul style="list-style-type: none"> Crypto alarm in the radio 	<ul style="list-style-type: none"> Press PTT to clear alarm; check that an encryption key is loaded into selected crypto position

3-3 REMOVAL/REPLACEMENT PROCEDURES - OPERATOR.

The first step for any remove/replace procedure is to power down the equipment. The operator can remove and replace only a limited number of external components - battery, antenna, and audio accessory. Removal/replacement procedures that can be performed by the operator are given in the following paragraphs.

1-3.1.4 Talk Group IDs.

Talk Group ID is a selective digital calling ID which is used to group users into functional teams. It is similar to NACs, but are more specific in application. A radio can be programmed to receive ONLY digital signals with the correct code.

1-3.2 Receiver Characteristics.

1-3.2.1 Receiver Performance.

The receiver is capable of demodulating a single-channel FM carrier using either conventional 25 kHz FM, C4FM, or binary frequency shift keying (FSK). The receiver demodulates analog or digital voice and data signals. The radio can receive clear messages while operating in secure mode and secure messages while in the clear mode, if encryption is enabled.

1-3.2.2 Receive Squelch.

There are five types of squelch operation:

- Noise - The receiver is activated on any recognizable analog or digital signal.
- Analog Selective CTCSS or DCS - The receiver is activated on any analog signal that has the correct CTCSS tone or DCS variable.
- Digital Network Access Code - The receiver is activated on any recognizable digital signal that has the correct NAC.
- Digital NAC and Talk Group ID - The receiver is activated on any recognizable digital signal that has both the correct NAC and Talk Group ID.
- Digital NAC, Talk Group ID, and Unit ID - All voice traffic is muted except for that which is explicitly addressed to the unit. Only digital signals that contain the correct NAC, talkgroup, and unit ID will be received.

1-4 COMMUNICATION SECURITY.

The handheld radio is capable of secure communication by means of Type 3 software-based encryption, and is fully compatible with any radio using Project 25 DES encryption. When the radio is operating in secure mode, the transmission of all tone squelch signals is disabled.

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1-2.3.3 Antenna Connector.

The antennas screw into a Sub-Miniature series A (SMA) female connector located on the top of the radio.

1-2.3.4 Battery Connector.

The battery connector is a reliable, long-wearing, easily-operated, twist-lock connector mechanism located on the bottom of the radio.

1-3 TRANSCEIVER CHARACTERISTICS.

The radio covers a frequency range of 136-174 MHz, in tuning steps of 2.5 or 5 kHz, with a selectable channel bandwidth of 12.5, or 25 kHz.

1-3.1 Transmitter Characteristics.

1-3.1.1 Transmitter Output.

The transmitter output consists of a single channel frequency modulated (FM) carrier using either conventional 25 kHz FM modulation or 12.5 kHz Compatible 4-level FM (C4FM). The signal source is analog or digitized voice or data signals.

1-3.1.2 Transmit Squelch Tones.

The radio can be programmed to transmit standard Continuous Tone Controlled Squelch System (CTCSS) tones or Digital Coded Squelch (DCS) variables superimposed on the analog transmit signal. These tones can be used to reduce interference from other traffic and background electronic noise because the radio can be programmed to receive ONLY signals with these tones superimposed. The radio can also be programmed to disable the squelch function using one of the three programmable side keys.

1-3.1.3 Network Access Codes.

The radio can be programmed to transmit digital Network Access Codes (NAC) with the Project 25 digital transmit signal. These codes can be used to eliminate interference from other traffic and background electronic noise because the radio can be programmed to receive ONLY signals with the correct code.

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3-3.1 Antenna Removal/Replacement.

To remove and replace the antenna:

- Disconnect the antenna from the antenna connector (see **Figure 2**) at the top of the radio by grasping the antenna at the base, turning counterclockwise until unthreaded and pulling the antenna from the connector.
- Replace the antenna with a known good antenna. Turn antenna clockwise to thread it into position.

