KENWOOD

VIKING®

VM5000/VM6000/VM7000 Mobile Radio Operating Manual

002-VMX000-100 Rev 09
March 2022

This revision covers Viking Firmware Version 8.34.x and earlier.

Information in this manual is subject to change without notice.

VM5000/VM6000/VM7000 Mobile Radio Operating Manual

March 2022

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RF Energy Exposure Information

Operational Instructions for FCC Occupational Use Requirements

Before using your mobile two-way radio, read this important RF Energy Awareness and Control Information and Operational Instructions to ensure compliance with the FCC's RF exposure guidelines.

Note *This radio is intended for use in occupational/controlled conditions where users have full knowledge of their exposure and can exercise control over their exposure to meet FCC limits. This radio device is NOT authorized for general population, consumer, or any other use.*

This two-way radio uses electromagnetic energy in the radio frequency (RF) spectrum to provide communications between two or more users over a distance. It uses radio frequency (RF) energy or radio waves to send and receive calls. RF energy is one form of electromagnetic energy. Other forms include, but are not limited to, electric power, sunlight and x-rays. RF energy, however, should not be confused with these other forms of electromagnetic energy, which when used improperly can cause biological damage. Very high levels of x-rays, for example, can damage tissues and genetic material.

Experts in science, engineering, medicine, health and industry work with organizations to develop standards for exposure to RF energy. These standards provide recommended levels of RF exposure for both workers and the general public. These recommended RF exposure levels include substantial margins of protection. All two-way radios marketed in North America are designed, manufactured and tested to ensure they meet government established RF exposure levels. In addition, manufacturers also recommend specific operating instructions to users of two-way radios. These instructions are important because they inform users about RF energy exposure and provide simple procedures on how to control it.

Please refer to the following web sites for more information on what RF energy exposure is and how to control your exposure to assure compliance with established RF exposure limits.

- http://www.fcc.gov/oet/rfsafety/rf-faqs.html
- http://www.osha.gov/SLTC/radiofrequencyradiation/index.html

Federal Communications Commission Regulations

The FCC rules require manufacturers to comply with the FCC RF energy exposure limits for portable two-way radios before they can be marketed in the U.S. When two-way radios are used as a consequence of employment, the FCC requires users to be fully aware of and able to control their exposure to meet occupational requirements. Exposure awareness can be facilitated by the use of a product label directing users to specific user awareness information. Your Viking two-way radio has a RF exposure product label. Also, your Viking user manual, or product manual, or separate safety booklet includes information and operating instructions required to control your RF exposure and to satisfy compliance requirements.

Compliance with RF Exposure Standards

Your Viking two-way radio is designed and tested to comply with a number of national and international standards and guidelines (listed below) for human exposure to radio frequency electromagnetic energy. This radio complies with the IEEE and ICNIRP exposure limits for occupational/controlled RF exposure environment at operating duty factors of up to 50% transmitting and is authorized by the FCC for occupational use only. In terms of measuring RF energy for compliance with the FCC exposure guidelines, your radio radiates measurable RF energy only while it is transmitting (during talking), not when it is receiving (listening) or in standby mode.

Your Viking two-way radio complies with the following RF energy exposure standards and guidelines:

- United States Federal Communications Commission, Code of Federal Regulations; 47 CFR §§ 1.1307, 1.1310, 2.1091 and 2.1093
- American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition

RF Exposure Compliance and Control Guidelines and Operating Instructions

To control your exposure and ensure compliance with the occupational/controlled environment exposure limits, always adhere to the following procedures.

Guidelines

- Do not remove the RF Exposure Label from the device.
- User awareness instructions should accompany the device when it is transferred to other users.
- Do not use this device if the operational requirements described herein are not met.

Operating Instructions

- Transmit no more than the rated duty factor of 50% of the time. To transmit (talk), push the Push-To-Talk (PTT) button. To receive calls, release the PTT button. Transmitting 50% of the time, or less, is important because this radio generates measurable RF energy exposure only when transmitting (in terms of measuring for standards compliance).
- Use only EFJohnson Technologies approved supplied or replacement antennas and accessories. Use of non-EFJohnson Technologies approved antennas and accessories may exceed the FCC RF exposure guidelines.
- For a list of EFJohnson Technologies approved accessories, see the operating manual or marketing accessory lists or contact EFJohnson.

Usage Compatibility

Do NOT operate the unit in areas that are sensitive to RF energy such as aircraft, hospitals, blasting sites, and fuel storage sites. Areas with potentially flammable atmospheres are usually, but not always, clearly posted. These may include gas stations, fuel and chemical storage and transfer stations, below deck on boats, and areas where the air contains flammable chemicals or particles such as grain dust or metal powders.

Electromagnetic Interference

This device complies with Part 15 of the FCC rules. Operation is subject to the condition that this device does not cause harmful interference. In addition, changes or modification to this equipment not expressly approved by EF Johnson Technologies, Inc., could void the user's authority to operate this equipment (FCC Rules, 47CFR Part 15.19).

Note *This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:*

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer for technical assistance.*

Note *IC Notice to Users English/French in accordance with RSS GEN Issue 3: This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.*

Cet appareil est conforme avec Industrie Canada RSS standard exempts de licence(s). Son utilisation est soumise à Les deux conditions suivantes: (1) cet appareil ne peut pas provoquer d'interférences et (2) cet appareil doit accepter Toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement du dispositif.

This device complies with Health Canada's Safety Code 6 / IC RSS-210. The installer of this device should ensure that RF radiation is not emitted in excess of the Health Canada's requirement. Information can be obtained at: http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct-eng.php#sc6

Cet appareil est conforme avec Santé Canada Code de sécurité 6 / IC RSS-210. Le programme d'installation de cet appareil doit s'assurer que les rayonnements RF n'est pas émis au-delà de l'exigence de Santé Canada. Les informations peuvent être obtenues: http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct-eng.php#sc6

Mandatory Safety Instructions to Installers and Users

- Use only manufacturer or dealer supplied antennas.
- Antenna Minimum Safe Distance:
  - VHF: 24 in. (60 cm), 50% duty cycle
  - VHF (110 W) and Low Band (110 W): 40 in. (100 cm), 50% duty cycle
  - UHF and 700/800 MHz: 16 in. (40 cm), 50% duty cycle

- Antenna Gain: 0 dBd referenced to a dipole.

The Federal Communications Commission has adopted a safety standard for human exposure to RF (Radio Frequency) energy which is below the OSHA (Occupational Safety and Health Act) limits.

- Antenna Mounting: The antenna supplied by the manufacturer or radio dealer must not be mounted at a location such that during radio transmission, any person or persons can come closer than the above indicated minimum safe distance to the antenna:
- 24 in. (60 cm), 50% duty cycle for VHF
- 40 in. (100 cm), 50% duty cycle for VHF (110 W) and Low Band (110 W)
- 16 in. (40 cm), 50% duty cycle for UHF and 700/800 MHz
- To comply with current FCC RF Exposure limits, the antenna must be installed at or exceeding the minimum safe distance shown above, and in accordance with the requirements of the antenna manufacturer or supplier.
- Vehicle installation: The antenna can be mounted at the center of a vehicle metal roof or trunk lid, if the minimum safe distance is observed.
- Base Station Installation: The antenna should be fixed-mounted on an outdoor permanent structure. RF Exposure compliance must be addressed at the time of installation.

Antenna substitution: Do not substitute any antenna for the one supplied or recommended by the manufacturer or radio dealer.

You may be exposing person or persons to excess radio frequency radiation. You may contact your radio dealer or the manufacturer for further instructions.

⚠ WARNING Maintain the following separation distances from the antenna to persons::

•At least **24 in. (60 cm), 50% duty Cycle** for VHF

•At least **40 in. (100 cm), 50% duty Cycle** for VHF (110 W) and Low Band (110 W)

•At least **16 in. (40 cm), 50% duty Cycle** for UHF and 700/800 MHz

This transmitter is authorized to operate with a maximum duty factor of 50%, in typical push-to-talk mode, for satisfying FCC RF exposure compliance requirements.

You, as the qualified end-user of this radio device must control the exposure conditions of bystanders to ensure the minimum separation distance (above) is maintained between the antenna and nearby persons for satisfying RF Exposure compliance. The operation of this transmitter must satisfy the requirements of Occupational/Controlled Exposure Environment, for work-related use, transmit only when person(s) are at least the minimum distance from the properly installed, externally mounted antenna. Transmit only when people outside the vehicle are at least the recommended minimum lateral distance away from the antenna/vehicle.

⚠ CAUTION Do not touch the metal surface of the transceiver while it is in use. Do not mount the transceiver such that the chassis can come in contact with skin. High temperatures may burn your skin.

Vocoder Patent Notice

The AMBE+2™ 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. This voice coding Technology is licensed solely for use within this Communications Equipment. The user of this Technology is explicitly prohibited from attempting to extract, remove, decompile, reverse engineer, or disassemble the Object Code, or in any other way convert the Object Code into a human-readable form. U.S. Patent Numbers #8,315,860; #8,595,002; #6,199,037; #6,912,495; #8,200,497; #7,970,606; and #8,359,197.

Software License

Non-open source software used in this product is licensed in accordance with E.F. Johnson Company's ("EFJohnson's") then current software license agreement.

Open Source Software License

Software used in this product includes open source software ("Open Source Software") and is subject to the General Public License ("GPL") provided at www.efjohnson.com. EFJohnson notifies you ("Licensee") hereunder that Licensee has the rights to obtain, modify and/or redistribute the source code of such software ("Open Source Software") in accordance with the terms of such GPL. Therefore, if Licensee obtains such Open Source Software, Licensee must strictly adhere to the terms and conditions of the GPL.

Contact Information

Toll-Free: 1-800-328-3911
E-Mail: customerservice@efji.com.

You may also contact the Customer Service Department by mail. Please include all information that may be helpful in solving your problem. The mailing address is as follows:

Customer Service Department
EFJohnson
1440 Corporate Drive
Irving, TX 75038-2401

SECTION

1

Radio Overview

This manual is applicable to Viking® Mobile (VM) 5000/6000/7000 radios (Figure 1.1, Figure 1.2, and Figure 1.3). The availability of many of the features is controlled by the radio model, factory coding, installed options, firmware version, and field programming.

This chapter contains the following sections:

Figure 1.1 VM5000 Radio [Kenwood Control Head (KCH-19V)]

Figure 1.2 VM6000 Radio [Viking Control Head (VCH)]

Figure 1.3 VM7000 Radio [Kenwood Control Head (KCH-20RV)]

Depending on the specific model (and options), the VM5000/VM6000/VM7000 radio operates in the following frequency bands:

- Low Band 110 W (39 to 50 MHz)
- VHF 50 W (136 to 174 MHz)
- VHF 110 W (136 to 174 MHz)
- UHF (380 to 470 MHz)
- UHF (450 to 520 MHz)
- 700/800 (763 to 870 MHz)

Note *As of January 2013, the FCC has mandated all UHF/VHF radios shall not allow wideband (25 kHz) mode. Federal frequencies are not under FCC jurisdiction. Therefore, Federal customers can continue to order wideband in VHF and UHF. This mandate does not affect 800 MHz models, which can continue to operate in wideband mode after January 1, 2013. This*

option shall prevent UHF/VHF radios bought after January 1, 2013 from operating in wideband mode.

1.1 Capabilities and Features

The VM5000/VM6000/VM7000 radio is designed to provide an extensive list of features and capabilities for most communications applications.

- Capabilities
  - A total of 255 zones with 255 channels are supported. A maximum of 4096 channels, depending on the option selected, can be enabled.
  - V16 Single Site, V16 Multi Site digital and analog, and Project 25 (P25) trunking are supported.
  - All supported protocols are available simultaneously.
  - Encryption is available depending on the model of your radio:
    - DES-OFB and AES-OFB encryption with 126 keys is available for VM5000/ VM6000/VM7000 radios.
    - ARC4 software encryption with 126 keys is available for the VM5000/VM6000/ VM7000 radio (compatible with Motorola ADP software encryption).
  - P25 conventional and trunked over the air rekeying (OTAR) are available.
  - P25 trunking authentication are supported.
  - Conventional vote scan is standard.
  - Supports key elements of MDC1200.
  - Supports GE Star Encode.
  - Supports two-tone encode/decode.
  - Compatible with Motorola Astro®.
  - Simplified cabling with a single multi-function accessory connection is available on the rear panel.
  - A programmable DB-25 pin connector is supported. Ask your Armada administrator about custom input or output functions available in your system through the DB-25 pin connector.
- **Operating Modes**
  - Conventional analog and P25 digital
  - Trunking mode P25 digital

  - V16 Single Site / V16 Multi Site

- **Data and Control Interfaces**
  - Supports P25 conventional IP packet data
  - P25 (Astro) IV and D
  - Supports GPS AVL data
- **Simplified Feature Updates and Option Selection**
  - The over the air programming (OTAP) option allows you to program radios without connecting them to a computer.
  - The over the internet programming (OTIP) option allows you to program radios connected through a mobile Ethernet interface or a Wi-Fi dongle.
  - Radio programming and feature updating is simple.
- **Configuration Options**
  - Dash mount option for VM5000
    - Internal or external speakers
    - Fixed control stations
  - Remote mount option for VM5000
    - Dual control heads
  - Remote mount option for VM6000
    - Single control head or dual control heads
  - Remote mount option for VM7000
    - Single control head or dual control heads

Note *The availability of many features is controlled by field programming and by the options ordered. See the EFJohnson Technologies product description and the following sections in this manual for additional information.*

1.2 Radio Software and Configuration Programming

The radio operating software can be easily updated to accommodate new releases and updates issued from EFJohnson technical support.

1.3 Available Options

The availability of optional features is controlled by factory programming of the control logic. Only those features that are specifically ordered and enabled in a particular radio are available for use and can be programmed. The optional features controlled by factory programming are the following:

P25 Options

- P25 conventional packet data
- P25 trunking packet data
- Digital conventional
- Digital Viking16
- P25 Phase 2
- P25 Authentication

Encryption Options

- DES OFB
- AES OFB
- ARC4 software encryption

OTAR Options

- OTAR P25 conventional
- OTAR P25 trunking

Trunking Options

- V16 Single Site
- V16 Multi Site
- Star Roaming
- P25 Trunking
- V16 800 MHz rebanding

Feature Options

- Keypad programming (Federal Government users only)
- 1024, 1536, 2048, or 4096 channels/talkgroups
- Audio Recording
- Automatic Volume Control
- Bluetooth
- Bluetooth Low Energy
- Cross Band Repeat
- Custom TX Power Levels
- Enhanced VRS (EVRS) – Mobile
- Industry Canada Power
- Instant Recording Replay
- Internal GPS
- MDC 1200/GE Star
- P25 conventional and trunking OTAP
- P25 Two Tone

- Radio-to-Radio Cloning
- Text Messaging
- Third-party interface
- OTIP
- Multideck Primary (VM7000 Only)
- Multideck Secondary (VM7000 Only)

Radios in the field can be upgraded with new features. A new feature can be purchased, and a special encrypted code string keyed to the electronic serial number (ESN) of the radio is then provided by EFJohnson Technologies. This string is in the form of a computer file, which enables the feature and is downloaded to the radio.

1.4 Licensing

This radio operates on radio spectrum frequencies assigned and licensed by the Federal Communications Commission (FCC). The FCC can penalize anyone operating an unlicensed radio. It is the radio operator's responsibility to obtain the necessary license for this radio equipment.

1.5 Radio Accessories

Various accessories that provide added capability and enhanced operation for this radio are available from EFJohnson. Table 1.1 lists some of the accessories available.

Table 1.1 Available Accessories

Accessory Type	Model Name	Description
Aid Vest, Bluetooth[a]	Datasoft/Select Engineering	
Cloning Cable	(Any standard DB-25 cable)	
DC Cable	KCT-23M	DC Cable, 10 ft (3.0 m) Leads. 35 to 50W Dash Mount.
DC Cable	KCT-23M3	DC Cable pos. 23 ft (7.0 m) neg. 3.3 ft (1.0 m) leads. 35 to 50W Remote Mount
Desktop Microphone	KMC-9C	Control Station Desktop Mic (8-pin mod. plug)
External Speaker	KES-3	External Speaker, Compact, Low Profile
External Speaker	KES-5	External Speaker, 40W Max
GPS Antenna	KRA-40G	GPS Active Antenna

Table 1.1 Available Accessories (Continued)

Accessory Type	Model Name	Description
Headset, Bluetooth[b]	Interspiro SpiroCom	
	MSA G1 SCBA	
	PRYME BTH-300	
	PRYME BTH-900	
	Savox BTR-155	
	Scott EPIC 3 RDI Amp	
	Sensear SM1x	
Ignition Sense Cable	KCT-46	Ignition Sense Cable. Plugs directly into mobile chassis ignition sense line.
Key Loader	250-5000-100	VK5000 Key Loader
Key Loader Cable	KPG-115	KVL 4000 Encryption Key Load Cable
Key Loader Cable	KPG-115AUT	KVL 4000 Radio Authentication Cable
Key Loader Cable	023-5000-95003	VK5000 Encryption Key Load and Radio Authentication Cable for VCH
Key Loader Cable	023-5000-95004	VK5000 Encryption Key Load and Radio Authentication Cable for KCH-19V
Key Lock Adapter	KMB-10	
Line Noise Filter	KLF-2	
Microphone, Speaker	KMC-35	Standard Dynamic Mobile Mic (8-pin mod. plug)
	KMC-65M	Standard Dynamic Speaker Mic
	KMC-67	Dual PTT Microphone
Microphone, Lapel, Bluetooth	PRYME BT-LMIC	
	PRYME BTH-LMIC	
Microphone, Speaker, with Keypad	KMC-36	Standard Dynamic Mobile Mic with Keypad (8-pin mod. plug)
	KMC-66M	Dynamic Speaker Mic with Keypad
Microphone, Speaker, Bluetooth	APTT1	AINA PTT Voice Responder remote speaker microphone • Standard Bluetooth functionality • Support for PTT • Five programmable buttons • Remote volume control **Note** *In the serial number on the back of the microphone, the value of the 4 underlined digits must be equal to or greater than 1735.*
	Revo NC2	OTTO Bluetooth Revo NC2 Includes programmable emergency button
Mounting Bracket	KMB-33	
Mounting Case	KMB-34	Control Station Mounting Case for KPS-15 Power Supply

Table 1.1 Available Accessories (Continued)

Accessory Type	Model Name	Description
PA/HA Relay Unit	KAP-2	Horn Alert/ P.A. Relay Option
Power Supply	KPS-15	DC Switching Power Supply (117/230 VAC; 23A max. continuous, 25A peak)
USB Programming Cable	KPG-46X	

a. This device requires radio Firmware Version 8.26.x or later.
b. These headsets require radio Firmware Version 8.26.x or later.

Consult with your EFJohnson representative for additional accessories that can be used with your EFJohnson mobile radio.

1.5.1 Digital Keypad Microphone

An optional accessory microphone is available with an integral digital keypad for the VM5000 radio. You can program various radio features to the keys and place often used functions conveniently on the microphone.

Tip *For radios using Firmware Version 8.30.x or later programmed by Armada 1.30.x and later, if the Armada administrator enabled Keypad DTMF for a P25 Trunking channel, the radio user can send DTMF tones by holding the Push-To-Talk (PTT) button and pressing the keypad buttons.*

Figure 1.4 Digital Keypad Microphone for VM5000

1.5.2 Control Station Unit

A Control Station Unit power supply is available to power the VM5000 radio from a 110 volt AC line voltage. This allows the radio be used in a field office, control station, or headquarters building.

Figure 1.5 VM5000 Radio Mounted in the Control Station Unit

1.5.3 Handheld Control Head

An optional KCH-21RV Handheld Control Head (HHCH) can be used with the VM6000 radio and the VM7000 multideck (Figure 1.6). The HHCH is a speaker microphone with full-featured control head. The handheld design offers one-handed operation of PTT, volume, and channel selection. The HHCH connects to the radio using a KRK-17B. (For more information, refer to the *KCH-21RV Handheld Control Head Quick Reference Guide*.)

Tip *For radios using Firmware Version 8.30.x or later programmed by Armada 1.30.x and later, if the Armada administrator enabled Keypad DTMF for a P25 Trunking channel, the radio user can send DTMF tones by holding the Push-To-Talk (PTT) button and pressing the keypad buttons.*

Figure 1.6 Handheld Control Head

SECTION

2

Controls and Display

This chapter contains the following sections:

2.1 Control Heads

This section contains descriptions of the controls and indicators for the following VM5000/VM6000/VM7000 radios:

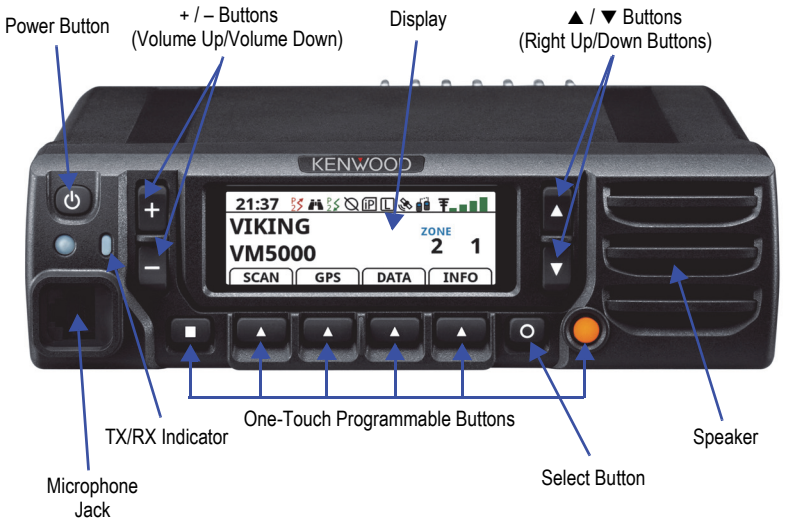
- VM5000 dash-mount and remote-mount radios with KENWOOD Control Head (KCH-19V)
- VM6000 remote-mount radio with Viking Control Head (VCH)
- VM7000 remote-mount radios with KENWOOD Control Head (KCH-20RV)

The control head provides the primary controls, display, and speaker settings for the mobile radio.

2.1.1 VM5000 Front Panel Controls

Figure 2.1 shows the controls for the VM5000 radio.

Figure 2.1 VM5000 Front Panel Controls



Power Button - Press to turn the power ON and OFF.

Note *The Armada administrator can program the VM5000 so that the radio turns on by turning on the automobile's ignition switch, instead of by using the Power Button.*

+/– Buttons – Press to activate programmable functions. The default button setting is Volume Up/Volume Down. Press to adjust the volume. The volume setting is indicated by a bar graph on the display as well as a volume setting number between 0 and 100.

The [–] button also activates radio setup features. To enter radio setup mode, press [–] during power up and hold the button until the radio enters radio setup mode. If there are multiple control heads, only the radio being configured will enter radio setup mode. The other control heads will display the Viking head screen.

Display – The display shows all primary operating information such as active channel, zone (along with channel/zone alias), status symbols, and labels for the programmable buttons under the display.

▲/▼ Buttons – Right Up/Down buttons. These buttons are **not** programmable.

Microphone Jack – Insert the microphone plug into this jack.

TX/RX Indicator – The indicator illuminates red, green, or orange to indicate the current status of the transceiver: red when transmitting, green when receiving, orange when transmitting in Secure Mode, and flashing red when receiving an encrypted call.

One-Touch Programmable Buttons – Press to activate programmable functions. Default settings are the following:

[■] – Also referred to as the Clear Button. This button can be assigned any setting, but it is typically reserved for Clear functionality. By default, the button is not assigned a function. It must be programmed.

[▲] – Press to activate programmable functions. Options are shown in the display.

Auxiliary (orange) Button – Also referred to as the Emergency Button. This button can be assigned any setting, but it is typically reserved for Emergency functionality. By default, the button is not assigned a function. It must be programmed.

Select Button [O] – For radios using Firmware Version 8.24.x programmed by Armada 1.24.x and later, this button is programmable. Press and hold to enter the Menu list showing user-programmed functions. This button also acts as an "Accept" button for selecting items in the menu.

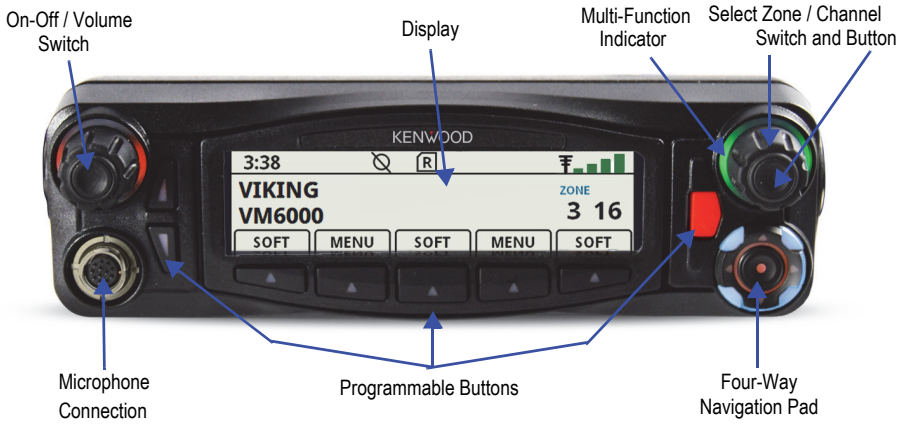
Speaker – The VM5000 includes a 4 ohm, 7 W max speaker located behind the grille. The following optional external speakers can be used if desired. The internal speaker should be disabled when an external speaker is used.

- The KES-3 speaker can be connected to the 1/8-in. speaker jack on the back panel. The KES-3 is rated at 4-ohm, 5W max.
- The KES-5 speaker can be connected to the back panel via a KAP-2 option board and E37-1113-25 6-pin connector. The KES-5 is rated at 4-ohm, 40W maximum. However, the radio cannot output 40W. The rated audio output power of the radio is 4W at 2% distortion.
- For the VM6000 (remote VCH) configuration with EFJ 250-0151-006 5-in. external speaker, the rated audio output power is 12W.

2.1.2 VM6000 Front Panel Controls

VM6000 radios use the VCH front panel (Figure 2.2). The VCH offers superior readability and display options for the VM6000 radio user.

Figure 2.2 Front Panel Controls for VM6000



On-Off/Volume - This control has two actions: rotation and press. Press the control to turn radio power ON/OFF. Rotate the control (when power is ON) to adjust the radio speaker volume. The volume setting is indicated by a bar graph on the display as well as a volume setting number between 0 and 100.

Note *The Armada administrator can program the VM6000 so that the radio turns on by turning on the automobile's ignition switch, instead of by using the On-Off/Volume switch.*

Display - The display shows all primary operating information such as active channel, zone (along with channel/zone alias), status symbols, and labels for the five programmable buttons under the display.

Multi-Function Indicator - The halo light surrounding the Select Zone/Channel switch indicates radio transmit and receive status.

- **Steady Red** Radio transmitting in clear mode
- **Steady Green** Radio receiving in clear mode
- **Steady Blue** Radio idle
- **Steady Yellow** Radio transmitting in encrypted mode
- **Flashing Red** Radio receiving encrypted

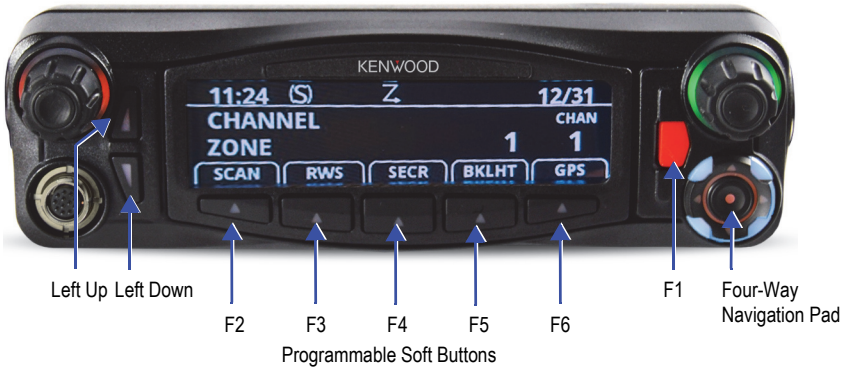
Select Zone/Channel Switch - This control has two actions: rotation and press. In normal non-menu mode, press the control to select either the zone or the channel (depending on Armada programming). Then rotate the switch to set either the zone or channel depending on the selection indicated in the display. Press and hold the Select switch to enter menu mode. If the menu functionality is not available, a “Menu Empty” message appears when you press and hold the Select switch. This switch can be locked so that it does not change the zone/channel.

Microphone Connection - A compatible EFJohnson Technologies mobile microphone plugs into this jack connector. The connector is a quarter-turn locking metal connection that provides a superior weather resistant connection between the microphone and radio.

One-Touch Programmable Buttons - The control head has 8 one-touch buttons: two to the left of the display (▲ and ▼), five under the display (▲), and a red button to the right of the display (Figure 2.3). These buttons can be programmed with different radio functions using a menu-driven user interface. (See the Armada online help for information on programming these button functions.)

The ▼ button to the left of the display also activates radio setup features. To enter radio setup mode, press ▼ during power up and hold the button until the radio enters radio setup mode. If there are multiple control heads, only the radio being configured will enter radio setup mode. The other control heads will display the Viking head screen.

Figure 2.3 VM6000 Programmable Soft Buttons

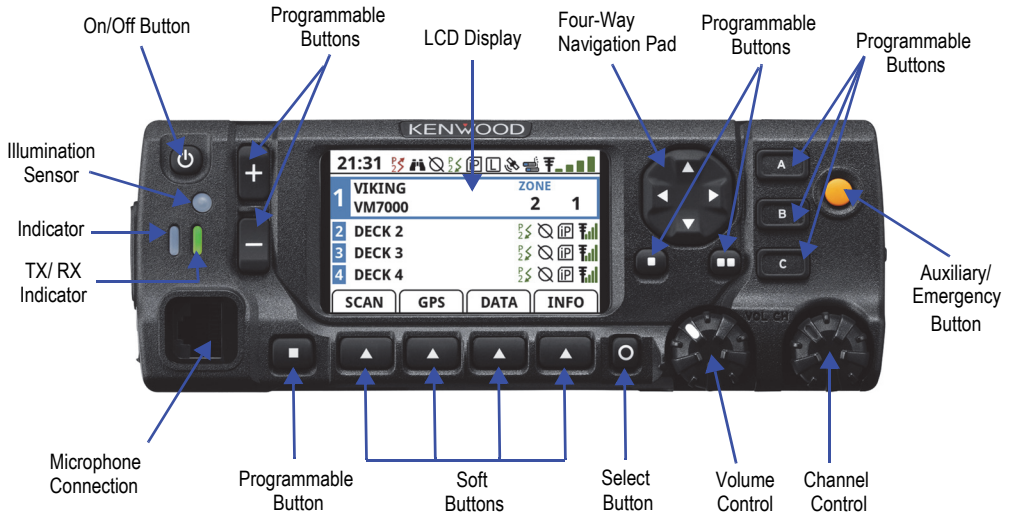


Four-Way Navigation Pad - This button pad is used to navigate through various radio functions and menus. The left and right buttons of the pad can be programmed with different radio functions.

2.1.3 VM7000 Front Panel Controls

VM7000 radios use the KCH-20RV front panel (Figure 2.4). The KCH-20RV displays up to 4 bands on its larger 2.75-in. multi-color LCD screen. Seven user-selectable day/night themes are available.

Figure 2.4 Front Panel Controls for VM7000



On/Off Button – Press the button to turn radio power ON/OFF.

Note *The Armada administrator can program the VM7000 so that the radio turns on by turning on the automobile's ignition switch, instead of by using the On/Off button.*

LCD Display – The display shows all primary operating information such as active channel, zone (along with channel/zone alias), status symbols, and labels for the soft buttons under the display.

Four-Way Navigation Pad – This button pad is used to navigate through various radio functions and menus. The left and right buttons of the pad can be programmed with different radio functions.

Programmable Buttons – Press to activate programmable functions. Default settings are the following:

[**+**/ **–**] – By default, these buttons are not assigned functions. They must be programmed.

[■] / [■■] – By default, these buttons are not assigned functions. They must be programmed.

[■] – Also referred to as the Clear Button. This button can be assigned any setting, but it is typically reserved for Clear functionality. By default, the button is not assigned a function. It must be programmed.

[▲] – Press to activate programmable functions. Options are shown in the display.

Auxiliary (orange) Button – Also referred to as the Emergency Button. This button can be assigned any setting, but it is typically reserved for Emergency functionality. By default, the button is not assigned a function. It must be programmed.

Select Button [O] – For radios using Firmware Version 8.24.x programmed by Armada 1.24.x and later, this button is programmable. Press and hold to enter the Menu list showing user-programmed functions. This button also acts as an "Accept" button for selecting items in the menu.

Channel Control – Rotate to set the channel.

Volume Control – Rotate to increase/decrease the volume.

Microphone Connection – Insert the microphone plug into this jack.

TX/RX Indicator–

Steady Red: Transmitting in unsecure mode.

Steady Orange: Transmitting in secure mode.

Steady Green: Receiving in unsecure mode.

Double-Blink Red: Receiving in secure mode.

Indicator – Not used.

Illumination Sensor – Not used.

2.1.4 VM5000/VM6000/VM7000 Display

The VM5000/VM6000/VM7000 control heads include highly readable liquid crystal displays (LCD) with 422 x 154 pixels (VM5000), 480 x 128 pixels (VM6000), and 400 x 240 pixels (VM7000). The display shows the radio's current channel, zone, and the other primary fields corresponding to the fields available on the VM5000/VM6000/VM7000 control head. The display also shows one-touch programmable soft button labels that can be assigned in Armada. Figure 2.5 shows the VM5000 front panel display, Figure 2.6 shows the VM6000 front panel display, and Figure 2.7 shows the VM7000 front panel display.

Note *Radios can display messages in English, French, or Spanish.*

Figure 2.5 VM5000 Display Screen

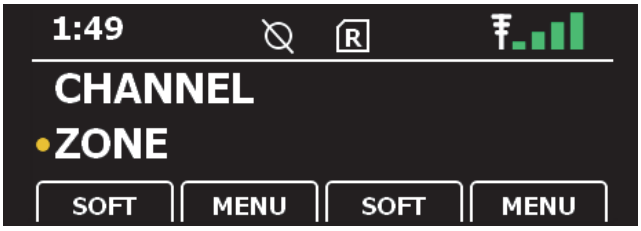
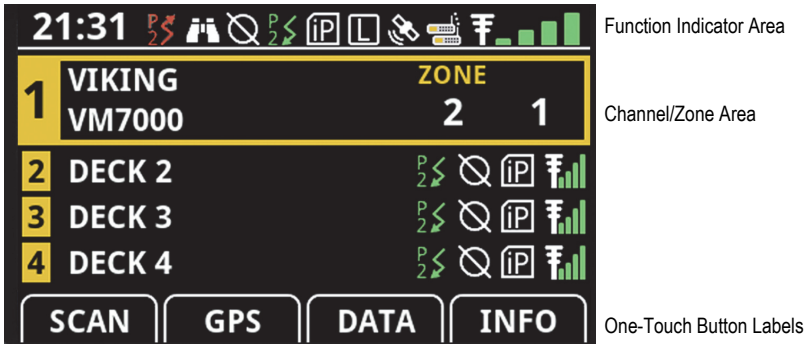


Figure 2.6 VM6000 Display Screen

Figure 2.7 VM7000 Display Screen



Function Indicator Area - Displays the various function indicators, signal strength indicator, and clock

Channel/Zone Area - Displays the transceiver information, such as channel number and zone number. For Multideck configurations, the number of the deck that is currently selected is also displayed on the far left.

- Radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later: If the radio is set to inhibit zone/channel indicators, the following appears when the operator changes the zone or channel:
  - If the operator changes zone, the channel appears in smaller text.
  - If the operator changes channel, the zone appears in smaller text.

One-Touch Button Area - Displays the button functions for the programmable (▲) soft buttons

Table 2.1 lists the icons used on the VM5000/VM6000/VM7000 display to indicate various operating modes and status. Table 2.2 lists the programmable status bar

Table 2.1 VM5000/VM6000/VM7000 Operating/Status Display Icons

Icon	**Description** (Icons marked by * appear if you program Show Tx/Rx Icon in Armada.)
	Keypad programming/edit mode. Displayed when the radio is in a mode where you can edit radio settings.
	Monitor mode enabled.
TA	Repeater Talk-Around mode enabled.
	Scan enabled. When the radio is in scan hold time, the icon flashes.
	Radio does not have a valid encryption key.
	DES encryption enabled.
	AES encryption enabled.
	ARC4 encryption enabled.
(S)	The current channel is in the enabled scan list (only when scan is on or when in scan edit mode).
(X)	The current channel is not in the enabled scan list (only when in scan edit mode).
P	The current channel is the priority channel in the enabled scan list (only when scan is on or when in scan edit mode).
P_2	The current channel is the priority 2 channel in the enabled scan list (only when scan is on or when in scan edit mode).
	Interconnect mode enabled (phone mode).
	Private call mode enabled.
	Unit call received. When receiving a unit call, the icon appears to notify the user they are receiving a unit call. This icon disappears as soon as unit call receive ends, and overwrites any text message notifications while a unit call is being received. (radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later)
	Radio is registered with the EFJohnson registration server.
	P25 data context enabled (radio is ready for data operations).
	P25 data packets are being sent/received.

Table 2.1 VM5000/VM6000/VM7000 Operating/Status Display Icons (Continued)

Icon	**Description** (Icons marked by * appear if you program Show Tx/Rx Icon in Armada.)
	Site lock mode enabled.
	Talkgroup lock mode enabled. Flashes when locked, disappears when unlocked, (radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later)
	GPS link active.
	GPS link active but in low power mode due to poor signal conditions.
	Call history (only when radio is in conventional unit call, call alert, or text messaging mode, and an applicable unit ID are selected).
	Text message mode active.
	Radio-wide scan mode enabled. The icon is solid when the radio is scanning channels. When the radio is in scan hold time, the icon flashes.
	Busy (displayed when radio enters a busy transmit state).
	The radio is making a call. *
	The radio is receiving a call. *
	The radio is making a Phase 2 (TDMA) call. *
	The radio is receiving a Phase 2 (TDMA) call. *
	The radio is making a Failsoft call. *
	The radio is receiving a Failsoft call. *
	Surveillance mode enabled.
DEC	The radio is in decimal entry mode.
HEX	The radio is in hexadecimal entry mode.
(N)	The channel is nuisance deleted.
	Bluetooth is turned on.
	The radio is connected to a Bluetooth device.
Wi-Fi	The radio is connected to a wireless access point (WAP).

Table 2.1 VM5000/VM6000/VM7000 Operating/Status Display Icons (Continued)

Icon	Description (Icons marked by * appear if you program Show Tx/Rx Icon in Armada.)
	The radio is affiliated with a trunking system.
	The radio is muted. The Armada administrator can program the radio so that this icon either flashes continually while the radio is muted, or appears only once. This icon appears on radios using Firmware Version 8.32.x or later programmed by Armada 1.32.x and later,

Table 2.2 VM5000/VM6000/VM7000 Operating Status Bar Symbols and Text

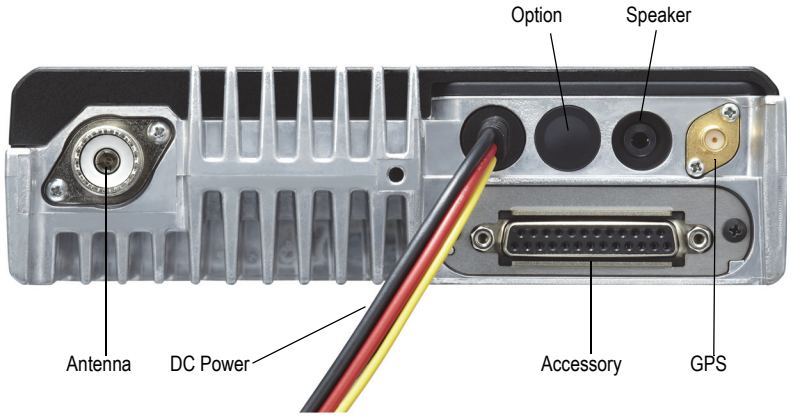
Icon	Description
[text]	Time
[text]	Date
	Signal strength (indicates an acceptable site, and can range from 0 to 4 bars). Shown in red or green on colored displays, depending on signal strength.
	Signal strength for radios roaming on a foreign system (radios using Firmware Version 8.32.x or later programmed by Armada 1.32.x and later). Indicates an acceptable site, and can range from 0 to 4 bars. Shown in red or green on colored displays, depending on signal strength.
	Indicates the volume of the radio
[text]	Zone
[text]	Channel
[text]	TX Squelch Code
[text]	RX Squelch Code
[text]	The current site of a radio in a P25 trunking system. For radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, the Armada administrator can program the radio to display the current radio site. The radio displays this information when the radio accepts affiliation or registration at a site. The site gets displayed in one of the following ways: • Site Alias (if available) - Displays as many letters of the alias as can fit in the display space. This ranges from 1 to 11 characters. • Site ID - Displayed in the form “St” followed by the site ID (for example, “St150” for a site ID of 150)

symbols and text that the radios use.

2.2 Rear Panel Connectors

The mobile rear panel connectors are shown in Figure 2.8. These are applicable to the VM5000, VM6000, and VM7000.

Figure 2.8 Rear Panel Connectors



Antenna – UHF Connector for VHF/UHF models, as shown in Figure 2.8. Type N Connector for 700/800 MHz model.

DC Power – Connection point for the nominal 12-volt, negative ground power source. (The yellow cable is the ignition sense.)

Option – Chassis exit point for optional horn alert/PA relay unit 6-pin connector (KAP-2).

Accessory – Connector for optional accessories. Refer to the operating manual for additional information about accessories.

Speaker – 1/8-in. jack for KES-3 speaker connection.

GPS – SMA connector for GPS antenna.

2.3 Dual Control Configurations

The VM5000, VM6000, and VM7000 radios are available in dual-control configurations that include the remote-mount radio with two remote control heads (Figure 2.9, Figure 2.10, and Figure 2.11).

Figure 2.9 Remote-Mount VM5000

Figure 2.10 Remote-Mount VM6000 with Two Remote Control Heads

Figure 2.11 Remote-Mount VM7000

Note *All heads are shipped from factory set as primaries. One of the heads must be programmed as a secondary to function correctly. Please refer to Section 2.3.3.*

2.3.1 Remote Control Head Kit

This kit includes the material required to add a remote control head to an existing dash-mount or remote-mount configuration. The kit includes the following:

- KCH-19V remote control head with mounting bracket

Or

- Viking remote control head with mounting bracket

Or

- KCH-20RV remote control head with mounting bracket

Or

- KCH-21RMV hand held control head with mounting bracket

Due to differing operational requirements, the following items are not included in the kit and must be ordered separately:

- Microphone: See Section 3 for further details.
- Remote control cable: Order 6, 17, 50, 100, or 150 ft cable as required.
- Remote accessory cable: See the following for part numbers.

VM5000 configurations using remote control heads require the VM5000 deck, two KCH-19V control heads, two KRK-14H remote head mounts (with EFJ code), one KRK-17B radio adapter, and appropriate connection cables (KCT-71 or similar).

VM6000 configurations using VCH remote control heads require the KRK-16B control head remote kit (adapter for the RF deck) and one KCT-78M connection cable per control head.

VM6000 configurations using a KCH-21RMV hand held control head need a KRK-17B control head remote kit and a KCT-77 connection cable for each control head.

VM7000 configurations using remote control heads require a VM5000 deck, KRK-17B control head remote kit for each deck, a KRK-14H for each remote head, and one KCT-71 connection cable for each control head and/or additional deck in a multideck configuration. (For example, a two deck configuration with two remote heads would require three KCT-71 cables. A three deck, two remote head configuration would require four KCT-71 cables, etc., wired in a daisy-chain configuration.)

2.3.2 Hardware Setup

In the VM6000 dual remote control configuration, the EFJohnson noise-canceling microphone (part number 589-0016-592) should be used with both control heads. This microphone can be identified by the small circular metal grill above the hang-up button on the rear of the microphone. VM5000/VM7000 dual remote control configurations use the standard microphone (KMC-35) or keypad microphone (KMC-36). Use of other microphones in these configurations could result in degraded operational performance.

2.3.3 Primary / Secondary Programming

In the dual control configuration, either control head can be designated as the Primary and the other as the Secondary. The Primary control head controls the volume of any external speakers that are connected to the radio's 1/8-in. (5.5 mm) speaker jack or the optional KAP-2 six-pin accessory connector (see *VM5000/VM6000/VM7000 Installation Manual* for connection details). The Primary control head also controls the volume of any deck, except those with RF Deck Adjustment assigned to them. The Secondary control head only adjusts the volume for the KES-5 speaker attached to it and has no effect on any KES-3 speakers attached to the back of each deck or the KES-5 speaker attached to the Primary control head. If you adjust the volume on the Secondary head, the Primary will display "Volume Update," but it will not be affected.

All VM5000/VM6000/VM7000 radios ship from the factory with the dash-mount control head and any remote control heads set as Primary, so in a dual-remote configuration, one control head must be set as the Secondary to ensure correct operation. If both remote control heads are set as Primary, or both are set to the same Secondary address, the radio will fail the self test on boot with a "CH ADDRESS CONFLICT" message appearing on the displays.

In dual control configurations, VM5000 radios are controlled by DIP switches.

To set up dual KCH-19V control heads:

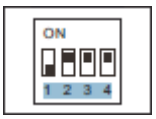
1 Connect a single KCH-19V locally to a VM5000 deck.

2 Ensure the firmware is updated to a minimum of version 8.20.x or later.

Note *Step 2 must be completed PRIOR to connecting dual KCH-19Vs or the radio will become stuck in self-tests if the radio firmware is older than 8.20.x.*

3 Disconnect the local KCH-19V, and connect a KRK-17B adapter to the radio deck.

4 Set the KRK-17B dip switches as follows:



5 Connect the two KCH-19V control heads to the KRK-14H remote-head mounts and set the following dip switches of KRK-14H (control head order is not important).

Control Head 1

Control Head 2

6 Connect the two remote KCH-19Vs to the KRK-17B.

Note *Ensure Control Head 1 (All DIP switches turned ON) is connected to the top slot on the KRK-17B.*

Control head addressing for the VM6000 dual control configuration is set as follows:

1. Power up the mobile radio while holding the Left Down button. The radio will briefly display "Radio Setup Mode" followed by "Select Setting: Address."
2. Press the Select switch. The display will read "Address: 0x21" if the control head is configured as the Primary, or "Address: 0x22" through "Address: 0x27" if the control head is configured as the Secondary.
3. Rotate the Select switch to select the appropriate address.
4. Press the Select switch or the "SAVE" soft button to save the selected address.
5. Press the "EXIT" soft button. The radio application will reboot, and the configuration will be updated.

Figure 2.12 VM6000 Option Buttons

In dual control configurations, VM7000 radios are controlled by DIP switches.

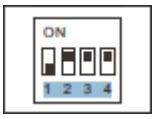
To set up dual KCH-20RV control heads:

1. Connect a single KCH-19V locally to a VM7000 deck.
2. Ensure the firmware is updated to a minimum of version 8.22.x or later.

Note *Step 2 must be completed PRIOR to connecting dual KCH-20RVs or the radio will become stuck in self-tests if the radio firmware is older than 8.22.x.*

3. Disconnect the local KCH-19V, and connect a KRK-17B adapter to the radio deck.

4 Set the KRK-17B dip switches as follows:



5 Set the following dip switches of the KCH-20RVs (control head order is not important).

Control Head 1

Control Head 2

6 Connect the two remote KCH-20RVs to the KRK-17B.

Note *Ensure Control Head 1 (with all DIP switches turned ON) is connected to the top slot on the KRK-17B.*

2.3.4 Dual Control Operation

2.3.4.1 Programming Dual Remote Control Configurations

The Dual Remote configuration requires special programming to accommodate both remote control heads in the mobile radio system. Removal of either control head will affect system performance.

2.3.4.2 Power ON/OFF

The power switching in VM6000 dual configurations is such that either control head can turn the radio ON, but both control heads must be off to turn the radio OFF. For VM5000/VM7000, both control heads are not required to be off to turn the radio OFF.

If the power button on both VM6000 control heads is pressed, then the power button on both control heads must be pressed again to turn the radio OFF. It is therefore recommended to always turn the VM6000 radio ON and OFF using one control head, to simplify operation and avoid confusion.

2.4 Multideck Configurations

Multiple VM7000 mobile radios and KCH-20RV or KCH-21RMV control heads can be connected in a multideck configuration (Figure 2.13). Radios in a multideck configuration must be programmed with one of two options: Multideck Primary or Multideck Secondary. A Multideck Primary conveys its options and various parameters to those radios programmed with the Multideck Secondary option. This allows the feature set of the multideck radio to be wholly contained within a single radio. Radios not programmed as a primary must still have an option file, but only the Multideck Secondary option is required for operation. At least one radio must be programmed as a Multideck Primary in order for a multideck radio to function.

Figure 2.13 Multideck Configuration Example

Only one radio should be programmed with a Multideck Primary option. If more than one subscriber is programmed as a primary, then the radio programmed as a Multideck Primary with the lowest hardware address will be considered the primary. The options for the multideck radio will be taken from that radio.

Note *In a multideck configuration, a KCT-71 (M2, M3, M4) can be used for the connection between the KCH-20RV and KRK-17B, but a KCT-71 (M4) must be used for the KRK-17B connections.*

2.4.1 DIP Switch Settings

The KRK-17B board contains a four-position DIP switch, which must be set properly for each radio in the multideck configuration:

- Switch 1: This is the CAN bus termination setting. If the device is at the end of the chain, meaning that only one of the CAN bus headers is connected to a cable, then the CAN bus should be terminated and this switch should be ON. If both CAN bus headers are in use, then the CAN bus should not be terminated, and the switch should be OFF.
- Switch 2: This is the RSET_2 value. This switch should always be OFF.
- Switches 3 and 4: These are the RSET_1 (3) and RSET_0 (4) values. These switches combine to determine the device hardware address. Table 2.3 shows the switch settings for each device address.

Table 2.3 KRK-17B DIP Switch Address Settings

Address	RSET_1 (Switch 3)	RSET_0 (Switch 4)	Notes
1	ON	ON	RF Deck with Primary Option **Note:** *The deck optioned as the PRIMARY Deck must be setup at address 1 in a multideck configuration.*
2	OFF	ON	
3	ON	OFF	
4	OFF	OFF	

Note *If the deck with the Multideck Primary option is not at address 1, the radio is more likely to experience power up/cycle issues where some of the decks are not registered. Having the deck with the Multideck Primary option at position 1 makes the system more reliable.*

2.4.2 KCH-20RV and KCH-21RMV DIP Switch Settings

KCH-20RV control heads use a four-position DIP switch, but only one switch is actually connected:

- Switch 4: This is the RSET_0 value. This switch determines the control head address. Table 2.4 shows what the switch should be set to for each address.

KCH-21RMV control heads have a two-position switch to the right of the modular adapter plug, under the back cover of the hand held controller.

Table 2.4 KCH-20RV and KCH-21RMV DIP Switch Address Settings

Address	KMC-20RV RSET_0 (Switch 4)	KMC-21RMV RSET_0 (Switch S57)
0x21	ON	ON
0x22	OFF	OFF

2.4.3 Multideck Functions

Many multideck-specific functions are assignable to a button or menu (Table 2.5). Button and menu features include the following:

- The individual deck selection buttons have both a press function and a press and hold function. Pressing the button changes the selected deck, while pressing and holding the button toggles a local value that mutes or unmutes audio when the deck is unselected. The mute flag can be infinite (or until the user holds the button again), or it can expire after an Armada-programmed time.
- RF Deck Volume Adjustment is a customer requested feature that allows the volume of each deck to be controlled individually instead of tied to the primary control head. When programmed, it is recommended that it be programmed for all system types for all radios.
- The function buttons and menu items displayed on the control head will be retrieved from the selected deck only. It is recommended that the functions programmed be mirrored for all decks.
- Deck selection is not allowed while emergency or surveillance mode is active.

Table 2.5 Multideck Functions

Function	Soft Key Label	Menu Function	Press Function	Press & Hold Function
Select Deck 1	DECK1		Changes selected deck to Radio 1	Toggles Deck 1 individual unselected deck mute
Select Deck 2	DECK2		Changes selected deck to Radio 2	Toggles Deck 2 individual unselected deck mute
Select Deck 3	DECK3		Changes selected deck to Radio 3	Toggles Deck 3 individual unselected deck mute
Select Deck 4	DECK4		Changes selected deck to Radio 4	Toggles Deck 4 individual unselected deck mute

Table 2.5 Multideck Functions (Continued)

Function	Soft Key Label	Menu Function	Press Function	Press & Hold Function
Select Deck Cycle	DKCYC		Increments selected deck with cycle back	N/A
Select Deck Down	DK DN		Increments select deck without cycle back (Down due to movement of selected deck on display)	N/A
Select Deck Up	DK UP		Decrements selected deck without cycle back (Up due to movement of selected deck on display)	N/A
Multiline Display Toggle	MDDIS	X	Toggles display between all radios and only the selected radio	N/A
Unselected RF Deck Mute	UNSEL	X	Toggles muting of all audio on unselected decks	N/A
RF Deck Volume Adjustment	VMADJ	X	Activates task to adjust the volume of an individual deck's volume	N/A
RF Deck Speaker Adjustment	SKADJ	X	Toggles a dB offset (0, -3, -6, -9) for all unselected deck audio	N/A

2.4.4 Received Audio

Audio can be configured two different ways when using a multideck configuration: normal and single speaker audio out.

If the radios are configured for normal operation, any speakers connected to control heads play the selected deck's audio while any speaker connected to the back of individual decks play that deck's audio regardless of whether that deck is selected.

If the radios are configured for single speaker audio out operation, all control heads and the external speaker of Radio 1 play the same audio (External speakers attached to Radios 2, 3 or 4 are not supported in this configuration). The source of the audio is determined by the radio's hardware address where the lowest address has priority over the highest address. For example, if the radio at address 3 is the only radio receiving audio, then all speakers will play that audio, but if radios at addresses 2 and 3 are receiving audio, then all speakers will play Radio 2's audio, and Radio 3's audio will not be heard.

2.4.5 Muting

There are several ways to mute audio in multideck configurations:

- **Mute Function**. This will mute audio from all devices, regardless of which device is selected. If the regular mute function is active, then it will override both the unselected deck setting and the individual unselected deck setting. If the regular

mute function is deactivated, then the unselected decks will revert first to the unselected deck mute setting if active, and then to the individual deck mute setting.

- **Unselected Deck Mute Function**. This will mute all audio on all unselected decks, but not audio from the selected deck. If Unselected Deck Mute is active, it will override the individual unselected deck mute setting. If the unselected deck mute setting is deactivated, then the unselected decks will revert to the individual unselected deck setting. Pressing and holding the button results in a temporary mute using the individual deck mute time programmed for the unselected decks. This time may be programmed as infinite. Pressing and holding the button while any of the decks has its temporary unselected mute active will set those decks to unmute.
- **Individual Unselected Deck Mute Function**. This is accessible using a press and hold of the deck selection button. This function mutes only the audio on a specific device when it is unselected. For example, if Deck 1 is selected, the user can mute the audio on Deck 2 by pressing and holding the Deck 2 selection button. The individual unselected deck mute setting is the lowest priority of the three settings and will be trumped by the unselected deck mute setting or the regular mute function. Individual unselected deck mute can be a standard mute function where it is toggled on or off, or it can be set to be temporary, where the mute function expires after a programmed time.
- **Selected Deck External Speaker Mute Function.** This parameter mutes received audio on the external speaker connected to the selected radio deck. However, the selected deck's audio will still be available on the control head audio output. This parameter applies to both the 3.5mm audio jack and the external speaker output of the KAP-2 audio board.

Global Mute, Unselected Deck Mute, and Individual Deck Mute are not persistent through power down.

2.4.6 Volume Adjustments

The control head located at hardware address 1 is considered the primary control head. This control head controls the volume of both the control head and all radios in a multideck configuration. If another control head is part of the configuration, its volume is independent of all other devices.

There is an additional mode of operation where the volume of each deck can be adjusted independently. If the RF Deck Volume Adjustment function is programmed to the radio, then control head volume adjustments only change the volume of control heads. To adjust the volume of the radio's external speaker, the radio must be chosen from the volume adjustment task, which then starts a menu task that allows the user to change the volume.

2.4.7 Emergency

When an emergency is activated on a multideck radio, it can perform the emergency actions of the currently selected radio or it can automatically switch to a specific deck and perform that deck's emergency actions. If the fixed emergency deck is programmed, the multideck radio will revert to the previously selected radio once the emergency has been cleared. During emergency, all unselected decks are muted, and manual deck selection is prohibited.

If more than one radio in the multideck configuration has the fixed deck option enabled, then the radio with the lowest hardware address will be considered the emergency deck, unless the primary option radio is configured for the fixed deck operation, in which case the primary radio will operate as the fixed deck regardless of the hardware address.

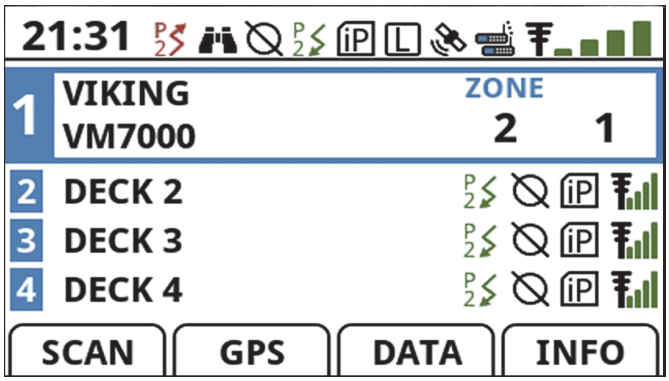
For radios using Firmware Version 8.30.x or later programmed by Armada 1.30.x and later, the Armada administrator can program unselected decks in a multideck configuration to enter emergency mode. This enables unselected decks to transmit emergency alarms when necessary.

⚠ CAUTION *Unselected decks cannot perform hot mic.*

2.4.8 KCH-20RV Multiline Display

By default, the KCH-20RV will display the information for all decks. The display can be changed to show only the selected deck using the Multiline Display Toggle function (Figure 2.14).

Figure 2.14 KCH-20RV Multiline Display



To allow as much text to display as possible when the multiline display mode is enabled, only three non-signal strength icons will be displayed for unselected radios.

Icons are prioritized so the most pertinent information is conveyed. Table 2.6 shows the prioritization.

Table 2.6 KCH-20RV Unselected Deck Icon Prioritization

Priority	Icon
1	Scan
2	Encryption
3	DES Encryption
4	AES Encryption
5	P25 Data Context Activated
6	P25 Registered with DRS
7	Bluetooth
8	Surveillance
9	Keypad Lockout
10	Monitor
11	Repeater Talkaround
12	All other icons

2.4.9 Primary Controlled Features

To maintain consistency between all radios in a multideck configuration, some parameters must be shared between radios when powering up (Table 2.7). The radio with the multideck primary option (or the radio with the lowest hardware address if multiple radios with a primary option exist) is the radio that will control these parameters.

For parameters that the user can change during runtime, the updated setting will be conveyed to all other radios to maintain synchronization.

Table 2.7 Shared Features Controlled by the Primary Radio

Feature	Notes
Boot Password	Only the password from the primary deck is required at boot, regardless of which deck powers up as the selected deck.
Control Head AUX Pin Configuration	
Backlight Level	
Multiline Enabled	Whether to show multiline or not after being programmed by Armada
Theme	
Theme Mode	
Single Speaker Audio Out	

Table 2.7 Shared Features Controlled by the Primary Radio (Continued)

Feature	Notes
Alert Tones Enabled	These are independent of the “Tones” check box located on the Armada Audio tab.
Voice Announcements Enabled	
Surveillance on Startup	
GPS Data Source	
Soft Power Down Button	

2.4.10 Global Features

Other features are shared among radios but the parameters are not dependent on the primary radio (Table 2.8).

Table 2.8 Shared Features Independent of the Primary Radio

Feature	Notes
Remote Control Head Outputs AUX 1, AUX 2 and AUX 3	Any selected deck can enable/disable the AUX 1-3 value for the remote control heads. The AUX 1-3 will also change on the selected DB-25 GPIO.
Tone Volume Edit	Any selected deck can adjust the tone volume. The adjustment is scaled, meaning that the adjustment does not require the volume ticks to be consistent across radios.

2.4.11 Inhibit

If one of the decks receives an inhibit command, all decks will enter inhibit mode. The deck that receives the command is in permanent inhibit mode, but the other decks are only part of the unit inhibit mode and are not considered inhibited themselves. If the deck that was inhibited is not the primary deck, it can be removed from the system and the other radios will operate normally.

Any deck that receives an uninhibit command will take the system out of inhibit mode.

2.4.12 Additional Considerations

Consider the following notes regarding multideck configurations:

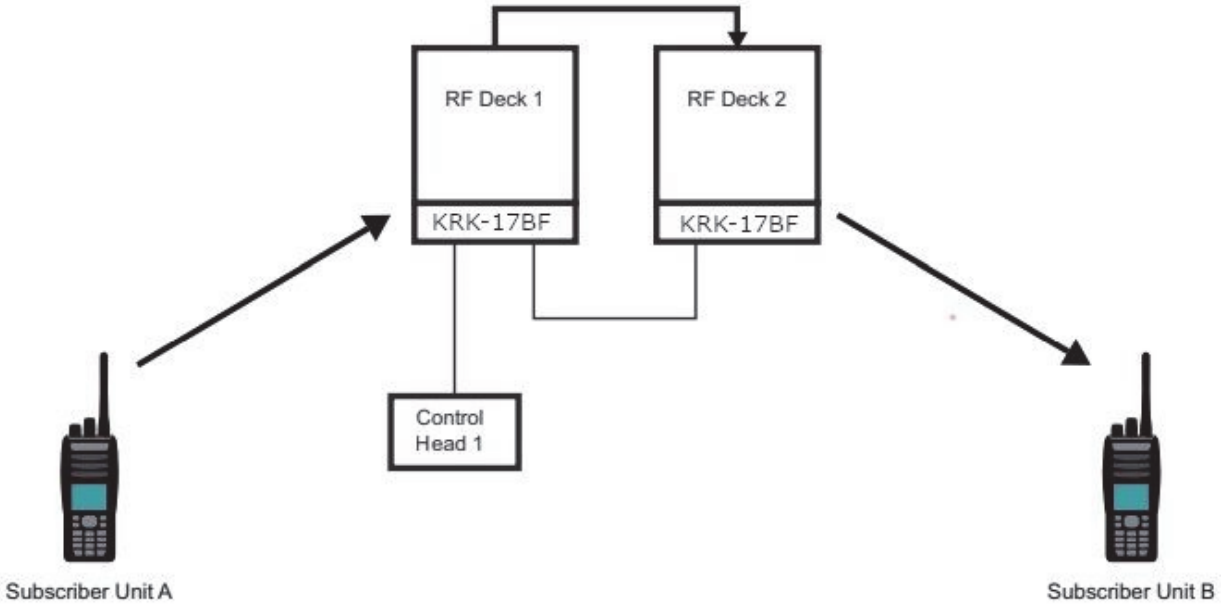
- Ignition sense should be connected to control heads. Otherwise, all decks will need to be connected in order to properly power up the unit.

- The GPS antenna should only be connected to the radio at hardware address 1. The NMEA sentences received will be automatically broadcast to the other radios in the system.
- When all radios' clock sources are set to "Internal," the time that the radios get synchronized to is the time of the radio that was updated last—not necessarily the time of the primary deck.
- While the selected deck is transmitting, all unselected decks are muted.

2.4.13 Cross Band Repeater

The Cross Band Repeater function allows the received signal from an RF deck to be transmitted on a second RF deck. Deck 2 can be in either a single deck configuration or a multideck configuration. The two decks are connected through the DB25 connector on the back of each deck. Figure 2.15 shows the multideck cross band repeater configuration.

Figure 2.15 Cross Band Repeater Multideck Configuration



Using the Cross Band Repeater feature requires the following configurations:

- Each deck must be configured on an analog or digital conventional channel. This can be accomplished through manual selection on each deck or assigning a cross band repeater channel in each deck's codeplug. The feature supports the following transmission types:
  - Analog-to-analog
    - Supported features: Optional Signaling (DTMF, two-tone, MDC)

- Digital-to-digital
  - Supported features: Emergency, Encryption, ID pass through (Source ID, Talk Group ID)
- Analog-to-digital
- Digital-to-analog

The two decks are connected through the DB25 connector on the back of each deck as shown in Figure 2.15. For digital operation only, the radios can be connected using a standard 25 pin-to-25 pin null modem cable. To support other transmission types, a custom cable is required. For more information, refer to the *VM5000/VM6000/VM7000 Installation Manual*.

Table 2.9 describes some features that change when mobile radios use them in Cross Band Repeater mode.

Table 2.9 Cross Band Repeater Feature Changes Descriptions

Feature	Description of Behavior Difference
Busy Channel Lockout	Disabled while repeating
Emergency	If a specific zone/channel is programmed to be reverted to on emergency, then the radio disables cross band repeat and enters emergency mode.
Encryption	User notifications are disabled while repeating
MDC Mute	Disabled
Talk Permit Tone	Disabled while repeating
TX ANI Signaling	Disabled while repeating. When using Pre-Tx ANI signaling, an initial delay of at least 300 mSec is required.

Cross Band Repeater gets enabled by assigning in Armada a cross band repeater On/Off function to a button on each deck (**Button/Menu > Buttons** and **Button/Menu > Menu**). If the Armada administrator programs a Cross Band Repeater channel, the radio changes to the programmed channel.

The serial port must be configured for Cross Band Repeater. The Armada administrator configures the serial port for Cross Band Repeater on the **Global > Mobile Options** page.

The Cross Band Repeater channel can be optionally enabled on the Armada **Global > Mobile** page. When this channel gets enabled, the Armada administrator can configure the zone and channel. A Cross Band Repeater On/Off notification can also be configured. A Cross Band Repeater On/Off function can be assigned on the **Button/Menu** page of any VM5000/VM6000/VM7000 radio. Each deck must be optioned with the Cross Band Repeater option. When the feature is enabled, the channel selectors for both decks get locked.

To enable speaker audio output on the receive deck when using the multideck configuration, the Armada **Unmute Receive Audio During Transmit** box must be checked (**Global > Audio > Mobile**).

Radios without the Cross Band Repeater option (or radios that use Firmware Version 8.28.x or earlier) give a warning if the repeater on/off function is assigned or Cross Band Repeater is enabled.

For more information, refer to the Armada Fleet Management software online help.

2.5 External Speaker

Optional 4-ohm, 5W (KES-3 or RPSP-15) and 4-ohm, 40W (KES-5) external speakers are available from EFJohnson (Figure 2.16). These can be used to enhance radio audio or to provide primary audio for the VM6000 radios. The KES-3 (or RPSP-15) speaker can be connected to the back panel 1/8-in. speaker jack. The KES-5 speaker can be connected to the back panel through a KAP-2 option board and E37-1113-25 6-pin connector. Although the KES-5 is rated at 4-ohm and 40W maximum, the radio cannot output 40W. The rated audio output power of the radio is 4W. Refer to the *VM5000/VM6000/VM7000 Installation Manual* for additional installation information.

Figure 2.16 KES-3 External Speaker (Left) and KES-5 External Speaker (Right)

2.5.1 Internal/External Speaker Programming (VM5000 Only)

All VM5000 radios ship from the factory with the internal speaker in the control head enabled. Audio is also routed to the 6-pin accessory connector and 5.5 mm audio jack at the rear of the radio.

If you connect a KES-5 external speaker to the 6-pin accessory connector (as described in the *VM5000/VM6000/VM7000 Installation Manual*), the internal speaker will not be automatically disabled, and both speakers will be active.

To disable the internal speaker, proceed as follows:

1 Power up the mobile radio while holding the [-] button to enter Radio Setup Mode.

2 Use the Right Up/Down buttons ▲/▼ to select the Internal Speaker option, and press the Select button [O].

3 Use the Right Up/Down buttons ▲/▼ to choose Disable, and then click the Save soft button.

4 Press the "EXIT" soft button to restart the radio application. The speaker should be disabled.

To re-enable the internal speaker, proceed as follows:

1 Power up the mobile radio while holding the [-] button to enter Radio Setup Mode.

2 Use the Right Up/Down buttons [▲/▼] to select the Internal Speaker option, and press the Select button [O]. Use the Right Up/Down buttons ▲/▼ to choose Enable, and then click the Save soft button. The speaker should be enabled.

SECTION

3

General Operation

This chapter contains the following sections:

3.1 Basic Operation

3.1.1 Turning Power ON/OFF and Entering Radio Setup Mode

To turn Power ON and OFF:

- Press the Power button on the VM5000/VM7000 radio.
- Press the ON-OFF/Volume switch on the VM6000 radio.

The radio performs a self test when the power is turned ON. When that is successfully completed, the software version, unit ID, zone, then channel are briefly displayed (except when a conventional analog channel is selected), a tone sounds (if tones are enabled), and the radio is ready for normal operation. If "Enter Password" is briefly displayed, refer to the next section. The radio can be programmed so that one of the following combinations is selected at power up:

- Last Zone/Last Channel
- Programmed Zone/Last Channel
- Programmed Zone/Programmed Channel

If the Radio Alias feature is enabled, the radio displays the radio alias (up to sixteen characters) in place of the Self Test message during startup. The radio Alias identifies the programming file used to program the radio, the service area for which the radio is programmed, or the functional grouping for which the radio is programmed. The Radio ID Alias display is included with the Radio Info display items in both button/scroll and menu modes. If disabled, the Radio Info menu mode displays a blank line.

Note *In dual-control configurations, both control heads must be off to turn the radio OFF.*

To enter radio setup mode, press the Radio Setup Entry button (the [–] button on the VM5000/VM7000 and the ▼ button on the VM6000) during power up and hold the button until the radio enters radio setup mode. If there are multiple control heads, only the radio being configured enters radio setup mode. The other control heads display the Viking head screen. Table 3.1 shows the configurable parameters for each model.

Table 3.1 Configurable Parameters

Model	Configurable Parameter	Button
VM5000	Internal speaker enable/disable Ignition sense	[–]
VM6000	Adjust address Ignition sense Microphone speaker enable/disable	▼

3.1.1.1 Standard and Soft Power Down

To turn power off, press the Power button or the On-Off/Volume switch.

A Soft Power Down feature can be programmed to prevent radio power from being turned off by accidentally pressing the On-Off/Volume switch. The display message portion of the display stops updating. The user is able to receive, transmit, and use function buttons, but the display message will not change. If the channel is changed the Zone/Channel indication will update.

The user can power the radio completely down by pressing the power button once and then pressing the Option button programmed for this purpose (F2, F6, or Select button).

If the user presses the On-Off/Volume switch while Soft Power Down is in effect, the radio returns to full power-up operation.

3.1.2 Setting Volume Level and Tones

You can set the volume by pressing the +/– buttons on the VM5000, by rotating the On-Off / Volume switch on the VM6000, or by rotating the Volume knob on the VM7000. The volume setting is indicated by a bar graph on the display as well as a volume setting number between 0 and 100.

The relative volume setting can be determined using a reference tone as follows:

- If the button press tones are enabled (see Section 4.7) and programmed, a short tone sounds when an option button is pressed or the Select switch is pressed or rotated.
- If a conventional channel is selected, take the microphone off-hook. If someone is talking, voice can be heard if the "Hangup Box Monitor" feature of the radio is enabled. If the MON (monitor) option button is programmed (see Section 5.2), pressing it unsquelches the radio and either voice or background noise is heard. If a P25 trunked or Viking16 channel is selected, the radio cannot be manually unsquelched.

The minimum volume level that the volume control can select can be programmed. This feature can prevent missed messages caused by unintentionally setting the volume too low. Relative levels of 0 to 255 can be set in steps of 1 ("0" sets the lowest minimum volume). The maximum volume level can also be set, if desired. Both the minimum and maximum settings will be indicated by markers on the volume bar if set to any value other than 0 and 255.

For radios using Firmware Version 8.32.x or later programmed by Armada 1.32.x and later, the Armada administrator can enable a programmable button to act as a high volume/low volume toggle button.

3.1.2.1 Unprogrammed Tones

The VM5000/VM6000/VM7000 radio can be programmed so that it will not play a tone in the following cases:

- Unprogrammed button pressed
- Unprogrammed toggle button activated
- Switched to an unprogrammed channel

3.1.3 Persistent Settings

Settings retained through a power cycle of the VM5000/VM6000/VM7000 radios include the following:

Table 3.2 Persistent Settings

Global Persistent Settings
Scan
Radio Wide Scan
Secure
Tones
Tx Power
Radio Inhibit
Keypad Lockout
Surveillance Mode
Conventional Persistent Settings
Selective Squelch
Repeater Talk Around
Display/Information
Disable Call Guard
P25 Trunking Persistent Settings
Dynamic Regrouping
Site Lock
Viking16 Persistent Settings
Dynamic Regrouping
Site Lock

3.1.4 Power-Up Password

The power-up password feature prevents unauthorized use of the radio by requiring that a four to twelve digit password be entered to operate the radio. This feature is enabled or disabled by programming. When it is enabled, “Enter Password” is briefly displayed when power is turned on. For the VM5000, the Right Up/Down buttons ▲/▼ cycle the numbers and the Select [O] button confirms that number, allowing you to enter the next digit. Pressing the Select [O] button again will confirm the password. For the VM6000, rotate the Select switch to enter the desired number, and then press it to move to the next digit. A single beep sounds when the switch is pressed. For the VM7000, use the NavPad Up/Down arrows to cycle the numbers. Press the NavPad left/right buttons to advance to the next digit or go back to the previous digit, or press the Select button to advance to the next digit and/or confirm the password.

After the last digit is entered, the radio will operate. If an incorrect password is entered, "INCORRECT" is displayed, and the password must be re-entered.

3.1.4.1 Programming Passwords

Passwords are set by programming. The applicable radio must be connected to the computer and powered up to program the password.

Note *Any password changes made to the radio will be immediately applicable when Password Management is exited.*

3.1.4.2 Lost Passwords

If a password is lost, contact customer service.

3.1.4.3 Changing Passwords

An assigned user password can be changed by the user if the Change User Password function is programmed. Selecting this function displays prompts for entering and confirming a new password. New passwords must be four characters minimum. Entering zero characters will clear the user password.

3.1.4.4 Password Entry Procedure

When a password is requested, use the Right Up/Down buttons ▲/▼ on the VM5000 to cycle the numbers and the Select [O] button to confirm that number. Press the Select [O] button again to confirm the password. For the VM6000, rotate and press the Select switch to enter the password. A single beep sounds when the switch is pressed. For the VM7000, use the NavPad Up/Down arrows to cycle the numbers. Press the NavPad left/right buttons to advance to the next digit or go back to the previous digit, or press the Select button to advance to the next digit and/or confirm the password.

3.1.4.5 Zone Password

A zone password can be programmed with the VM5000/VM6000/VM7000 radio to prevent unauthorized reprogramming of zones by keypad programming.

Note *The programming and usage of this password has not changed. It is independent of the preceding passwords, and is set by programming.*

3.1.5 Speaking into the Microphone

For best results, hold the microphone about 1 to 2 in. (2 to 5 cm) from your mouth and speak at a normal conversational level. Do not shout since it distorts your voice and does not increase range.

Note *If excessive background noise consistently interferes with communications, microphone levels can be adjusted by programming.*

Press the PTT (push-to-talk) switch before you begin to speak and release it as soon as your message is complete.

3.1.6 Display Backlight Control

If the Backlight function is programmed, it can be used to select Bright, Medium, Dim, or Off backlight modes. Otherwise, the keypad and display backlight is fixed in one of these modes by programming. If the user has Backlight on Receive enabled and the timer set, the backlight will turn on whenever a call is received. It will remain on for the set timer length. The backlight is totally disabled when the Surveillance mode is programmed (see Section 4.11).

For radios using Firmware Version 8.34.x or later programmed by Firmware Version 8.34.x or later, the Armada administrator can program the radio so that its microphone keypad backlight turns on and off at the same time that the radio display does.

3.1.7 Zone/Channel Display and Select

The selected zone and channel are shown on the radio display. The selection is indicated by a dot next to Zone or Channel or by the word “Zone” or “Chan” above the zone or channel number (Figures 3.1 and 3.2), depending on the settings in Armada.

Figure 3.1 Dot Indicator

Figure 3.2 Word Indicator

If channel scanning is enabled, the channel number will change to show the current active channel being scanned. The Channel Identifier Alias also changes to identify the current active scanned channel.

The front panel Select button (VM5000/VM7000) or Select switch (VM6000) is used to change the zone and channel. Pressing this button toggles between the zone and channel select modes, and rotating it (VM6000) or pressing the Right Up/Down buttons ▲/▼ changes the zone or channel. The radio beeps when the Select switch is pressed.

The current mode is indicated by the yellow dot next to Zone or Channel or the word “Zone” or “Chan” displayed over the zone or channel number. For example, when ”Zone” is over the zone display, the zone select mode is enabled.

For the VM5000, the Right Up/Down buttons ▲/▼ decrease and increase the Zone and Channel Numbers. Rotating the Select switch (VM6000) or Channel Control (VM7000) clockwise increases the zone or channel and rotating it counterclockwise decreases the zone or channel number. A single beep sounds when the channel is changed. After the highest zone or channel is displayed, wrap-around to the lowest zone or channel occurs and vice versa. If an unprogrammed channel is selected, “UNPROGRAMD” is displayed and a tone sounds. The radio can also be configured so that only programmed channels are selected.

The radio can be programmed so that the bar defaults to either the zone or channel display when power is turned on and after a change is made. The return delay is programmable for 0 to 255 seconds. It can also be programmed to remain in the last selected mode.

3.1.7.1 Direct Channel Select

The Direct Channel Select feature is available if the Channel Select option switch or menu parameter is programmed. This feature allows channels to be directly selected using the Digital Keypad Microphone. Note that a Digital Keypad Microphone is required for Direct entry.

For direct selection purposes, channels are numbered sequentially starting with the lowest zone. Each zone can be programmed with up to 255 channels for a maximum of 4096 channels.

Table 3.3 Channel Numbering

Seq. Ch. No.	Zone	Channel
1 ↓ 255	1	1 ↓ 255
256 ↓ 510	2	1 ↓ 255
511 ↓ 765	3	1 ↓ 255
. . 4096	. . .	. . 255*

Proceed as follows to select channels using this mode:

1 Enable the Direct Channel Select mode by selecting it in the menu or by pressing the Channel Select option switch. A single beep sounds when the switch is pressed. The alias and sequential number of the current channel are alternately displayed.

2 Select the desired channel using the Select Zone/Channel switch or directly enter it using the 0 through 9 buttons. A single beep sounds when the channel is changed. If using the 0 through 9 buttons, the radio attempts to display the entered number after the third digit is entered or approximately two seconds after the last button is pressed.

3 To exit this mode and select the entered channel, press the Channel Select switch again. This mode is also exited automatically without changing the channel after approximately one minute of no activity.

Other features of this mode include the following:

- When using the Channel Up/Channel Down buttons (VM5000) or the Channel Select switch (VM6000/VM7000), wrap-around to the lowest zone/channel occurs after the last channel in the highest programmed zone is displayed and vice versa. For example, if Zone 1/Channel 5 is the highest programmed channel, wrap-around occurs after Zone 1/Channel 16 is displayed if the "Programmed Channels Only On Display" is not selected. If "Programmed Channels Only on Display" is selected, the wrap around occurs at Channel 5.
- When an unprogrammed channel is displayed, the sequential channel number and "UNPROGRAMD" are alternately displayed.
- If an invalid channel number is entered using the 0 through 9 buttons, or the Channel Select option switch is pressed with "UNPROGRAMD" displayed, an error tone sounds, "INVALID" is briefly displayed, and the displayed channel does not change.

3.1.7.2 BCD Remote Channel Control

For radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, the Armada administrator can enable an external 4-pin deskset remote control to change a maximum of 15 radio channels (through BCD channels).

3.1.8 Setting Squelch Control

The user can program a menu item, single-touch programmable button, or function button, for squelch adjust. While on a conventional analog channel without emergency or scan active, the user can select the programmed button or menu item for squelch adjust. The current squelch setting appears on the display. Using the Up/Down navigation buttons, or turning the Select switch clockwise or counter-clockwise on the mobile radio, the user can adjust the squelch setting to a desired level from -7 to +7. Decreasing the value toward -7 causes the squelch to open sooner for weaker signals, while increasing toward +7 has the opposite effect. Pressing the select button will store the new squelch setting and return the user to the main display.

The squelch level is preset and may not require readjustment. However, if the squelch threshold needs to be changed on a conventional analog channel, it can be changed using keypad programming, if available (see Section 5.15).

Note *The Keypad programming feature is available to Federal Government users only.*

3.1.9 Zone Edit

Users can build a virtual zone consisting of channels already present in the radio. They can add or remove channels from zones that are programmed as Zone Editable while the radio is running, allowing changes to be made at runtime.

The Zone Edit feature is intended to allow a user to create a “favorite channels” zone. The Zone Edit feature can be programmed as a button or menu function as long as an editable zone exists. It can be toggled on or off on a per-zone basis using Armada. When enabled, it allows you to copy and delete existing channels from a zone, as long as that zone is programmed as editable using Armada.

⚠ CAUTION *Only program empty zones as Zone Editable. Otherwise, you can lose channels.*

Any channel in the radio can be copied but only channels within an Editable Zone can be deleted or overwritten.

- Zone Edit mode can be entered by pressing a button or through the menu.
- A momentary button press performs *channel copy*.
- A press-and-hold performs *channel delete*.

To copy a channel:

1. Navigate to the desired channel and select “Channel Copy” or momentarily press **Zone Edit** button. The channel is now stored in memory and the user must pick a destination for the stored channel.
2. Select the destination, first the zone and then the channel. Only zones programmed as editable get displayed. To select these, use either the navigation pad or direct entry.
3. If the destination channel exists, it gets overwritten without warning. If the destination channel is unprogrammed, the channel gets copied to the unprogrammed channel location.

When deleting a channel, first select a zone and then select the channel to delete.

There are a number of restrictions in place to prevent you from causing problems with the existing radio configuration. If you want to copy or delete a channel that is blocked by one of these restrictions, the radio programming software can be used to make the change. (Please contact your system administrator.)

⚠ CAUTION *Any changes using Zone Edit will be permanent. Your system administrator can reverse these changes using Armada programming software.*

Table 3.4 shows conditions in which copy and delete functions are allowed.