3-3.2 Battery Removal/Replacement.

To remove and replace the battery:

CAUTION

TURN OFF the Radio POWER before removing the battery by setting the ON/OFF/VOLUME switch to OFF position. Failure to do so can result in loss of keyfill data.

- Disconnect the battery from the radio by pushing the battery latch (see **Figure 4**) down away from the radio, grasping the battery in one hand and the radio in the other, turning the battery one-half turn, and pulling the battery away from the radio.
- Replace the removed battery with a known good battery. Connect the battery to the hand held radio by first placing the top of the battery perpendicular to the bottom of the radio with the center of the battery top aligned with the center of the battery bottom. Turn the battery one-half turn until the latch on the side of the radio locks into place.

3-3.3 Audio Accessory Removal/Replacement.

To remove and replace the audio accessory:

- Disconnect the audio accessory from the audio accessory connector by disengaging the latch and tilting the connector slightly towards the other end while pulling it away from the radio.
- To replace the audio accessory, first align the keyway on the accessory cable connector with the tab on the inside of the radio connector. Press the accessory cable directly onto the radio connector.

1-2.2 Indicators.

1-2.2.1 Liquid Crystal Display (LCD).

The Racal 25 Portable has an 80 x 32 pixel LCD that uses both characters and graphics to provide the operator with radio operating information. The display provides backlighting for nighttime operation.

1-2.2.2 LED Status Indicator.

Operating status is visually indicated by a three color LED that is viewable from both the top and front of the radio. The LED indicator lights and their corresponding operating status are shown in **Table 1**.

Table 1. LED Status Indicators

Indicator	Operating status
Red	Transmit
Green	Receive carrier present (clear)
Green flashing	Receive carrier present (encrypted)
Red flashing	Low Battery

1-2.2.3 Audible Tones.

The radio has several audible tones that are activated by states of operation or radio faults. Signal Tones are described in Appendix C.

1-2.3 Connectors.

The radio connectors are shown in **Figure 2**.

1-2.3.1 Side Connector.

The side connector is an 18-pin connector located on the right side of the radio. This connector is used for multiple functions, including PC Programming, keyfill, cloning, and audio accessory attachment.

1-2.3.2 Side Connector Assembly.

An audio adapter assembly that allows several audio accessories to be connected to the radio side connector.

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1-2.1.6 Emergency Push Button.

The Emergency switch is activated by the operator for emergency calling. Once activated, the emergency condition remains active until it is cleared by a different means, such as turning off the radio. When the radio's emergency mode is activated, an emergency message is broadcast over the Emergency channel. There are two programmable audio (full alert and silent) and display modes (alert and silent) that are activated when the radio is in emergency mode. Full Alert is an emergency mode where EMERGENCY flashes on the radio display and an audio tone is sounded. Silent shows nothing in the display and has no audio tone. This button can also be programmed by the PC Programmer, to zeroize encryption keys.

1-2.1.7 16 Button Keypad.

The radio includes a 16-button conductive rubber keypad, shown at **Figure 3**, with tactile feedback on the front panel. The keypad provides adjustable backlighting for nighttime viewing. The function of the four keys on the top row are indicated on the bottom line of the display. The remaining keys correspond to a standard 12 button DTMF keypad.

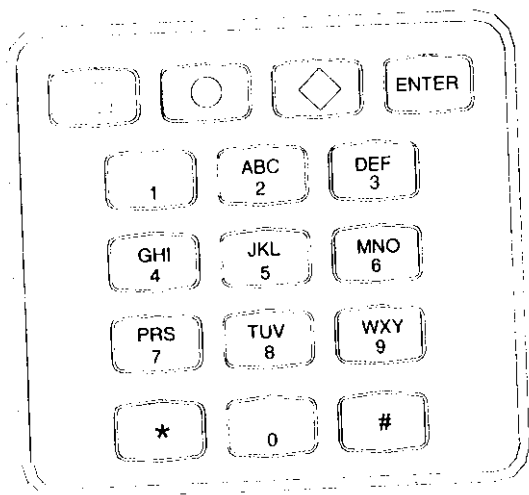


Figure 3. Racal 25 Portable Keypad

SPECIFICATIONS AND PARTS LIST

CHAPTER 4 SPECIFICATIONS AND PARTS LIST

4-1 PARTS LIST.