Table 3.4 Channel Conditions for Copy and Delete Functions

Condition	Copy Allowed?	Delete Allowed?
The destination channel is the current channel	No	No
The selected zone is full (255 Channels)	No	Yes
The radio has no free channels	No	Yes
The channel is a fire mode channel	No	No
The channel is a scan list channel	No	No
The channel is a RWS list channel	No	No
The channel is a global emergency channel	No	No

3.1.10 Transmit Disable

Transmitting can be disabled on each conventional, P25 Trunking, V16 Single Site, and V16 Multi Site channel so that the channel is monitor-only. When transmitting is attempted on a receive-only channel, “Receive Only” is displayed and an error tone sounds.

3.1.11 Operation at Extended Range

When approaching the limits of radio range, the other party may not be able to hear your transmissions, and there may be an increase in background noise when messages are received. You may still be out of range even though you can hear a message. The reason for this is that the signal you are receiving is usually transmitted at a higher power level than the one transmitted by your radio. Communication may be improved by moving to higher ground or away from shielding objects such as tall buildings or hills. The radio can be programmed to provide an out-of-range indicator when used on an EFJohnson Infrastructure system. For more information, refer to Section 5.14.4.

3.1.12 Preventing Vehicle Battery Discharge

In standby mode (power on, not transmitting), radio power consumption is relatively low. Therefore, you should be able to leave the radio ON for one or two days without operating the vehicle, and the battery should not discharge considerably. However, if the outdoor temperature is low enough to significantly decrease battery capacity, the radio should be turned OFF when not in use. Also, if the display is set to "high" and you are receiving calls, the battery charge can drain in less than a day.

Since power consumption is significantly higher when transmitting, it is good practice to have the vehicle running while transmitting. This ensures that optimum power is being delivered to the radio and that the battery does not become discharged.

3.1.13 Cleaning the Control Head

The radio control head requires periodic cleaning, depending upon the operating environment. You will need a soft brush of a size that can access all exposed areas of the control head. You will also need a vacuum cleaner that is portable enough to easily access the control head.

To Clean the Control Head

1 Use the brush to remove the bulk of sand and dust from the control head.

⚠ CAUTION *Ensure that this is done in a manner that prevents other equipment from being affected by the removed sand and dust. If necessary, use the vacuum to collect material as it is removed.*

2 When the bulk of sand and dust is removed, use the brush to clean the interface joint between the buttons and control head plastic.

3 Position the vacuum nozzle two inches (or more, as required) from the face of the control head. Use the brush to remove any remaining sand and dust.

4 Repeat this procedure until the control head is completely clean.

3.1.14 Radio Service

If "UNPROGRAMD" is displayed, the cause can be any of the following:

- An unprogrammed channel is selected. Select a programmed channel.
- The selected channel is programmed for an option that is not installed or an error in programming was detected. Contact your system operator for service.

If the channel is programmed for a system type not programmed, “DISABLED” is displayed.

If some other problem is occurring, turn power OFF and then ON again to reset the control logic. Also make sure that the controls are properly set and that the power, external speaker, and accessory cables (if used) are securely plugged into the back of the radio.

If the radio is completely inoperative, check the Main power and ignition sense line fuse. If it is blown, remedy the cause if possible and replace it with the same type (1A, 15A). If the radio still does not operate properly, return it to your system operator for service.

Note *There are no user-serviceable components in the radio. Altering internal adjustments can cause illegal emissions, void the warranty, and result in improper operation that can seriously damage the radio.*

Note *If the vehicle itself needs to be jump started, the mobile fuses must be pulled before jump starting to prevent damage to the radio!*

3.1.15 Clock Sync

The radio’s internal clock can be synced with a GPS or system clock source. There are three clock source options:

- Internal
- GPS
- System

The GPS option syncs the internal clock when the GPS is on and there is a valid GPS signal. The system syncs the internal clock when there is a valid TIME_DATE_ANN outbound signaling packet (OSP). The GPS and system only syncs the internal clock once when power is applied to the radio. Toggling between clock sources will also sync again when there is a valid GPS signal or a valid TIME_DATE_ANN OSP.

The clock source can be selected on the radio in the Clock submenu, which includes the following three options:

- Src:Intern
- Src:GPS
- Src:System

These options can be toggled by pressing the **Enter** button. A second option to toggle between clock sources is to press the Clock Source button. When the clock source is set to system, the radio overrides the Armada time zone if the OSP has a valid local time offset. Otherwise, the radio uses the Armada time zone. The local time offset will be saved through a power cycle and will be used as long as the clock source is set to “System.” If the clock source changes, the time zone from Armada is used.

3.2 Single Touch

The Single Touch feature allows a Viking radio user to send a predefined Status, Message, Call Alert™, Unit Call, or Interconnect Call by pressing and holding a button. For each system, up to eight buttons in Armada can be programmed for Single Touch. The Single Touch feature allows a user to bypass the menu and PTT to send a Status, Message, Call Alert, Unit Call, or Interconnect Call. A maximum of eight buttons are programmable to the radio per system and zone.

- For radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, the Single Touch buttons can be either activated on press or press & hold.
- For radios using Firmware Version 8.32.x or earlier programmed by Armada 1.32.x and earlier, Single Touch buttons are press and hold buttons preventing a user from sending statuses, messages, and calls by accident.

On a Single Touch button press, the radio displays two dual temporary messages. The first displays which Single Touch button was pressed along with the press and hold message. The second displays the Alias and the ID/Phone Number (if applicable. Only the Alias is displayed for Status and Message since neither has an ID).

3.2.1 Single Touch Buttons

1 The Single Touch buttons are activated on a press and hold, which is in the range of 0.5 to 2.5 seconds. This is set in Armada.

2 Both physical and soft buttons can be used for Single Touch, but Single Touch is not available as a menu item.

3 If a Single Touch button is pressed, or pressed and held, but the Feature combo box is set to Disabled in Armada, then “Disabled” is displayed along with a short bad beep tone.

4 Table 3.5 shows the supported Single Touch functions for each system.

Table 3.5 Single Touch Functions

Function	Supported Functions			Specific Entry Type
	Conventional	P25 Trunking	Viking16	
Disabled	✓	✓	✓	-
Unit Call	✓	✓	✓	Call List
Call Alert	✓	✓	✓	Call List
Status	✓	✓	✓	Status List

Table 3.5 Single Touch Functions

Function	Supported Functions			Specific Entry Type
	Conventional	P25 Trunking	Viking16	
Message	✓		✓	Message Aliases List
Interconnect Call	✓[a]	✓	✓	Phone List

a. For radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later

3.2.2 Detailed Single Touch Operation

The following describes how each supported Single Touch function operates, and how functions vary slightly from system to system. As a note, only Digital conventional channels support Single Touch functionality. If a Single Touch button is used on an Analog Conventional channel, the temporary message “Analog” is displayed.

3.2.2.1 Conventional Unit Call

This is the only function that requires the user to press the PTT to send the call.

To Send a Single Touch Unit Call

1 Press and hold the Single Touch button assigned to Unit Call.

2 The Unit ID to call is displayed on the top line with the Alias displayed on the bottom line.

3 To send the call, press the PTT button.

4 The operation will now continue in the same manner as a Unit Call.

5 To exit the call, press the Clear button or the Single Touch button assigned to Unit Call.

To Answer a Unit Call Using Single Touch

1 When the radio is receiving an incoming call, press and hold the Single Touch button assigned to Unit Call.

2 The PTT button must then be pressed to answer.

3 Once the PTT button has been pressed the operation continues in the same manner as the typical Unit Call.

4 To exit the call, press the Exit soft button or the Single Touch button assigned to Unit Call.

3.2.2.2 Conventional Call Alert

Note *For radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, analog conventional channels support Single Touch Call Alert, as do digital conventional channels.*

1 To use Call Alert, the Call Alert Encode option must be checked in **Armada** under **Systems (Conventional) > General Options > P25 Conv System Options**.

2 Without this checked, a bad tone will sound on a press and hold.

3 To send a Call Alert, press and hold the Single Touch button assigned to Call Alert.

4 While sending the Call Alert, the Unit ID of the radio receiving the alert is displayed on the top line along with the alias on the bottom line.

5 Once a Call Alert has been sent, operation continues in the same manner as the normal Call Alert.

6 To exit the call alert, press the Exit soft button or the Single Touch button assigned to Call Alert.

3.2.2.3 Conventional Status

1 To send a Status, press and hold the Single Touch button assigned to Status.

2 While sending a Status, the alias of the Status being sent is displayed.

3 Once the Status has been sent, operation continues in the same manner as the normal Status, with the following exception: only the PTT can be used to resend the Status while the transmission is still active.

4 Once the status transmission is successful or fails, a success or failure message is displayed.

5 After a success or failure, the radio exits status mode.

6 To exit before the Status finishes, press the Exit soft button or the Single Touch button assigned to Status.

3.2.2.4 Conventional Message

This is the same operation as Conventional Status except that a Message is being sent.

1 To send a Message, press and hold the Single Touch button assigned to Message.

2 While sending a Message, the alias of the Message being sent is displayed.

3 Once the Message has been sent, operation continues in the same manner as the normal Message, with the following exception: only the PTT can be used to resend the Message while the transmission is still active.

4 Once the Message transmission is successful or fails, a success or failure message is displayed.

5 After a success or failure, the radio exits Message mode.

6 To exit before the Message finishes, press the Exit soft button or the Single Touch button assigned to Message.

3.2.2.5 Conventional Interconnect

For radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later

1 To start an Interconnect Call, press and hold the Single Touch button assigned to Interconnect.

2 The alias of the phone number being called will be displayed.

3 Once the call begins through Single Touch, operation continues as normal for an Interconnect Call.

4 To exit the call, press the Exit soft button or the Single Touch button assigned to Interconnect.

5 To answer an Interconnect Call with the Single Touch button, press and hold it.

6 Once pressed and held, the incoming call will be answered and operation will continue as normal for an Interconnect Call answer.

Note *The Armada administrator can configure Conventional Interconnect calls to use the interconnect encryption key.*

3.2.2.6 P25 Unit Call

In Armada, the Unit Call can be set to Standard or Enhanced. Single Touch supports both, and they each operate the same as a normal Standard or Enhanced Unit Call. To answer a unit call, the PTT should be pressed after the Single Touch button is pressed and held.

To Send a Single Touch Unit Call

1 To send a Unit Call, press and hold the Single Touch button assigned to Unit Call.

2 For the radio to send, the Unit Call Usage in Armada under **Systems (P25) > Lists > Call Settings** must be set to **Unlimited** or **List Only**.

3 If Unit Call Usage is set to Disabled or Response Only, the radio will display "Disabled" or "Response Only" when the Single Touch button is pressed and held.

4 Once the Unit Call has been sent, operation continues as normal for Unit Call.

5 The alias of the radio being called followed by "wait" will be displayed.

6 If the radio called does not answer, a time-out message is displayed. When this is displayed, any button on the radio exits the Unit Call.

7 To exit the call press the Exit soft button or the Single Touch button assigned to Unit Call.

To Answer a Unit Call Using Single Touch

1 When receiving a Unit Call, press and hold the Single Touch button assigned to Unit Call.

2 Press the PTT button to answer the Unit Call.

3 For the radio to receive, the Unit Call Usage in Armada under **Systems (P25) > Lists > Call Settings** must be set to **Response Only**, **List Only**, or **Unlimited**.

4 Once the received Unit Call is active, operation continues as normal for Unit Call.

5 The alias of the calling radio will be displayed.

6 To exit the call press the Exit soft button or the Single Touch button assigned to Unit Call.

3.2.2.7 P25 Call Alert

1 To send a Call Alert, press and hold the Single Touch button assigned to Call Alert.

2 For the radio to send the Call Alert, the Call Alert Usage in Armada under **Systems (P25) > Lists > Call Settings** must be set to **List Only** or **Unlimited**.

3 Once the alert is sent, operation continues as normal for Call Alert.

4 After the alert is sent, either an Ack Received message or a No Ack message is displayed, and Call Alert is exited.

5 To exit before those messages, press the Exit soft button or the Single Touch button assigned to Call Alert.

3.2.2.8 P25 Status

1. To send a Status, press and hold the Single Touch button assigned to Status.
2. The Status alias programmed to Single Touch is displayed for one second.
3. Either an Ack Received message or a Status Fail message is displayed after the Status has been sent.
4. Once the Status is sent, operation continues as normal. For example the same buttons are available for use as they would be by sending a Status through the menu.
5. The Status cannot be exited during sending unless it is canceled by another function. The user must wait for the Ack or the Fail message.

3.2.2.9 P25 Interconnect

1. To start an Interconnect Call, press and hold the Single Touch button assigned to Interconnect.
2. The alias of the phone number being called will be displayed.
3. Once the call begins through Single Touch, operation continues as normal for an Interconnect Call.
4. To exit the call, press the Exit soft button or the Single Touch button assigned to Interconnect.
5. To answer an Interconnect Call with the Single Touch button, press and hold it.
6. Once pressed and held, the incoming call will be answered and operation will continue as normal for an Interconnect Call answer.

3.2.2.10 V16 Unit Call

In Armada, the Unit Call can be set to Standard or Enhanced. Single Touch supports both, and they each operate the same as a normal Standard or Enhanced Unit Call. To answer a unit call, the PTT button must be pressed after the Single Touch button is pressed and held.

To Send a Single Touch Unit Call

1. To send a Unit Call, press and hold the Single Touch button assigned to Unit Call.
2. For the radio to send, the Unit Call Usage in Armada under **Systems (Viking16) > Lists > Call Settings** must be set to **Unlimited** or **List Only**.

3 If it is set to Disabled or Response Only, the radio will display “Disabled” or “Response Only” when the Single Touch button is pressed and held.

4 The alias of the radio being called will be displayed.

5 The operation will now continue the same as a normal Unit Call.

6 If the radio called does not answer, a No Ack message is displayed. When this is displayed, any button on the radio exits the Unit Call.

7 To exit the call, press the Exit soft button or the Single Touch button assigned to Unit Call.

To Answer a Unit Call Using Single Touch

1 When receiving a Unit Call, press and hold the Single Touch button assigned to Unit Call.

2 Press the PTT button to answer the Unit Call.

3 For the radio to receive, the Unit Call Usage in Armada under **Systems (Viking16) > Lists > Call Settings** must be set to **Response Only**, **List Only**, or **Unlimited**.

4 Once the received Unit Call is active, operation continues as normal for a Unit Call.

5 The alias of the calling radio will be displayed.

6 To exit the call, press the Exit soft button or the Single Touch button assigned to Unit Call.

3.2.2.11 V16 Call Alert

1 To send a Call Alert, press and hold the Single Touch button assigned to Call Alert.

2 For the radio to send the Call Alert, the Unit Call Usage in Armada under **Systems (Viking16) > Lists > Call Settings** must be set to **List Only** or **Unlimited**.

3 The Unit ID of the radio receiving the alert is quickly displayed, followed by the wait message until an Ack or No Ack message is displayed.

4 Once the alert is sent, operation continues as normal for Call Alert, and all buttons that are available in Call Alert are available in Single Touch Call Alert.

5 To exit before those messages are received, press the Exit soft button or the Single Touch button assigned to Call Alert.

3.2.2.12 V16 Status

1 To send a Status, press and hold the Single Touch button assigned to Status.

2 The Status alias programmed to Single Touch is displayed for one second.

3 Either an Ack Received message or a Status Fail message is displayed after the Status has been sent.

4 Once the Status is sent, operation continues as normal for Status.

5 The Status cannot be exited during sending unless it is canceled by another function. The user must wait for the Ack or the Fail message.

3.2.2.13 V16 Message

This is same operation as Viking16 Status except that a Message is being sent.

1 To send a Message, press and hold the Single Touch button assigned to Message.

2 The Message alias programmed to Single Touch is displayed for one second.

3 Either an Ack Received message or a Message Fail message is displayed after the Message has been sent.

4 Once the Status is sent, operation continues as normal for Message.

5 The Message cannot be exited during sending unless it is canceled by another function. The user must wait for the Ack or the Fail message.

3.2.2.14 V16 Interconnect

1 To start an Interconnect Call, press and hold the Single Touch button assigned to Interconnect.

2 The alias of the phone number being called will be displayed.

3 Once the call is started through Single Touch, operation continues as normal for Interconnect Call.

4 To exit the call, press the Exit soft button or the Single Touch button assigned to Interconnect.

5 To answer an Interconnect Call with the Single Touch button, press and hold it.

6 Once pressed and held, the incoming call will be answered and operation will continue as normal for Interconnect Call.

3.3 Radio Inhibit

The radio can receive inhibit commands over the air. When the radio receives an inhibit command the screen goes blank, audio stops, lights turn off, and most of the controls are disabled. The radio is (from the user's perspective) frozen. In the background, however, the radio is still running. It is waiting for an uninhibit command. If it receives an uninhibit command, the radio User Interface is enabled, and the radio operates normally.

The idea behind the radio inhibit feature is simple, but there are exceptions:

- Armada cannot be used to uninhibit a radio. (Unless an "Allow Uninhibit with RSD" security policy is on the radio)
- If the radio is rebooted while inhibited, the radio is forced to power up on the channel it was inhibited on.
- When powering up while inhibited, the backlight and LED will not come on.
- When powering down while inhibited, the display will not display "Powering Down."

Note *For radios in conventional systems using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, the Armada administrator can program the radio to enable the user to block incoming inhibit requests. If the user disables inhibits and the radio receives an inhibit request, the message BLOCKED RADIO INHIBIT appears on the radio.*

3.4 Setting Squelch

The user can program a menu item, soft button, or function button, for squelch adjust. While on a conventional analog channel without emergency or scan active, the user can select the programmed button or menu item for squelch adjust. The current squelch setting shows on the display. The user can adjust the squelch setting to a desired level from -7 to +7 as follows:

- On the VM5000, use the Right Up/Down buttons ▲/▼.
- On the VM6000, press the Up/Down buttons on the Navigation Pad or rotate the Select switch.
- On the VM7000, press the Navigation Pad Up/Down buttons.

Decreasing the value toward -7 causes the squelch to open sooner for weaker signals, while increasing toward +7 has the opposite effect. Pressing the Select button stores the new squelch setting and returns the user to the main display.

The squelch level is preset and may not require readjustment. However, if the squelch threshold needs to be changed on a conventional analog channel, it can be changed using keypad programming, if available. The squelch level is preset during alignment. If the keypad programming feature is available (see Section 5.15), the squelch threshold can be changed by the user on each conventional analog channel.

Note *The Keypad Programming feature is available to Federal Government users only.*

3.5 Operating Modes

Each selectable channel can be programmed for the conventional (analog or Project 25 digital), Viking16, or Project 25 digital trunking operating mode. For example, Zone 1/ Channel 1 could be a conventional channel, Zone 1/Channel 2 a V16 Single Site channel, and so on. More information on these modes follows.

Note *All operating modes use certain functions that are activated/deactivated by pressing and holding a particular button or switch. The "hold" interval is preset. When instructed to "press and hold", do so until the desired action occurs or a tone sounds indicating the option is activated. For other operations (not specified "press and hold") only momentary pressing is required.*

3.5.1 Conventional Mode

Conventional mode is a non-trunked operating mode that accesses independent radio channels. There is no automatic access to several channels. Selecting a conventional channel selects a transmit and receive frequency and other channel parameters such as squelch control coding.

Conventional channels can be either standard (analog), P25 (digital), or mix mode. With digital operation, the digital signal processor (DSP) converts the audio signal to digital data packets. Another difference is that analog channels use Call Guard (CTCSS/DCS) squelch control and P25 channels use a network access code (NAC) and talkgroup ID codes.

With P25 operation, a NAC is transmitted which must match the NAC programmed in the repeater or base station equipment and the radio(s) being called for communication to occur. In addition, to receive standard group calls, the receiving radio must be programmed to detect the transmitted talkgroup ID code.

With conventional operation, a busy channel condition is detected automatically if the busy channel lockout (transmit disable on busy) feature is programmed. Otherwise, it must be detected manually. If the Out of Range indicators are not programmed, an out-of-range condition is not indicated by special tones or messages as with trunking operation because there is no initial data exchange with the repeater that allows this condition to be detected. (For more information about Out of Range indicators, please see Section 3.1.11.) Operating features unique to conventional channels are described in Section 5.

3.5.2 Viking16 Mode

This is a trunked operating mode in which automatic access is provided to several radio frequency (RF) channels. ID codes are used to select which radios are being called and which calls are received. Monitoring is performed automatically, and special messages and tones indicate busy and out-of-range conditions.

V16 Single Site and V16 Multi Site operation and programming is very similar. Basically, V16 Single Site operation is limited to a single repeater site, and V16 Multi Site operation allows automatic roaming between sites. Viking16 features include roaming (V16 Multi Site only), telephone, unit, emergency calls, Call Alert, and messaging. Either analog or digital signaling can be used. Enhanced Viking16 features provide the same functionality, plus responses from the system. For example, if the ID you are calling is turned OFF, the system will display “NOT AVAILABLE”.

When a V16 Single Site or V16 Multi Site channel is selected or the radio is powered up on one of those channels, it searches for a control channel. During the search, the alias (name) of the selected channel is displayed, and the radio attempts to register on the trunked system. If a control channel could not be found (for example, because of an out of range condition or the system ID is not correct), “OUT OF RNG” is displayed, and the radio continues to search for a control channel.

The control channel transmits and receives system information to and from all radios registered on the system. Therefore, once a control channel is found, it is continuously monitored for incoming call information and is used to make call requests. When the radio is keyed, a channel grant request is sent through the control channel. The system then informs the requesting radio what traffic channel to use, through the control channel. After the request is granted by the system, the radio moves to the designated traffic channel for the actual talkgroup call. After the transmission has ended, the radio returns to the control channel.

Operating features unique to Viking16 channels are described in Section 6.

3.5.3 P25 Trunking Mode

The P25 Trunking operating features are similar to the V16 Multi Site features described previously. Since V16 Multi Site features are also similar to V16 Single Site features, all three modes are described in Section 6. Some differences between the P25 Trunking and V16 Multi Site modes are as follows:

- Digital signaling is always used with P25 calls. Either analog or digital signaling can be used for V16 Multi Site calls.
- Calls made to a specific radio in P25 mode are called Unit Calls. In Viking16 mode, they are also called Unit Calls.
- Telephone calls are available in this mode.
- The P25 control channel data rate is 9600 baud and the digital voice data rate is also 9600 baud. With V16 Multi Site operation, the control channel data rate is 3600 baud (both digital and analog calls) and the narrowband digital voice data rate is 9600 baud.
- The P25 mode uses a system ID, wide area communications network (WACN) ID, and RF subsystem ID (RFSS). The V16 Multi Site mode does not use the WACN or RFSS IDs.
- P25 Unit IDs can be between 1 and 16,777,211 (000001-FFFFFB hex), and V16 Multi Site Unit IDs can be between 1 and 65,534 (0001-FFFE hex).

3.5.4 Systems, Channels, and Zones

A zone and channel are selected to place and receive calls. The following describes the relationship between systems, channels, and zones.

3.5.4.1 Systems

A system is a collection of channels or talkgroups belonging to the same repeater site. It defines all the parameters and protocol information required to access a site. Up to 255 systems of any type can be programmed depending on the option enabled. The maximum number of channels assignable to a system is limited to 4096. Channels can also be limited by radio limitations, programmed options, and/or available memory space as described in the following information.

3.5.4.2 Channels

A channel selects a radio (RF) channel or talkgroup as follows:

- **Conventional Analog Mode -** A channel selects a specific radio channel, Call Guard (CTCSS/DCS) squelch coding, and other parameters unique to that channel.

- **Conventional Project 25 Mode -** A channel selects a specific radio channel, NAC squelch coding, talkgroup ID, and other parameters unique to that channel.
- **Trunked P25 and Viking16 Modes -** A channel selects a specific talkgroup/ announcement group, emergency group, and other parameters unique to that talkgroup.

A maximum of up to 4096 channels can be programmed with the preceding modes depending on the option enabled. These channels can belong to a single system or multiple systems.

3.5.4.3 Zones

A zone is a collection of up to 255 channels of any type. For example, a zone could include 12 conventional channels and four P25 Trunking channels. Zones can be used to program the channels used for operation in different geographical areas. The maximum number of zones is 255.

3.5.4.4 Talkgroups

There are two types of talkgroups: home and foreign. These talkgroups have separate counters when Inter-System roaming is enabled, and each is limited to 2048 for a total of 4096 possible talkgroups. Selecting Add Home adds a default home talkgroup. Selecting Add Foreign displays a dialog allowing the user to select a Talkgroup ID, System ID, and WACN for the new talkgroup.

3.6 Manual Trace Creation

When troubleshooting with the assistance of KENWOOD technical support or engineering personnel, gathering debug trace information for their review might be helpful. Viking Trace Lite is a software tool that can be provided by KENWOOD technical support or engineering personnel to assist with troubleshooting. However, in some cases Viking Trace Lite is not immediately available.

For radios using Firmware Version 8.32.x or later programmed by Armada 1.32.x and later, when an engineer needs to gather a trace out in the field, the user can press ◀, ▶, ◀, ▶ on the Four-Way Navigation Pad, followed by the Select Button within four seconds. Then when the user gets access to Viking Trace Lite, the trace data can be pulled off the radio.

Exception: The VM5000 and its KCH-19 does not have a Four-Way Navigation Pad. However, the user can perform the same procedure by pressing the F2, F3, F2, F3 one-touch programmable buttons, followed by the Select Button within four seconds.

SECTION

4

Radio Wide Features

Radio wide features are features common to all operating modes. This chapter contains the following sections:

4.1 Option Buttons

For the VM6000, five soft buttons with a programmed display can be programmed to control different functions. In addition, there are 5 other programmable buttons:

- Red Auxiliary button
- Left Up/Down buttons
- Navigation Pad Left/Right buttons

Figure 4.1 VM6000 Option Buttons

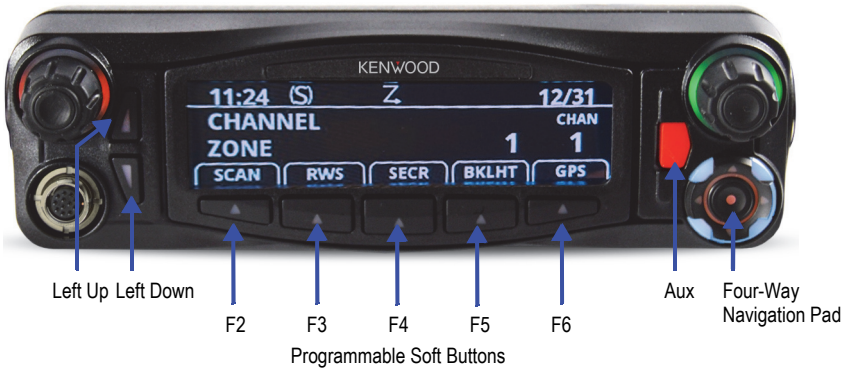
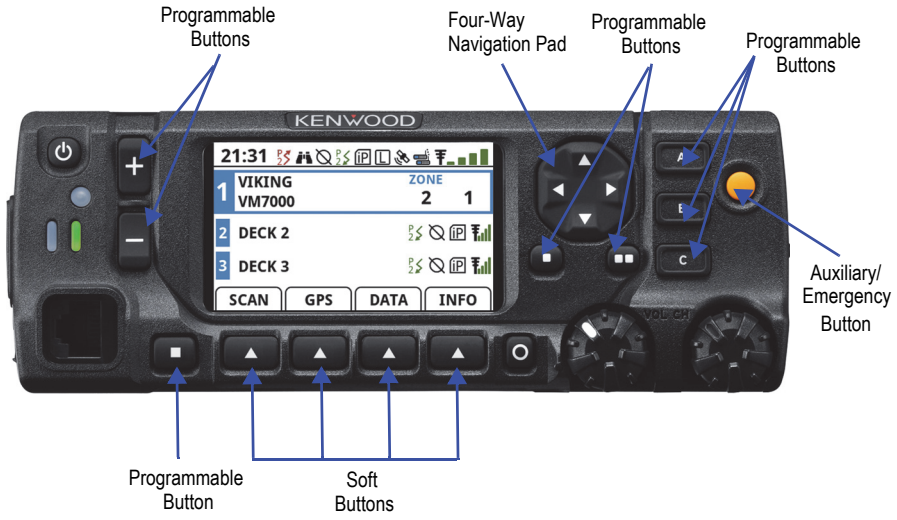


Figure 4.2 VM5000 Option Buttons

Figure 4.3 VM7000 Option Buttons



For both the VM5000 and VM6000 models, up to 10 rows of functions can be assigned to the soft buttons per protocol, and you can cycle through them using the programmed Soft Left/Right buttons (typically the Navigation Pad Left/Right buttons, which are also manually programmed for this function.

Table 4.1 shows the available functions in each mode.

Table 4.1 Available Functions

Function	X = Available in Mode:				Menu Display (VM5000/6000/7000)
	Conventional	Project 25 Trunking	V16 Single Site	V16 Multi Site	
AUX1	X	X	X	X	AUX1
AUX2	X	X	X	X	AUX2
AUX3	X	X	X	X	AUX3
Alert tones	X	X	X	X	Tones
Analog Noise Reduction	X		X	X	Analog Noise Rd
Analog Two Tone List	X				Analog 2T List
Authentication Keyload		X			Auth Keyload
Auto Site Search		X		X	Auto Site
Backlight Bright/ Medium/Dim/Off	X	X	X	X	Backlight
Bluetooth	X	X	X	X	Bluetooth
Bluetooth Rx Audio	X	X	X	X	BT Rx Audio
C-Channel PTT	X	X	X	X	

Shaded features support the secondary press and hold function.

Table 4.1 Available Functions (Continued)

Function	X = Available in Mode:				Menu Display (VM5000/6000/7000)
	Conventional	Project 25 Trunking	V16 Single Site	V16 Multi Site	
C-Channel/PA Toggle	X	X	X	X	
Call Alert (Paging)	X	X	X	X	Call Alert
Call Response	X	X	X	X	Call Response
Cancel Dynamic Regroup		X	X	X	Cancel Dyn Rgrp
Change Keyset	X	X	X	X	Change Keyset
Change Theme	X	X	X	X	Change Theme
Change User Password	X	X	X	X	Password
Channel Down	X	X	X	X	
Channel Announcement	X	X	X	X	Chan Announce
Channel Rx OST	X				Channel Rx OST
Channel Tx OST	X				Channel Tx OST
Channel Select	X	X	X	X	Channel Select
Channel Up	X	X	X	X	
Clear	X	X	X	X	
Clear/Secure Encryption Select	X	X	X	X	Security
Cross Band Repeat On/Off	X				Cross Band Repeat On/Off
Clock	X	X	X	X	Clock
Clock Source	X	X	X	X	
Deck Volume Offset Down	X	X	X	X	Deck Vol Off Down
Deck Volume Offset Up	X	X	X	X	Deck Vol Off Up
Disable Call Guard	X				Disable CG
Display GPS	X	X	X	X	Display GPS
Display Information	X				Display
Emergency Mode	X	X	X	X	Emergency
Emergency Clear	X	X	X	X	Emergency Clear
Erase Keys	X	X	X	X	Erase Keys
Function Recall	X	X	X	X	Function Recall
GPS	X	X	X	X	GPS
GPS/BT Reset	X	X	X	X	GPS/BT Rst
High/Low Power	X	X	X	X	Tx Power
Home	X	X	X	X	Home

Shaded features support the secondary press and hold function.

Table 4.1 Available Functions (Continued)

Function	X = Available in Mode:				Menu Display (VM5000/6000/7000)
	Conventional	Project 25 Trunking	V16 Single Site	V16 Multi Site	
Home 2	X	X	X	X	Home 2
Home 3	X	X	X	X	Home 3
Home 4	X	X	X	X	Home 4
Home 5	X	X	X	X	Home 5
Horn Honk	X	X	X	X	Horn Honk
Instant Recording Replay	X	X	X	X	IRR
Key Select	X	X			Key Select
Keypad Programming	X				Keypad Program
Menu	X	X	X	X	
Message	X	X	X	X	Message
Mic To PA	X	X	X	X	Mic To PA
Monitor Mode	X				Monitor
Monitor Rx	X				Monitor Rx
Mute/Unmute	X	X	X	X	Audio Mute
Noise Blanker	X				Noise Blanker
Normal/Selective Squelch	X				Squelch
Nuisance Delete	X	X	X	X	Nuis Del
OORI Tone	X				OORI Tone
P25 Packet Data	X	X			P25 Data
P25 Two Tone List	X	X			P25 2T List
P25 Two Tone Unmute	X	X			P252T Unmute
Phone Call	X	X	X	X	Phone
Priority Channel Select	X				Priority
RWS List Edit	X	X	X	X	RWS Edit
RWS List Select	X	X	X	X	RWS Selct
Radio Info	X	X	X	X	Radio Info
Radio Wide Scan	X	X	X	X	RW Scan
Rekey Request	X	X			OTAR Rekey
Repeater Enable	X	X	X	X	Repeater Enable
Repeater Enable With Priority Lock	X	X	X	X	Repeater Enable with Lock
Repeater Priority Lock	X	X	X	X	Rep Pri Lock
Repeater Talk Around	X				Talk Around

Shaded features support the secondary press and hold function.

Table 4.1 Available Functions (Continued)

Function	X = Available in Mode:				Menu Display (VM5000/6000/7000)
	Conventional	Project 25 Trunking	V16 Single Site	V16 Multi Site	
Request to Talk	X				RTT
RX to PA	X	X	X	X	Rx To PA
S-Channel PTT	X	X	X	X	
Scan Mode	X	X	X	X	Scan
Scan List Edit	X	X	X	X	Scan Edit
Scan List Select	X	X	X	X	Scan Select
Select	X	X	X	X	
Single Tone Encoder	X				Single Tone Enc
Single Touch 1	X	X	X	X	
Single Touch 2	X	X	X	X	
Single Touch 3	X	X	X	X	
Single Touch 4	X	X	X	X	
Single Touch 5	X	X	X	X	
Single Touch 6	X	X	X	X	
Single Touch 7	X	X	X	X	
Single Touch 8	X	X	X	X	
Site Lock		X		X	Site Lock
Site Search		X		X	Site Search
Smart Siren Button 1	X	X	X	X	SmartSiren 1
Smart Siren Button 2	X	X	X	X	SmartSiren 2
Smart Siren Button 3	X	X	X	X	SmartSiren 3
Smart Siren Button 4	X	X	X	X	SmartSiren 4
Smart Siren Button 5	X	X	X	X	SmartSiren 5
Smart Siren Button 6	X	X	X	X	SmartSiren 6
Smart Siren Button 7	X	X	X	X	SmartSiren 7
Smart Siren Button 8	X	X	X	X	SmartSiren 8
Smart Siren Button 9	X	X	X	X	SmartSiren 9
Smart Siren Button 10	X	X	X	X	SmartSiren 10
Smart Siren Button 11	X	X	X	X	SmartSiren 11

Shaded features support the secondary press and hold function.

Table 4.1 Available Functions (Continued)

Function	X = Available in Mode:				Menu Display (VM5000/6000/7000)
	Conventional	Project 25 Trunking	V16 Single Site	V16 Multi Site	
Smart Siren Button 12	X	X	X	X	SmartSiren 12
Smart Siren Button 13	X	X	X	X	SmartSiren 13
Smart Siren Button 14	X	X	X	X	SmartSiren 14
Smart Siren Button 15	X	X	X	X	SmartSiren 15
Smart Siren Signal Master Button	X	X	X	X	SS Signal Master
Smart Siren Slide Position 1	X	X	X	X	SS Slide 1
Smart Siren Slide Position 2	X	X	X	X	SS Slide 2
Smart Siren Slide Position 3	X	X	X	X	SS Slide 3
Smart Siren Warning Button	X	X	X	X	SS Warning
Soft Buttons Left	X	X	X	X	
Soft Buttons Right	X	X	X	X	
Speaker Attenuation On/Off	X	X	X	X	Speaker Attenuation On/Off
Squelch Adjust	X				Squelch Adjust
Squelch List Select	X				Squelch Code
Status	X	X	X	X	Status
Surveillance Mode	X	X	X	X	Surv Mode
Talkgroup Lock	X				TG Lock
Talkgroup Select	X				Select TG
Text Messaging	X				Text Message
Toggle Theme Mode	X	X	X	X	Theme Mode
Tone Volume Edit - Alert	X	X	X	X	Alert Volume
Tone Volume Edit - Keypress	X	X	X	X	Keypress Vol
Two Tone Encoder	X				Two Tone Enc
Two Tone Unmute	X				2T Unmute
Tx Audio	X	X	X	X	Tx Audio
Unit Call	X	X	X	X	Unit Call

Shaded features support the secondary press and hold function.

Table 4.1 Available Functions (Continued)

Function	X = Available in Mode:				Menu Display (VM5000/6000/7000)
	Conventional	Project 25 Trunking	V16 Single Site	V16 Multi Site	
Unprogrammed	X	X	X	X	
Unselected Volume Offset	X	X	X	X	US Vol Offset
Voice Announcements	X	X	X	X	Announce
Volume Down (VM5000 only)	X	X	X	X	
Volume Up (VM5000 only)	X	X	X	X	
Wi-Fi (VM5000 Remote and VM6000 only)	X	X	X	X	Wi-Fi
Zone/Channel Down	X	X	X	X	
Zone/Channel Up	X	X	X	X	
Zone Down	X	X	X	X	
Zone Edit	X	X	X	X	Zone Edit
Zone Select	X	X	X	X	Zone Select
Zone Up	X	X	X	X	
Select Deck 1	X	X	X	X	
Select Deck 2	X	X	X	X	
Select Deck 3	X	X	X	X	
Select Deck 4	X	X	X	X	
Select Deck Cycle	X	X	X	X	
Select Deck Down	X	X	X	X	
Select Deck Up	X	X	X	X	
Multiline Display Toggle	X	X	X	X	Multiline Display Toggle
Unselected RF Deck Mute	X	X	X	X	Unselected RF Deck Mute

Shaded features support the secondary press and hold function.

4.2 Menu Mode

To enter menu mode, press and hold the Select button (the [O] button on the VM5000/VM7000) or the Select switch button on the VM6000.

If “Load Menu From Last Selection” is enabled in programming, the last-used menu item will be highlighted when entering menu mode.

To scroll through the items on the menu list, use the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch to the desired item (VM6000), or use the Navigation pad (VM7000).

To select the desired item, press the Select button again. A single beep sounds when the switch is pressed.

To return to the previous screen, select Back or press <*F5*>.

Some radio features use “Left” and “Right” action buttons. On the VM6000/VM7000, these buttons are the left and right arrows on the 4-Way Navigation Pad. On the VM5000, <*F2*> performs as the “Left” button, and <*F3*> performs as the “Right” button.

To exit Menu mode, press <*F6*>.

4.3 Time-Out Timer

The time-out timer disables the transmitter if it is keyed for longer than the programmed time. It can be programmed on each channel for times of 5 seconds to 3 minutes 45 seconds, or it can be disabled. If the transmitter is keyed continuously for longer than the programmed time, the transmitter is disabled, a continuous tone sounds, and “TX TIMEOUT” is displayed. Five seconds before timeout occurs, a warning beep sounds to indicate that timeout is approaching. The timer and tone are reset by releasing the PTT switch.

A different time can be programmed for each system, and the timer can be enabled or disabled on each conventional channel. With conventional channels, a penalty time can also be programmed that prevents further transmissions for a certain time after the transmitter is disabled (see Section 5.6).

For conventional channels, the Tx Time Out, Penalty, and Conversation timers are enabled when “Time Out Alert” is checked in the Channels tab of Armada. The call will be ended if a unit call or interconnect individual call exceeds the Tx timeout time or the conversation timeout time. The call will not call through again until the penalty timer expires. One use of this feature is to prevent a channel from being kept busy for an extended period by an accidentally keyed transmitter. It can also prevent possible transmitter damage caused by transmitting for an excessively long period.

4.4 Receive-Information Display Time

For radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, if the radio is configured to display incoming call information when receiving a call, the Armada administrator can configure that information to display on the radio for an extended time period. This information can continue to appear even after the call ends.

4.5 Home Channel Select

If the HOME option button is programmed, pressing it selects the preprogrammed home channel. This provides a quick way of returning to a frequently used channel. Pressing and holding this button until a tone sounds makes the currently selected channel the new Home (if not disabled by Armada programming). Home channels 2 through 5 can also be programmed. If enabled by Armada programming, pressing the button again while still on the programmed home channel will cause the radio to revert to the channel the radio was on prior to the first press of the home button.

If a radio is programmed to use the “Selected” channel as a Home channel, then the “Selected” setting is not overwritten by a Home button Press and Hold.

Note *The radio can be optionally programmed with “Disable Home Press and Hold” so that Pressing and holding the Home option button causes the radio to switch to the existing Home or Home 2, 3, 4, or 5 instead of making the current selection the new Home.*

Home Zone and Home Channel cannot be set to “Selected” simultaneously. The same applies for Home Zones 2 through 5 and Home Channels 2 through 5. If Home or Home 2 through 5 is set to “Selected,” then the respective Home Channel will populate with channels 1 to 256.

If the user programs any of the home channels to a channel that is unprogrammed in the “Selected” zone, the display will show “Unprogrammed” and the unprogrammed channel tone will be heard. The radio is not in a locked state. Changing the channel or zone to a valid channel will allow normal radio operation.