The Parts List shows the complete radio system divided into main groups. The main groups are broken down into assemblies, subassemblies, and details. In general, the assemblies and parts installed at the time the end item was manufactured are listed and identified in the manual.

4-1.1 Figure and Index Number.

This column lists the figure and index number of each part illustrated in the related figure. The index numbers are in numerical sequence and identify each part number shown in the related figure.

4-1.2 Part Number.

This column lists the manufacturer's part number, including dash numbers, assigned to each part.

4-1.3 Description.

This column contains the description of all items appearing on the Parts List. The indentation headed "1" through "7" consists of the contractor's drawing title. Description contains modifiers necessary to identify the particular item.

4-1.4 Units Per Assembly.

This column contains the number of units required per assembly and/or subassembly. If more than one assembly is required, the total number of assemblies is listed.

4-2 ESD SENSITIVE DEVICES.

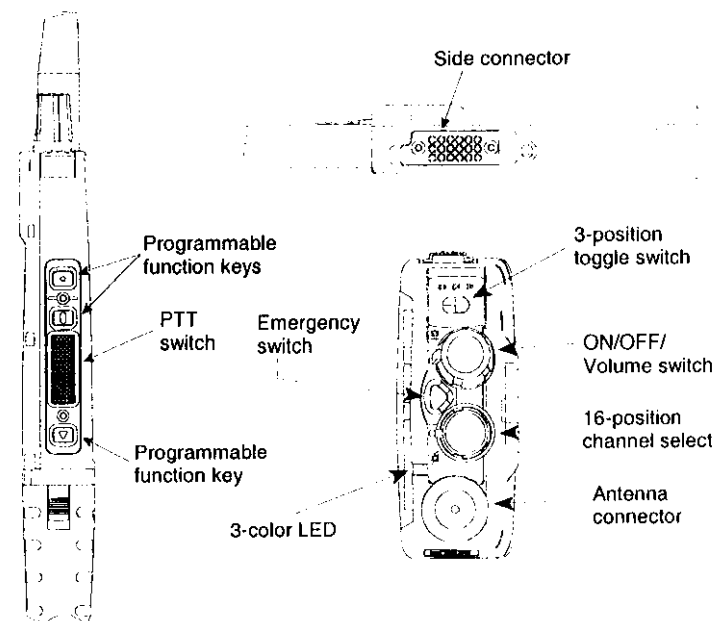
This equipment contains parts and assemblies that are sensitive to damage by Electrostatic Discharge (ESD).

4-3 SPECIFICATIONS.

Physical characteristics of the Racal 25 radio are shown in **Table 6.**

Table 6. Physical Characteristics

Characteristic	Measurement
Weight	16 ounces, excluding battery and antenna
Dimensions	2.6"W x 7.50"H x 1.05"D, including battery
RF Power Output	Programmable on a channel by channel basis to 0.1, 0.5, 1, 2 or 5 watts, limited to 1.5 W maximum when using alkaline batteries; even if it is set to 2W or 5W.
Audio Output	500 mW
Current Drain	Standby : 100 mA nominal Receive : 100 - 350 mA nominal, depending on volume setting. Transmit : 500 - 1,500 mA nominal, depending on power setting
Operating Temperature	-30°C (-22°F) to +60°C (140°F)
Storage Temperature	-40°C (-40°F) to +85°C (185°F)
Relative Humidity	95% non-condensing relative humidity throughout its operating temperature range
Immersibility	2 meters

**Figure 2. Radio Controls and Connectors****1-2.1.4 Push-To-Talk (PTT) Switch.**

The PTT switch is located on the left side of the radio.

1-2.1.5 Three Programmable Function Side Keys.

Three programmable side keys are located on the left side of the radio, two above and one below the PTT switch. These keys can be programmed, using the PC Programmer, for Backlight dim/bright/off, Encryption on/off, Scan List add/delete, Keypad Disable, Monitor (squelch Adjust) on/off, Scan on/priority/off, Signal Strength Meter on/off, Talkaround on/off, Home Channel, Audible Tones on/off, Next Zone, Open Microphone, Previous Channel, and Disabled.

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1-1.7 Vehicle Charging Cable.

The vehicle charger cable is used to power the radio from a vehicle cigarette lighter. One end of the cable terminates in a cigarette lighter adapter, the other end attaches to a "cup" that fits over the battery contacts on the radio.

1-1.8 PC Programmer.

The PC Programmer consists of a Windows 95/98/NT compatible software program and an RS-232 compatible cable that connects from a computer serial port to the radio side connector to load the radio with its operating parameters. A separate User's Guide is included with the PC Programmer.

1-2 CONTROLS, INDICATORS, & CONNECTORS.

1-2.1 Controls.

The handheld radio controls, shown at **Figure 2**, consist of the following: a 16 channel quick select rotary knob, an On/Off/Volume control knob, a 3 position programmable toggle switch, 3 programmable function side keys, an emergency push button, a PTT switch, and a 16 button keypad.

1-2.1.1 3 Position Toggle Switch.

The three position toggle switch located on top of the radio can be programmed for Encryption enabled/disabled, Zone Select, Scan on/priority/off, High/Low Power, Talkaround, Monitor on/off, and Disabled.

1-2.1.2 16 Channel Quick Select Rotary Knob.

The Channel Select switch located on top of the radio allows the operator to rapidly switch between 16 different pre-selected channels.

1-2.1.3 On/Off/Volume Knob.

The On/Off/Volume knob, located on top of the radio, is a 16-position mechanical switch. The first position is "On/Off", the second position is "On With Speaker Off", the remaining positions are used for increasing volume levels.

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SPECIFICATIONS AND PARTS LIST

4-4 ACCESSORY EQUIPMENT.

Accessory equipment that is not provided with the standard radio is listed in **Table 7**.

Table 7. Accessory Equipment

Description	Part Number	Application
Cloning cable	4500153-501	Allows the cloning (transfer) of programming information from one radio to another.
PC Programmer	MA6941C	Loads programming into the radio from a PC. It includes software, manual, and a cable.
Single Unit Battery Charger	1600426-1	Recharges one battery at a time.
Six-Unit Battery Charger (AC)	1600426-3	Recharge up to six batteries at once, in an office environment.
Six-Unit Battery Charger (AC/DC)	1600426-2	Recharge up to six batteries at once, under field conditions.
Surveillance Harness	1600497-1 3-wire, tan 1600497-2 3-wire, black 1600497-3 2-wire, tan 1600497-4 2-wire, black	Earpiece and wiring harness with an audio connector for covert use of the radio.
Wireless Earpiece	1600497-6	Inductively coupled earpiece worn inside the ear.

Description	Part Number	Application
Audio Transducer	1600497-5	Part of surveillance harness; transmits a signal between the radio and the earpiece.
Voice Tube	1600497-7	Part of surveillance harness; sound tube.
Flexible Open-Ear Insert	1600497-8	Part of surveillance harness; voice tube attachment to ear.
Vehicle Charger Clip	2100410-501	Plugs into vehicle cigarette lighter to charge the battery.
AC Adapter	2100411-511	Adapter used to plug charger clip into AC wall outlet.
Speaker-mic	1600469-1	External audio accessory.
Alkaline battery	4101170-501	Non-rechargeable battery.
AA Battery Casette	4101171-501	Reusable case for disposable commercial alkaline batteries.
Audio Adapter Assembly	4101179-501	Allows audio accessories to attach to radio side connector.
DES Encryption Keyfill Cable	3500459-501	Allows the loading of DES encryption keys through the side connector
Nylon Bag	1600467-1	A harness-type support for the radio.
Leather Bag	1600467-2	A harness-type support for the radio.
AA Battery Casette	4101171-501	Reusable case for disposable commercial alkaline batteries.