4.6 Power Output Select

Each conventional channel, P25 Trunking, and Viking16 system can be programmed for High, Low, or Switchable transmit power. If Switchable power is programmed on the channel or system, the Hi/Lo Power option button can then be used to select high or low transmitter power. All models support switchable power. The low power target is typically 5W, and the rated power output level of the radio at the high power target is typically 28.5 to 50 W, depending on frequency band.

Pressing the Hi/Lo Power button toggles the power setting. The new level is flashed in the display when this button is pressed as HI POWER or LOW POWER. If selectable power is not permitted on the current channel or system, the fixed power level is flashed and no power change occurs. The selected power level is permanent until it is manually changed again. The power levels are set at the factory or when the radio is tuned using the Viking Tune™ software.

4.6.1 Transmit Power

The VM5000/VM6000/VM7000 protects the transmitter power amplifier by adjusting power during transmissions. Transmissions begin at full power, assuming the radio is not already hot. As the radio heats up, it reduces power slightly, by approximately 1 dB. If the radio's temperature continues increasing and approaches dangerous temperatures, a “Hot” message appears, and power is significantly reduced to approximately 2 W. Power is restored when the radio cools, and the cycle continues throughout the transmission. The values for temperature and power depend on the radio configuration.

For FDMA transmissions, the VM5000/VM6000/VM7000 only adjusts transmit power based on conditions at the start of a transmission. The VM5000/VM6000/VM7000 does not adjust transmit power based on voltage changes during an FDMA transmission.

4.7 Alert Tone Select

The various alert tones that sound are described in Section 9.1. These tones can be enabled and disabled if the TONE option button is programmed. To turn all tones OFF, press this button and “TONE OFF” is displayed. Then to turn all tones on again, press it and “TONE ON” is displayed. If this button is not programmed, tones are fixed in the ON or OFF condition by programming. Alert tones can be disabled depending on programming. If the Surveillance mode is programmed (see following), tones are totally disabled.

The Alert Tone volume can be adjusted relative to the volume control setting. This is done by programming and also by the user if the Alert Tone Volume option button is programmed. Relative levels of –255 to +255 can be set with "0" as the default setting. The range is divided into the number of volume ticks set in "Volume Ticks." For example, if "Volume Ticks" is 10, the tone adjustment on the radio ranges from 1 to 10. A negative value decreases the tone volume and a positive value increases it. The user adjusted level permanently overrides the programmed level if applicable.

4.8 Ignition Power Down Duration

The radio can be installed so that the vehicle ignition switch, as well as the front panel power switch of the radio, controls the power. This is accomplished by connecting the accessory cable ignition switch input to the vehicle ignition switch. Refer to the *VM5000/VM6000/VM7000 Installation Manual* for more information. A Power Down Duration of up to 1,440 minutes can then be programmed, or this feature can be disabled by programming "Infinite" delay so that there is no automatic power-off.

Both the ignition switch and the power switch must then be ON for radio power to turn on. The delay can be overridden at any time by turning power OFF using the front panel power switch or turning the ignition switch back ON.

This power down delay can allow calls to be received or the horn alert to be active for a time after the ignition switch is turned OFF. At the same time, the advantages of ignition switch control are available, such as preventing the battery discharge that might occur if the radio is left ON for an extended period.

4.9 Horn Alert

The horn alert feature sounds an external alert such as the vehicle horn when certain calls are received. It is available if a KAP-2 option board is installed, a Horn option button is programmed, and the proper connection has been made to the external alert. The horn alert output is Pin 6 of the E37-1113-05 accessory cable, and an external driver circuit of some type is usually required. Refer to the *VM5000/VM6000/VM7000 Installation Manual* for more information about installing this feature.

Additional information on the horn alert feature follows:

- For radios using Firmware Version 8.30.x or later programmed by Armada 1.30.x and later, the Armada administrator can program the radio to activate it when receiving any Unit Call, Call Alert, Interconnect Call, and/or Two Tone Page in the P25,

Conventional, Viking16, and P25 Trunking modes. It does not sound when receiving standard Group or telephone calls, and is not programmable on a per call basis.

- It must be manually enabled and disabled by the Horn option button. It is not controlled by the vehicle ignition switch. When it is enabled, "HORN ON" is briefly displayed, and when it is disabled, "HORN OFF" is briefly displayed. It defaults to the OFF mode whenever power is turned on.
- If a power down duration is programmed as just described, it is functional during that delay.
- When activated, it can be programmed to sound for three 0.5-second beeps or continuously for 2 to 255 seconds. It then turns OFF until another Unit call or Call Alert is received.
- For radios using Firmware Version 8.30.x or later programmed by Armada 1.30.x and later, all radios in a multideck configuration activate horn alert when any one radio in that configuration activates horn alert.

4.10 Microphone Off-Hook Detect

The microphone hanger can be connected to chassis ground and the radio programmed to detect an off-hook condition (Hangup Box Monitor selected). The following operation then occurs when the microphone is taken off-hook:

Conventional Channel Selected - Scanning temporarily halts (if applicable) and the Monitor Mode described in Section 5.2 is enabled. However, the receiver unsquelches only if a carrier is detected.

P25 Trunking/Viking16 Channel Selected - Scanning temporarily halts if applicable.

If the off-hook condition is not detected (Hangup Box Monitor not selected), the microphone hook state has no effect on radio operation.

4.11 Surveillance Mode

If the Surveillance mode is programmed, the backlight, all alert tones, and front panel LED indicator can be disabled individually or totally, based on programming.

The transmit/receive LED indicator, display and keypad backlight, and all alert tones can be disabled. When setting is enabled, the radio will power up in Surveillance mode with the selected options active. A function button can also be assigned which will activate and deactivate surveillance mode at the user's discretion. It overrides any other programming of these functions such as a Tone or Backlight option button.

This feature can be turned ON and OFF by the user by a menu selection or by the Surveillance Mode option button (if programmed). The user selected mode permanently overrides the programmed mode if applicable.

4.12 Public Address

This feature allows a single microphone to be used for either radio or public address. An external public address system can be connected to the radio accessory pigtail cable. External PA function without a siren controller is provided for cases when the siren function is not required. This is a low level output, so some type of PA amplifier is required. The Mic To PA option button (or menu selection) controls this feature.

In the public address mode, microphone audio is always routed to the PA system, and the radio can be programmed so that receive audio is also routed. When the PA is enabled/disabled, "EXT PA ON/OFF" is displayed momentarily. The radio can also be programmed to display "EXT PA ON" continuously. A button/menu function also allows the user to turn the "Receive Audio to External PA" function on and off.

A KAP-2 option board and E37-1113-05 6-pin connector are required. Pins 2 and 3 of the 6-pin connector are used to interface Public Address audio.

4.13 Scanning

Scanning monitors the channels in the scan list for traffic the radio is programmed to receive. When traffic is detected, scanning stops and the message is received. Shortly after traffic is complete, scanning resumes.

The user can enter the scan list edit mode for the selected scan list while the radio is scanning without manually turning scan off. If the user presses the scan edit button while the radio is scanning, the radio shall stop scan and enter directly into scan list edit mode for the selected scan list. The scan edit mode shall timeout after seven seconds of inactivity. If the scan edit mode times out, or the user exits the mode using the exit button or the scan list edit function button, the radio does not save changes to the scan list and restarts the scan. Pressing the select button in scan edit mode saves changes to the scan list and restarts the scan.

If the microphone off-hook condition is detected (Hangup Box Monitor selected by programming), scanning stops and selective squelch (such as Call Guard CTCSS or NAC/group ID detect) is disabled on conventional channels. If the microphone off-hook condition is not detected (Hangup Box Monitor is not programmed), taking the microphone off-hook has no effect on radio operation. When a call is received in the scan mode, the alias of the channel on which a call is received (and any other display parameters that may be programmed) are displayed until scanning resumes. The selected channel alias is then displayed if applicable.

There are two scan modes available: Priority (standard) and Radio Wide. The operation of the priority type is unique to the system type programmed on the selected channel, and the operation of the Radio Wide type is the same regardless of the system type programmed on the selected channel. Only one type of scanning can be enabled at a time. For example, if priority scanning is enabled and Radio Wide Scan is enabled, priority scanning is automatically disabled and vice versa. Refer to the following for more information.

4.13.1 Priority (Standard) Scanning

Priority scanning (also referred to as standard scanning) monitors only channels that are the same type as that currently selected. For example, if a conventional channel is selected, only conventional channels are scanned and likewise for P25 trunking and Viking16 channels. For more information on scanning functions in the Conventional mode, refer to Section 5.11, and for more information on how it functions in the other modes, refer to Section 6.11. Scanning is turned ON and OFF by menu selection or (if programmed) by the Scan option button as follows.

- To turn priority scanning on, press the Scan option button (or select using the menu). Scanning is enabled when  is displayed in the top middle of the display. When the radio is scanning channels, is solid. When the radio is in scan hold time, the icon flashes.
- To turn scanning OFF, press the SCAN option button again. Scanning is disabled when “SCAN OFF” is briefly displayed and is no longer indicated in the status display.
- If the zone or channel is changed while scanning is selected, scanning continues on the same or a different scan list (see Section 4.14.1).

Note *Each Conventional, P25 trunked, and Viking16 channel can be programmed so that scanning is automatically enabled when the channel is selected.*

4.13.2 Radio Wide Scanning

Radio wide scanning (RWS) monitors the channels in the preprogrammed radio wide scan list. This scan list may contain up to 16 channels of any type assigned to any zone (see Section 4.14.2). Radio wide scanning is turned ON and OFF by menu selection or by the RWS option button (if programmed) as follows:

Note *Use radio wide scanning only if two different types of channels need to be scanned at the same time, such as conventional and Viking16. Otherwise, use the more efficient priority scanning because there is less chance of missed calls.*

- To turn radio wide scanning on, press the RWS option button and "RW Scan On" is briefly displayed. In addition,  is displayed along with an **R** in the left Status position. When the radio is scanning channels,  is solid. When the radio is in scan hold time, the icon flashes.
- To turn radio wide scanning OFF, press the RWS option button again and "RW SCN OFF" is briefly displayed and  with **R** is no longer displayed.
- If the zone or channel is changed during radio wide scanning, scanning continues normally.
- Auto Scan is available for RWS. When the user has a channel set for Auto RWS, RWS begins whenever that channel is selected. The user can turn RWS off using the RWS button. If Auto Radio Wide Scan is turned ON for a specific channel, the radio scans the channels in the Radio Wide Scan List specified by Armada. It does not stop unless you change the scan mode manually using one of the programmed scan controls or you change the channel to a channel that does not have Auto Radio Wide Scan enabled.

  If the Force Auto Scan checkbox is checked and there is a valid scan list, Priority Auto Scan or Radio Wide Auto Scan cannot be turned off by the user. The user is also prevented from turning off Nuisance Delete, Entering Scan Edit, and Entering Scan List Select. Force auto scan is a per-channel option and uses a per-channel scan list. The user has the option of choosing a radio wide scan list per channel without force auto scan if the Global Radio Wide Scan List is programmed in Armada. Otherwise, all channels will use the Global Radio Wide Scan List.

4.13.3 Scan Hold Time

When traffic is received or transmitted while scanning, there is a delay before scanning resumes. The delay after receiving a call prevents other traffic from being received before a response can be made. The delay after transmitting a call ensures that a response is heard and prevents other traffic from occurring on some other channel.

Separate delay times are programmable for radio wide and priority scanning. With radio wide scanning, delays of 2 to 7.5 seconds can be programmed. With priority scanning, delays of 0 to 7.5 seconds can be programmed. With Viking16 and P25 Trunking scanning, scan delays of 0 to 8 seconds can be programmed.

4.13.4 Transmitting in the Scan Mode

Priority Scan Mode - When the transmitter is keyed while scanning is enabled, the transmission may occur on various channels as follows.

Conventional Operation - Transmissions can be programmed to always occur on the priority, selected, or receive channel (if applicable). Refer to Section 5.11 for more information.

P25 Trunking/Viking16 Operation - If scanning is halted to receive a message, programming determines if transmissions occur on the selected or active channel. Transmissions at other times occur on the selected channel.

Radio Wide Scan Mode - The radio can be programmed to transmit on the selected or active channel similar to P25 trunking/Viking16 operation just described.

4.13.5 Nuisance Channel Delete

With priority scanning, channels can be temporarily deleted from the scan list, for example, if messages become annoying. Radio Wide Scan Nuisance Delete is available for radios using Firmware Version 8.30.x or later programmed by Armada 1.30.x and later. Channels can also be permanently added or deleted from a scan list as described in the next sections. Proceed as follows to temporarily delete a channel:

Note *The selected channel and also conventional priority channels cannot be deleted from the scan list.*

1 While receiving a message on the channel to be deleted, press and hold the SCAN option button until a tone sounds (based on radio programming) or press the Nuisance Delete option button. The channel is then deleted and scanning of the remaining channels in the scan list resumes.

Note *Pressing and holding this button with scanning OFF may select the scan list. Refer to Section 5.11.1 for more information.*

2 Deleted channels are added back into the scan list based on Armada programming and specific user actions:

- The selected channel is changed (Nuisance Delete Mode = Reset on Channel Change)

- The selected zone is changed (Nuisance Delete Mode = Reset on Zone Change)
- Radio power is turned off and then on again (Nuisance Delete Mode = Reset on Power)
- Scan or Radio Wide Scan is turned off and then on again (Nuisance Delete Mode = Nuisance Delete Mode = Reset on Scan Toggle)
- For radios using Firmware Version 8.30.x or later programmed by Armada 1.30.x and later, the radio user can use the left and right navigation pad buttons to add deleted channels back into the scan list.

4.14 Scan Lists

Priority and Radio Wide Scan lists can be programmed.

Note *Pressing and holding the Scan Edit button allows the user to access the feature. Alternatively, users can reset scan lists from the Scan Edit menu item. "Reset Lists" will be displayed. Pressing the Select button will reset the lists and "Lists Reset" will be temporarily displayed before returning the user to the main display. Selecting Exit will return the user to the main display without reverting the scan lists. This shall only be accessible through a function button press and hold and is not implemented though a menu item.*

4.14.1 Priority Mode Scan Lists

A scan list is simply the channels that are scanned when scanning is enabled. With all operating modes, as many priority scan lists as are required can usually be programmed (up to 255). The only limitation is the available memory. Each list can include up to 255 channels/talkgroups. More information follows on selecting and editing priority scan lists.

Note *The selected channel is always scanned.*

4.14.1.1 Determining Channels in Priority Scan List

Channels in the conventional priority scan lists are determined as follows. Channels in the P25 Trunked/Viking16 priority scan lists are indicated only when editing a list (see "Editing a Priority Scan List").

1 Enable Priority scanning as described in Section 4.13.1. Also select the scan list if applicable as described in the following "Selecting a Priority Scan List" description.

2 Select the desired zone and then scroll through the channels by rotating the Select switch. When the displayed channel is in the scan list (scanned normally), the Z icon is displayed.

4.14.1.2 Selecting a Priority Scan List

Conventional Operation - The scan list is user selectable by the SCAN option button. The scan list can also be temporarily changed if the Scan (List) Select option button is programmed or by pressing/holding the scan button if this feature is enabled. Refer to Section 5.11.1 for more information.

P25 Trunked/Viking16 Operation - The scan list can be temporarily changed if the Scan (List) Select option button is programmed or by pressing/holding the scan button if this feature is enabled. Refer to Section 6.11.2 for more information.

Both of the above operations are also menu and soft button selectable.

Note *Only Priority scan lists are selectable.*

4.14.1.3 Editing a Priority Scan List

If the Scan Edit option button is programmed, priority scan lists can be user edited as follows (all operating modes). This option is also selectable by using the menu. Changes are permanent (cycling power does not reselect a default condition). Proceed as follows:

1 Select a conventional, P25 Trunked/Viking16 channel corresponding to the scan list being edited.

2 Select the scan list edit mode by pressing the Scan Edit option button. This mode is indicated by the icon on the top of the display.

3 If applicable, select the list to be edited by rotating and then pressing the Select switch. A single beep sounds when the switch is pressed. The selected scan list is indicated as “LIST x” as described in the preceding section. If user programming is disabled on a list, “NO EDIT” is momentarily displayed and it cannot be edited.

4 Select the channel you want to add or delete by rotating the Select switch. After the last channel in the current zone is displayed, the first valid channel in the next zone is displayed and vice versa. Lists are limited to 256 channels. If an attempt is made to add more than 256, “LIST FULL” is displayed and a channel must be deleted before another can be added.

- For conventional and P25 Trunking radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, the operator can do the following:
  - Press and hold the ▲ button to select the first channel of the next zone.
  - Press and hold the ▼ button to select the last channel of the previous zone.

- Press the Select button to skip to the next channel in the scan list. [Select no longer saves and exits from the menu. The operator must press SAVE to save changes. SAVE does not appear until the operator makes a change. SAVE does not exit the menu. After the operator presses SAVE, the button changes back to EXIT, which functions as expected. (If the operator presses Select when the list is empty, a "List Empty" error banner appears.)]

Note *Priority channels can be deleted if Priority Channel User Editable is enabled on the scan list.*

5 If the selected channel is in the scan list (scanned), the (S) icon is displayed on the top of the display. To change the scan list status of the displayed channel, press the Left/Right soft buttons (VM5000) or the Left/Right buttons on the four-way navigation pad (VM6000/VM7000).

A single beep sounds when the button is pressed.

With conventional and P25 Trunking channels only, if the selected scan list is programmed with fixed priority channels, press the Left/Right soft buttons (VM5000) or press the Left/Right buttons on the four-way navigation pad (VM6000/VM7000) to make the current channel the priority channel indicated by "**P**" in the left status display next to the zone number.

If dual priority channels are used, press the Left/Right soft buttons (VM5000) or press the Left/Right buttons on the four-way navigation pad (VM6000/VM7000) to again make it the second priority channel indicated by "**P2**" in the left status display.

Then press the same button again to take the channel out of the scan list.

Refer to Section 5.11.2 and Section 5.11.3 for more information on priority channel sampling.

6 To exit this mode choose one of the following steps:

- To exit and discard the changes, press the Scan Edit option button or Exit (F6) button.
- To exit and save the changes, press the select button (VM5000/VM7000) or select knob (VM6000).
  - For conventional and P25 Trunking radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, the SAVE soft button appears only after a change has been made to the scan list. In this case, The SAVE soft button takes the place of the EXIT soft button. The operator must press SAVE to save changes. A banner temporarily displays the message, "Saving," to confirm this. After the user presses SAVE, the soft button gets replaced by EXIT. Pressing EXIT exits the menu as before. (The operator can exit without saving by pressing the BACK soft button.)

4.14.2 Radio Wide Scan List

With radio wide scanning, up to 255 scan list can be added regardless of the type of channel selected. This list is user programmable, and can contain up to 255 channels of any type. More information on selecting and editing radio wide scan lists follows.

Each scan list can be selected as User Editable. With this option selected, the user can edit the active scan list only from their radio. The user can also select which scan list is active through a programmed function button or menu function selection. This active scan list is retained through power down.

4.14.2.1 Determining Channels in Radio Wide Scan List

The channels can be determined only by selecting the scan list edit mode (see Section 4.14.2.2). When the displayed channel is in the scan list (scanned normally), an (X) is displayed at the top of the screen.

4.14.2.2 Editing a Radio Wide Scan List

If the RWS Edit option button is programmed, the radio wide scan list can be edited. Changes are permanent (cycling power does not reselect a default condition). Proceed as follows:

1 You can edit Scan Lists and use Scan List Select while Scanning is enabled. The radio app will “pause“ the scan or radio wide scan feature and resume it upon exiting the menu. The radio will not actively scan while in scan edit or scan list select menus. If you attempt to edit a Radio Wide Scan list in this example, it will “pause” the Radio Wide Scanning and allow you to edit the lists (and vice versa for Scan Lists with Scan Mode).

2 Select the channel you want to add or delete by pressing the Right Up/Down buttons ▲/▼ (VM5000), rotating the Select switch (VM6000), or rotating the Channel control (VM7000). A single beep sounds when the channel is changed. After the last channel in the current zone is displayed, the first valid channel in the next zone is displayed and vice versa. The list is limited to 255 channels. If an attempt is made to add more than 255, “LIST FULL” is displayed and a channel must be deleted before another can be added.

- For conventional and P25 Trunking radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, the operator can do the following:
  - Press and hold the ▲ button to select the first channel of the next zone.
  - Press and hold the ▼ button to select the last channel of the previous zone.
  - Press the Select button to skip to the next channel in the scan list. [Select no longer saves and exits from the menu. The operator must press SAVE to save changes. SAVE does not appear until the operator makes a change. SAVE does not exit the menu. After the operator presses SAVE, the button changes back to

EXIT, which functions as expected. (If the operator presses Select when the list is empty, a "List Empty" error banner appears.)]

3 If the selected channel is in the scan list (scanned), (S) is displayed at the top of the screen. To change the scan list status of the displayed channel, press the Left/Right soft buttons (VM5000) or Left/Right buttons on the Navigation Pad (VM6000/ VM7000).

4 To exit this mode and save the changes, press the Select button (VM5000/VM7000) or Select knob (VM6000).

- For conventional and P25 Trunking radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, the SAVE soft button appears only after a change has been made to the scan list. In this case, The SAVE soft button takes the place of the EXIT soft button. The operator must press SAVE to save changes. A banner temporarily displays the message, "Saving," to confirm this. After the user presses SAVE, the soft button gets replaced by EXIT. Pressing EXIT exits the menu as before. (The operator can exit without saving by pressing the BACK soft button.)

4.15 Over the Air Programming

OTAP is an "Over the Air" programming feature for the subscriber parameter (codeplug) files. Using the OTAP feature, parameter files can be updated and changed in the field, eliminating the need to take the radio out of service to perform the updates. Firmware updates cannot be made using this feature.

4.15.1 Radio Set Up

The current profile in the radio controls how an OTAP download is handled. How this is programmed determines the possible actions the radio should take: "Activate Immediately" or "Update on Reboot".

For Update on Reboot

- After a successful OTAP download, the radio displays the following message, prompting the user to reboot the radio to apply the update: "OTAP Update Received. Reboot radio to update."

4.15.2 OTAP Transfer Times

Larger files tie up the radio for a long time. Therefore, any user interface event, such as a channel change, zone change, button press, or toggle switch position change stops the OTAP procedure and returns the radio to normal operating mode. For button presses/toggle switch position changes, the radio exits OTAP mode only if a function is programmed for the button/toggle switch. Otherwise, the bad tone sounds. Low signal conditions may also cause the radio to exit OTAP. If the radio does not receive a response from programming one minute after receiving its last data packet, the radio stops the OTAP procedure and returns to normal operating mode.

4.15.3 Retries after Unsuccessful Operation

For radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, if the first attempt at an OTAP operation is unsuccessful, OTAP tries the operation again a maximum of 2 times.

Note *This includes read and write of codeplugs and security policies. OTAP does not retry option writes.*

1. The first retry happens one hour after the initial failure (±10 minutes as you select).
2. The second retry happens 4 hours after the first retry fails (±10 minutes as you select).

4.16 Over the Internet Programming

Over the Internet Programming (OTIP) enables you to program VM6000/VM7000 radios remotely using IP-based network services. It works with both wired (Ethernet) and wireless (Wi-Fi) networks.

Note *OTIP is only supported by VM6000 radios with the OTIP option enabled. Portable radios do not support OTIP.*

Note *Each deck is individually connected in the same manner as OTAP (Section 4.15) and USB.*

4.16.1 Security

There are inherent security risks with exposing your radios on a LAN or WAN. Your system administrator or IT department should be made aware that VM6000/VM7000 radios using OTIP will periodically use Multicast DNS and DNS-Based Service Discovery to coordinate availability. You may choose to completely disable OTIP functionality by not ordering the OTIP option. Because OTIP-enabled radios are available to all computers on the network, you should use network security policies with upload/download restrictions.

4.16.2 Voice Announcements

OTIP has no special restrictions for voice announcements. You can use the OTIP interface to quickly transfer large codeplugs with many voice announcements.

4.16.3 Encryption

Armada supports industry-standard (SSH) encrypted transfers when using USB, Ethernet, or Wi-Fi network connections. If Wi-Fi is configured, you must use WPA2 Pre-Shared Key (PSK).

4.16.4 Wi-Fi Supported Hardware

To connect a VM6000/VM7000 radio to your Wi-Fi network, you must purchase a supported Wi-Fi dongle. This dongle must contain the RTL8192CU chipset or undesired behavior can occur. Recommended models are the following:

- Rosewill RNX-N250
- Belkin F7D2102

While Wi-Fi is active (turned on using a button press or menu selection), USB connections will not work, with the notable exception of supported Wi-Fi dongles. If you turn Wi-Fi off, USB functionality resumes. In the case of multideck configurations, this feature is deck specific.

4.16.5 Limitations

4.16.5.1 Disconnection Events

Armada may show a radio OTIP-connected when it is not. This is due to the nature of service discovery on IP networks. Here are a few examples of scenarios in which this may happen. There may be other such scenarios also:

- A Wi-Fi-connected radio goes out of range.
  - When you disconnect a radio's USB programming cable to replace it with a Wi-Fi dongle—or vice versa—wait at least 3 seconds after you disconnect the first device before you connect the second device.
- Miscellaneous unexpected network events occur.

USB connections can interfere with OTIP connection and disconnection events. Do not use OTIP with more than two USB-connected radios. (EFJohnson plans to address this limitation in a future Armada release.)

4.16.5.2 Concurrent Transfers

Do not try to update a single radio from multiple instances of Armada at the same time. In general, radio administrators are expected to coordinate with each other when managing radios. OTIP is designed to allow a radio service center to connect to mobile radios without running cables.

4.16.5.3 USB Limitations with PTT and Wi-Fi

Direct USB connections between the radio and PC do not function while you are actively pressing the PTT switch or have Wi-Fi service active. When you turn Wi-Fi off or release the PTT, direct USB functionality resumes.

4.17 Mute / Auto Unmute

Users can mute the radio by pressing the Mute soft button or selecting Mute through the menu so they do not have to listen to dispatch. (An example is an EMT who uses a radio's call alert feature for notification of an emergency event.) "MUTED" flashes in the display when the radio is muted. "MUTED" will only flash in receive and idle states and not in transmit states. When receiving a call alert the radio will automatically unmute and notify the EMT of the event. If the user has the radio muted, this feature automatically unmutes the radio if certain programmable events occur. These events include the reception of a Call Alert, Unit Call, or Emergency Call.

4.18 Location Services

Location Services provides GPS location information to the radio user and to network administrators using a standardized IP-based protocol. For example, a radio can send its current location over the radio network and then IP to an application that is mapping user locations. That application can also send commands to the radio telling it what data to report and when to report it.

To use GPS on VM5000/VM6000/VM7000 radios, the Kenwood KRA - 40 (G) antenna must be attached to the rear of the radio. When GPS is turned on, the radio detects whether an antenna is attached. If no antenna is attached, a "No GPS Antenna" message is displayed on the radio. The status of the GPS antenna (Attached, Detached, or Short) is available at any time using the GPS Display function. If the user attaches an antenna that is short-circuited, the radio turns off power to the Antenna and displays "Short" in the GPS Display. To sync with GPS, the user must attach a working antenna and power cycle the radio.

On the VM5000/VM7000, the internal GPS can be disabled, and external Serial GPS Connections are not supported. The GPS data source can be set to "GPS Disabled" or "Internal" on the VM5000.

The VM5000 uses a combination GPS and Bluetooth IC, which can be reset with a single button press. When a reset is initiated, the GPS shuts down, followed by the Bluetooth. Immediately after both have shut down, Bluetooth is started again, followed by the GPS. The feature cannot be used if the GPS/Bluetooth module is already shut down.

P25 Trunking and Conventional IP data between a radio and an application with access to the fixed host is supported. Data flows between the radio and the system. However, radio-to-radio operation is not currently supported.

The radio processes GPS data from the receiver and sends it over the system to the Location Services Host System (LSHS). The LSHS is an application that can request and receive GPS data from radios (sometimes called "Location Server"). The Tier 2 Location Services Standard defines a protocol between the LSHS and the radios. The protocol is called the Location Request/Response Protocol (LRRP). EFJohnson radios with software supporting Location Services, support the LRRP protocol. The system must support IP data and can be P25 Digital Conventional and/or P25 Trunking.

The radio has two general Location Service features. The first is the ability to display GPS data on the radio's display. The second is the ability to receive commands from and send data to a location server.

The "Display GPS" function can be accessed through a programmed function button or the menu. It functions as follows:

1 Button Press activates the GPS Data Display menu.

2 Button Press and Hold sends GPS data to the location server.

3 F5 sends GPS data to the location server while viewing the GPS Data Display Menu.

Refer to the software manual for function programming. The following table shows the GPS data display elements.

Table 4.2 GPS Data Display

Element	Description	Notes
Lat/Long	The current latitude and longitude of the radio	Pressing the Menu/Select button will toggle between display formats for this element.
Altitude	The altitude	
Ground Speed	The horizontal speed	
Course	The course over ground in degrees	
Date/Time	The current GPS time and Date	Adjusted for the time zone programmed by Armada.
Num of Sat	The number of satellites used in the current GPS fix	This element displays the satellites used in the current fix not the number of satellites currently in view.

The GPS function allows the user to turn GPS on or off. Pressing the button will toggle the GPS. The display will show “GPS On” or “GPS Off”.

GPS data is stored for 90 minutes after a satellite sync, which allows the internal GPS module to be turned off between GPS On/Off cycles, resulting in power savings.

Figure 4.4 GPS Icon

The GPS icon displays in the three modes shown in the following table.

Table 4.3 GPS Icon Modes

Mode	Description
Off	The icon is not visible because GPS hasn’t been enabled or has been turned off.
Flashing	GPS is enabled and turned on but has not synced with the satellite.
On	The radio has satellite sync and valid data.

4.18.1 Built-In GPS Receiver

The VM5000/VM6000/VM7000 models use a built-in GPS receiver. Read the following warnings before using these models' built-in GPS receiver.

The following frequency ranges are known to create interference in GPS satellite acquisition and/or operation:

- 393.0 MHz~394.7 MHz

Using GPS while operating the radio within these frequency ranges is not recommended. When the GPS receiver is used along with radio operation in these frequencies, the GPS receiver may not position normally as follows.

- When using the GPS:

  Frequency interference in the GPS receiving frequency range may prevent the GPS receiver from operating normally.

  If the GPS receiver positions during transmission:

  - The GPS receiver may be unable to position if the transmit spurious emission of the radio interferes within the GPS receive frequency range.
  - The interference to the GPS receiver changes depending on the transmission power of the radio. Greater transmission power results in a higher probability of being unable to position.

  If the GPS receiver positions during reception:

  - The GPS receiver may be unable to position if the harmonics of the radio's oscillator interfere within the GPS receive frequency range.

  Effects of other interfering frequencies (such as other radios transmitting):

  - The GPS receiver may be unable to position if frequencies emitted from other radios and electronic equipment interfere within the GPS receive frequency range.
- Because the GPS receiver unit consumes more power when powered on compared to when powered off, the battery life of the radio becomes shorter compared to when the built-in GPS receiver unit is powered off.

4.18.2 LRRP

LRRP is the TIA standard that defines sending and receiving location commands and location data. The radio supports receiving commands from an LSHS and sending data to the LSHS. The following table shows the LRRP messages supported by the radio. These interactions do not cover all possible interactions defined in the standard. See the TIA Tier 2 Location Services Document for the full LRRP specification (TIA-102.BAJC).

Table 4.4 Supported LRRP Messages

Message	Description
Immediate-Location-Request	Sent from the LSHS to the radio. The radio responds with data or an error.
Immediate-Location-Report	Send from the radio to the LSHS in response to the Immediate-Location-Request.
Triggered-Location-Request	Sent from the LSHS to the radio. Radio determines if it can do the specified trigger and responds.
Triggered-Location-Answer	Sent from the radio to the LSHS in response to the Triggered-Location-Request. Contains information about whether or not the radio can support the requested trigger.
Triggered-Location-Report	Sent from the radio to the LSHS when a trigger happens.
Triggered-Location-Stop-Request	Sent from the LSHS to the radio to tell it to stop doing a previously specified trigger.
Triggered-Location-Stop-Answer	Sent from the radio to the LSHS to acknowledge the Triggered-Location-Stop-Request.
Unsolicited-Location-Report	Sent from the radio to the LSHS when the user sends data using the “Display GPS” function.
Location-Protocol-Request	Sent from the LSHS to the radio to determine the LRRP protocol version of the radio.
Location-Protocol-Report	Sent from the radio to the LSHS in response to the Location-Protocol-Request

4.18.3 Triggering

There are many different types of triggers and many more combinations of those types. See the TIA standard for more information about triggers.

Triggers are divided into two types. One Shot triggers happen once and then are complete. Periodic triggers happen periodically. Triggers **may** have start and stop times. Triggers will only be armed within their specified start/stop times.

Triggering can be started both by commands from an LSHS and from programming. Triggers marked with a * below are programmable.

The radio only supports a single trigger of each type. Sending a new trigger of a type that is already in use will overwrite the existing trigger. This includes triggers set by the LSHS and programming software.

The following table shows the supported triggers. The radio does not support combinations of triggers.

Table 4.5 Supported Triggers

Trigger	Description
One Shot	This trigger happens once at the time specified in the Triggered-Location-Request.
One Shot PTT	This trigger happens once when the user PTTs the radio. This trigger is activated when the user presses the PTT button but the data will usually be sent after the call is over. We do this to avoid delaying the call.
One Shot Emergency	This trigger happens once when the user puts the radio into emergency.
One Shot Status	This trigger happens after a Status Message gets sent. Refer to Section 4.18.4.
Periodic*	This trigger happens every period specified by the Triggered-Location-Request.
Periodic PTT*	This trigger happens every time the user presses PTT. This trigger is activated when the user presses the PTT button but the data will usually be sent after the call is over. We do this to avoid delaying the call.
Periodic Emergency*	This trigger happens every time the user puts the radio into emergency.
Periodic Distance*	This trigger happens every time the user moves the radio a distance defined in the Triggered-Location-Request.

* Programmable in Armada.

For radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, the Armada administrator can program the radio to do the following:

- Send triggers as either confirmed or unconfirmed data. Sending triggers as unconfirmed data can reduce the use of system resources and prevent hindering the shutdown process. (Radios with earlier firmware always send confirmed data.)
- Send triggered location reports on power on and power off. The power on trigger gets sent the first time the radio receives IP context and valid GPS data. The power off trigger gets sent during the shutdown process if the radio has IP context and valid GPS data.

4.18.4 GPS Status

Conventional P25 and P25 Trunking systems only

The Armada administrator can program radios using Firmware Version 8.32.x or later programmed by Armada 1.32.x and later to do the following: After the radio user selects a conventional P25 or P25 Trunking status in the radio menu, the radio sends a Location Request and Response Protocol (LRRP) Status with the same status ID.

4.19 Emergency Alarm Receive Indicator

The Emergency Alarm Rx feature allows a user to receive an Emergency Alarm display and/or alert on their radio when another radio on the same system sends out an Emergency. This feature is supported in Conventional, P25, and Viking16 systems. On Viking16 systems the Emergency Alarm can only be received on a radio with the same Talkgroup as the sending radio. On P25 systems the Emergency Alarm can be received by any radio on the same system. On Conventional systems, the emergency alarm can only be received on a radio with the same channel as the sending radio.

When an Emergency Alarm is received the radio will either sound an alert tone, display the sending radio's ID or Alias, or do both depending on the settings programmed. When received, the display context of the radio is changed to display "EA Received" on the top line and either the ID or the Alias of the radio who sent the Emergency Alarm. If the received ID is in the Call List, then the Alias will be displayed. If it is not, the ID will be displayed.

An Emergency Alarm will not be received when the radio is active on a voice channel, in Emergency, or in Radio Wide Scan Mode. Also, if in Surveillance mode, the backlight will not turn on when an Emergency Alarm is received.

When received, the display context of the radio is changed to display "EA Received" on the top line and either the ID or the Alias of the radio who sent the Emergency Alarm. If the received ID is in the Call List, then the Alias will be displayed. If it is not, the ID will be displayed.

After an Emergency Alarm has been received, any press of a button (except for the PTT) will exit the display and clear the ten-second timer. If no buttons are pressed, the display will continue to show "EA Received" along with the ID or Alias for ten seconds. However, the alert tone is only heard once upon receiving the alarm. There is also a timer that will not allow the radio to receive another Emergency Alarm from the same ID for twenty seconds. This timer is only cleared on a channel change, zone change, or after twenty seconds has expired.

If multiple Emergency Alarms from different radios are received within the ten second period while the display is still showing, then only the most recent Emergency Alarm ID is shown and the ten-second timer is reset.

4.20 Emergency Keep Alive

For radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, the Armada administrator can configure the radio to prevent it from shutting down while an emergency is active. If the power switch is still off when emergency exit occurs, the radio shuts down. Soft power down overrides this, allowing the user to initiate soft power down while the emergency is still active.

4.21 Analog Noise Reduction

If your administrator configures Analog Noise Reduction, the radio filters out background noise on Conventional Analog channels, V16 Single Site channels, and V16 Multi Site Analog channels. To use this feature on your radio, an Analog Noise Reduction button, menu item, or soft button must be programmed to turn on noise reduction.

4.22 Enhanced Vehicular Repeater System

The enhanced vehicular repeater system (Pyramid SVR-P255 vehicular repeater) provides coverage extension of VM5000/VM6000 radios to VP5000/VP6000 radios (for VM5000/VM6000 radios using Software Version 8.22.x or later). Both mobile and portable radios must be optioned to enable the mobile Enhanced VRS system on networks designed for mobile coverage. Users communicate through the Viking Mobile radio while in the vehicle and enable the vehicular repeater system to allow communications with the VP5000/VP6000 through the vehicular repeater/mobile combination. Portable users are connected to their dedicated vehicular repeater on a simplex digital conventional channel. Features available through the enhanced system include the following:

- Single PTT Calls
- Talk Permit Tone
- Busy Indication
- Deny Indication
- Emergency Notification
- Out-of-Range Notification
- Signal Strength Indicator
- Unique Unit ID
- Conventional Channel Support
- Viking16 Support
- TDMA Support for P25 Trunking
- Portable Data Registration Turned Off Automatically on EVRS Enabled Channels
- Scan Turns Off And On Automatically on EVRS Activation and Deactivation
- Conventional Out of Range Reported from Mobile to Portable
- Door Switch Support
- Busy Channel Lockout for Conventional
- Special Talk Permit Tone for EVRS Out of Range State
- Features for Software Version 8.28.x and later
  - "Vehicular Repeater On" Notification
  - DB25 C Channel PTT Function
  - Priority Repeater Lock Function
  - Repeater Channel Number and Priority Display
  - Enhanced Emergency Function
  - Repeater On/Off with Lock

The remote access function must be programmed to a button or menu in the VM5000/VM6000. Enabling this function powers on the Pyramid SVR-P255 vehicular repeater.

4.23 Audio Recording

The Audio Recording feature allows VM5000/VM6000/VM7000 received and transmitted audio to be logged for future retrieval in Armada.

The radio can be configured in Armada to save either Rx Audio only or Rx+Tx Audio. When optioned and enabled, call audio will be saved automatically to the radio's internal memory. No radio user interaction is required.

Note *You must use Armada to retrieve the audio files.*

After the Audio Recording storage limit is reached, old calls will be deleted (as necessary) to allow the new audio to be saved.

4.24 Instant Recording Replay

Instant Recording Replay (IRR) is a feature that allows the radio user to playback recent audio. Although this feature uses the same internal mechanism as Audio Recording to save audio for future playback, IRR is optioned and enabled separately from Audio Recording, and so Audio Recording does not need to be optioned or enabled for IRR to function. The amount of audio to be played back is configurable, and can be specified in number of seconds or number of calls.

Call audio will be automatically recorded for future playback. The IRR function can be invoked using a button press or the menu. When invoked, the audio that IRR plays back is determined by several settings:

- IRR Mode: If set to Rx Audio, only the most recent Rx Audio will be replayed. If set to Rx+Tx Audio, both recent Rx and recent Tx audio can be replayed.
- Playback Type: If set to Timed, audio will be replayed up to Playback Time setting in seconds. If set to Number of Calls, all audio from the last Playback Num Calls calls will be replayed, regardless of length.
- Playback Time: The length of audio to be played back (if Playback Type is set to Timed).
- Playback Num Calls: The number of calls to be played back (if Playback Type is set to Number of Calls).

- Play Last Call First: If enabled, the last call will be played first, followed by the oldest call in the internal IRR list, the next to oldest call, etc., until the last call is played again. If not checked, playback starts with the oldest call in the IRR list.
- Play End Tone: If enabled, a short tone sounds after every recording.

Pressing the function button during playback skips the remaining audio for the currently playing call. A press-and-hold of the function button during playback exits playback mode. IRR will automatically exit if a call is received during playback, or if the user presses PTT.

For radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, IRR call information gets displayed on the main display as well as in the IRR menu. The following lines get displayed on loop for 1.5 seconds each for the length of each call:

- Source ID (if receiving) or Destination ID (if transmitting)
- Call Type
- Timestamp

In multideck setups, invoking IRR replays recently recorded audio from the currently selected radio.

4.25 Bluetooth

VM5000/VM6000/VM7000 radios include a Bluetooth option that is compatible with a set of wireless speakers/headphones, microphones, and PTT devices. Bluetooth can be turned on or off by pressing the Bluetooth soft button (Figure 4.5) or by selecting the Bluetooth menu On/Off option (Figure 4.6).