that tracks the charge remaining in the battery. The battery can hold a charge of 1.5 Ampere Hours (AH) and can provide over eight hours of battery life at the 5 watt transmit power level with an 90:5:5 Standby: Receive:Transmit (Stby:Rx:Tx) duty cycle. In addition to the standard rechargeable battery, there is also available a sealed nonrechargeable alkaline battery pack and a reusable battery case that holds eight (8) nonrechargeable AA-size alkaline batteries. When the alkaline battery pack is used, the radio limits the maximum RF power to the nominal power of the 2W setting.

1-1.4 Battery Chargers.

There are three available chargers: a single-unit charger and a six-unit charger that operate from 90 to 265 Volts, Alternating Current (VAC), 50 to 400 Hz; and a six-unit charger that operates on 10 to 32 Volts, Direct Current (VDC) input power, in addition to the AC supply. All of the battery chargers are capable of recharging the lithium ion battery to full charge in 3 hours. The chargers monitor charge current, temperature, and voltage to prevent improper charging. Indicator Light Emitting Diodes (LEDs) on the chargers provide status. The chargers can also charge the battery while it is attached to the radio, with the radio turned On or Off. If the radio is turned On, the battery can be charged while the radio is in the receive mode, or in the transmit mode at output power up to 1W. The battery "fuel gauge" is not correct while the battery is charging. The fuel gauge will refresh 30 seconds after the radio is removed from the charger

1-1.5 Surveillance Harness.

The surveillance harness allows covert operation of the radio. The harness operates via an inductively-coupled wireless earpiece, a microphone capable of being hidden in the wearer's shirt or jacket, and a single button, Push-To-Talk (PTT) switch that can be strung through a shirt sleeve or coiled in a pocket. When the Racal 25 Portable is being used with a surveillance harness, the internal speaker/microphone is automatically disabled. The surveillance harness includes a covert antenna.

1-1.6 Cloning Cable.

The cloning cable is used to transfer programming information (excluding crypto key) from one radio to another. The cable mates to the radio side connector on both the sending and receiving radios.

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SPECIFICATIONS AND PARTS LIST

1-1.1 Handheld Radio.

The Racal 25 Portable is a handheld, battery operated transceiver capable of providing secure and non-secure communications over a 136-174 MegaHertz (MHz) Radio Frequency (RF) range. The handheld radio unit is illustrated in **Figure 1**. The radio includes a graphics display, a Dual-Tone Multiple-Frequency (DTMF) keypad, an emergency push-button, a speaker/microphone, a side connector, three programmable function side keys, a 16 channel quick select rotary knob, an ON/OFF/Volume rotary switch, a three position programmable toggle switch, an antenna connector, and a battery connector. The Racal 25 Radio has an adjustable power output ranging from 0.1 watt up to 5 watts. The radio is designed to operate in the following modes:

- Clear Analog Voice FM, 12.5 and 25 kiloHertz (kHz),
- Clear Digital Data, 25 kHz, 12 kilobits per second (kbps),
- DES Continuously Variable Slope Delta (CVSD) Modulation Voice, 25 kHz, 12 kbps,
- DES Encrypted Data, 25 kHz, 12 kbps,
- Project 25 Clear Digital Voice, 12.5 kHz,
- Project 25 Clear Digital Data, 12.5 kHz,
- Project 25 DES Digital Voice, 12.5 kHz,
- Project 25 DES Digital Data, 12.5 kHz,
- Project 25 Telephone Interconnect,
- Project 25 Low Speed Data, and
- DTMF Overdial.