Table 1.1 identifies Bluetooth devices that work with VM5000/VM6000/VM7000 radios.

Figure 4.5 Bluetooth Soft Button On/Off

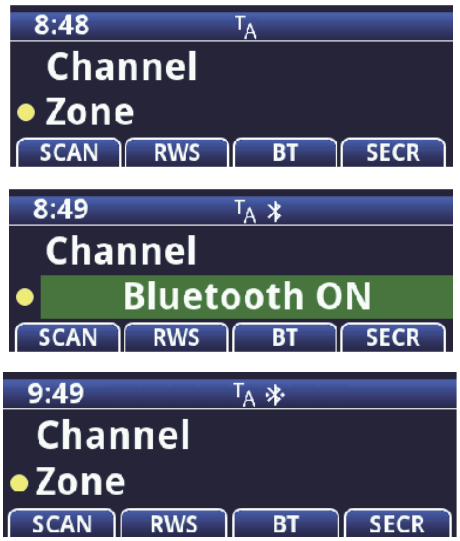
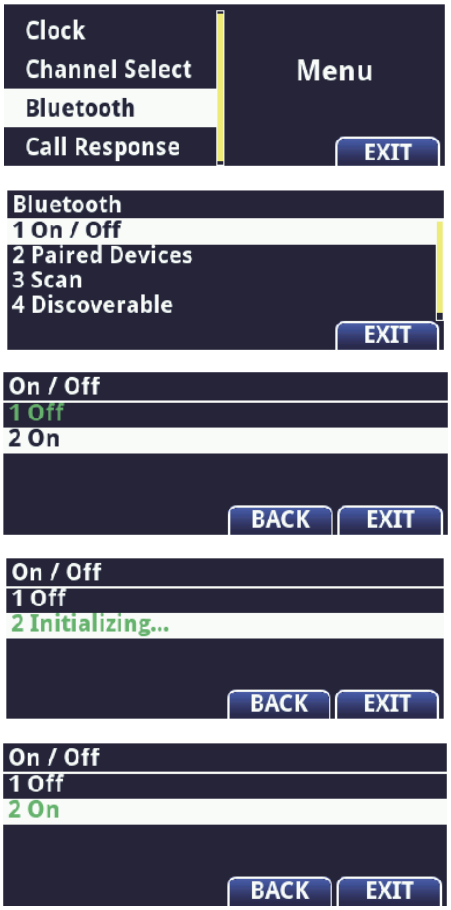


Figure 4.6 Bluetooth Menu Option On/Off



Additional Bluetooth menu options include the following (Figure 4.7):

- Paired Devices—View a list of paired devices and unpair or disconnect/connect paired devices
- Scan—View a list of devices available for pairing
- Discoverable—Make a radio discoverable by other Bluetooth devices
- Disc Timeout—Set the length of time the device remains discoverable
- Info—View Bluetooth information for the radio

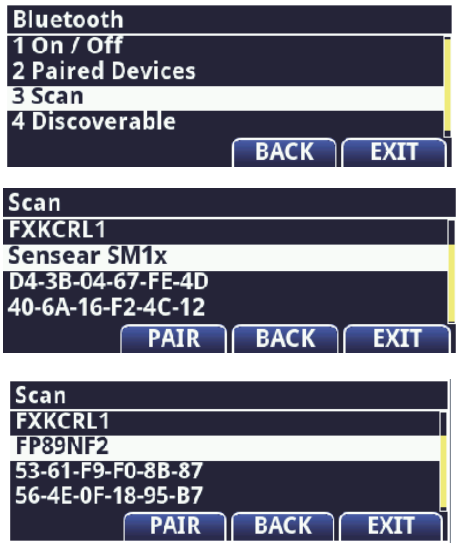
Figure 4.7 Bluetooth Menu Options

A list of paired devices can be viewed by accessing the Paired Devices menu option (Figure 4.8). Paired devices can be unpaired and connected or disconnected, depending on current connection status.

Figure 4.8 Paired Devices Menu Option

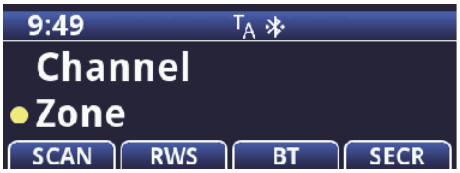
To scan for available Bluetooth devices, select the Scan menu option (Figure 4.9). Select a device name and press the Pair soft button to pair the device with the radio.

Figure 4.9 Scan Menu Option



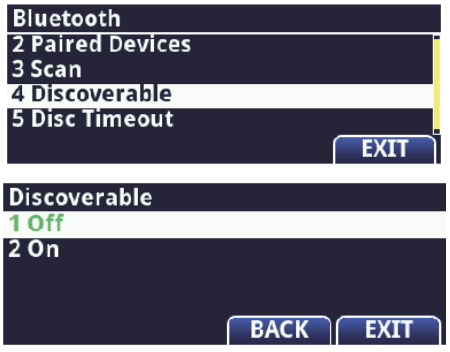
Once a radio is connected to a device, the radio shows a Bluetooth Connected icon (Figure 4.10).

Figure 4.10 Bluetooth Connected Icon



To make the radio discoverable by other Bluetooth devices, select the Discoverable menu option and select On (Figure 4.11).

Figure 4.11 Discoverable Menu Option

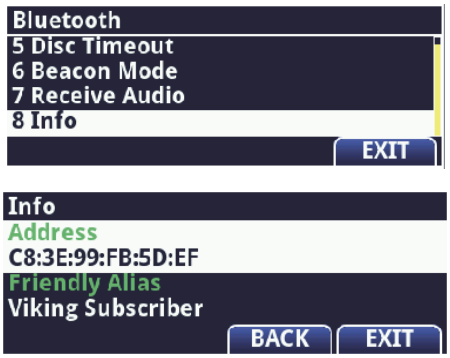


The Discoverable Timeout menu option allows users to choose how long their radio will remain discoverable (Figure 4.12).

Figure 4.12 Discoverable Timeout Menu Option

Use the Info menu option (Figure 4.13) to see information about your radio.

Figure 4.13 Info Menu Option



Bluetooth protocol supports automatic reconnecting of previously paired devices. Paired and connected devices will disconnect from the radio when they are turned off and then reconnect when they are powered back on. Reconnect also occurs if the device remains powered on during the radio power cycle. The radio remains connected to the currently connected device even if another paired device powers up and becomes available.

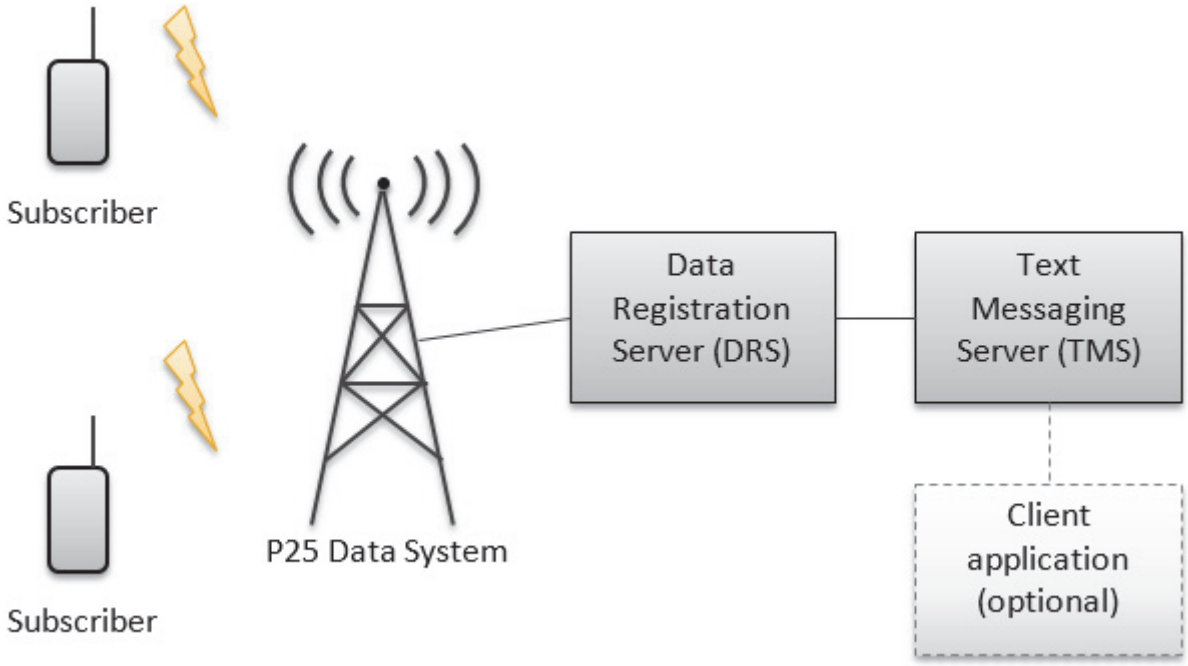
Note *Auto reconnect does not work for device power up on Interspiro devices.*

4.26 Text Messaging

Text messaging on VM5000/VM6000/VM7000 radios provides a simple and clear method to share textual information in the field. The implementation is made up of four components (Figure 4.14):

- Text Messaging Server (TMS)
- Data Registration Server (DRS)
- P25 Conventional or Trunking Data System
- Viking Subscriber

Figure 4.14 Text Messaging Components



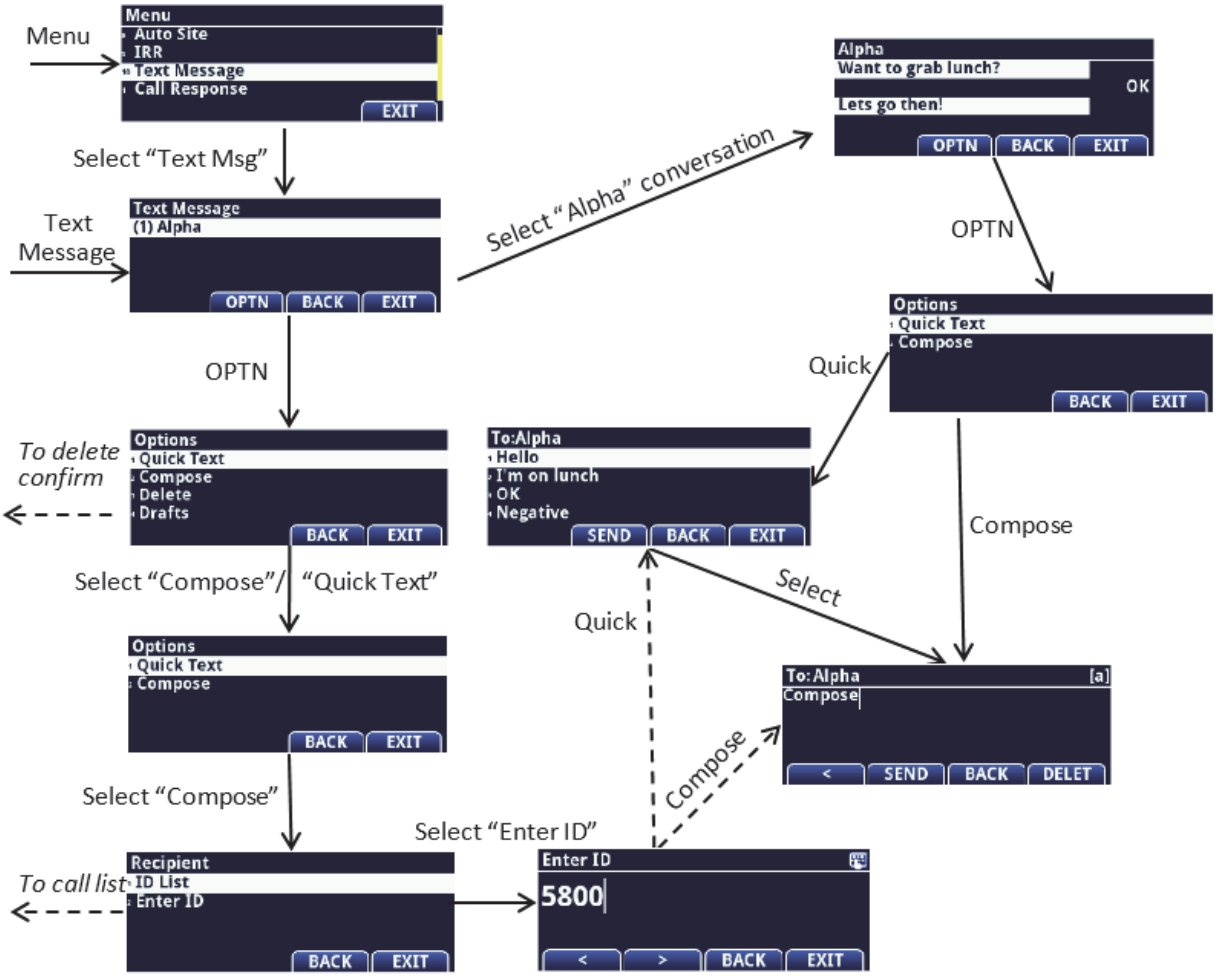
This section contains information on the following topics:

- Text Message Menu System
- Restrictions
- Receive Behavior
- Buttons

4.26.1 Text Message Menu System

Text messages are organized in a way that is similar to the way a mobile phone manages messages. They are grouped by receiver and displayed in a chat or conversation format. The text messaging menu (Figure 4.15) diagrams the menu flow of the text messaging system. The details of each screen are covered in the following paragraphs. Pressing the back button at any time takes you to the previous screen. Pressing the **F6** soft button at any time takes you out of the text messaging menu system.

Figure 4.15 Text Messaging Menu



This section contains information on the following topics:

4.26.1.1 Inbox

The Inbox is the landing page for text messaging in the VM5000/VM6000/VM7000 (Figure 4.16). A list of all conversations is displayed using the recipient's alias (if available) or unit ID. The number of unread messages for each conversation is displayed next to it. Conversations are sorted by most recent activity. Use the direction pad to select up and down.

Figure 4.16 Inbox with Text Messages

If there are no messages, the screen displays "No Message", as shown in Figure 4.17.

Figure 4.17 Empty Text Message Inbox

Enter the Inbox by pressing the "Text Message" function in the main menu, button or soft button.

Using the select/enter button takes you to the selected conversation. Pressing the **F4** soft button takes you to the Options for All Messages.

4.26.1.2 Options for All Messages

The "Options" menu for all messages has all the general text message actions that may be taken. These include:

- Quick Text
- Compose
- Delete
- Drafts

Note *For options related to a single conversation (Conversation Options), refer to Section 4.26.1.7.*

To enter "Quick Text", the Recipient Usage must be set to **Respond Only**, **List Only**, or **Unlimited**. There must be at least one quick text programmed in Armada also.

To enter "Compose", the Recipient Usage must be set to **Respond Only**, **List Only**, or **Unlimited** and there must be a keypad.

To enter "Drafts", the Recipient Usage must be set to **Respond Only**, **List Only**, or **Unlimited** and there must be a keypad.

There will be a temp message describing the error if the preceding requirements are not met.

Typing in the number on the left in **Options** and **Delete** selects the corresponding item.

This **Options** menu is reached by pressing the **F4** soft button from the Inbox (Figure 4.18).

Figure 4.18 Text Messaging Options Menu

Choosing “Compose” or “Quick Text” takes you to the **Receiver Selection** menu. Choosing “Delete” takes you to a confirmation allowing you to confirm or back out of the delete action (Figure 4.19),

Figure 4.19 Text Messaging Delete Confirmation

After you make a choice, the Inbox appears again. The **Delete** option deletes all conversations for the selected alias/unit ID. Choosing **Drafts** (Figure 4.20) opens up the last message typed after pressing the BACK button or interrupted.

Figure 4.20 Choosing Text Messaging Draft Selection

4.26.1.3 Receiver Selection

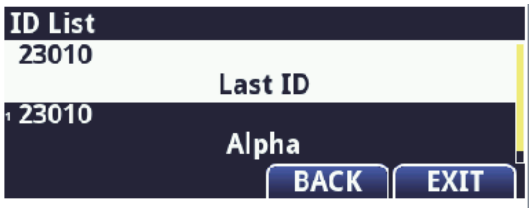
The receiver selection menus are used to pick the text message recipient. In the **Recipient** menu (Figure 4.21), the user can choose either “ID List” or “Enter ID”. Typing in the number on the left in the **Recipient** and List Entry menus selects the corresponding item

Note *If the conditions described below are not met, a message appears that describes the error.*

Figure 4.21 Text Messaging Recipient Menu

Radios listed in the system's Call List can be chosen on the **List Entry** menu (Figure 4.22). To enter **List Entry**, the **Recipient Usage** must be set to **List Only** or **Unlimited**.

Figure 4.22 Text Messaging List Entry Menu



The radio user can enter Unit IDs manually on the **Direct Entry** menu (Figure 4.23). To enter **Direct Entry**, the **Recipient Usage** must be set to **Unlimited**.

Figure 4.23 Text Messaging Direct Entry Menu

After the user chooses a receiver, either the **Quick Text** or **Compose** menu appears, based on the user's choice on the **Options for All Messages** menu.

4.26.1.4 Quick Text

The **Quick Text** menu contains a list of predefined text messages (Figure 4.24). These messages are configured on the System's Text Messages list in Armada. The quick text menu is entered from either options menu (using the receiver selection menu in the general case or directly in the conversation case). Typing in the number on the left in the **Quick Text** menu selects the corresponding item.

Figure 4.24 Quick Text Menu

Long text messages will scroll. The quick text can be modified by pressing **Enter** (Figure 4.25). The radio must have a keypad to be able to modify the quick text.

Figure 4.25 Modifying Quick Text

Pressing the **F4** soft button sends the quick text immediately and takes you back to normal operation. Pressing the **Select/Enter** button takes you to the **Compose** menu with the quick text already entered.

4.26.1.5 Compose

Custom text messages are entered on the **Compose** menu (Figure 4.26).

Note *To use the **Compose** menu, the radio user must have a keypad.*

Figure 4.26 Text Messaging Compose Menu

Typing characters on the keypad keys creates text as follows:

* - Alternates between capital letters, lowercase letters, and numbers. Shown by [A], [a], and [1] in the top right corner of the screen

- is a space. If it is pressed multiple times it will add a period if needed and change the next character to upper case

2 through 9 – Alternates between the letters and number on the key

1 – Alternates between ".", "@", ",", ":", "?", "-", "!", "'", "/", "1"

0 – Alternates between "+", "=", "<", ">", "$", "%", "&", "0"

The delete soft button deletes the character to the left of the cursor. If it is held down it deletes everything.

The nav up and down buttons– moves the cursor up and down

The nav left and right buttons– moves the cursor left and right

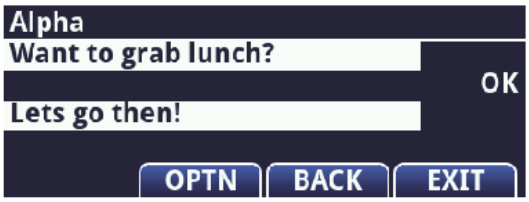
Pressing the **F4** soft button sends the text immediately and take the user back to normal operation.

Pressing **Emergency**, pressing PTT, or pressing the back button saves the current text message to the text draft.

4.26.1.6 Conversation

The **Conversation** menu lists all messages sent and received from a particular radio (Figure 4.27). All text gets wrapped and the direction pad is used to scroll up and down.

Figure 4.27 Text Messaging Conversation Menu



Message status also gets displayed on this menu. Possible statuses are:

- Pending
- Queued
- Error
- Text Failed

Pressing the **F4** soft button takes the user to the **Conversation Options** menu.

4.26.1.7 Conversation Options

The **Conversation Options** menu mirrors the general options by applying them to the selected conversation (Figure 4.28). These options include:

- Quick Text

- Compose

Figure 4.28 Text Messaging Conversation Options Menu

Quick Text and **Compose** take the user to the **Quick Text** and **Compose** menus respectively.

Typing in the number on the left in the **Conversation Options** menu selects the corresponding item.

4.26.2 Restrictions

This section contains information on the following topics:

- General Restrictions
- Conventional Systems

4.26.2.1 General Restrictions

Radios that do not have a keypad cannot send custom text messages.

A maximum of 224 bytes may be sent if encryption is used, 255 bytes if encryption is not used. This is equivalent to 224 (or 255) ASCII characters, but fewer for international characters. The default TMS message size must be increased to sending messages longer than 200 bytes (after encryption).

Up to 5000 messages get stored on the radio. While they may be deleted manually, the oldest message is deleted when the 5000th message gets stored. There will be delays in loading and viewing text messages if there is a large amount stored. For best operation, the user should delete old messages manually.

Systems using Text Message Server Version 1.14.x and later can be configured to forward messages back and forth between conventional systems and P25 trunking systems.

4.26.2.2 Conventional Systems

Conventional text messages do not have a WACN and System ID and are stored in the same place. That means they cannot be filtered by system as P25 trunking does. Conventional text messaging requires Text Message Server Version 1.12.x or later text message server.

4.26.3 Receive Behavior

When a message gets received, the following occurs:

- A brief message appears saying “Text Received” (Figure 4.29)
- A tone plays
- A mail icon appears in the status bar
- An Alert tone can be customized in Armada

Figure 4.29 “Text Received” Message

If a message with a bad encoding gets received, “Text Received” appears with an alert background. A bad tone will also sound.

4.26.4 Buttons

There is a single “Text Message” function that can be programmed to a button, soft button or menu. Activating the function takes the user to the Text Message Inbox.

SECTION

5

Conventional Mode Features

Conventional mode features are radio features unique or used only when operating in conventional mode. This chapter contains the following sections:

5.1 Monitoring Before Transmitting

With conventional operation, you may need to manually monitor the channel before transmitting to make sure that it is not being used by someone else. If you were to transmit while someone else was using the channel, you would probably disrupt their conversation. With P25 Trunked and Viking16 operation, monitoring is performed automatically. Monitor conventional channels automatically or manually as follows.

5.1.1 Automatic Channel Monitoring

If the selected channel is programmed for Busy Channel Lockout (also called Transmit Disable On Busy), monitoring is performed automatically. Refer to Section 5.3 for more information on this feature.

5.1.2 Manual Channel Monitoring

The automatic monitoring just described may occasionally disable the transmitter when the channel is not in use, such as if the repeater has extended hang time. In this case, you may not want to use it and the channel must then be monitored manually as follows:

Busy Indicator - With scanning disabled, note if the multi-function indicator on the front panel is steady green. If it is green, a carrier is being detected, so the channel may be busy. If it is not, the channel is not being used and a call can be transmitted.

Monitor Mode - There may be times when the busy indication is displayed even though no one is using the channel. Monitoring should then be performed by disabling Call Guard squelch (or group ID detect on P25 channels). This is usually done by selecting the Monitor Mode (see following) or by the Normal/Selective option button (see Section 5.4.1).

5.2 Monitor Mode

The monitor mode unsquelches the receiver and monitors the channel even if a carrier is not detected. Other features of this mode are as follows:

- Call Guard (CTCSS/DCS) squelch is disabled on analog channels, and NAC and group ID detect are disabled on P25 (conventional) channels.
- Signaling-dependent Busy Channel Lockout options for Tone/NAC and P25 status are overridden (see next section). (Noise option is not overridden: Monitor mode disables the protocol-signaling events that the Busy Channel Lockout option Tone/NAC/Status depend on, but not carrier events.)
- Scanning temporarily halts.

The Monitor Mode operates as follows:

1 To monitor the transmit frequency for activity before transmitting, briefly press the Monitor option button. The display then shows . The receiver unsquelches and noise is heard even if carrier not present. The transmit frequency can also be monitored by selecting **TX Channel** in the Monitor menu function's sub-menu.

2 To monitor the receive frequency instead, press and hold the Monitor or Monitor Rx option button until a tone sounds (based on radio programming). This can be used, for example, to improve reception if intermittent squelching is making a weak message difficult to understand.

3 To disable the monitor mode and return to normal operation, press the Monitor option button again (or select **Off** from the menu), or simply release the Monitor Rx button.

If off-hook detection is enabled, taking the microphone off-hook monitors the receive frequency similar to Step 2. However, the receiver unsquelches only if a carrier is detected (see Section 4.10). Pressing the Normal/Selective option button disables Call Guard squelch/P25 group ID detect but not scanning and P25 NAC detect (see Section 5.4).

5.3 Busy Channel Lockout

The Busy Channel Lockout (also called Transmit Disable on Busy) feature automatically disables the transmitter if the channel is busy when the PTT switch is pressed. When the transmitter is disabled by this feature, "BUSY" is displayed, a busy tone sounds, and the transmitter is disabled.

The Busy Channel Lockout feature can be programmed to operate as follows. Each conventional channel can be programmed differently.

"Off" - Busy channel lockout is disabled and the transmitter keys even if the channel is busy.

"Noise" - If a carrier is detected on the channel, the transmitter is disabled when the PTT switch is pressed.

"Tone (NAC)" - If an incorrect Call Guard (CTCSS/DCS) or P25 NAC code (see Section 5.14.3) is detected, the transmitter is disabled when the PTT switch is pressed. An incorrect code is any code other than the one programmed for the current channel.

"Status" - Transmission is disabled if the repeater inbound channel busy status symbol is detected.

"Talkgroup" - Prevents transmission during calls with a different NAC or talkgroup. Transmission is allowed during data or short terminators with the correct NAC. Applicable to Conventional Digital channels.

If Busy Channel Override is permitted by programming, it is possible to transmit even when the transmitter is disabled by this feature. Release the PTT switch and then quickly press it again within one second.

5.4 Call Guard Squelch

Tone or digital Call Guard squelch (also called CTCSS/DCS signaling) can be programmed on each conventional analog transmit and receive channel in any order desired. The reverse burst and turn-off code are always transmitted and also detected on channels programmed with Call Guard squelch.

The Call Guard squelch feature eliminates distracting messages intended for others using the channel. This is done by using a subaudible tone or digital code to control the squelch. This tone or code is unique to a user or a group on that channel. This tone or code is transmitted with the voice signal but is not heard because it is in the subaudible range and is attenuated by a filter. Call Guard squelch must be used in both the transmitting and receiving radio to be functional.

5.4.1 Call Guard Squelch Enable / Disable

The Normal/Selective option switch (if programmed) can be used to disable receive Call Guard squelch (Normal/Selective Squelch) on analog channels or group ID code detection on P25 channels. This option is also selectable through the menu. When selective squelch is disabled, “SQ NORMAL” is flashed in the display. When it is enabled, “Squelch Selective” is displayed.

When Normal Squelch is selected, the receiver unsquelches only if a carrier is detected. Scanning and P25 NAC detection are not disabled with this mode selected. The selected mode remains in effect until it is manually changed. Selecting another channel or cycling power does not reselect a default condition. There is a programmable option to display the monitor icon when the Normal Squelch mode is selected.

5.4.2 Tone Call Guard Squelch

Tone-type Call Guard squelch uses subaudible CTCSS tones from 67-254.1 Hz. Although there are 42 tones assigned, those above 33 (210.7 Hz) are normally not used because of their close proximity to the voice band which starts at 300 Hz. In addition, tones 11 (97.4 Hz), 39 (69.3 Hz), 40 (206.5 Hz), 41 229.1 Hz), and 42 (254.1 Hz) are normally not used because they may cause interference with adjacent tones.

A reverse burst is transmitted when the push-to-talk switch is released and also detected when calls are received. It is a 180-degree phase reversal for a period of time determined by the tone frequency, and it eliminates the squelch tail (noise burst) in the receiving radio. Both the transmitting and receiving radio must be equipped with this feature for it to be used. The radio can be programmed to turn OFF the reverse burst feature so that the squelch tail is not eliminated.

5.4.3 Digital Call Guard Squelch

Digitally Coded Squelch (DCS) uses digital data instead of subaudible tones to control the squelch. This data consists of continuous repetitions of 23-bit words. There are 84 DCS digital data tones to select from. No bit or word synchronization information is used. When the push-to-talk switch is released, a turn-off code is transmitted which eliminates the squelch tail similar to the reverse burst.

5.4.4 Disable Call Guard

The Disable Call Guard feature option lets the radio disregard any CTCSS/DCS or NAC/Talkgroup information on the current channel. This programmable feature is best described as a monitor mode with no white noise. In analog it is functionally the same as turning the squelch mode to “normal.” In digital mode it is analogous to checking the “digital squelch” box when programming the radio. The function can be programmed to any button and the menu. The mode will stay active though channel changes (between conventional channels) and during scan. While the feature is active, the monitor icon will be displayed.

5.4.5 Conventional Squelch Adjust

Squelch settings on a conventional analog channel can be changed by the user from -7 to +7. A menu item or function button can be programmed for squelch adjust. While on a conventional analog channel without emergency or scan active, the user can select the programmed button or menu item for squelch adjust. The current squelch setting will show on the display.

Using the Up/Down navigation buttons on the mobile radio, or turning the rotary switch clockwise or counter-clockwise, the user can adjust the squelch setting to a desired level from -7 to +7. Decreasing the value toward -7 causes the squelch to open sooner for weaker signals, while increasing toward +7 has the opposite effect. Pressing the select button will store the new squelch setting and return the user to the main display.

5.4.6 System Squelch Code

This feature allows the normal transmit and receive Call Guard (CTCSS/DCS/NAC) programming to be temporarily overridden with a code selected from a preprogrammed list. It is available if the System Squelch Code option switch and a CTCSS/NAC code list have been programmed. It is also selectable through the menu and soft buttons.

In addition, with the Digital Keypad Microphone, conventional systems can be programmed for the System Keypad CTCSS/DCS feature. Codes can then be selected directly from the table by pressing the button for the code. For example, to select code 3 from the table, simply press the "3" button. No other conventional mode functions can then be assigned to these buttons.

The CTCSS/DCS/NAC list is programmed with up to 255 tone (CTCSS) or digital (DCS) Call Guard codes. Different codes can be programmed for the transmit and receive modes, and carrier squelch (selective squelch disabled) can be programmed if desired. In addition, each position can be programmed with an NAC code for use with P25 operation.

When the Call Guard code is changed using this feature, it remains selected even if other channels are selected. However, if radio power is cycled or a talk-around channel is selected, the normal codes are reselected. When scanning, the selected code also applies to all scanned channels. Each channel can also be programmed to always ignore the code selected from this list and use the default code instead.

If both analog and digital (Project 25) channels can be selected or scanned, the CTCSS/DCS code for the selected position is used for analog channels and the NAC code for the selected position is used for P25 channels. If a channel is programmed for mixed mode operation, the selective squelch type (analog or digital) programmed for the transmit mode determines the selective squelch type used.

Note *Call Guard codes may be permanently reprogrammed by keypad programming (see Section 5.15).*

Proceed as follows to select a code using the System Squelch Code option switch:

1. Press the System Squelch Code option button and then press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to select the desired position. The display indicates "SQ xx" where, "xx" is the selected code from 1-255. The code number and actual code are alternately displayed (NACs are displayed in hexadecimal).

2. To select the displayed code and return to the normal display, press the System Squelch Code switch again.

3. To check which code is selected, press the System Squelch Code option switch once to display the current selection and then again to return to normal operation.

4. To return to the normal selective squelch codes, select "DEFAULT" in this mode. As previously described, the normal codes are also automatically reselected whenever radio power is cycled or a talk-around channel is selected.

5.5 Channel- and Direction-Specific Operator Selectable Tones

For radios using Firmware Version 8.26.x or later (programmed by Armada 1.26.x or later), the radio operator can select CTCSS/DCS tones (OST/IST) on a per-channel and per-direction (TX or RX) basis.

Two related functions are available for programming on conventional systems:

- Channel Rx OST
- Channel Tx OST

These are available on analog channels and digital mixed-mode channels.

The CTCSS/NAC system list must be set up to use these functions. Channel Rx OST lists the Rx tones, and Channel Tx OST lists the Tx tones. (NACs in the "CTCSS/NAC" list can be ignored).

Each conventional channel can control whether OSTs are allowed, and in which direction (Tx, Rx, Both, None).

When a new tone is selected with one of these functions, the selected channel's settings get overwritten. The function can also be used to return to original settings.

For clarity, several functions and parameters were renamed in Firmware 8.26.x/Armada 1.26.x as compared with previous versions (Table 5.1). Each of these functions/parameters works as they did before.:

Table 5.1 OST/IST-Related Renamed Functions

Armada Window	Name before Firmware 8.26.x/ Armada 1.26.x	Name for Firmware 8.26.x/ Armada 1.26.x and Later
Button/Menu (Conventional) > Buttons > Button Assignments	Squelch List Select	System Squelch Code
Systems (Conventional) > General Options 2 > Other	Keypad CTCSS/DC	System Keypad CTCSS/DCS
Channels (Conventional) > Channel Options > Other	Ignore Keypad CTCSS	Ignore System Squelch Code

5.6 Penalty Timer

A penalty timer can be programmed on conventional systems to prevent transmissions for the programmed time after the time-out timer disables the transmitter (see Section 4.3). The penalty timer can be programmed for the same times as the time-out timer, and timing starts when the PTT switch is released. If the PTT switch is pressed while the timer is running the timer stops, and continues when the PTT switch is released. When the penalty timer expires, a beep sounds and the transmitter can then be keyed.

5.7 Conversation Timer

A conversation timer can be programmed on conventional systems in addition to the time-out timer (see Section 4.3). This timer limits that total length of a conversation rather than just the length of each transmission as with the time-out timer. The following is more information on this timer.

- It can be programmed for times up to 7.5 minutes.
- It is reset when the time between transmissions exceeds the time programmed for the penalty timer.
- A warning beep sounds five seconds before this timer disables the transmitter.
- When this timer disables the transmitter, a continuous tone sounds and the red transmit indicator turns OFF. The PTT switch must then be released until the penalty timer expires (indicated by a beep).

5.8 Repeater Talk-Around

Normally, all transmissions go through a repeater which usually increases range. However, there may be times when a radio is out of range of the repeater and therefore unable to talk to anyone even though the radio being called is only a short distance away. To allow communication in this situation, repeater talk-around can be selected. Transmissions then occur on the receive frequency which permits direct radio-to-radio communication.

Repeater talk-around can be selected if the RTA option switch is programmed. This feature can also be selected through the menu. When talk-around is enabled by this switch, “RTA ON” is flashed in the display, and when it is disabled, “RTA OFF” is flashed. This feature remains enabled during scanning, and changing channels or turning power OFF does not change the selected condition. Talk-around is available on conventional channels only. The Talkaround capability can be Disabled on a per-channel basis, requiring the user to use the infrastructure if disabled. (Radio-to-Radio communication is not allowed.)

Note *The channel configured for simplex operation displays the Talkaround icon.*

5.9 Displaying Transmit / Receive Frequency

If the Display Information option button is programmed, it can be used to display the channel frequency in megahertz. Pressing this switch toggles between displaying the standard channel alias and the frequency. The receive frequency is displayed while receiving and the transmit frequency is displayed while transmitting. This feature may also be selected through the menu and soft buttons.

This feature is available on conventional channels only.

5.10 Emergency Alarm and Call

Emergency Alarms and Calls are separate functions that can be individually enabled or disabled on each analog and P25 conventional system.

Emergency Alarms are signaling that the radio transmits when it enters Emergency Mode. Emergency Calls occur when a user makes calls while the radio is in Emergency Mode. The radio is put into Emergency Mode by means of the function button, menu item, or external input line. Emergency Alarm and Call operations are programmable on a per channel basis by selecting a configuration from Systems > Lists > Emergency configuration in Armada.

Emergency Alarm and Call behaviors depend on the per channel programming of an emergency configuration.

The user can set an external line by pressing the emergency button. External devices can trigger off of the radio’s external line. If the “Ext Emergency” Option is enabled by programming and the user presses the emergency button, the corresponding line on the DB-25 accessory connector shall be set to low (0V). It remains low until the External Emergency Time has passed or the user exits the emergency. If the user presses

emergency during the External Emergency Time, the timer starts over. If the user exits emergency before the External Emergency Time has passed, the output line returns to +5V (output pins 4, 8, 12, 13, 20, 21, 22, 23, 24) or high impedance (output pins 15, 16).

5.10.1 Emergency Alarms

An emergency alarm is a special transmission that alerts a dispatcher of an emergency situation. It is sent automatically by pressing Emergency option switch. The system to which the emergency channel is linked must have Emergency Alarms enabled. If it does not, Emergency Alarms are disabled. Emergency alarms and calls can be received on smart consoles with message receiving capabilities.

In the P25 conventional mode, a special P25 emergency data transmission is sent, and in the conventional analog mode, a DTMF emergency ID is sent. Refer to Section 5.13.5 for information on the MDC1200 Emergency Alarm.

Proceed as follows to send an emergency alarm:

1 If required, select a channel of a system on which Emergency Alarms are enabled and then press the Emergency option switch. The radio then automatically transmits the emergency alarm.

2 Either Normal or Silent operation can be programmed. With the Normal mode, the red LED lights, the emergency tone sounds, and "EMERGENCY" flashes in the display. This indication continues to flash until the alarm mode is ended (see Step 4).

If silent programmed, none of these indications occur. If "No Receive Activity During Emergency" is programmed, receive audio, the front panel LED, and receive icons are disabled in the receive mode.

3 When the emergency alarm is acknowledged by the dispatcher, "ACK Received" is displayed, and the emergency acknowledge tone (five beeps) sounds. This alert tone can be disabled if desired, and neither occur if Silent operation is programmed.

Retries will automatically occur for conventional analog until the retry counter completes.

4 The user can exit emergency mode by cycling radio power or by pressing and holding the Emergency option switch.If "Silent" is programmed, a tone sounds when the operator exits Silent Emergency (for radios using Firmware Version 8.26.x or later programmed by Armada 1.26.x and later).

5.10.2 MDC Call Alert

VM5000/VM6000/VM7000 allows you to send and receive MDC call alerts using the Call Alert button or menu item. You can choose target IDs using list entry or direct entry. When you receive a call alert, the radio indicates that an alert has been received and displays the ID the alert is from. The radio also sounds a repeating indicator tone an LED lights until you clear the indication by pressing any button.

5.10.3 Emergency Call Alert

This feature notifies a user when an emergency call is being made on their selected P25 Conventional or P25 Trunking Talkgroup. The radio should also be programmed with an “Emergency Clear” button.

If an emergency call is received by the radio on the selected channel, the emergency alarm ACK tone will sound (five consecutive tones), and the Emergency Received message will display, followed by the unit ID of the emergency radio. If any other emergency calls are made after this initial one using a different radio, the tone will not sound, but the unit ID will be updated to reflect the most recent emergency call. To exit out of this state, press the “Emergency Clear” button. The radio should return to its normal display, and the Emergency Received message should no longer show.

5.10.4 Emergency Calls

The Emergency Call feature allows a user to place an emergency voice call by pressing the PTT switch after pressing the Emergency option button. If the Emergency Hot Mic feature is enabled, the emergency call is automatically transmitted without having to press the PTT switch (see following description). The system to which the emergency channel is linked must have Emergency Calls enabled. Analog and Digital (P25) calls can be individually enabled.

If the emergency call is sent on a P25 channel, an emergency indication is sent according to the P25 standard (the emergency bit is set in the Common Air Interface). If it is sent on an analog channel, the DTMF Emergency ID is sent in place of the ANI DTMF PTT ID if applicable.

For radios that use Firmware Version 8.26.x or later programmed by Armada 1.26.x and later, if emergency call ANIs are enabled and the conventional channel is configured with post-TX ANI, then the emergency call ANI gets sent post-TX.If the conventional channel is configured with pre-TX ANI or no ANI, but emergency call ANIs are enabled, then the emergency call ANI gets sent pre-TX.

Note *The DTMF Emergency ID is sent only if pre- or post- DTMF ANI is enabled on the channel by programming.*

5.10.4.1 Emergency Hot Mic

If Emergency Hot Mic has been enabled for emergency calls for the system, automatic transmitting occurs with microphone audio unmuted without having to manually press the PTT switch. The automatic transmit period is programmed for 10 to 120 seconds in ten-second intervals. The radio can be configured to re-enter emergency hot mic transmit after a set receive time has elapsed. The radio continues cycling in and out of emergency hot mic transmit until the programmed number of cycles have taken place, until PTT is asserted by the user (if configured), or until the user takes the radio out of emergency mode. If this feature or emergency calls are not enabled, automatic transmitting does not occur. This feature is initiated only on the first press of the Emergency switch. Subsequent presses do not trigger automatic transmissions. To reset this function, hold emergency button or cycle power.

5.10.4.2 Placing an Emergency Call

To place an Emergency Call:

1. If required, select a channel of a system on which Emergency Calls are enabled and press the Emergency option switch. The Emergency Call is then sent as described in Section 5.10.1 if applicable.
2. If the preceding Emergency Hot Mic feature is enabled, the call is automatically transmitted without pressing the PTT switch. If it is disabled, press the PTT switch and begin speaking as with a standard call. If the channel is changed, operation continues on the new channel in the emergency mode.
3. With analog calls, subsequent presses of the PTT switch cause the DTMF emergency ID to be sent according to the ANI programming (if DTMF ANI is enabled on the channel). With digital calls, the calls continue to have the emergency bit set.
4. If the Surveillance Mode is enabled (see Section 4.11), all indicators, lights, and tones are disabled. If “No Receive Activity During Emergency” is programmed, receive audio, the front panel LED, and receive icons are disabled in the receive mode.
5. To exit this mode, cycle radio power or press and hold the Emergency switch.

5.10.5 Emergency Press and Hold

The Viking radio provides two means of activating emergency mode. With an emergency button programmed, the radio will enter emergency mode upon a press or a press and hold. Pressing and holding the emergency button while in emergency mode will cancel emergency. When enabled, the Emergency Press and Hold feature restricts activation to the press and hold scenario.