1-1.2 Antennas.

The Racal 25 antenna is a six (6) inch whip antenna designed to cover the entire 136-174 MHz frequency range, with an impedance of 50 ohms nominal. It is attached to the radio by a Sub-Miniature series A (SMA) connector. There are three 7.5-inch whip narrowband antennas available for the Racal 25 radio. Each antenna operates with a nominal impedance of 50 ohms.

1-1.3 Battery.

A rechargeable lithium-ion battery is the standard power source for the radio. The battery is a self-contained unit connected to the radio by a reliable twist-lock mechanism. The interface includes battery monitoring

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**CHAPTER 1
INTRODUCTION**

1-1 SYSTEM DESCRIPTION.

The Racal 25 Portable Radio system consists of the following components:

- Chassis, Including
 - Display
 - Transceiver
 - Control CCA, and
 - Keypad CCA

Available accessories include:

- Standard Broadband Antenna, 136-174 MHz,
- Low-Band Narrowband Antenna, 136-152 MHz,
- Mid-Band Narrowband Antenna, 147-163 MHz,
- High-Band Narrowband Antenna, 158-174 MHz,
- Lithium-Ion Rechargeable Battery,
- Non-Rechargeable Sealed Alkaline Battery Cassette,
- Cloning Cable,
- Single Unit Battery Charger (AC/DC),
- Six-Unit Battery Charger (AC),
- Six-Unit Battery Charger (AC/DC),
- PC Programmer
- Surveillance Harness,
- Wireless Earpiece
- Audio Transducer
- Belt Clip,
- Leather Carrying Case,
- Nylon Carrying Case,
- Speaker/Microphone,
- Side Connector Assembly,
- Vehicle Charging Cable, and
- Data Encryption Standard (DES) Keyfill Cable.

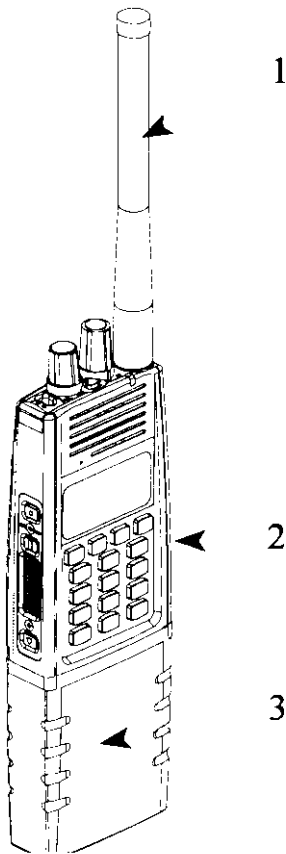


Figure 66. Racal 25 Portable Radio

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Table 8. Racal 25 Portable Radio

Figure & Index No.	Part Number	Description	Units per Assy
66 1	1600468-1	Antenna 136-174 MHZ Standard	1
66 2	4101256-501	Unit Assy Racal 25 Portable	1
66 3	4101106-501	Battery Rechargeable, Lithium Ion	1