With the emergency press and hold feature enabled, the emergency button must be pressed and held for the duration of the press and hold timer for emergency mode to be activated. If the button is released before the timer has expired a bad beep tone sounds and emergency mode fails to activate. To cancel emergency mode, the emergency button must be pressed and held for the duration of the press and hold timer again.

The user has the ability to use two different timers for Emergency mode (Conventional system) - one to enable and one to disable emergency mode, preventing accidental enabling and disabling of emergency mode. With Emergency Press and Hold enabled, emergency mode is enabled when the Button Press/Hold Duration Timer expires. In both cases, emergency mode is canceled when the Emergency Cancel Timer expires.

5.10.6 Emergency Talkgroup

A user can program an Emergency Talkgroup. If Emergency is activated, the radio uses the Emergency Talkgroup instead of the programmed talkgroup. If Talkgroup Lock is programmed, the Emergency Talkgroup has priority.

5.11 Conventional Mode Channel Scanning

Channel scanning features common to all operating modes are described in Section 4.13. The following sections describe features unique to conventional operation.

5.11.1 Selecting a Scan List

Conventional systems are programmed with user defined scan lists that are then selected per channel in that system.

The default scan list (which is to be used by all conventional channels, can be temporarily changed by using the SCAN option switch or menu parameters. A scan list selected in this manner is retained through radio power down.

Currently if the user presses and holds the Scan button, the **Scan List Select** feature is activated. This function can be disabled on a per-system basis by programming.

5.11.1.1 Conventional Scan List Select Procedure

The scan list select procedure is as follows:

1 You can edit Scan Lists and utilize Scan List Select while Scanning is enabled, but not Radio Wide Scan (and vice versa). The radio app will "pause" scan or radio wide scan feature and resume it upon exiting the menu. The radio will not actively scan while in scan edit or scan list select menus. If Radio Wide Scan is enabled and you attempt to edit a Scan List, the radio will bonk and display "Disabled" (and vice versa). If you attempt to edit a Radio Wide Scan list in this example, it will "pause" the Radio Wide Scanning and allow you to edit the lists (and vice versa for Scan Lists with Scan Mode).

2 The currently selected list is then indicated in the display as "LIST x", where "x" is the scan list number. Press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation pad Up/Down buttons (VM7000) to select the desired list and then exit this mode by pressing the Select or SCAN option button. A single beep sounds when the Select switch is pressed.

5.11.2 Transmitting in Scan Mode

Each conventional scan list can be programmed for one of the following modes. These modes determine if priority sampling occurs and also the channel on which transmissions occur while scanning. Refer to Section 5.11.3 for more information on priority sampling.

Priority on Programmed – The Priority 1 channel is user defined

Talk Group Scan – Monitors a single digital conventional channel. When a call is received, the radio searches the scan list for a talkgroup that matches the received talkgroup

Vote Scan - **Analog** – Scan based on received signal strength (analog channels).

Vote Scan - **Digital** – Scan based on received signal strength (digital channels)

Talkback Type - **Selected Group** – The radio always transmits on the selected group.

Talk Back Type - **Active Group** – The radio transmits on the last group received until the Scan Hold Timer expires. After the Scan Hold Timer expires the radio transmits on the selected group.

5.11.2.1 Data Transmission During Conventional Scan

Radios using Firmware Version 8.32.x or later can send P25 data on a conventional channel with the scan function enabled. All scan modes are supported except vote scan. The default setting for sending data is confirmed mode.

If data needs to be transmitted when scan is enabled, the radio pauses scan until all data gets transmitted and acknowledged by the FNE. When all data finishes getting transmitted, scan resumes.

The data gets queued on the following conditions:

- When data needs to be transmitted and a voice call is active, the data gets queued until the call ends (including scan hold time). When the call ends, the radio transmits any queued data and resumes scan.
- Data also gets queued when the radio is transmitting a voice call. All queued data gets sent when the voice transmission ends.
- If the Push-To-Talk (PTT) button gets pushed when the radio is transmitting a data packet or waiting for an "ack" from the FNE, the data transaction aborts, but the data packet remains in the queue.

There are changes to the sequence of packet data registration/deregistration and DRS registration/deregistration:

- When the radio sends a packet data registration (channel change or scan mode) and is previously packet-data-registered on the system, a DRS registration does not get sent if the IP address received matches the previously-received IP address. (Previous releases always sent the DRS registration.
- Packet data deregistration and DRS deregistration get sent upon channel change when the new channel is on a different system.

5.11.3 Priority Channel Sampling

The following describes priority sampling when scanning conventional channels.

Note *Priority sampling when scanning P25 Trunking/Viking16 channels is described in Section 6.11.1.*

The priority channel sampling feature ensures that when priority scanning, messages on the priority channel are not missed while listening to a message on some other channel. The radio can be programmed as just described so that the priority channel is a fixed channel programmed in the current scan list, the currently selected channel, or not used.

Note *In addition, the priority channel is not scanned if the active channel is an analog channel on the same frequency as the priority channel and is programmed with CTCSS/DCS squelch control.*

Either a single or dual priority channels can be programmed if desired. With dual priority, a call on the second priority channel is interrupted by a call on the first priority channel but not vice versa. When scanning and the selected channel is a single or first priority channel, "P" is indicated on the top of the screen. This indication is displayed regardless of whether the priority channel is fixed or always the selected channel. When the second priority channel is displayed, "P2" is indicated on the display screen.

The priority channel sampling frequency is determined by the programmed Priority Lookback Time A (see description which follows). For example, if 2.0 seconds is programmed, the priority channel is sampled every 2.0 seconds when listening to a message on a non-priority channel. When not listening to a message, the priority channels are scanned in the normal scan sequence. With dual priority, the first and second priority channels are alternately sampled at the Loopback Time.

Priority channel sampling occurs only with conventional scanning. It does not occur with radio-wide scanning, when listening to any type of P25 trunking/Viking16 call, encrypted call, or when transmitting.

The priority sampling times are programmed by the following parameters:

Lookback Time A - This time determines how often the priority channel is checked for activity. Times of 0.25 to 4.00 seconds in 0.25-second steps can be programmed.

Lookback Time B - This time determines how often the priority channel is checked once an incorrect Call Guard (CTCSS/DCS) or NAC code is detected. Since it takes much longer to detect an incorrect Call Guard signal than a carrier, this time should be relatively long to prevent the interruptions from making a message difficult to understand. Times of 0.5 to 8.0 seconds can be programmed in 0.5-second steps.

5.11.3.1 Changing the Priority Channel

If a fixed priority channel is associated with the current scan list, it can be changed to another channel if the Priority option switch, menu function, or soft button function is programmed. With dual priority, this changes only the first priority channel. To change both priority channels, use the Scan List Edit function described in Section 4.14.1. Proceed as follows to change a priority channel using the Priority option button:

1 Make sure that both priority and radio wide scanning are OFF.

2 Select the channel that you want to be the priority channel using the Select switch in the normal manner. A single beep sounds when the channel is changed. If the channel is in a different zone, also select the appropriate zone.

3 Press the Priority option switch and “PRIORITY” is briefly displayed to indicate that the selected channel is now the priority channel. Other indications that may occur are as follows:

- If “NO PRIORTY” is displayed, priority sampling may not be enabled on the scan list.
- If “Selected Chan” is displayed, the priority channel is always the selected channel and cannot be changed.
- If “No Edit” is displayed, the scan list is either not user editable or priority channel user editable.
- If no indication is displayed, the scan list may not be user editable or the channel may not be in the scan list.

5.11.4 Talkgroup Scanning

In additional to conventional channel scanning, a list of talkgroups can be scanned on a specific channel. Talkgroup scan monitors a single digital conventional channel. When a call is received, the radio searches the scan list for a talkgroup that matches the received talkgroup. Audio opens up if a match is found.

The radio can be programmed for Talk Group Scan with Active Talk Back type to return calls on the received talkgroup if the user talks back during scan hold time. The Talkgroup Scan with Selected Group Talk Back Type will always return calls on the talkgroup from the selected channel.

The radio can be programmed to display the talkgroup being transmitted at the beginning of a conventional digital call. After the display time has passed, the radio displays the selected channel alias.

Often a user wants to stay on one specific talkgroup when traveling from site to site. The Talkgroup Lock feature allows users to store the current active talkgroup to memory and the radio will use this talkgroup until the Talkgroup Lock feature has been disabled. The feature can be enabled / disabled with a programmable button, menu item, or soft button item.

1 The Talkgroup Lock Feature can be enabled / disabled from a programmable button or menu. The radio must be on a P25 Conventional Channel or else the radio will bad beep.

2 Talkgroup Select

a The current functionality of Talkgroup Select is (TG Lock Disabled)

- User is able to directly enter a Talkgroup or select a Talkgroup from a list. The selected Talkgroup will permanently replace the selected channel's Talkgroup.
- If Direct Entry is used, and the Talkgroup does not exist in the radio's profile, the Talkgroup is replaced and the radio will automatically enable the Override Talkgroup Security Settings on the Zone page. The current Override settings will be used for that Talkgroup since it doesn't reside the radio's profile.
- For Direct Entry, a valid Talkgroup of 1 to 65535 must be entered, otherwise the radio will display "Invalid TG" and bad beep.

b If Talkgroup Lock is Enabled, the Talkgroup Select feature will have new functionality.

- If Talkgroup is entered through Direct Entry and the talkgroup resides in the Armada profile, the radio will store the Talkgroup as the Lock Talkgroup and will exit menu mode.
- If the Talkgroup is entered through Direct Entry and the Talkgroup does not reside in the Armada profile, the radio will display "Invalid TG" and bad beep.
- If the Talkgroup is selected from the list, the radio will store the Talkgroup as the Lock Talkgroup and will exit menu mode.

- If Talkgroup Lock is enabled, no permanent changes will be made to the selected Talkgroup. Only the Lock Talkgroup will be affected.

3 The radio will use the security parameters that are assigned to the active talkgroup unless the Override Talkgroup Security Settings is active. In that case it will use the security parameters that are defined in the Security section on the Channels tab.

4 If Talkgroup Lock is enabled, the radio will only use the Lock Talkgroup for the selected channel. The rest of the channels will use the programmed Talkgroup. If this is not done, then the radio would only be able to monitor a single talkgroup for all scan channels.

5 If Emergency is declared while Talkgroup Lock is active, the radio will use the Emergency Talkgroup first if it is defined. If no emergency Talkgroup is defined, it will use the Lock Talkgroup.

5.12 Standard Conventional Calls

Standard conventional calls can be placed to other radios monitoring the selected channel. The proper coded Call Guard squelch tone or code or P25 NAC may need to be transmitted by your radio for them to receive your call (see Sections 5.4 and 5.14.3).

5.12.1 Placing a Standard Conventional Call

To place a standard conventional call, proceed as follows:

1 Turn power ON and set the volume as described in Section 3.1.1. Select the channel programmed for the radio you want to call (Section 3.1.7).

2 Monitor the channel automatically or manually as described in Section 5.1.

3 Press the PTT switch and if the Busy Channel Lockout feature is programmed on the channel, the transmitter is automatically disabled if the channel is busy (see Section 5.3). Otherwise, busy and out-of-range conditions are not indicated and speaking can begin after monitoring the channel.

4 Press (and hold) the PTT switch to talk and release it to listen. When the call is finished, place the microphone back on-hook.

5.12.2 Receiving a Standard Conventional Call

To receive a standard conventional call, proceed as follows:

1 Select or scan the channel programmed for the call you want to receive (refer to Section 5.11 for more scanning information).

2 After the call is received, take the microphone off-hook and press the PTT switch to talk and release it to listen. If scanning, responses may occur on the priority, selected, or receive channel as described in Section 5.11.2.

3 When the call is finished, place the microphone back on-hook.

When the radio is receiving an incoming call, you can press the Select knob to refuse the call.

5.13 DTMF / ANI Signaling

DTMF (Dual Tone Multi-Frequency) tones can be generated for ANI (Automatic Number Identification) and other purposes on conventional analog channels. One of the following options may be enabled on each channel:

Pre-Tx ANI - A preprogrammed ANI sequence is automatically sent each time the PTT switch is pressed.

Post-Tx ANI - A preprogrammed ANI sequence is automatically sent each time the PTT switch is released.

When an emergency alarm or call is placed, this ANI signaling is replaced by the Emergency DTMF ID (see Section 5.10). Refer to Section 5.13.5 for information on MDC1200 ANI.

5.13.1 Single Tone Encoder

The radio will transmit and send a single tone as programmed. Single tone ANI provides call-in signaling, but does not provide identification of individual units. That is, all units use the same single tone. Generally 1050 Hz is used for single tone RTT, but the radios and decoders are programmable to other tones in the audio range. All tones have a +/-0.2% frequency stability, and the tone length is programmable to a period of time from 0.5 to 2.5 seconds, in increments of 100 ms.

To use the single tone encoder functionality, program the radio with RTT with Single Tone Encoder selected as the type of RTT. The radio transmits and sends a tone of the programmed frequency and duration. When the tone is sent, all other radios on the system will unmute and hear the tone transmitted.

5.13.2 Two Tone Encoder

The Two Tone Encoder operates in the same fashion as the Single Tone Encoder except it sends two tones back to back. The two tone encoder Initial Delay, Modulation, and Inter Digit Delay are programmable, as are the Tone Alias, tone frequencies, and tone durations.

A maximum of 255 tone sequences can be programmed. Each sequence is generally programmed to send two tones, each of its own frequency and duration. Long single tones, generally used for group paging, are also supported. The tone frequencies are programmable from 288.5 Hz to 3,000.0 Hz in 0.1 Hz increments. First tone durations are programmable from 0.5 seconds to 2.5 seconds in 0.1 second increments. Second tone durations are programmable from 0.5 to 4.0 seconds in 0.1 second increments. Single tone durations are programmable from 3.0 to 10.0 seconds in 0.1 second increments.

The user can activate Two Tone in several ways:

- The first is to program a button for Two Tone then press and hold it. This will send the current, active Two Tone, which is defaulted to the first tone in the Two Tone list upon profile download.
- The second is to program Two Tone to the menu, select it from the menu, scroll to the desired tone in the list, and press PTT. Pressing PTT will send the tone and store it as the active Two Tone. Pressing the select button instead of PTT will store the selected tone as the active Two Tone. The Two Tone List is exited if the Menu Mode Timer expires, if the user presses the exit button (Exit button on the mobile), or if the user presses the button programmed for Two Tone while in the Two Tone List. Exiting the menu will not save the current Two Tone as the active Two Tone.
- The third is pressing a button programmed for Two Tone. This will enter the Two Tone List. Operation is the same as described above for entering Two Tone via the menu. Finally, Two Tone can be activated by using Emergency Analog Signaling, ANI Analog Signaling, or RTT Analog Signaling.

For direct activation (through Two Tone button press and hold or PTT press in the Two Tone List), the “Allow Two Tone Page” function must be enabled in programming. If “Allow Two Tone Page” is not enabled and the user tries to send a Two Tone Page directly the radio will bad beep and display “Denied”.

5.13.3 Two Tone Decoder

The Two Tone Decoder allows the radio to be configured to require tones of a particular frequency and pattern to be received before the radio plays alert tones and/or unmutes the speaker to received audio. If the Two Tone Decoder list Unmute Type is set to “AND,” then the carrier, valid CTCSS/DCS (if enabled), and the programmed two tone sequence must be received before the radio plays alert tones and unmutes the speaker. Setting the Unmute Type to “OR” will allow the radio to unmute to voice traffic on the channel without receiving a valid two tone sequence. The radio will still play alert tones when receiving the programmed two tone sequence in the “OR” configuration.

If a conventional channel is not configured with a two tone decode list, the radio operates as normal and the radio does not decode two tone codes.

Two tone decode is available on digital mixed mode channels. However, the two tone encoder is disabled unless the transmit type is set to analog.

An option is available to enable side tones. When the two tone encoder is activated the radio plays the tones on the speaker.

For radios using Firmware Version 8.30.x or later programmed by Armada 1.30.x and later, the Armada administrator can do the following:

- Configure the automobile's horn to sound (horn honk) when the radio receives and decodes a two tone page. This feature has the following requirements:
  - Horn Honk is enabled
  - Auxiliary B output is set to “Horn”
  - Two Tone Decode matches Two Tone Encode of the transmitting radio
- Prevent the radio user from changing the Two Tone Decoder list.

5.13.4 Five Tone Encoder

The radio transmits five tones. The first four tones are the Five Tone ID of the radio. The last tone is based on the radio mode (Normal Call, Emergency Call).

5.13.5 MDC1200 Compatibility

MDC1200 is a signaling protocol designed and implemented by Motorola for analog channels only. The following features of this protocol are supported. Either MDC1200 or standard DTMF ANI/Emergency signaling can be programmed on each conventional system.

MDC1200 ANI - Both pre and post ANI are supported.

MDC1200 Decode - MDC1200 decode functionality is supported so that the radio can handle the following MDC1200 features:

- Process the system acknowledgment of emergency transmissions – so that the user knows that the emergency has been received
- PTT ID Decode - Display the ID / Alias of a calling radio on all other radios
- Selective Radio Inhibit – Allow the dispatcher to inhibit a radio
- Call Alert – Alerts the user to call the dispatcher
- Radio Check – Verify that the unit is within the operating area

MDC Mute - When the feature is enabled, the radio mutes the speaker upon receiving the MDC tone. This causes a short audible chirp on the radio before the radio can mute. The radio unmutes the speaker after MDC has faded and a programmable delay has expired.

MDC Side Tone - Allows the radio to be programmed with an MDC Side Tone as an alternative to the normal talk permit tone. Four settings are available:

- None - No side tone
- PTT-ID - The radio plays a side tone while the MDC ID gets transmitted
- PTT-ID Short - The radio plays a brief side tone after the MDC ID gets transmitted
- Both - Both tones get played

MDC1200 Emergency Alarm - The radio continues trying its emergency transmission until the emergency is acknowledged by the system or the retry attempts expire (as determined by Armada programming).

Inhibit/Uninhibit Commands - Command to inhibit (disable) and uninhibit (enable) mobile access to the radio system.

5.13.6 GE Star

GE Star signaling is implemented for transmit functionality. Two programming modes are available:

Standard format (normal ANI for pre- and post- ANI and RTT and emergency).

NYSP format (emergency)

5.14 Project 25 Mode Features

The following features are unique to conventional P25 channels.

5.14.1 Digital Unit ID

Each radio that operates on Project 25 (digital) channels is programmed with an up-to-eight-digit unit ID. This ID is unique for each radio and can be any number from 1-16,777,215. When power is turned on with a Project 25 channel selected, this ID is briefly displayed.

5.14.2 Talkgroup ID

Each Project 25 channel is programmed with a group ID that determines which group of radios will receive the call. A call is received on a channel if a selected or scanned channel is programmed with that ID and the correct NAC is detected (see following). Group IDs can be any number from 1-65,535. Group ID detect can be disabled by the Normal/Selective squelch function described in Section 5.4 and the Monitor Mode described in Section 5.2.

5.14.3 Network Access Code (NAC)

Project 25 conventional channels also use a NAC (Network Access Code) to control which calls are received on a channel. The NAC can be 1-4095, and each transmit and receive channel can be programmed for a different code. Other operation, such as monitoring before transmitting, is similar to that of analog channels. NAC (and group ID) detect can be disabled by the monitor mode described in Section 5.2.

5.14.4 EFJohnson System Out-of-Range Indicator

If programmed, Out-of-Range (OOR) monitoring and indicators to the user are provided. The radio can be programmed to provide an out-of-range indicator when used on an EFJohnson Infrastructure system. If the radio fails to receive the beacon signal or a voice call from the system, then (if programmed) an out-of-range status will be indicated on the radio by a tone, display, or tone and display.

The out-of-range function operates on conventional analog and digital channels that have been programmed for the feature. The radio goes out of range if it does not receive transmission from the current site for a specified time. The radio comes back into range if it receives a transmission on an OOR channel.

- Scanning Mode - the same as above
- Unit and Interconnect Calls - OOR operates in the background. Tone indicators will sound, but the OOR message is not displayed.
- PTT Operation - Pressing the PTT does not reset the inactivity timer. If the timer expires while the radio is transmitting, no indication will be provided to the user until they release the PTT. When the PTT is released, the radio will flash “Out of Rng” and beep, if applicable.

If the user is in a fringe area or is entering an area that has poor coverage such as a building and wishes to disable the tone, an Out-of-Range Indication Tone feature can be programmed to the menu or to a button. In the menu, the feature is labeled “OORI Tone”, and the soft menu label is “OORI”. The feature will allow the user to disable / enable the Out-of-Range Indication tone from the radio. The Out of Range display messages will not be affected.

- If the OORI tone is disabled in programming (No Indication, Display Only), pressing the OORI Tone button results in “Disabled” on the display.
- If the OORI Tone is active, pressing the OORI Tone button disables the tone and the display will flash “OOR Tone Off” for one second.
- If the OOR tone is not active, pressing the OOR Tone button enables the tone and the display will flash “OOR Tone On” for one second.
- Both the Entering OOR and Exiting OOR Tones will be disabled to avoid excess tones from fringe areas where the radio is toggling in and out of coverage.

Tones are restored on power cycle.

5.14.5 EFJohnson System Automatic Registration

When used in an EFJohnson P25 conventional infrastructure radio system, an option on the radio can be programmed to provide additional identifying information to the system upon receipt of a dynamic data registration request. If the “EFJ Affiliation” option is enabled, the radio will transmit its current talkgroup to the system in addition to its unit ID during a dynamic data registration request. EFJohnson also supports conventional standardized IP data context activation registration without the EFJ affiliation enabled.

The radio will attempt a data registration on channel change. If the radio does not receive a registration response after the programmed number of retries it will display “IP Reg Failed”. If the radio is out of range and then returns to within range of a site where it had not yet registered, it will initiate another registration.

5.14.6 P25 Group Calls

P25 Group calls are placed by simply selecting the channel programmed for the desired group, monitoring the channel if required, and transmitting. When a P25 group call is received, the alias (or frequency) of the selected channel is displayed. The radio can be programmed so that the following are also displayed for 0.5 to 7.0 seconds or continuously during the call.

PTT ID – The unit ID of the radio placing the call is displayed.

P25 Talkgroup – The alias of the talkgroup on which the call is being received is displayed.

User Group ID – If the group ID of the call being received is included in a preprogrammed User Group ID list, the alias programmed in that list for that group is displayed.

Received Key ID – The Key ID (or the alias, if programmed) of the key used to decode the call is displayed.

P25 Talkgroup – The radio displays the number or alias of the talkgroup on which the call is being transmitted. This can be programmed to display for 0.5-7.0 seconds or infinitely.

5.14.6.1 Changing Talkgroup Assigned To a Channel

If the Talkgroup Select option switch is programmed, the talkgroup assigned to a channel can be changed by the user. The operation can also be selected from the menu as Select TG, or "TGSEL" from the soft button menu. The new talkgroup continues to be assigned to the channel until it is manually changed again (cycling power or selecting another channel does not reselect a default talkgroup). Change the talkgroup assigned to a channel as follows:

1 Select the channel to be changed and then press the Talkgroup Select option switch.

2 Press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to display the talkgroup to be assigned to that channel. Talkgroups are indicated by a unique identification in the alphanumeric display.

3 To select that talkgroup and return to normal operation, press the Talkgroup Select switch again or press the Select button [O](VM5000/VM7000) or the Select switch (VM6000). A single beep sounds when the Select switch is pressed. If talkgroup selection has been disabled on the channel by programming, the talkgroup does not change, "No Edit" is displayed, and a tone sounds.

5.14.7 P25 Unit Calls

Unit calls (also called Individual Calls) can be placed to a specific radio on Project 25 channels using the Unit Call option switch (if programmed) or by menu selection. Only the individual ID of the target radio is sent (a talkgroup ID is not sent). The radios that can be called are preprogrammed in the Unit Call list.

To receive a unit call, the RF channel of the call must be selected or scanned and the correct NAC and unit ID must be detected. The ID of the calling radio is then transmitted back. To respond to the call, the radio must be programmed with the Unit Call option switch, and have a Unit Call programmed with the ID of the calling radio.

5.14.7.1 Place and Receive a Unit Call

To place and receive a Unit Call:

1 To transmit a unit call, press the Unit Call option switch, menu option, or soft button option. The alias (tag) of the last Unit Call is displayed.

Direct entry is allowed using the front buttons of the Digital Keypad Mic.

2 If required, press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to display the desired alias/ID. The alias and ID of the unit calls that have been programmed are alternately displayed.

3 Press and then release the PTT switch.

4 When a unit ID call is received, two beeps sound (if tones are enabled), and "Call Received" and the alias of the Unit ID are alternately flashed.

5 To respond, select the Unit Call mode by pressing the Unit Call option button, Call Response option button, or the corresponding menu items.

- If the call timer times out (60 seconds) before a response is made, the unit call mode is exited and "Timeout" is displayed. If the channel is changed before a response is made, the unit call mode is exited.

5.14.7.2 Direct Channel Entry

The direct Channel entry feature is available if the Channel Select option button parameter is programmed. This allows channels to be directly selected using the keypad on the Digital Keypad Microphone

For direct selection purposes, channels are numbered sequentially starting with the lowest zone, and each zone can be programmed with up to 255 channels. For example, if Zones 1, 2, and 3 are programmed with 16 channels each, Zone 1 channels are numbered 1 through 16, Zone 2 channels 17 through 32, and so on. Zone 1/Channel 16 is selected by Channel 16, and Zone 2/Channel 16 is selected by Channel 32, as shown below.

Table 5.2 Channel Numbering

Seq. Ch. No.	Zone	Channel
1 - 16	1	1 - 16
17 - 32	2	1 - 16
33 - 48	3	1 - 16

Proceed as follows to select channels using this mode:

1. Enable the direct Channel Select mode by selecting it through the menu or by pressing the Channel Select soft button. A single beep sounds when the switch is pressed. The alias and sequential number of the current channel are alternately displayed.

2. Select the desired channel using the Up/Down buttons or directly enter the four-digit number using the 0 to 9 buttons. A single beep sounds when the channel is changed. If using the 0 to 9 buttons, the radio attempts to display the entered number after the third digit is entered or approximately two seconds after the last button is pressed.

3. To exit this mode and select the entered channel, press the Channel Select button again. Pressing PTT will select the entered channel, exit channel select mode, and begin transmission. This mode is also exited automatically without changing the channel after approximately one minute of no activity.

5.14.8 P25 Conventional Telephone Calls

Telephone calls can be placed and received on P25 conventional channels with a Network Interface Unit (NIU) or Telephone Interconnect Gateway (TIGW). EFJohnson also supports telephone calls to be placed and received over other vendor's public telephone. Telephone calls are programmed to operate in one of the following modes:

- Disabled
- Answer-only capability
- List only—Telephone numbers can be selected from a preprogrammed list only (direct entry as follows is not allowed)
- Unlimited—Telephone numbers can be selected from a list and also dialed directly (press and hold) entered using the front panel controls or the keypad on the Digital Keypad Microphone.

All models have the capability to place telephone calls by recalling the number from a list or dialing it using the front panel controls or using the keypad on the Digital Keypad Microphone. More information on how to do this follows.

5.14.8.1 Access / De-Access Codes

P25 conventional telephone calls use an access code to access the system when placing a telephone call, and a de-access code to terminate the call when it is finished. These codes are preprogrammed in pairs by the Access/De-Access Code list, and up to 255 pairs can be programmed. Each conventional P25 channel can be programmed to automatically select one of these code pairs. They must match the system codes, and the default code is ***1P#** (the P represents a pause).

For radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, the phone access code for a conventional digital channel has a **None** option. If the operator selects **None**, the radio does not send in an access or deaccess code to a repeater when entering or exiting conventional interconnect. (If the operator selects an access code, the feature works as before.)

5.14.8.2 Placing a Telephone Call

To recall from list:

1 Select the conventional channel that is programmed to select the desired access and de-access codes.

2 Momentarily press the PHONE option button, make the menu selection, or press the PHONE soft button. The display indicates the last number dialed by alternately displaying “LAST NUM” and the telephone number. In addition, the phone mode is indicated by the ☎ icon.

3 If required, press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to display the desired number. The alias and telephone number are alternately displayed.

4 Briefly press the PTT switch to send the access code. A dial tone sound should then be heard. Briefly press the PTT switch again to send the digits. Proceed to Step 5 (in next steps):

For direct entry using front panel controls or the keypad on the Digital Keypad microphone:

1 Select the conventional channel that is programmed to select the desired access and de-access codes.

2 Press and hold the PHONE option switch until a tone sounds (approximately one second). The alias of the last called telephone number is displayed if it is in the

phone number list. Otherwise, only the last eight digits are displayed. In addition, the phone mode is indicated by the ☎ icon.

3 If using the front panel controls, enter the telephone number by rotating and pressing the Select switch. The 0-9, *, #, and P (pause) characters can be entered. Numbers up to sixteen digits (including pauses) can be entered, and the number scrolls to the left in the display so that the eight right-most digits are always displayed. With the Digital Keypad Microphone, enter the number using the DTMF keypad (a pause indicated by "P" is entered by * #).

4 Briefly press the PTT switch to send the access code. A dial tone sound can then be heard. Briefly press the PTT switch again to send the digits.

5 Press the PTT switch to talk and release it to listen. Since the radio operates half duplex, it is not possible to talk and listen at the same time.

6 When the telephone call is finished or if it could not be completed for some reason, end it by pressing the PHONE option switch again or by pressing the "EXIT" soft button and placing the microphone back on-hook. This sends the de-access code which tells the system that the call is finished and that the repeater can be released.

5.14.8.3 Answering a Telephone Call

To answer a telephone call:

1 When a telephone call is received, "ringing" similar to a standard telephone is heard and "Phone Call" is displayed.

2 To answer the call, press the Phone option button and press the PTT switch to talk and release it to listen.

3 When the call is finished, end it as in the preceding Step 6.

5.14.9 Call Alert

The Call Alert™ feature allows pages to be sent and received on P25 conventional channels. The Call Alert Encode and Decode options must be enabled (by programming) to send or receive an alert. Operation is similar to Viking16 and P25 Trunking channels.

To answer a page:

1 When a page is received, five beeps sound and "Page Receive" is displayed. The ID of the radio paging you is stored as the last ID received.

- Conventional calls trigger the Call Alert message & tone only once. Then, the message & tone wait to play again until after the last transmission in the call has ended.

- For conventional radios using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, the Armada administrator can configure a longer minimum time period between Call Alert tones. This prevents rapid carrier loss and gain from playing the tone multiple times a second if there are issues with the tone playing multiple times in a call.

2 To clear or ignore the page, press any option switch. If the PTT switch is pressed, a group call is placed on the selected channel.

3 To answer the page as a unit call (see Section 5.14.7), press the Unit Call option switch (or select the option from the menu). The alias of the radio paging you is displayed. Press the PTT switch and respond. One of the following conditions then occur:

- If the radio being called is on the air, ringing is heard until the called party answers or for 20 seconds, whichever occurs first. If no answer occurs within 20 seconds, a continuous tone sounds and "No Answer" is displayed.
- If the radio being called is not on the air, a continuous tone is heard instead of ringing and "No Acknowledge" is displayed.

4 When the call is finished or if it could not be completed for some reason, end it by pressing the Unit Call option switch or the <F6> (Exit) button.

To initiate a page:

1 With a P25 conventional channel selected, momentarily press the Call Alert option switch. The alias of the last ID called is displayed. Or press and hold the switch to directly enter the ID of the radio you wish to page.

2 If required, press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to display the desired radio. The alias of each number is displayed.

3 Press the PTT switch and one of the following occur:

- If five beeps sound, the system received the page and the paged radio is on the air and received it. The page mode is automatically exited.
- If the system received the page but the called radio is not on the air, a single beep sounds "No Acknowledge" is displayed six seconds after the PTT switch is pressed. Auto exit then occurs.

5.14.10 Call History

If programmed, the Call History feature stores the IDs of the last five radios that have made talkgroup calls, unit calls, or call alerts to the user's radio. To view the Call History list:

1 Access Call Alert or Unit Call List from the menu. The first call displayed is the most recent call received.

2 Scroll through the list to view up to 5 calls, in order from most recent to least recent.

5.14.11 Messaging

The messaging feature allows preprogrammed messages to be sent to a dispatcher on P25 channels. Up to 255 messages can be preprogrammed, and they are identified by an alias. If a Message option switch is programmed, messages are sent as follows:

1 Momentarily press the Message option button, menu option, or soft button. The alias of the last message sent is displayed.

2 If required, press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to display the desired message. Then send the message by momentarily pressing the PTT or Select switch. A single beep sounds when the Select switch is pressed. One of the following events then occurs:

- If five beeps sound and "Ack Received" is displayed, the message was received and automatically acknowledged by the system.
- If after five tries the message is not acknowledged, a tone sounds and "No Acknowledge" is displayed.

Note *A smart console with message receiving capabilities must be used to receive messages.*

5.14.12 Status Messaging

The status messaging feature allows you to manually or automatically send your current status to your dispatcher on P25 channels. Up to 255 status conditions can be preprogrammed, and they are identified by an alias. If the STATUS option switch is programmed, status conditions are sent as follows:

1 Momentarily press the STATUS option switch or soft button, or select the option through the menu. The alias of the current status condition is displayed.

2 To change the current status, press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) until the desired status is displayed. Then to send the status, momentarily press the PTT switch. One of the following events then occurs:

- If five beeps sound and "Ack Received" is displayed, the status was received and acknowledged by the system.

- If after five tries the message is not acknowledged, a tone sounds and “No Acknowledge” is displayed.

Note *A smart console with message receiving capabilities must be used to receive status messages.*

5.14.13 P25 Packet Data

See Section 8 for information on data functions and services.

5.14.14 P25 Trunking Two Tone Decoder

P25 Trunking channels can be configured with a Two Tone Decode list. The radio can be configured to require that a two tone page be received before unmuting to received audio. A P25 Trunking channel with a P25 Two Tone Decoder list decodes tones after moving to the traffic channel. If the Unmute Type is set to “Talkgroup,” the radio will unmute when receiving traffic from an appropriate talkgroup, regardless of whether a two tone page was received. If the Unmute Type is set to “Talkgroup and Signaling,” the radio must receive traffic from an appropriate talkgroup and a valid two tone pattern that matches the decoder list setting.

Regardless of the Unmute Type, once the radio decodes a valid two tone page, it will emit an alert tone and turn on the Selective LED (if enabled). After the call ends, the Auto-Reset Timer will begin (if enabled). If the Auto-Reset LED option is enabled, the Selective Call LED will be turned off when the timer expires. If the Auto-Reset Monitor option is enabled and the timer expires, the radio will be required to receive another valid two tone page in order to unmute to received audio. The Auto-Reset Monitor option is only functional when the Unmute Type is set to “Talkgroup and Signaling”.

If enabled, the LED on the radio will blink orange and green after decoding a valid two tone code and a carrier is present. Once the carrier is no longer detected, the LED will blink orange for a length of time corresponding to the Auto-Reset Timer.

After receiving a call with a valid two tone page, the radio will begin the auto-reset timer once the carrier is no longer detected. When the timer expires, the radio will check the LED and Monitor options. The Timer can be configured from 0 to 300 seconds. Setting the timer to 0 disables the timer (effectively infinite). If enabled, the Selective Call Alert LED will be canceled when the auto-reset timer expires. If this option is enabled and the auto-reset timer expires, the radio must receive another valid two tone code before the radio will open to received audio.

Radios using Firmware Version 8.30.x or later programmed by Armada 1.30.x and later can use the following P25 Trunking Two Tone Decoder enhancements

- A P25 Two Tone List Select feature has been added. This allows the user to select a different decode list for the selected channel at any time. “No List” can also be selected to disable Two Tone Decoder. The Armada administrator can program it to a button or the menu. (This feature is also available for conventional analog.)
- DSP enhancements have been added to allow the radio to decode Phase 1 Quick Call II pages from other manufacturers’ radios.
- The Armada administrator can configure the radio to do the following:
  - Sound the automobile’s horn (horn honk) when the radio receives and decodes a two tone page. This feature has the following requirements:
    - Horn Honk is enabled
    - Auxiliary B output is set to “Horn”
    - Two Tone Decode matches Two Tone Encode of the transmitting radio
  - Prevent the radio user from changing the Two Tone Decoder list.

5.14.15 P25 Trunking Two Tone Encoder

P25 Trunking Two Tone Encoding is similar to analog Two Tone Encoding (Section 5.13.2). The user can scroll through the list of tones programmed in Armada. Pressing PTT sends the selected Two Tone sequence, after which the radio transmits voice as normal. Alternatively, the user can perform a “Press-and-Hold” of the Two Tone button, which sends the last selected Two Tone sequence and then immediately stops transmitting.

Note *The “Press-and-Hold” operation fails if the radio is performing data operations.*

On mixed-mode channels, the Two Tone Encoder function performs analog or digital encode corresponding to how the mixed-mode “Transmit Type” is programmed.

5.15 Keypad Programming

Since keypad programming is permitted by US Federal Government users only, only Federal models of this radio can be programmed with this feature. It is then available only if it has been enabled by factory programming and a conventional mode option switch is programmed for the “Keypad Programming” function.

Note *The Keypad programming feature is available to US Federal Government users only. Users regulated by the Federal Communications Commission (FCC) are not allowed to have this feature. This feature must be factory enabled to be selected.*

Keypad programming is selected by pressing the Keypad Programming option button or by selecting the option from the menu (password entry is not required). The keypad programming mode is indicated by "Change Zone" and the icon in the display.

Keypad programming allows conventional channel parameters such as the transmit and receive frequency, Call Guard squelch code, and encryption key to be changed. In addition, several conventional mode timers can be changed. It cannot be used to reprogram disabled channels or any P25 Trunked, V16 Single Site, or V16 Multi Site information.

5.15.1 Menu Structure

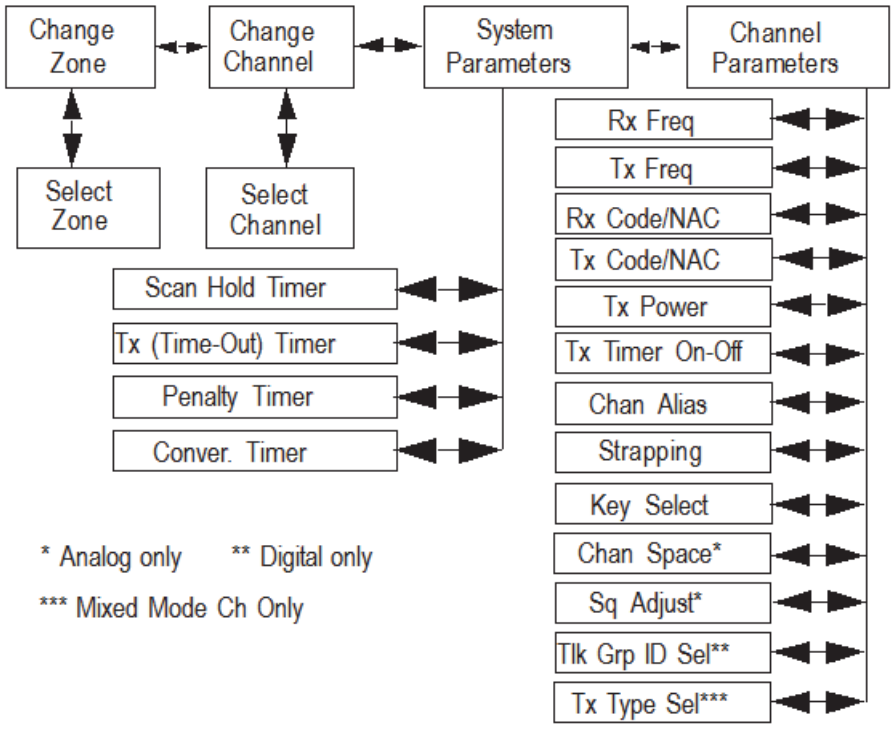
A menu system is used to select parameters in the keypad programming mode. To enter the Menu Mode, press and hold the Select button until it beeps and enters the Menu Mode. Press the Right Up/Down buttons ▲/▼ (VM5000), rotate and press the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to scroll through and select the available parameters. The available parameters and the section in which each is described are as follows:

- Zone Change Parameter (Section 5.15.3)
- Channel Change Parameter (Section 5.15.4)
- System Parameters (Section 5.15.5)
- Channel Parameters (Section 5.15.6)

Press the Select switch to select the displayed parameter. A single beep sounds when the switch is pressed. Press the Keypad Programming option button from one of the main menus to exit keypad programming or from other menus to exit back one level.

The flowchart in Figure 5.1 shows the keypad programming mode menu structure. Refer to the descriptions that follow for more information.

Figure 5.1 Viking Keypad Programming Menu Flowchart



5.15.2 Zone Password

Each zone can be programmed with a password to prevent unauthorized reprogramming of zone by keypad programming. When this password is programmed, it must be entered before system or channel parameters in that zone can be changed by keypad programming. A different password can be programmed for each zone.

Note *Make sure that the zone passwords are not lost because they cannot be overridden in the field. Armada must be used to add a new password.*

When an attempt is made to select a system or channel parameter in a password protected zone, "PASSWORD" is flashed. The password can be one to eight digits long and is entered using the same procedure as used for the power-up password described in Section 3.1.4. After the password is entered, system and channel parameters for that zone can be reprogrammed normally.

5.15.3 Zone Change Parameter

The "Change Zone" menu parameter selects the zone containing the conventional channel to be reprogrammed. It does not change the zone selected for normal operation.

To select the Change Zone parameter and then scroll through the programmed zones, press and rotate the Select switch (VM6000), press the Right Up/Down buttons ▲/▼ (VM5000), or press the Navigation Pad Up/Down buttons (VM7000) to cycle through the list. When the desired zone is displayed, select it by pressing the Select switch/ button. A single beep sounds when the switch is pressed.

5.15.4 Channel Change Parameter

The "Change Channel" menu parameter selects the conventional channel to be reprogrammed. Disabled or P25 Trunking/Viking16 channels cannot be selected. This does not change the channel selected for normal operation.

To display Change Channel and then scroll through the programmed channels, press and rotate the Select switch (VM6000), press the Right Up/Down buttons ▲/▼ (VM5000), or press the Navigation Pad Up/Down buttons (VM7000) to cycle through the list. When the desired channel is displayed, select it by pressing the Select switch/ button. A single beep sounds when the switch is pressed.

5.15.5 System Parameters

The "System Parms" menu parameter selects the conventional mode timer to be reprogrammed. For the VM5000, press the Right Up/Down buttons ▲/▼ to cycle through the list to select System Parms, and press the Select button [O] to confirm the selection. For the VM6000, press the Select switch to select System Parms and then rotate that switch to display the desired parameter. Press the Select switch again to select it. A single beep sounds when the switch is pressed. For the VM7000, press the Navigation Pad Up/Down buttons and then press the Select button. The following timers can be programmed.

Note *If "PASSWORD" is briefly displayed when attempting to select a parameter, see Section 5.15.2.*

SCAN TIMER - Selects the Scan Hold timer. Press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to decrement/increment the timer in 0.5-second steps from 0 to 7.5 or set it to 0 seconds to disabled it. When the desired value is displayed, store it by pressing the Select button [O] (VM5000/VM7000) or the Select switch (VM6000). A single beep sounds when the switch is pressed.

TX TIMER - Selects the transmit time-out timer. Press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to decrement/increment the timer in 15-second steps from 0 to 225 or disable it by selecting 0 seconds. When the desired value is displayed, store it by pressing the Select button [O] (VM5000/VM7000) or the Select switch (VM6000). A single beep sounds when the switch is pressed.

Penalty Timer - Selects the penalty timer. Press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to decrement/increment the timer in 15-second steps from 0 to 225 or disable it by selecting 0 seconds. When the desired value is displayed, store it by pressing the Select button [O] (VM5000/VM7000) or the Select switch (VM6000). A single beep sounds when the switch is pressed.

Conversation Timer - Selects the conversation timer. Press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to decrement/increment the timer in 30-second steps from 0 to 450 or disable it by selecting 0 seconds. When the desired value is displayed, store it by pressing the Select button [O] (VM5000/VM7000) or the Select switch (VM6000). A single beep sounds when the switch is pressed.

5.15.6 Channel Parameters

The "Channel Parms" menu parameter selects the following conventional channel parameters that can be reprogrammed. Press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to select the "Channel Parms" parameter. Then press the Select button [O] (VM5000/VM7000) or the Select switch (VM6000) again to select it. A single beep sounds when the switch is pressed. The squelch control parameters are unique to the type of conventional channel selected (analog or P25).

Note *If "PASSWORD" is briefly displayed when attempting to select a parameter, see Section 5.15.2.*

Note *If a mixed mode channel is selected, both the Rx Code (analog) and Rx NAC (P25) which follow can be programmed. In addition, if the Tx Type is Analog, a Tx Code is programmed, and if it is Digital (P25), a Tx NAC is programmed.*

RX FREQ - Programs the receive channel frequency. To select the digit to change or move the cursor to the right, press the Right Up/Down buttons ▲/▼ (VM5000) or the Right button on the navigation pad. To move the cursor to the left, press the Left button on the navigation pad. Then to display the desired digit, press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000). The frequency is stored after programming the last digit. If an invalid frequency is entered, a beep sounds, "INVALID" is briefly displayed, and the frequency editing mode continues to be selected.

TX FREQ - Selects the transmit frequency the same the preceding RX FREQ.

RX CODE - Sets the receive Call Guard (CTCSS/DCS) code. The currently selected code is initially displayed. If required, press the Right Up/Down buttons ▲/▼ (VM5000), rotate and press the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to select the desired code type (CTCSS analog or DCS digital). If an invalid code is entered, a beep sounds, "INVALID" is briefly displayed, and the editing mode continues to be selected. For radios using Firmware Version 8.26.x or later programmed by Armada 1.26.x and later, setting the CTCSS/DCS code to 0 resets the channel back to carrier squelch instead of displaying "INVALID".

TX CODE - Selects the transmit codes the same as RX CODE above.

RX NAC - Selects the receive Network Access Code (NAC) which can be any number from 1 to 4095. This number is displayed in hexadecimal from 000 to FFF. Press the Right Up/Down buttons ▲/▼ (VM5000), rotate and press the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to enter the desired code. A single beep sounds when the switch is pressed. The displayed code is stored after the last digit is programmed. If an invalid code is entered, a beep sounds, "INVALID" is briefly displayed, and the NAC editing mode continues to be selected.

TX NAC - Selects the transmit NAC the same as RX NAC above.

TX POWER - Selects the desired power output level. Press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch to scroll through the following choices, or press the Navigation Pad Up/Down buttons (VM7000). When the desired setting is displayed, store it by pressing the Select button [O] (VM5000/VM7000) or the Select switch (VM6000). A single beep sounds when the switch is pressed.

- POWER High - Selects high transmit power.
- POWER Low - Selects low transmit power.

TX TIMER - Enables or disables the time-out timer on the current channel. Press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch to toggle between the ON and OFF mode, or press the Navigation Pad Up/Down buttons (VM7000). When the desired setting is displayed, store it by pressing the Select button [O] (VM5000/VM7000) or the Select switch (VM6000). A single beep sounds when the switch is pressed.

Channel Alias - Programs the alias for the channel. Up to sixteen characters from A to Z and 0 to 9 and spaces can be entered. To program a new alias, press the Select button [O] (VM5000/VM7000) or the Select switch (VM6000) once to display the current alias and then press the Right Up/Down buttons ▲/▼ (VM5000). Press the Select switch (VM6000) again or rotate it to display the desired character and then press the Right button on the navigation pad to move to the next position. For the VM7000, press the Navigation Pad Up/Down buttons to select the desired character. A single beep sounds when the switch is pressed and the alias is then stored.

Note *The next two parameters are programmed only if the radio is programmed for encryption.*

Strapping - Selects the encryption strapping mode for the channel as Clear, Secure, or Switched.

Key Select - Selects the encryption key for the channel if applicable. The key storage location of 0 to 63 (PID) or 1 to 64 (SLN) is selected (see Section 7.2.2). If no keys are programmed, "NO KEYS" is displayed.

Channel Space (Analog Only) - Selects either wide or narrow band channel spacing on analog channels only. Press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch to toggle between "WIDE" and "NARROW", or press the Navigation Pad Up/Down buttons (VM7000). When the desired setting is displayed, store it by pressing the Select button [O] (VM5000/VM7000) or the Select switch (VM6000). A single beep sounds when the switch is pressed.

Note *The channel spacing is not set with P25 channels because it is always narrow, and the squelch cannot be changed because the setting is critical for proper receiver operation.*

Squelch Adjust (Analog Only) - Changes the preset squelch setting on that channel. The default setting is "0" and values of –7 to +7 can be selected. Decreasing this setting toward -7 causes the squelch to open sooner so that weaker signals can be received, and increasing it toward +7 causes the opposite to occur.

TG ID (P25 Only) - Selects the talkgroup for the selected channel. Press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch to display the alias of each preprogrammed talkgroup, or press the Navigation Pad Up/Down buttons (VM7000). Then press the Select button [O] (VM5000/VM7000) or the Select switch (VM6000) to store the desired talkgroup. A single beep sounds when the switch is pressed.

Transmit Type (P25 Mixed Mode Only) - If the selected channel is a mixed mode, analog and P25 channel, this selects the transmit type. Either Analog or Digital (P25) can be selected. This then determines if a Tx Code or Tx NAC is programmed above.

5.16 Text Messaging

If enabled, mobile radios have text message receiving capability (digital conventional mode only).

Note *All mobile radios can receive text messages, but only mobile radios equipped with a digital keypad microphone can transmit them. All received messages are limited to 200 characters.*

5.16.1 Data Setup for Text Messaging

A mobile radio can receive a text message from another radio on a digital conventional channel regardless of whether the channel uses a repeater.

The radio's text message menu contains the item "Set R to R". The default for this setting is enabled, in which the following capabilities are operable:

- A text message can be received from radios on a simplex digital channel
- A text message can be received from radios on a digital channel with a repeater (if repeater talk-around is enabled)
- The repeater in use is programmed for Repeated Data mode (not supported by EFJ 2600 repeaters)

If "Set R to R" is disabled:

- A text message can be received from radios on a digital channel with a repeater if PCTextMessage is connected to that repeater (all radios must be dynamically registered to the repeater)
- A text message can be received from a radio and PCTextMessage on a digital conventional channel (if PCTextMesssage is connected to that repeater)

5.16.2 Receiving a Text Message

When a text message is received, a short alternating tone is sounded and the display flashes "Text Message".

To view the message, press the assigned text message function button. The sender's Unit ID (or alias, if programmed) will be displayed for approximately one second. Following this, the text of the message is shown.

If the message is fifteen characters or less in length, the text will remain stationary.

- To pause scrolling, press the Select button [O] (VM5000/VM7000) or Select switch (VM6000).
- If desired, adjust the message position by using the Right Up/Down buttons ▲/▼ (VM5000), by turning the Select switch (VM6000), or by pressing the Navigation Pad Up/Down buttons (VM7000).
- To resume scrolling, press the Select button [O] or the Select switch again.

Note *The message displayed is the message most recently received. To view messages received earlier, refer to Section 5.16.3.*

5.16.3 Viewing Previously Received Messages

To view previously received messages:

1. Press and hold the text message button, or select the text message menu item, and select “View Msg”. The display will show “Message 1”, which is the most recent message received.
2. Use the Select switch to move through the list to the desired message.
3. To view the message text, press the Select switch.

Note *Text messages are retained only while the radio is powered up. If power is removed, all text message data is lost.*

5.17 Conventional RSSI Display

For radios in conventional systems using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, the radio continuously displays the Receive Signal Strength Indicator (RSSI) [in dBm] during calls. Because this is primarily a test feature, the RSSI display overrides other display information, such as PTT ID or other display options. The feature is off on boot. After the operator turns the radio on, the feature remains on until they turn the radio off.

The radio displays a red “alert” banner if the RSSI falls to a level corresponding to 0 bars on the signal strength indicator. Otherwise, a green banner displays.

The hardware on the radio is limited to measuring RSSI up to around -70 dBm (depending on the band).

SECTION

6

P25 Trunked / Viking16 Features

The features described in this section are radio features unique to these modes of operation. This chapter contains the following sections:

6.1 Analog and Digital Operation

Either analog or digital operation can be selected for communication on V16 Multi Site traffic channels. Each talkgroup can be programmed for either type of operation. Digital operation is an optional feature.

6.2 Viewing Unit ID

When power is turned on with a Viking16 channel selected, the five-digit Unit ID from 1 to 65,534 is briefly displayed as xxxxx. When a P25 channel is selected, the eight-digit unit ID from 1 to 16,777,211 is displayed (see Section 5.14.1).

6.2.1 Radio Info Button

Pressing the Radio Info button (if programmed) or selection of the menu parameter allows the user to display the ID programmed for the currently selected protocol. If the radio is on a digital conventional channel, it shows the digital conventional ID. If the radio is currently on a P25 Trunking or Viking16 channel location, it shows the ID associated with that protocol. This feature also shows the following items:

- Radio Alias
- Radio Tag
- Profile Tag
- Unit ID for active protocol
- Encryption Key location programmed for the currently selected channel
- Over the Air IP Address
- ESN
- Encryption Module Version
- Wi-Fi Menu
- Band
- Current Software version in the radio

6.3 Standard Group Calls

Standard calls are between you and another mobile, group of mobiles, or a control station (a radio in a fixed location). Most calls are probably this type. Proceed as follows to place and receive group calls.

6.3.1 Placing a Standard Group Call

To place a Standard Group Call:

1 Turn power ON and set the volume as described in Section 3. Select the channel programmed for the talkgroup you want to call (see Section 3.1.7).

2 If the talkgroup is programmed for encryption and is not strapped to Clear or Secure, select the desired mode by pressing the Clear/Secure option button, soft button, or selecting the menu parameter. The status of that switch is ignored if the talkgroup is strapped to Clear or Secure, or if the "Ignore Clear/Secure Switch when Strapped" is programmed. When you change to Secure mode, the display will briefly display the Key Alias assigned to this encryption key. Refer to Section 7.3 for more information.

3 Press the PTT switch and begin talking. An optional talk permit tone may sound to indicate when talking can begin. Other indications that may occur are as follows:

- If in the secure mode and your radio is not programmed with the proper encryption key, "KEYFAIL" is displayed and the call must be made in the clear mode or the proper button must be programmed.
- If the busy tone sounds and "BUSY" is displayed, the system is busy. Release the PTT switch and wait for the call back tone to sound. Then press the PTT switch within three seconds.
- If a continuous tone sounds and "OUT OF RANGE" is displayed, you may be out of range of the site or blocked from it by radio-shielding structures or objects. Drive away from shielding structures or objects and try again. If this does not work, drive closer to the site.
- If your unit ID is denied, the call is being made to an invalid group ID, or group calls are not enabled, "Denied" is displayed and an alert tone sounds.
- If an attempt is made to change a channel from the clear to the secure mode and there is no available secure channel, "CLEAR ONLY" is flashed, an error tone sounds, and the call is terminated. (V16 Single Site Only)
- If the Secure mode is selected by the Clear/Secure option button, soft button, or menu parameter and an attempt is made to transmit on a channel strapped as Clear, "CLEAR ONLY" is displayed and the transmitter is disabled. Likewise, if the Clear mode is selected and the channel is strapped as secure, "Secure Only" is displayed and the transmitter is disabled.

6.3.2 Receiving a Standard Group Call

Calls are received on only the talkgroup and/or announcement group programmed for the selected channel (with scanning disabled).

When a group call is received, the alias of the selected channel is displayed. The radio can be programmed so that the following are also displayed for 0.5 to 7.0 seconds or continuously during the call.

PTT ID - The unit ID of the mobile placing the call is displayed.

TG on Rx - The alias of the talkgroup on which the call is being received is displayed (typically for use by technicians).

User Group ID - If the group ID of the call being received is included in a preprogrammed User Group ID list, the alias programmed in that list for that group is displayed.

Receive Key ID - The Key ID (or the alias, if programmed) of the key used to decode the call is displayed.

6.4 Unit Calls

Unit calls allow calls to be placed to a specific radio. Either the Enhanced or standard modes may be programmed depending on the capabilities of the radio system. One difference between these call types is that the Enhanced type provides an indication that the called mobile is not on the air and the standard version does not. Operation in each of these modes is described in the following sections.

The Unit Call option button is required to place these calls, and either that button or the Call Response button is required to answer them. The feature is also selectable through menu parameter or soft button. Unit calls are programmed to operate in one of the following modes:

- Disabled
- Answer-only capability
- List only - Unit IDs can be selected from a preprogrammed list only (direct entry as follows is not allowed)
- Unlimited - Unit IDs can be selected from a list and also dialed directly using the front panel controls or keypad on the Digital Keypad Mic

6.4.1 Placing an Enhanced Unit Call

To recall from a list:

1 Momentarily press the Unit Call option button, soft button, or select the menu parameter. The alias of the last called mobile is displayed.

2 To select another mobile, use the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) until the alias for the desired mobile is displayed.

3 Press the PTT switch and one of the following events then occurs:

(Proceed to the bulleted list that follows Step 3 in the next section for events that may occur next.)

To make direct entry from the Menu (scroll down to select direct entry) or by using front panel controls or the keypad on the Digital Keypad microphone:

1 Press and hold the Unit Call option button until a tone sounds (approximately one second). The last ID called is displayed.

2 If using the front panel controls, enter the ID of the radio you are calling (eight digits for Unit Call) by pressing the Right Up/Down buttons ▲/▼ then the Select button [O] to enter the selection (VM5000), by rotating the Select switch and pressing the Right button on the navigation pad to advance the cursor (VM6000), or by pressing the Navigation Pad Up/Down buttons then the Select button [O] (VM7000). The Left button on the navigation pad can be used to move the cursor left to correct an entered number. With the Digital Keypad microphone, enter the number using the DTMF keypad. To cancel the call, press the Unit Call Option button again or press the "EXIT" soft button.

3 Press the PTT switch to initiate the call. If the entered number is valid, the display indicates the alias of the ID if it matches an ID in the call list. Otherwise, the ID you entered continues to be displayed.

Events that may then occur are as follows:

- If the mobile being called is on the air, "WAIT" is displayed and ringing is heard until the called party answers or for 20 seconds, whichever occurs first. Pressing the PTT or an option button stops the ringing but not the call. When the call is answered, the voice of the called party is heard.
- If the called mobile does not answer within 20 seconds, a continuous tone sounds and "NO ANSWER" is displayed.
- If the called mobile is not on the air, a continuous tone sounds instead of the ringing tone and "No Acknowledge" is displayed.
- If the busy tone sounds and "BUSY" is displayed, the called mobile has answered the call but the system is busy. When the system is no longer busy, the call back tone sounds.
- If your radio or the called radio is inhibited or not programmed to make this type of call or for the requested secure mode, "Response Only" is displayed, and an alert tone sounds.
- If your radio does not have the proper encryption key, "KEYFAIL" is displayed and the call must be made in the clear mode by pressing the Clear/Secure option

button (if encryption is selectable on the channel). Otherwise, the correct key must be loaded.

- If you enter an invalid ID in direct entry, the unit ID will be cleared and "Invalid ID" will be displayed.

4 When the call is finished or is not answered, end it by pressing the Unit Call option button and placing the microphone back on-hook, or by pressing the appropriate exit button.

6.4.2 Placing a Standard Unit Conversation Call

To recall from a list:

1 Momentarily press the Unit Call option button, soft button, or select the menu parameter. The alias of the last called radio is displayed.

2 To select another mobile, press the Right Up/Down buttons ▲/▼ then the Select button [O] to enter the selection (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) until the alias for the desired mobile is displayed.

3 Press the PTT switch to initiate the call.

(Proceed to the bulleted list which follows Item 3 in the next section for events that may occur next.)

To make a direct entry from the menu (scroll down to select direct entry), or by using front panel controls or the keypad on the Digital Keypad microphone:

1 Press and hold the Unit Call option button until a tone sounds (approximately one second). The last ID called is displayed.

2 If using the front panel controls, enter the ID of the radio you are calling (eight digits for Unit Call) by pressing the Right Up/Down buttons ▲/▼ then the Select button [O] to enter the selection (VM5000), by rotating the Select switch and pressing the Right button on the navigation pad to advance the cursor, or by pressing the Navigation Pad Up/Down buttons then the Select button [O] (VM7000). The Left button on the navigation pad can be used to move the cursor back to correct an entered number. If an invalid ID is entered in direct entry, the unit ID will be cleared. With the Digital Keypad microphone, enter the number using the DTMF keypad. To cancel the call, press the Unit Call Option button again.

3 Press the PTT switch to initiate the call. If the entered number is valid, the display indicates the alias of the ID if it matches an ID in the call list. Otherwise, the ID you entered continues to be displayed.

Events that may then occur are as follows:

- The called party answers the call.

Note *If programmed, the tone sounds until the called party answers or until the timer expires.*

- The called party does not answer. Press the Unit Call option button to end the call.
- If the selected mobile ID is not valid, "Invalid ID" is displayed and an alert tone sounds.
- If the radio system is busy, four low tones sound and "BUSY" is displayed. When the system is no longer busy, the call back tone (four beeps) is heard and the channel is automatically acquired. Press the PTT switch to continue the call.
- If the call is in the secure mode and your radio does not have the proper encryption key, "KEYFAIL" is displayed and the call must be made in the clear mode by pressing the Clear/Secure option button (if encryption is selectable on the channel). Otherwise, the correct key must be loaded.

4 When the call is finished or if it is not answered, end it by pressing the Unit Call option button and placing the microphone on-hook, or by pressing the appropriate exit button.

6.4.3 Receiving a Unit Call (All Types)

To receive a Unit Call:

1 When a unit call is received, "Call Received" is displayed, and the call tone sounds once. The unit ID of the calling mobile is displayed. The display toggles between "Call Received" and the calling ID. If programmed, the tone sounds until answered or timer expires.

2 To answer the call, select the menu parameter, press the Unit Call soft button or option button and then the PTT switch and begin speaking. More information follows:

- If the PTT switch is pressed before the Unit Call button, the call is transmitted as a group call.
- If unit calls are not permitted (the Unit Call option button is not programmed), press the Call Response option button to respond.
- The call must be answered within 20 seconds or it is automatically terminated.
- If the system is busy when a response is made, "BUSY" is displayed and the busy tone sounds.

Note *To ignore a received call (on a P25 Trunking system), the user can press the select switch on the mobile radio after a radio receives the unit call. This sends a unit call answer response to the system, denying the call from the radio. The system will repeat this, and the initiating radio immediately displays "No Answer."*

6.5 Telephone Calls

The telephone call feature allows telephone calls to be placed and received over the public telephone system using your radio. The type of call (secure/clear) is determined by the mode selected by the Clear/Secure option button or the menu parameter selected.

Telephone calling is programmed to operate in one of the following modes:

- Disabled (telephone calls not available).
- Answer-only capability.
- List only - Telephone numbers can be selected from a preprogrammed list only (direct entry as follows is not allowed).
- Unlimited - Telephone numbers can be selected from a list and also dialed directly using the keypad on the Digital Keypad Mic.

6.5.1 Placing a Telephone Call

To recall from a list:

1 With a P25/Viking16 channel selected, momentarily press the Phone option button, soft button, or select the menu parameter. The alias of the last called telephone number is displayed.

2 If required, press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to display the desired number. The alias of each number is displayed.

3 Press and then release the PTT switch. Refer to the bulleted list following Step 3 in direct entry instructions below for events that may then occur.

4 When the telephone call is finished or it could not be completed for some reason, end it by pressing the Phone option button and placing the microphone back on-hook or by pressing the appropriate exit button.

To make a direct entry from the menu (scroll down to select direct entry), or by using front panel controls or the keypad on the Digital Keypad microphone:

1 Select the menu parameter, press the soft button, or press the PHONE option button until a tone sounds (approximately one second). The alias of the last called telephone number is displayed if it is in the phone number list. Otherwise, the last ten digits of the last called telephone number are displayed. The phone call mode is indicated by ☎.

2 If using the front panel controls, enter the telephone number by pressing the Right Up/Down buttons ▲/▼ then the Select button [O] to enter the selection (VM5000), by rotating the Select switch and pressing the Right button on the navigation pad to advance the cursor, or by pressing the Navigation Pad Up/Down buttons then the Select button [O] (VM7000). The Left button on the navigation pad can be used to move the cursor back to correct an entered number. The 0-9, the *, #, and P (pause) characters can be entered (# is displayed as a "+"). Numbers up to sixteen digits (including pauses) can be entered, and the number scrolls to the left in the display so that the ten right-most digits are always displayed. With the Digital Keypad microphone, enter the number using the DTMF keypad (a pause indicated by "P" is entered by * #).

3 Press and hold the PTT switch. Events that may occur are as follows:

- If the access is successful, a dial tone sounds and the dialed number is displayed and sent. Either ringing or a busy signal is then heard as with a standard telephone call. When the called party answers, press the PTT switch to talk and release it to listen (since the radio operates half-duplex, it is not possible to talk and listen at the same time).

  Each time the PTT switch is released, a go-ahead tone is sent to the landside party to indicate when they can respond. To dial a number after the connection is made, press the PTT switch and dial the number using the keypad on the Digital Keypad microphone.

  - If the selected telephone number is not valid, "INVALID" is displayed and an alert tone sounds. Select a valid number.
  - If the system is busy, "BUSY" is displayed and the busy tone sounds. The call automatically proceeds when the system becomes available.
  - If you are out-of-range or the radio cannot be accessed for some reason, "NO PHONE" is displayed and an alert tone sounds.
  - If the interconnect call you are making or the selected secure mode is not authorized, "REJECT" is displayed and an alert tone sounds.
  - If your radio does not have the proper encryption key, "KEYFAIL" is displayed and the call must be made in the clear mode by pressing the Clear/Secure option button (if strapped to switchable). Otherwise, load the correct key.

4 When the telephone call is finished or it could not be completed for some reason, end it by pressing the Phone option button and placing the microphone back on-hook or by pressing the appropriate exit button.

6.5.2 Receiving a Telephone Call

To receive a telephone call:

1 When a telephone call is received, "ringing" similar to a standard telephone is heard and "Phone Call" is displayed. If available, the incoming phone number is also displayed.

2 To answer the call, select the menu parameter or press the Phone option button. Press the PTT switch to talk and release it to listen (since the radio operates half duplex, it is not possible to talk and listen at the same time).

3 When the call is finished, end it by pressing the Phone option button and placing the microphone back on-hook or by pressing the appropriate exit button.

Note *If the user wants to ignore a received telephone call, after a radio receives a telephone call, the user can press the select switch on the mobile radio. This sends a telephone call answer response to the system, denying the call from the radio.*

6.6 Call Alert

The Call Alert™ feature allows pages to be sent and received.

6.6.1 Answering a Page

To answer a Page:

1 When a page is received, five beeps sound and "Page Receive" is displayed. The ID of the radio paging you is stored as the last ID received.

2 To clear or ignore the page, press any option button. If the PTT switch is pressed, a group call is placed on the selected channel.

3 To answer the page as a unit call (see Section 6.4), press the Unit Call option button, soft button, or select the menu parameter. The Call Response button, soft button, or menu selection can also be used. If the ID of the radio paging you is in the Call list, the display will toggle between the Calling ID and the Alias. If not, only the Calling ID is displayed. Press the PTT switch and respond.

4 When the call is finished or it could not be completed for some reason, end it by pressing the Unit Call option button and placing the microphone back on-hook, or by pressing the appropriate exit button.

6.6.2 Initiating a Page

To initiate a page by recall from a list:

1 With a P25 trunking or Viking16 channel selected, momentarily press the Call Alert option button. The tag (alias) of the last ID called is displayed. Call Alert also can be selected from the menu and soft buttons.

2 If required, press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to display the desired mobile. The tag of each number is displayed.

3 Press the PTT switch and one of the following then occur:

- If five beeps sound, the system received the page and the paged mobile is on the air and received it. The page mode is automatically exited.
- If the system received the page but the called mobile is not on the air or configured to be able to receive Call Alerts, a single beep sounds and "No Acknowledge" is displayed six seconds after the PTT switch is pressed. Auto exit then occurs.

To make direct entry from the Menu (scroll down to select direct entry) or by using front panel controls or Digital Keypad microphone.

1 Press and hold the Call Alert option button until a tone sounds (approximately one second). The last ID called is displayed.

2 If using the front panel controls, enter the ID of the radio you are calling by pressing the Right Up/Down buttons ▲/▼ then the Select button [O] to enter the selection (VM5000), by rotating the Select switch and pressing the Right button on the navigation pad to advance the cursor (VM6000), or by pressing the Navigation Pad Up/Down buttons (VM7000). The Left button on the navigation pad can be used to move the cursor back to correct an entered number. If an invalid ID is entered in direct entry, the unit ID will be cleared. With the Digital Keypad microphone, enter the number using the DTMF keypad. To cancel the call, press the Call Alert Option button again or press the EXIT soft button.

3 Press the PTT switch to initiate the call. If the entered number is valid, the display indicates the alias of the ID if it matches an ID in the call list. Otherwise, the ID you entered continues to be displayed.

Events that may then occur are as follows:

- If five beeps sound, the system received the page and the paged mobile is on the air and received it. The page mode is automatically exited.
- If the system received the page but the called mobile is not on the air or configured to be able to receive Call Alerts, a single beep sounds and "No Acknowledge" is displayed six seconds after the PTT switch is pressed. Auto exit then occurs.

6.7 Messaging

The messaging feature allows preprogrammed messages to be sent to your dispatcher. Up to 255 messages can be preprogrammed, and they are identified by an alias. Messages are sent as follows:

1 Momentarily press the Message option button, soft button, or select the menu parameter. The alias of the last message sent is displayed.

2 If required, press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to display the desired message. Then send the message by momentarily pressing the PTT or Select switch. A single beep sounds when the Select switch is pressed. One of the following then occurs:

- If five beeps sound and "Ack Received" is displayed, the message was received and automatically acknowledged by the system.
- If after five tries the message is not acknowledged, a tone sounds, and "No Acknowledge" is displayed.

Note *Only the message number assigned to the alias is sent– not the actual text of the alias. For example, If MSG 1 is assigned to alias "In Service", "MSG 1" is sent– not "In Service".*

6.7.1 P25 Messaging

There is a two-menu design with this feature that allows the user to select a Unit ID and then a Message. To exit the menu, the Message button on the radio or the exit button can be pressed. However, if the user is in the second menu (selecting the Message to send), the exit button will take them back to the menu that allows them to select a Unit ID. From there, one more press of the exit button exits the menu.

A P25 Message Alias list may be programmed for this feature. Also a new menu button, soft button, and an alias for Message can be programmed.

6.7.1.1 Sending a Message

To send Messages from one radio to another, the user must select a Unit ID and a Message. The Unit ID can either be selected from the Unit Call list programmed, or may be entered by the user. To select a Unit ID from the Unit Call list, press the button or soft button assigned to Message on the radio or select "ID List" from the Message menu. To enter a Unit ID, press and hold the button or soft button assigned to Message on the radio or select "Enter ID" from the Message menu. Once the Unit ID has been selected, the radio takes the user to a list which displays the Messages that have been programmed in the Message List. A selection (which attempts to send the Message

from this point) can be made by pressing the select button or the PTT. Upon sending the Message, the radio will wait until the Message has been sent, and then display the appropriate message for whether it was received successfully or not. If the Message was not sent successfully, the radio will return back to the Message menu to allow the user to try again or try a different Unit ID or Message.

6.7.1.2 Receiving a Message

When a radio receives a Message, it will flash the green LED next to the toggle switch, sound a Message Received Tone, and display three flash messages ("Msg Rcvd", Unit ID of sending radio, Message Alias or ID received). The Message is cleared upon any button press when not in the menu. When in the menu, the Message is only cleared by pressing the Back/Clear button.

6.8 Sending Status Conditions

The status feature allows you to send your current status to your dispatcher. Up to 255 status conditions can be preprogrammed, and they are identified by an alias. If the Status option button is programmed, status conditions are sent as follows:

1. Momentarily press the Status option button. The alias of the current status condition is displayed. (STATUS can also be selected from the menu.)

2. To change the current status, press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) until the desired status is displayed. Then press the Select switch to accept that status. A single beep sounds when the switch is pressed. One of the following conditions then occurs:

   - If five beeps sound and "Ack Received" is displayed, the status was received and acknowledged by the system.
   - If after five tries the message is not acknowledged, a tone sounds and "No Acknowledge" is displayed.

Note *Only the status number assigned to the alias is sent—not the actual text of the status condition alias itself.*

6.9 Emergency Alarm and Call

Emergency Alarms and Calls are separate functions that can be individually enabled or disabled on each P25 Trunking and Viking16 system. The Emergency option button or menu selection is used for these functions.

The user can set an external line by pressing the emergency button. External devices can trigger off of the radio's external line. If the "Ext Emergency" Option is enabled by programming and the user presses the emergency button, the corresponding line on the DB-25 accessory connector shall be set to low (0V). It remains low until the External Emergency Time has passed or the user exits the emergency. If the user presses emergency during the External Emergency Time, the timer starts over. If the user exits emergency before the External Emergency Time has passed, the output line returns to +5V (output pins 4, 8, 12, 13, 20, 21, 22, 23, 24) or high impedance (output pins 15, 16).

Other emergency features are as follows:

- Emergency Alarms are transmitted on the selected talkgroup if emergency calls are disabled, and on the emergency talkgroup if emergency calls are enabled.
- Emergency Call talkgroup selection priority is as follows. For example, if a global emergency channel is not programmed, the emergency talkgroup of the selected channel is used and so on.
  - Global (radio wide) emergency channel
  - Emergency group of the selected channel
  - Talkgroup of the selected channel (tactical)
  - Announcement group of the selected channel
- The emergency programming of the system to which that emergency talkgroup is linked controls the emergency operation.

6.9.1 Emergency Alarms

An emergency alarm is a special transmission that alerts a dispatcher of an emergency situation. It is sent automatically by pressing the Emergency option button, soft button, or by selecting the menu parameter. The system to which the emergency channel is linked must have Emergency Alarms enabled. If not, Emergency Alarms are disabled. The alarm is sent on the control channel.

Proceed as follows to send an emergency alarm:

1 Press the Emergency option button. The radio automatically transmits the emergency alarm if programmed.

2 When the emergency alarm is acknowledged, "Ack Received" is briefly displayed and the emergency acknowledge tone (five beeps) sounds. Silent operation may also be programmed in which case no tone sounds and there is no indication that an acknowledgment occurred.

3 The radio continues to transmit this message until an acknowledgment is received or the programmed number of attempts have been made. The user can exit emergency mode by cycling radio power or by pressing and holding the Emergency option switch.If “Silent” is programmed, a tone sounds when the operator exits Silent Emergency (for radios using Firmware Version 8.26.x or later programmed by Armada 1.26.x and later).

6.9.2 Emergency Call Alert

This feature notifies a user when an emergency call is being made on their selected P25 Conventional or P25 Trunking Talkgroup. The radio should also be programmed with an “Emergency Clear” button.

If an emergency call is received by the radio on the selected channel, the emergency alarm ACK tone will sound (five consecutive tones), and the Emergency Received message will display, followed by the unit ID of the emergency radio. If any other emergency calls are made after this initial one using a different radio, the tone will not sound, but the unit ID will be updated to reflect the most recent emergency call. To exit out of this state, press and hold the “Emergency Clear” button. The radio should return to its normal display, and the Emergency Received message should no longer show.

6.9.3 Emergency Calls

An emergency call urgently requests access to a voice channel (an emergency tone usually does not sound at the console unless the call is combined with an Emergency Alarm). An emergency call is placed by pressing the Emergency option button. If the Emergency Hot Mic feature is enabled, the emergency call is automatically transmitted without having to press the PTT switch (see following description). The system to which the emergency channel is linked must have Emergency Calls enabled.

6.9.3.1 Emergency Hot Mic

If Emergency Hot Mic has been enabled for emergency calls, automatic transmitting occurs with microphone audio unmuted without having to manually press the PTT switch. The radio can be configured to re-enter emergency hot mic transmit after a set receive time has elapsed. The radio continues cycling in and out of emergency hot mic transmit until the programmed number of cycles have taken place, until PTT is asserted by the user (if configured), or until the user takes the radio out of emergency mode. If the Emergency Hot Mic feature or emergency calls are not enabled by programming, automatic transmitting does not occur. This feature is initiated only on the first press of the Emergency button. Subsequent presses do not trigger automatic transmissions. To reset this function, hold the emergency button or cycle power.

6.9.3.2 Placing an Emergency Call

To place an Emergency Call:

1 If required, select a channel of a system on which Emergency Calls are enabled and press the Emergency option button, soft button, or select the menu option. The Emergency Call is then sent as described in Section 5.10.1 if applicable.

2 Emergency tones sound as follows: Emergency Call entry is played upon the pressing of the Emergency button. Console Acknowledgment is played when an acknowledgment is received back from the console for an emergency Call. Emergency Exit is played when you press and hold the emergency button. Below are the tones for Emergency.

Console Acknowledgment	Emergency Alarm Ack	Emergency Alarm Acknowledged Successfully	Two 1000 Hz 175 ms tones with 50 ms spacing followed by Three 1000 Hz 175 ms tones with 150 ms spacing
Emergency Call Entry	Emergency Button Press	Emergency button has been Pressed	1000 Hz continuous tone for 175 ms.
Emergency Exit	Emergency Canceled	Emergency is Canceled	1000 Hz continuous tone for 1 sec.

3 If the preceding Emergency Hot Mic feature is enabled, the call is automatically transmitted without pressing the PTT switch. If it is disabled, press the PTT switch and begin speaking as with a standard call.

4 All group calls which follow are then emergency calls (unit, telephone, and call alert calls are not allowed). If the channel is changed, the call is made on the emergency talkgroup programmed for the new channel. If the Surveillance Mode is enabled (see Section 4.11), all indicators, lights, and tones are disabled. If "No Receive Activity During Emergency" is programmed, receive audio, the front panel LED, and receive icons are disabled in the receive mode.

5 To exit this mode, cycle radio power or press and hold the Emergency button.

6.9.4 Emergency Press and Hold

The VM5000/VM6000/VM7000 radios provide two means of activating emergency mode. With an emergency button programmed, the radio will enter emergency mode upon a press or a press and hold. Pressing and holding the emergency button while in emergency mode will cancel emergency. When enabled, the Emergency Press and Hold feature restricts activation to the press and hold scenario.

With the emergency press and hold feature enabled, the emergency button must be pressed and held for the duration of the press and hold timer for emergency mode to be activated. If the button is released before the timer has expired a bad beep tone sounds and emergency mode fails to activate. To cancel emergency mode, the emergency button must be pressed and held for the duration of the press and hold timer again.

6.10 Failsoft Operation

If a failure occurs in the P25 Trunking or Viking16 system so that system traffic cannot be centrally managed, the system directs the radio to automatically enter the failsoft mode. When in this mode, "FAILSOFT" is displayed. A failsoft tone may also be heard, depending on how the repeater is programmed.

When in the failsoft mode, operation is in the conventional mode on the preprogrammed failsoft channel (a different failsoft channel can be programmed on each talkgroup). If a transmission is attempted before a failsoft channel is located, a continuous tone sounds until the PTT switch is released. When the radio system returns to normal operation, this is automatically detected and normal operation resumes.

6.10.1 Programmable Failsoft Connect Tone

On Viking16 trunking systems, a different radio failsoft connect tone can be programmed. This allows the radio to emit a distinct and different tone for failsoft than tones used during other operating modes.

The failsoft connect tone setting will normally be selected to "Default." This means that the connect tone used during failsoft will be the connect tone setting the system sends over the air, or the programmed connect tone if no over the air value is received. If it is known what the connect tone will be during failsoft operation, this can be programmed. If a value other than "Default" is programmed, the radio will always use this connect tone setting during failsoft operation.

6.11 P25 Trunking / Viking16 Scanning Features

Scanning on a P25 Trunked or Viking16 system is called Priority Monitor Scan. The following are unique features of this type of scanning. For general scanning information applicable to all operating modes, refer to Sections 4.13 and 4.14.

- Scanning is turned ON and OFF by the Scan option button, soft button, or selecting the menu parameter. Talkgroups (channels) can be programmed so that scanning automatically starts whenever the talkgroup is selected (Autoscan).
- When responding to calls in the scan mode, the programming of the Talkback Scan parameter determines if a response always occurs on the talkgroup of the call (Active Group) or the Selected Group if they are different. Transmissions at other times always occur on the selected talkgroup.
- Up to 255 scan lists or the number that fit in available memory can be programmed. Each list can include the number channels/talkgroups (enabled for your radio) from the same system, one of which can be a priority group as described in the next section.
- If the Scan List Edit option button is programmed (or if the menu parameter is selected), scan lists are user programmable (see Section 6.11.2). In addition, nuisance channels can be temporarily deleted as described in Section 4.13.5.
- Each talkgroup is programmed to select one of the programmed scan lists or “No List” (scanning is disabled). If scanning is enabled and the selected channel does not permit scanning, it is automatically enabled again when a channel is selected that permits scanning.
- The selected scan list can be temporarily changed if the Scan (List) Select option button is programmed. The procedure is described in Section 6.11.2.
- In addition to calls on channels in the scan list, pages, private/unit calls, and telephone calls are received while scanning. Private and telephone calls are not interrupted by priority messages.
- P25 Trunking allows two Priority talkgroups per list.

Every radio on the system has to register with the Zone or Site Controller so that the system knows where everyone is and if traffic from one site needs to be sent to another site. This is determined by the list of Talkgroups registered with the radio.

When a call needs to be passed to a radio at another site, the traffic from one site to another is then sent out over the control channel to the radios. When a radio is scanning, it is monitoring the call information being sent out over control channel. The radio compares the call information (Talkgroup and voice channel handling the Talkgroup) to the scan list to see if any of the Talkgroups it is scanning are receiving a call. If it finds a match, the radio moves to the voice channel for this call. If no one is registered on that Talkgroup on the Site being scanned, the call information for the call is not sent out by the control channel because the Zone or Site Controller did not see a requirement to pass this information for this call and the call will not be received.

For example: Radio 1 is on a call on Talkgroup 1 on Site 1. Radio 2 is on Talkgroup 2 on Site 2 and scanning. The call on Talkgroup 1 from Radio 1 is not heard by Radio 2. Then, if Radio 3 registers on Talkgroup 1 on Site 2, the call from Radio 1 on Site 1 will go to Site 2. Radio 2, Radio 3, and any other radios on Site 2 and scanning, will hear the call.