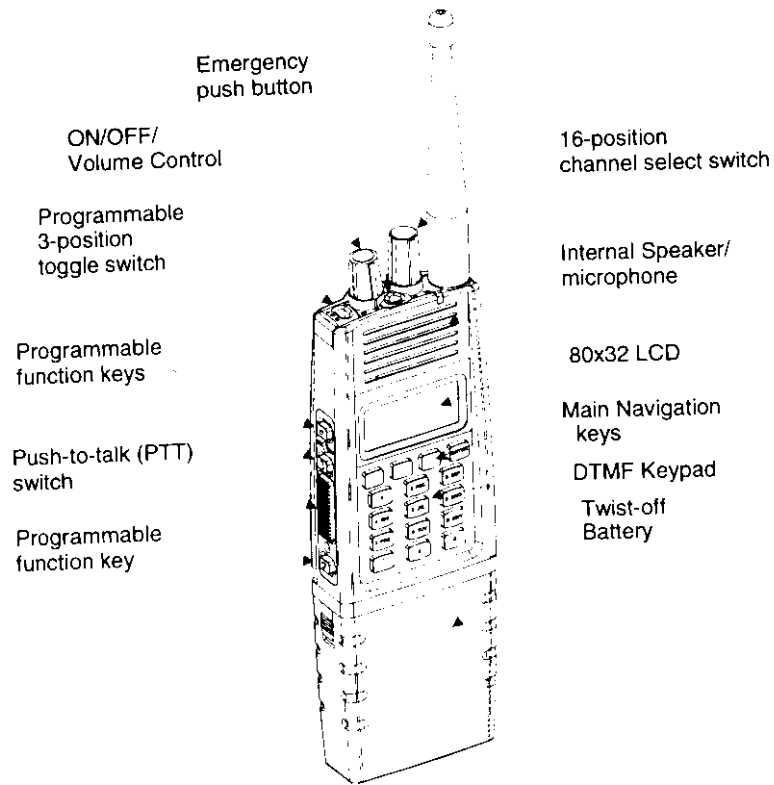


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**APPENDIX A
DEFINITIONS**

- **All Scan Mode** - The radio will scan for and open a carrier regardless of CTCSS, DCS, or Digital ID.
- **Bank** - A Bank is a group of zones. There are four (4) Banks per radio and each Bank can contain up to 16 zones.
- **Channel** - A channel is memory location with defined: receive, transmit, squelch, modulation, and power settings. There are 256 channels per radio.
- **Channel Scan** - Will scan all "scan list" channels in a given 16 channel zone. The scan starts on the Home Channel, checks each channel in the Scan Plan, returns to the Home channel, and then scans each channel in the Scan Plan.
- **Dual Tone Multiple Frequency (DTMF)** - DTMF is a signaling scheme used by the telephone system in which two voice band tones are generated for each keypad key press.
- **Global Search** - Global Search will scan all channels programmed into the radio regardless of scan plan designation.
- **Monitor Time** - The amount of time the radio will stay on a channel picked up during scan before the radio goes back into Scan mode.(0 - 90 seconds).
- **Network Access Code (NAC)** - Selective squelch for the radio's digital mode. NACs are used to eliminate interference from other traffic and background noise.
- **Priority 1 Scan** - Allows the priority channel to be sampled during scanning, receive of an active channel, or standby. Activity on the priority channel will override all other modes except emergency.

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- **Priority 2 Scan** - Allows the secondary channel to be sampled in a similar fashion to the priority channel. This channel can be reassigned to the active receive channel.
- **Priority Revert Channel** - When the PTT is pressed during following a priority message, this is the transmit channel to which the radio will revert.
- **Scan Delay** - The amount of time (0 - 7 seconds) that the scanner dwells on an active receive channel after the carrier has dropped. This prevents another message from being received before a response can be made to the received message.
- **Scan Reply** - If the PTT interrupts the Scan Delay timer, the Scan Reply timer (0 - 20 seconds) resets to allow time for a reply.
- **Scan List** - A group of channels in a zone that have been designated as active scan list channels. Channels can be added/deleted from the scan list using the radio keyboard or the PC Programmer.
- **Talk Around** - Direct radio-to-radio communication, i.e., without the use of a repeater.
- **Talk Group ID** - A selective calling ID code used to group users into functional teams.
- **Zone** - A zone is a group of channels. 3 zones can be selected by the toggle or 16 zones by the front panel keyboard. There are 16 Zones per radio and each Zone can contain up to 16 channels.
- **Zone Scan List** - A group of Zones in a Bank that have been designated as active scan list zones. Zones can be added/deleted from the scan list using the radio keyboard or the PC Programmer.

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APPENDIX B GLOSSARY

AH	Ampere Hour
C4FM	Compatible 4-level Frequency Modulation
CAI	Common Air Interface
CCA	Circuit Card Assembly
CTCSS	Continuous Tone Controlled Squelch System
CVSD	Continuously Variable Slope Delta Modulation
DCS	Digital Coded Squelch
DES	Digital Encryption Standard
DSP	Digital Signal Processing
DTMF	Dual Tone Multiple Frequency
ESD	Electrostatic Discharge
FM	Frequency Modulated/Frequency Modulation
FSK	Frequency Shift Keying
Hz	Hertz
kbps	kilobits per second
kHz	kiloHertz
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MHz	MegaHertz
NAC	Network Access Code
PC	Personal Computer
POST	Power-On Self Test
PTT	Push-To-Talk
RF	Radio Frequency
Rx	Receive
RXNAC	Receive Network Access Code
SCBF	Single-Bit Cipher feedback
SMA	Sub-Miniature series A
Tx	Transmit
TXNAC	Transmit Network Access Code
VAC	Volts, Alternating Current
VDC	Volts, Direct Current
W	Watts

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**APPENDIX C
SIGNAL TONES**

TONE	SIGNAL	CAUSE
Brief Low-Pitched	Key Press Error	Invalid key is pressed.
	Failed POST	Radio fails POST.
	Transmit Timeout Warning	Transmit timeout interrupts PTT.
	Empty Channel Warning	No Rx/Tx frequencies programmed for the channel.
Steady Low-Pitched	Transmit Timeout Timed Out	Transmission time is exceeded and the PTT is still pressed.
	Transmit Inhibit	PTT is pressed with activity on transmit channel.
	Invalid Mode	No programmed data on selected channel.
	Radio Locked	Radio locks after three consecutive wrong password attempts.
Brief Medium-Pitched	Key Press	Valid key press is accepted by the radio.
	Passed POST	Radio passed POST.
	Clear Voice being received.	Radio is receiving a clear signal.
	PTT Sidetone	

SIGNAL TONES

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TONE	SIGNAL	CAUSE
Repeated Medium-Pitched	Emergency Call State	the emergency button is pressed.
	Key Error	Encryption is selected but no key is present.
Brief High-Pitched	Low Battery	Battery current falls below a preset value.
Repeated High Pitched	Individual Call	An individual call is received.

The Racal 25 Portable Radio is a portable, handheld, battery operated radio capable of providing both secure and non-secure communications. Immersible and weighing only 16 oz., the radio operates in the 136-174 MHz Frequency Modulation (FM) band with adjustable Radio Frequency (RF) power output up to 5 Watts. The Racal 25 Portable conforms to the Project 25 Common Air Interface (CAI). A display and keypad provide easy programming and feature selection for the 256 available channels. The radio has a separate internal speaker and microphone for improved audio fidelity. A side connector is available for radio-to-radio cloning, programming from a personal computer (including key fill), and incorporating software upgrades. A clip-on side connector is provided for external audio accessories. The Racal 25 Portable radio uses Digital Signal Processing (DSP) and microprocessor control for easy evolution towards advanced capabilities.

This device made under license under one or more of the following U.S. Patents: 5,164,986; 5,146,497; 5,185,795; 4,636,791; 4,590,473; 5,185,796; 5,148,482; 5,271,017; 5,377,229; 4,833,701; 4,972,460.

The IMBE™ voice coding technology embodied in this product is protected by intellectual property rights including patent rights, copyrights and trade secrets of Digital Voice Systems, Inc. The voice coding technology can only be used as part of the North American land mobile radio communication system for the APCO Project 25. The user of this technology is explicitly prohibited from attempting to decompile, reverse engineer, or disassemble the Object Code, or in any other way convert the Object Code into a human-readable form.

RACAL

FCC ID: OKC4101256
2.1033(c)(3) USER MANUAL

USER'S GUIDE

RACAL 25 PORTABLE RADIO

(PRC6894 and PRC6994)

software version 4.0



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5 MARCH 1999