6.11.1 Priority Talkgroup Sampling

One talkgroup in the scan list can be designated a priority talkgroup by programming or it can be the selected talkgroup. When scanning, messages on a non-priority talkgroup are interrupted by messages on the priority talkgroup. Priority scanning must also be supported at the system level for it to occur as programmed in the radio. P25 Trunking supports dual priority scan, therefore two priority talkgroups can be selected.

The Control Channel handles all traffic for the radios and communicates which talkgroups are using which channels. If the radio "receives" the ID for one of its talkgroups, it can go to that voice channel and hear the talkgroup. When the radio is ON the voice channel, it cannot receive information about which talkgroups are on which channel. The radio will not know about any new talkgroup activity until it finishes the voice channel and returns to the Control Channel.

If a Talkgroup is set as a Priority Monitor talkgroup on the system, the system sends the Talkgroup's call information over the voice channel so it can be detected and move to this priority call. So even if the radio cannot hear the Control Channel, it will receive the call information and switch to the channel with the priority call.

Note *The Priority Monitor must not be confused with Transmit Priority, which is used when a call is placed in Queue when all the Voice Channels are busy.*

6.11.2 Scan List Editing and Selection

P25 Trunking and Viking16 scan lists are user programmable if the Scan Edit option button is programmed (or if the menu parameter is selected). The procedure is described in Section 4.14.1.

With P25 trunking and Viking16 operation, each channel (talkgroup) can be programmed to select one of the programmed scan lists or to disable scanning (No List). In addition, each channel can be programmed so that scanning is automatically enabled (Auto Scan) when the channel is selected. P25 Trunking supports dual priority scan, therefore two priority talkgroups can be selected.

Radio-wide scanning is also available. If you have Auto Radio Wide Scan turned ON for a specific channel, the radio scans the channels in the radio wide scan list specified by Armada. It does not stop unless you change the scan mode manually using one of the programmed scan controls or you change the channel to a channel that does not have Auto Radio Wide Scan enabled. If the Force Auto Scan checkbox is checked and there is a valid scan list, Priority Auto Scan or Radio Wide Auto Scan cannot be turned off by the user. The user is also prevented from turning off Nuisance Delete, Entering Scan Edit, and Entering Scan List Select.

If the Scan List Select option button is programmed (or if the menu parameter is selected), the list that is selected by all talkgroups in the current system can be temporarily changed by the user as follows. Also selectable if desired is "Programmed" (default list). The temporary programmed scan list is retained through radio power downs.

Proceed as follows to temporarily change the currently selected scan list:

1. You can edit Scan Lists and utilize Scan List Select while Scanning is enabled, but not Radio Wide Scan (and vice versa). The radio app will "pause" the scan or radio wide scan feature and resume it upon exiting the menu. The radio will not actively scan while in scan edit or scan list select menus. If Radio Wide Scan is enabled and you attempt to edit a Scan List, the radio will bonk and display "Disabled" (and vice versa). If you attempt to edit a Radio Wide Scan list in this example, it will "pause" the Radio Wide Scanning and allow you to edit the lists (and vice versa for Scan Lists with Scan Mode).

2. The currently selected list is displayed as "LIST x", with "x" the currently selected list. To exit without changing the selected list, press the appropriate exit button.

3. To select another list, "PROGRAMMED", or "NO LIST", press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000). When the desired list is displayed, select it and exit this mode by pressing the appropriate exit button.

6.12 Dynamic Regrouping

The dynamic regrouping feature allows a dispatcher to change the current talkgroup or switch radios to a predefined regrouping channel to receive a new talkgroup. When the console issues a regroup order, the radio switches to the designated regroup talkgroup.

Note *For certain Viking16 dynamic regrouping operations (such as pre-recorded messages) to function properly, the regroup talkgroup must be defined in the system talkgroup table. Otherwise the radio cannot determine whether the regroup talkgroup is analog or digital.*

If the Cancel Dynamic Regrouping option button is programmed, it can be pressed to exit the dynamic regrouping mode. The mode can also be exited through the menu.

Otherwise, if the lock mode was not specified, the selected talkgroup can be manually changed and the previous talkgroup is reselected if power is cycled. If a locked regroup command is received, the displayed talkgroup cannot be changed manually or by cycling power. It can be changed only after a clear order is received from the console.

Dynamic regrouping operates as follows:

1. When this command is received, alternating tones sound and the radio automatically changes to the regrouping talkgroup. The display shows the alias entered for the dynamic regroup enabled channel. If the Lock Order was sent with the Dynamic Regrouping Order, the mobile with no user involvement moves to the predefined Dynamic Channel.

2. If a predefined channel was changed above, go to Step 3. Manually select the channel corresponding to that alias. If this is not done, transmission still occurs on the new channel, but the alternating tones sound each time the PTT switch is pressed. If you did not have a predefined channel, the talkgroup of the channel you are on is temporarily changed. If this happens and you change channels, you lose the temporary talkgroup.

3. Talk and listen as usual. When dynamic regrouping is canceled by the dispatcher, a short tone sounds. If a standard channel is not selected after this occurs, transmission is not allowed if the talkgroup is assigned as a dynamic regrouping talkgroup only. If it is assigned as a normal talkgroup, normal transmissions are allowed. When a Cancel order is received, the mobile moves back to your last channel unless the Lock order was received.

6.13 P25 Radio Unit Monitor

This feature allows a dispatcher to remotely monitor a radio from the console. This can be especially useful when a radio is lost, stolen, or in cases of emergency.

The dispatcher may choose to make the user aware of this monitor or not. This is done by toggling a silent mode flag when sending in the request. If silent mode is enabled during the call, the user has no indication of the call occurring. However, any user input to the monitored radio will end the call while in this mode.

To perform Radio Unit Monitor, the radio uses Hot Mic functionality. This means the radio transmits without the user holding the PTT button. In the case of silent mode, no indication such as display notifications or LEDs display. While in the silent mode state, user input such as PTT or function button input will immediately end the call, affiliate the radio back to the original talkgroup if necessary, and perform the user input action. This implementation places priority on the call being “silent” while not taking any functionality from the user.

Also specified in the Radio Unit Monitor command is the transmit time. The dispatcher may choose any time between 1 and 255 seconds.

Additionally, a group for the radio to transmit is also specified in this request. The radio keys up and transmits on this group for the specified transmit time. If the dispatcher desires this to be a private call, it is recommended that a group be created solely for radio unit monitor. This will keep traffic off this talkgroup and allow the call to be "private" – between the dispatcher and target radio only. Unit-to-unit transmissions are not supported.

If encryption is desired, an algorithm ID and key ID can be specified. Invalid algorithm or key IDs result in the radio ignoring the request. If these parameters are not valid, the user will only be notified if silent mode is not enabled.

6.14 P25 and V16 Multi Site Trunking Unique Features

P25 and V16 Multi Site Trunking modes can provide access to single or multi-site systems. The P25 Trunking mode can provide access to a single trunking site or roaming between several trunking sites.

6.14.1 Busy Override

The busy override feature is enabled at the system level by the system manager and is not a programmable radio feature. It allows a call to be placed even if not all of the sites you are calling have a free traffic channel. The only sites guaranteed to be included are Critical Sites and sites where a Critical User is located. This feature operates as follows:

1. Assume you attempted to place a call and the system was busy ("BUSY" displayed and busy tone sounded). The regroup group is automatically selected and displayed.
2. Release the PTT switch and then press it for five seconds or more. If a chirp-like tone sounds with the PTT switch pressed, busy override is occurring.

Note *Remember that not all members of the talkgroup are receiving your message. Missing members will start receiving your message as channels become available.*

6.14.2 Site Trunking

Site trunking occurs when a site can no longer participate in wide area trunking. It is disconnected from other sites and only supports calls with other radios on that site and cannot route audio to other sites. When site trunking is occurring, the radio searches for other sites that may provide wide area coverage.

Site trunking ends when a wide area coverage site is located, the current site is operating again as a wide area coverage site, an out-of-range condition occurs, or the failsoft mode is entered. The radio can be programmed so that "SITE TRUNKING" is displayed and/or an alert tone sounds when site trunking occurs.

P25 and V16 Multi Site trunking systems can be programmed for "Disable Site Trunking Operation." The radio is then not allowed to start or operate on a site trunking site. If a site goes into site trunking, the radio leaves that site's control channel and attempts to find another valid wide area site. If no wide area site is available, the radio displays "OUT-OF-RANGE." If a site adjacent to the current Home Site was in site trunking but then enters wide area trunking, it is evaluated to determine if it should move to that site as a better site.

6.14.3 Determining Current Site and Searching for a New Site

To display the Receive Signal Strength Indicator (RSSI) level of the current site, press the SITE SEARCH option button. The display then indicates the current site number as "SITE xx" and the RSSI signal level as "RSSI xx." This mode is then automatically exited.

To scroll through the other programmed sites, press and hold the SITE SEARCH option button while "SITE xx" or "RSSI xx" is displayed. If site lock is ON when site search is entered (see following), the radio will be locked on the new site when this function is exited.

Note *If a site failure occurs, the radio will automatically leave the failed site and register on another site (after a predetermined delay). When the failed site recovers, the radio will (after a predetermined delay) return to the site.*

6.14.4 Locking / Unlocking a Site

It is sometimes desirable to stay connected to a specific site. To prevent the radio from searching for a new site, lock it on the current site by pressing the Site Lock option button. To unlock the site, press the LOCK option button again and "Site Unlock" is momentarily displayed.

When the user site locks the radio, the L icon will begin to flash. The site lock indicator will be hidden while the radio is in Menu, Unit Call, or Interconnect Call mode.

6.14.5 Auto Site Search

Auto site search automatically searches sites and ranks them in a “Best Sites” list. Press the Auto Site Search option button to display the current site number or alias and RSSI level of the current site. A “Press and Hold” of the Auto Site Search option button will cause the radio to automatically move from the current site and select the first/next site from the “Best Sites” list.

6.14.6 P25 Wide Area Scan

This feature is intended to enhance roaming performance, especially when system level steering through radio or talkgroup permissions is used.

To use system channel resources more efficiently, some system operators are using system access permissions to steer certain talkgroups to particular sites. For example, a police department may be allowed to use only Site 1, and a public works department may be allowed to use only Site 2.

A Wide Area Scan can be programmed to minimize the problem just outlined. This feature is programmed on a Talkgroup basis. However, System Site Preference lists can still be used. The Wide Area Scan feature functions as follows:

1 Assume TG1 is selected. If it is the first time this talkgroup is selected, normal searching for a control channel occurs according to the hunt methods previously described.

2 When another talkgroup is selected, the active valid site for TG1 is stored in memory.

3 The next time TG1 is selected, the following procedure is performed before performing the normal hunt methods previously described.

- **a** The last valid site ID and its receive and transmit channel numbers are loaded from memory.
- **b** The dynamic site list is checked to see if any newer receive/transmit channel information is available for the last site ID.
- **c** The best receive/transmit information is used, and the radio determines whether this control channel is available.

The result of the preceding operation is that the radio has a reasonable chance of finding a valid site, usually on the first try. This greatly reduces access time, even on systems which have highly restricted talkgroup based access.

With this option enabled on a talkgroup, as the talkgroup affiliates with a site that site is saved if the mobile is changed to a new talkgroup. When the radio moves back to the Wide Area Scan talkgroup, it attempts to affiliate on the saved site before looking for a new site.

6.14.7 Normal P25 and V16 Multi Site Control Channel Hunt

The following control channel search methods are normally used to find a control channel:

Short Hunt - The dynamic array of 8 adjacent sites (V16 Multi Site) or 16 adjacent sites (P25 Trunking) is searched. This list is saved on power down and loaded again at power up. It is erased whenever parameters are downloaded to the radio.

Long Hunt - If no valid control channel is located by the preceding short hunt method, the radio searches the list of control channels programmed into the radio.

Full Spectrum CC Scan - If the two preceding methods do not locate a control channel, every channel available to the radio is searched (V16 Multi Site) or channels are searched based on the programmed channel ID table followed by every channel available to the radio (P25 Trunking). Use of the channel ID table in P25 Trunking speeds full spectrum CC acquisition.

6.14.8 Talkgroup Steering through System Access Permissions

To use system channel resources more efficiently, some system operators use system access permissions to steer certain talkgroups to particular sites. For example, a police department may be allowed to use only Site 1, and a public works department may be allowed to use only Site 2.

The problem with this operation is that every time a different talkgroup is selected, the access permission may be different and a different site may need to be accessed. This could result, in a worst case, in a delay of up to 30 seconds in finding a new site. This could occur if there are no valid sites for the new talkgroup in the dynamic site list.

6.14.9 Radio Information

Various radio information can be viewed on the radio display. Select the “Radio Info” radio button or menu item to view this information. When selected, the information will scroll across the radio display. You can pause, and move the text back and forth using the same controls as you would for text messaging.

This information includes the following:

- Band – Current operating frequency band.
- Software – Current software version running on the radio.
- Radio Alias – Current radio alias programmed to the radio.
- Radio Tag – Current Radio Tag

- Profile Tag – Current Profile Tag
- Unit ID – Current assigned unit ID number.
- Key – Current assigned encryption key ID number.
- USB IP – Current IP address assigned to the attached USB interface.
- OTA IP – Current IP address assigned to the radio.
- ESN – Displays the electronic serial number of the radio.
- Enc Module – Displays the version of software running on the encryption module.
- Wi-Fi – Opens the wireless settings menu on select. Optionally, the Wi-Fi menu can be accessed by pressing and holding the Wi-Fi button.
- Third Party Interface – Displays the current compatible version of the third-party interface.

6.15 P25 Trunking System Single Touch

Single Touch on the VM5000/VM6000/VM7000 functions the same as sending a status through a menu. The only difference is that a user does not have to go through the menu to send a status with Single Touch. Since Single Touch is not a menu function, it is not in the menu in the VM5000/VM6000/VM7000 models.

To use Single Touch, press and hold whichever radio button it has been programmed in Armada. The button press and hold duration is set by the global press and hold duration setting. If the status is enabled through Armada, the radio displays the status which is attempting to be sent for one second. If the status is sent successfully, a Success Tone will sound. If the status fails to be sent, the radio will display the message “Sts Failed” for a duration of one second.

If the button for Single Touch is not pressed and held, the message “Press & Hold” is displayed for one second.

If the status is disabled or not set correctly in Armada, the message “Disabled” is displayed for one second, regardless of whether the button was pressed and held or just pressed.

Since sending a status is not allowed while in Emergency mode, Single Touch is not allowed in that mode either. The radio will not display anything to the screen if Single Touch is attempted while in Emergency. It will however sound a Bad Tone.

6.16 P25 Messaging

This feature allows a user to send a predefined short Message from one radio to another. This feature is supported in P25 only. There is a two menu design with this feature which allows the user to select a Unit ID and then a Message. To exit the menu, the Message button on the radio or the Exit button can be pressed. However, if the user is in the second menu (selecting the Message to send), the Exit button will take them back to the menu that allows them to select a Unit ID. From there, one more press of the Exit button exits the menu.

6.16.1 Sending a Message

To send Messages from one radio to another, the user must select a Unit ID and a Message. The Unit ID can either be selected from the Unit Call list programmed in Armada, or may be entered by the user. To select a Unit ID from the Unit Call list, press the button or soft button assigned to Message on the radio or select “ID List” from the Message menu. To enter a Unit ID, press and hold the button or soft button assigned to Message on the radio or select “Enter ID” from the Message menu. Once the Unit ID has been selected, the radio takes the user to a list which displays the Messages that have been programmed in the Message List from Armada. A selection (which attempts to send the Message from this point) can be made by pressing the select button or the PTT. Upon sending the Message, the radio will wait until the Message has been sent, and then display the appropriate message for whether it was received successfully or not. If the Message was not sent successfully, the radio will return to the Message menu to allow the user to try again or try a different Unit ID or Message.

6.16.2 Receiving a Message

When a radio receives a Message, the green LED next to the toggle switch will flash, sound a Message Received Tone, and display three flash messages (“Msg Rcvd”, Unit ID of sending radio, Message Alias or ID received). The Message is cleared by any button press when not in the menu. When in the menu, the Message is only cleared by pressing the Back/Clear button.

6.17 P25 Trunking Keypad DTMF

For radios using Firmware Version 8.30.x or later programmed by Armada 1.30.x and later, if the Armada administrator enabled Keypad DTMF for a P25 Trunking channel, the radio user can send DTMF tones by holding the Push-To-Talk (PTT) button and pressing the keypad buttons.

6.18 Cancel P25 Deregistration Retries on PTT

For radios on a P25 Trunking channel using Firmware Version 8.34.x or later programmed by Armada 1.34.x and later, if deregistration retries are occurring, the user can press or hold the PTT button to skip remaining deregistration attempts. This applies to unit deregistration, DRS deregistration, and context deactivation. This does not apply to deregistration on power down.

For example, if DRS deregistration retries are occurring and the user presses PTT, remaining DRS deregistration retries get skipped, and context deactivation gets skipped along with unit deregistration.

6.19 Trunking Terms and Definitions

The following is a list of common terms and definitions related to trunking operation:

Busy Bonk – A tone that sounds on P25 trunking systems when multiple radios attempt to key up at the same time on the same talkgroup. Only one radio occupies the channel at a time. Any other radio attempting to key up receives a busy bonk or bad bonk indicating that the talkgroup is busy. The radios are not in queue since they are on the same talkgroup that is occupying the channel. The only radios that are queued are radios on a different talkgroup when there is not an available channel.

Channel – The pair of frequencies (input and output) used by an LMR device. Each channel is assigned a talkgroup, which is designated by the Channel Alias shown on the radio front and top displays.

P25 Trunking System– A land mobile radio (LMR) system that includes an access control channel and voice channels for audio communications. At power up, the radio registers the Radio ID and affiliates the talkgroup for communications.

PTT Tone – The push-to-talk (PTT) tone is a double-beep permit tone that sounds when the radio is connected to the Voice channel.

Talkgroup – LMR system users who are organized into different groups so they can communicate between group members without interfering with other groups.

Zone – Typically a block of 16 channels.

SECTION

7

Secure Communication (Encryption)

This radio may be equipped to provide secure communication on some or all channels. This feature encrypts the voice so that it can be understood only by someone using a radio equipped with a similar encryption device and matching encryption keys.

If equipped with the Clear/Secure option button and the current channel is programmed to allow switch selection, secure communication can be manually enabled and disabled by that button. Otherwise, channels are strapped to Clear or Secure operation (see Section 7.3). Secure communication can be programmed on a per-channel or per-talkgroup basis to operate in various ways. When a secure call is received, the LED flashes Red and  flashes on the display. When a secure call is transmitted, the LED will be orange.

This chapter contains the following sections:

7.1 Encryption Algorithms

The following subsections describe Encryption algorithms:

7.1.1 Encryption Available With Various Channel Types

Digital Channels - On conventional P25, Viking16, and P25 Trunking channels, the DES-OFB, AES-OFB, or ARC4 protocol is used.

7.1.2 AES

An encryption standard called Advanced Encryption Standard (AES) is replacing DES-OFB encryption on digital (P25) channels. It uses a 256-bit encryption key instead of the 64-bit key used with DES. The type of encryption (DES or AES) is determined by the type of encryption key that is loaded (see Section 7.2). AES encryption, like DES encryption, is an optional radio feature that must be purchased and then enabled at the factory (or by a factory-created option file).

7.1.3 ARC4

Alleged Rivest Cipher 4 (ARC4) software encryption uses software keys created in Armada and is compatible with Motorola's ADP encryption. ARC4 software encryption is an optional radio feature that must be purchased and then enabled by the EFJohnson factory (or by a factory-created option file).

7.1.4 FIPS and Non-FIPS Modes

FIPS 140-2 is a Federal Information Processing Standard for encrypted radios used by the Federal Government. This standard specifies Federal security requirements for cryptographic modules for a wide range of applications and environments. All Viking models are FIPS certified.

7.1.5 Authentication without Encryption Options

This feature allows the Authentication features of the radio to be used without the AES or DES options. The radio needs to be configured with the Authentication option to use the Authentication features of the radio. With this feature addition the radio can perform all the Authentication procedures without needing the AES/DES options.

7.2 Encryption Keys

An encryption key is a cryptographic variable that is required by the encryption algorithm to encrypt and decrypt voice or data. To maintain system security, these keys must be protected from disclosure and also periodically replaced or updated.

With the AES and DES hardware encryption and ARC4 software encryption used by EFJohnson Technologies radios (see Section 7.1), the same encryption key is used by both the encrypting (sending) and decrypting (receiving) radio. AES encryption keys are generated from a string of 64 hexadecimal characters, and DES keys are generated from a string of 16 hexadecimal characters. Another four hexadecimal characters are used to specify the key ID. Multiple keys can be loaded into a radio using OTAR or manual loading. ARC4 software encryption keys are generated from a string of 10 hexadecimal characters. Multiple keys can be loaded into a radio using Armada.

If an attempt is made to transmit a secure message without loading the corresponding key, “KEYFAIL” is displayed. The message must then be transmitted in the clear mode (this is possible only if the channel is strapped to “switchable”) or the key must be loaded.

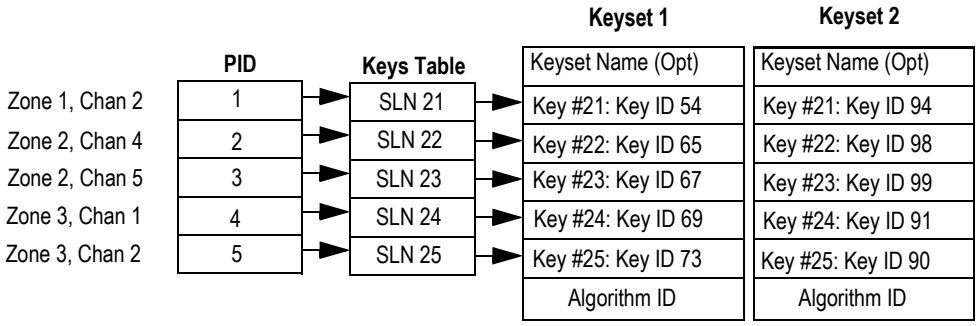
7.2.1 Key and Algorithm IDs

Each encryption key is programmed with a Key ID (also called Logical ID). This ID plus the algorithm ID (ALGID) is transmitted in the message on digital channels. The radio receiving the message must have a key with the same IDs to decrypt it.

7.2.2 PID / SLN Key Management Modes

The channels, talkgroups, and other calls that use encryption are linked to a specific Physical ID (PID) when the radio is programmed. For example, Zone 1, Channel 1 could be programmed to select the key in PID 1 and Zone 1, Channel 2 could select the key in PID 3. The PID ranges are 0 to 125 when the PID mode is selected, and 1 to 126 when the SLN mode is selected (see Figure 7.1).

Figure 7.1 Key Selection Example



PID or SLN key management modes can be programmed on the **Global** programming screen. More information on these modes follows.

PID Mode - When this mode is selected, keys are loaded directly into a PID of 0-125 that corresponds to the PID programmed for each channel (if applicable). Since the EFJohnson Technologies System Management Assistant (SMA) does not support PID mode: PID mode can be used only when keys are loaded using the Motorola KVL 3000 or KVL 3000 Plus keyloader.

SLN Mode - The SLN mode must be selected if either Over-the-Air-Rekeying (OTAR) or the EFJohnson Technologies System Management Assistant (PDA keyloader) is used. It can also be used if OTAR is not used. SLN mode is digital encryption, and can also be used with the Motorola KVL 3000, KVL 3000 Plus, and KVL 4000. With this mode, keys are loaded into a SLN (Storage Location Number), typically from 0-4095. A Keys Table must then be programmed to link channel PIDs to a specific SLN.

The use of this type of indirect linking allows keysets and key IDs to be changed through OTAR while keeping the mapping from the channel or talkgroup the same. For example, as shown in Figure 7.1, PID 4 selects SLN 24 which selects key slot 24 in both keysets. This slot contains Key ID 69 in Keyset 1 and Key ID 91 in Keyset 2. Only one keyset is active at a time. The actual key chosen between these two to transmit with will depend on which keyset is active, Keyset 1 or Keyset2.

7.2.3 Maintaining Keys in Memory

The radio may need to be connected to a constant power source to preserve the encryption keys in memory. The programming of the Infinite Key Retention parameter determines if keys are permanently stored in memory or erased soon after power is removed.

When Infinite Key Retention is enabled, keys are stored in memory and are not lost when power is removed.

With VM5000/VM6000/VM7000 models, the keys are maintained for approximately 24 hours with this feature disabled. However, a tamper switch causes immediate key erasure when the radio cover over the logic board is removed.

⚠ CAUTION *Unchecking Infinite Key Retention on the radio and writing the radio triggers a tamper event and instantly erases any stored keys.*

7.2.4 Encryption Key Select

When multiple encryption keys are programmed (see preceding information), the Key Select option button can be programmed to allow selection of another key for the current channel. This feature changes the PID (hardware location) of the key on the channel for Conventional Digital and P25 Trunking Talkgroups, and the change is permanent (cycling power or selecting a different channel does not reselect the original key). Therefore, to switch back to the original key, it must be manually reselected. Proceed as follows to select a key:

Note *This feature is available on conventional channels or on P25 Trunking channels.*

1. Press the Key Select option button and HW KEY (or SW KEY, if optioned/programmed for software keys) will be displayed.
2. Press the Right Up/Down buttons ▲/▼ (VM5000), rotate the Select switch (VM6000), or press the Navigation Pad Up/Down buttons (VM7000) to display the desired key and then press the Select button [O] (VM5000/VM7000) or Select switch (VM6000) to select it. Press the Key Select option button again to return the display to normal operation.

7.2.5 Encryption Key Erase

An Erase Keys option button can be programmed that allows the user to permanently erase all stored keys. If OTAR TEK and KEK keys are stored, all keys of both types are erased. This function can be used to ensure that unauthorized encrypted calls can no longer be placed or received by a radio. If the radio receives an encrypted call but does not have the key, the radio indicates the call is secure instead of clear. Additionally, the encryption icon blinks, and the "Invalid Key" message is displayed for two seconds. This applies to P25 Conventional mode only.

⚠ CAUTION *.When the Erase Keys command comes from a keyloader (such as a VK5000S), only hardware keys get erased. However, when the Erase Keys command comes from the radio, all keys get erased--both hardware keys and software keys*

7.2.6 Encryption Icon Operation

The encryption icon ⃠ flashes when a secure call is received or transmitted. Other operation is as follows:

- The icon is always displayed when the radio is in secure mode and receives a clear call on a digital and P25 trunking channel.
- An option can be programmed to sound a beep whenever a secure call is received on a clear channel.

7.2.7 Per-System ESK-Only Setting

For radios using Firmware Version 8.28.x or later programmed by Armada 1.28.x and later, individual P25 trunking systems may be marked as Enhanced System Keys-only (ESK-only). This allows a radio to use soft keys for some systems and requires hard keys for others.

A master hard key for that system must be present to change this setting. This setting may not be checked if no key has been assigned. If a system is marked ESK only, its system key may not be changed.

The radio keeps track of these hard-key-only systems. If a hard-key-only system is ever changed to not be hard-key-only (or if there are multiple systems with the same key where one is not ESK only), the radio deletes that system's authentication key. If a system does not use authentication keys, there is no enforcement mechanism outside of the radio security policy.

You cannot write to radios using Firmware Version 8.26.x or earlier when any of their systems are marked to be ESK only

Note *To downgrade a radio to Firmware Version 8.26.x or earlier, all hard-key-only systems with authentication keys must be removed from that radio.*

When viewing the radio information menu on a radio (Section 6.14.9), P25 trunking systems will list whether they are hard-key only.

7.3 Clear / Secure Strapping

Certain options are available when transmitting and receiving when encryption is selected.

7.3.1 Transmit Mode Options

The following transmit options are available when encryption is selected:

Clear - All calls are in the clear mode.

Secure - All calls are made in the selected secure mode.

Switched - The mode is selected by the Clear/Secure button. When the clear mode is selected by this switch and a secure call is received, or vice versa, you will hear a beep. Press the programmed option button to change to the appropriate mode. When the clear mode is selected by this button, "CLEAR" is flashed, and when the secure mode is selected, "SECURE" is flashed.

If the channel has been strapped "Clear" and the option button selects the "Secure" mode on power up and a transmission is attempted, "CLEAR ONLY" is displayed and transmitting is disabled. Likewise, if the channel is strapped "Secure" and the option button selects the "Clear" mode on power up and a transmission is attempted, "SECURE ONLY" is displayed and the transmitter is disabled.

The radio can be programmed to ignore the "Clear" or "Secure" button setting. The preceding indications then do not occur and transmissions always occur in the strapped mode.

Note *If all channels/talkgroups are strapped clear or secure and no Clear/Secure option button is programmed, this parameter must always be selected (see following).*

If the Clear/Secure button is not programmed, the radio is always in the last known state (usually Clear) and there is no way to change it. For example, if the last known state is Clear and this parameter is not selected, it is never possible to transmit a Secure message on a channel strapped Secure because all that happens is transmitting is disabled, an error tone sounds, and "Secure Only" is displayed.

7.4 Security Settings Override

The default security settings that determine how encryption keys are used for talkgroups and channels can be changed for different operating modes.

7.4.1 P25 Conventional and Trunking Talkgroup Security Override

Conventional digital (P25), Viking16 and P25 Trunking encryption strapping is programmed on a "per talkgroup" basis. However conventional digital and P25 trunking talkgroup encryption strapping can be overridden on a "per channel" basis. Therefore, if desired on Conventional Digital and P25 Trunking channels, encryption can be programmed differently for each channel.

7.4.2 Secure Call Behavior

7.4.2.1 Failsoft, Group Regroup, or Dynamic Regroup Call

If the radio is in failsoft or is dynamically regrouped, the radio will behave as it always has. That is, the radio will use any key to decrypt a received call and will transmit using switched strapping and the key PID specified as originally programmed.

If the radio is group regrouped, most functionality is retained. The radio will continue to use the key PID specified (as programmed) or use any key to decrypt a received call. The radio will use the keys based on programming values for Failsoft, Patch, Unit Call, Interconnect, and Dynamic TG: when the radio is in these modes, the radio will not use the strapping of the current channel. This means that if the channel has the override feature enabled, the strapping specified in this section will be used for the channel. If the override feature is not enabled, then the strapping of the currently selected talkgroup will be used.

7.4.2.2 Channel with Talkgroup Specified

If the override security settings feature is enabled, then the override parameters will be used. If the override feature is not enabled, then the talkgroup parameters will be used. If the **Any Key** option is disabled and a secure talkgroup call is received that uses a different key than the one specified, the radio will not unmute but will display the received call information.

7.4.2.3 Channel with Announcement Group Specified

If a secure component talkgroup call is received, the first check will be for the any key option as specified on the announcement group list. If the any key option is enabled, all secure traffic (both component talkgroups and the announcement group) will unmute provided the proper key is stored in the radio. If the any key option is disabled, then the radio will determine the key that the talkgroup is supposed to use by reading the programmed key PID from the talkgroup list. If the received key matches the expected key, then the component talkgroup call will unmute. If the keys do not match, then the radio will not unmute but will display the component talkgroup call information.

7.4.2.4 Announcement Group Call

The settings specified on the announcement group list will be used. If the any key option is disabled and a secure announcement group call is received that uses a different key than the one specified, the radio will not unmute but will display the received call information.

7.4.2.5 Emergency Calls on Emergency Groups

Emergency talkgroup calls will not use the override settings, but will be subject to the any key rules specified above.

7.5 OTAR

Over-the-Air-Rekeying (OTAR) is the process of sending encryption keys and related key management messages over-the-air to specific radios. The advantage of OTAR is that it allows these keys to be quickly and conveniently updated when necessary. It is no longer necessary to periodically travel to the radio location or bring the radio into a maintenance facility to load new keys.

The actual OTAR rekeying functions are performed by a Key Management Facility (KMF) that sends Key Management Messages (KMM) to the RSI (Radio Set Identifier) assigned to a specific radio or radios. These messages are themselves encrypted using a unique key called the UKEK (Unique Key Encryption Key). Radios must be OTAR-compatible, programmed for OTAR, and the UKEK loaded for OTAR for this type of rekeying to occur.

Note *The RSI is enabled in the KMF and must be assigned to the radio by programming.*

OTAR is available only on P25 conventional and trunking channels, and only to program DES-OFB and AES-OFB keys. It is not used on Viking16 channels.

7.6 Radio Setup for Encryption

The following radio setup is required for encryption regardless of whether OTAR is used:

Options Enabled - The desired encryption type must have been enabled at the factory (DES-OFB, AES-OFB, ARC4 software encryption).

The following are set through programming:

PID/SLN Mode - If the SLN mode is used, the Hardware Keys Table must be programmed also. If Software Keys are used, the Software Keys Table must also be programmed.

Infinite Key Retention - This parameter enables the option to store keys permanently in memory (see Section 7.2.3).

Erase Old Keyset on OTAR Changeover - This parameter erases keys on an OTAR changeover if the SLN mode is selected, it does not erase keys on a manual keyset changeover.

Talkgroup PIDs/Software Keys - This information is programmed in the talkgroup list selected on the Systems - Lists tab. In addition, with conventional digital and P25 Trunking calls, the group programming can be overridden on the Channels tab (Section 7.4.2). Additional PIDs/software keys for special calls can also be specified on the Systems - General - Options 2 tab for digital and trunking calls.

Note *Key Loss Key (KLK), offered by Motorola, does not erase the UKEK which allows the radio to be rekeyed by the KMF remotely. By not erasing the UKEK, the KLK does not meet TIA standards and is no longer FIPS 140-2 certified.*

The VM5000/VM6000/VM7000 radios support OTAR. However, an RSI, UKEK and other information must be programmed as described in Section 7.6.1.

7.6.1 Programming by Keyloader

The following are the minimum parameters that need to be programmed in the radio to perform OTAR. It is not necessary to program a TEK but it is necessary that a UKEK be manually programmed to perform OTAR. If the radio does not contain a TEK, the KMF initiates a warm start-up sequence in which a temporary TEK is transferred to the radio to perform the key transfer.

UKEK - This key normally has SLN (CKR) 61440 for DES protocol, SLN (CKR) 61442 for AES protocol, and Key ID 62880 (F5A0 hex).

Unit RSI - This is normally initially the same as the P25 Unit ID and is set by programming.

KMF RSI - This RSI is normally 9,999,999 and should not need to be loaded since it defaults to this number.

Verify that the above information was properly stored in the radio by viewing it using the keyloader.

7.6.2 Radio OTAR Capabilities

The Over-the-Air-Rekeying (OTAR) capabilities of the SCM-equipped Viking Series mobile are as follows.

Keysets

- Up to three keysets are used and it is assumed all three are always present. Keyset IDs 1 and 2 are for TEKs and only one is active at a time. Keyset ID 255 is for KEKs and is considered active all the time.
- Each keyset can have up to 126 keys. However, 16 or less are normally used.

7.6.3 OTAR Option Buttons

The following additional option buttons can be programmed with the VM5000/VM6000/VM7000 to control OTAR functions.

Change Keyset - Toggles the active keyset between Keyset 1 and Keyset 2. The new active keyset is briefly displayed and then normal operation resumes. To change to the other keyset, highlight it and press the Select Knob.

Clear/Secure - This enables and disables encryption regardless of whether OTAR is used. Refer to Section 7.3 for more information.

Erase Keys - Erases all TEK and KEK keys contained in the radio.

Key Select - This allows a different key to be selected for the current channel or group (Conventional Digital and P25 Trunking channels only). Refer to Section 7.2.4 for more information.

OTAR Rekey Request - Sends a message which tells the KMF that the radio is on the air and requests rekeying. The following status messages are displayed which indicate the progress of this function.

Rekeying - A radio-initiated rekeying session is in process.

No Acknowledge - No response was received from the KMF in response to an Identify request before time out occurred (approximately 30 seconds).

Ack Received - An acknowledgment was received in response to an Identify request.

No Service - A “No Service” reply was received from the KMF. No rekeying will take place.

Rekey Fail - Either the rekey command failed or timed out (after approximately 30 seconds). This message could indicate that the rekey request message was not received by the KMF. However, depending on the KMF configuration and channel traffic, it is possible that the message was received and a response is still pending.

Rekeyed - The rekey session initiated by the radio was successful.

7.6.4 P25 Trunking Icons

There are three different P25-data related icons that indicate if the radio is on a trunking system.

This icon indicates P25 Data Context Activated. Radio is ready for data operations.


This icon indicates Radio is operating on a data channel.

This icon indicates Radio is registered with the Data Registration Server. Radio is ready for OTAP operations.

Every time the radio goes to a data channel, the data channel icon will come ON, and stay ON, until the radio leaves the data channel. The radio goes to the data channel to do P25-data related tasks, such as data register, OTAR register, send/receive OTAR data, and send/receive OTAP data.

You must have successfully data registered before you can successfully initiate an OTAR session. The usual sequence when the radio is attempting to data register will be:

- The data channel icon comes ON.
- The data context icon comes ON (once we successfully data register).
- The data channel icon goes out (once the radio returns to a control channel), but the data context icon stays ON.
- The Data Registration Server icon comes ON once successfully registered with the DRS.

If the data context icon is not ON, you do not have an SNDCP context (that is, you are not data registered). If the data registration icon is not ON, you are not DRS registered.

Once the radio has a data context, if it is configured for OTAR and has a UKEK, it will attempt to OTAR register. Depending on timing, the radio may stay on the data channel for a longer period of time (the second step above) while it OTAR registers, an action which can kick off an OTAR update procedure. Eventually the radio will leave the data channel. The radio will be told by the system when it should the data channel.

A sign that the radio has not successfully OTAR registered is that the radio's data context icon will be ON, but the radio will periodically keep going back to the data channel (the data channel icon will periodically come ON and then OFF). The number of times the radio will attempt to OTAR register and the amount of time it will wait between events is set by programming.

SECTION

8

Data Features

Advances in digital communications allow for new data features and services using the radio link. This chapter describes the data features and services available for the VM5000/VM6000/VM7000 radio and contains the following sections:

8.1 P25 Packet Data

P25 packet data transmission capability is available with VM5000/VM6000/VM7000 radios. A Data option button can be programmed to toggle the data mode ON and OFF (or the menu option can be used).

The P25 Packet Data mode allows a radio to act as a packet data modem for a remote application connected to the radio through an RS-232 connection.

Three P25-compliant conventional data operating modes are supported:

- **Direct Radio to Radio mode** - In this mode the radio will transmit data directly to another radio without any involvement of fixed network equipment.
- **Repeater mode** - In this mode, the radio will transmit data on the inbound channel of a repeater. The repeater will retransmit the data on the outbound to another radio listening on the outbound channel.
- **FNE data mode** – In this mode, the mobile radio transmits data to a fixed network computer connected to the FNE.

8.2 P25 Trunking Data Services

P25 Trunking supports data service on a P25 Trunking system using an EFJohnson Technologies radio and a portable computer. The radio communicates with the computer over the P25 Mobile Data Peripheral (MDP) Interface, which uses an RS232 hardware interface at 9600 bits/s. The following protocols are supported across the interface:

- Point to Point Protocol (PPP)
- Internet Protocol (IP)
- Universal Datagram Protocol (UDP)
- Transmission Control Protocol (TCP)

8.2.1 Radio Configuration

The radio must be programmed for data operations on the Trunked IV & D system. The following parameters apply:

Data Registration On/Off - Enables/disables data registration.

ICMP Echo - Enables the radio to send back an ICMP response once an ICMP request has been received.

CAI Data Max Tx Attempts - Selects the maximum number of times the radio attempts to send a CAI data packet. Attempts to send the data packet continue until the radio receives an acknowledgment confirming the successful receipt of the packet, or until the radio exceeds the selected amount of transmit attempts.

Response Timer - Selects the period of time the radio waits for an acknowledgment that a CAI transmission is successful before it tries the transmission again.

SNDCP Activation Wait Timer - Controls the time that a radio waits for the KMF to respond to a SNDCP context activation request.

Rx Voice Interrupts Data - Enables/disables whether a voice call can interrupt data.

Subscriber IP Address - The IP Address assigned to the subscriber for a PPP connection.

Mobile Computer IP Address - IP address assigned to the mobile computer for a PPP connection.

Tx Limited Patience - Selects the amount of time radio attempts to transmit a common air interface packet. Once time expires, radio ceases transmission. Times are 1 to 255 seconds, infinite in increments of 1. The default is infinite.

Min Response Timer - Selects the minimum amount of time that the radio waits for an acknowledgment of a successful CAI to be sent across the channel. Times are 50 to 2000 milliseconds, in increments of 50 milliseconds. The default is 700 milliseconds.

Frame Sync Seek Period - Selects the amount of time the radio listens for a frame sync sequence before a packet is transmitted. Times are 0 to 5000 milliseconds, in increments of 50 milliseconds. The default is 750 milliseconds.

Tx Short Random Range - Selects the maximum amount of time the radio waits to transmit once the first qualified FS is received indicating the channel is clear. Times are 50 to 500 milliseconds, in increments of 50 milliseconds. The default is 50 milliseconds.

Tx Long Random Range - Selects the upper range of the random range. When the radio detects a busy, the radio uses a random time within this range (Back off delay) to determine when to retransmit the packet. Times are 50 to 5000 milliseconds, in increments of 50 milliseconds. The default is 2000 milliseconds.

Tx Response Random Range - Selects amount of time radio waits before rechecking a channel's status once a busy channel status symbol has been received. Only applies to ACKs. Times are 50 to 1000 milliseconds, in increments of 50 milliseconds. The default is 1000 milliseconds.

8.2.2 Interface Connection

The radio connects from its MDP Interface to the RS232 COM port of the computer using the P25 Mobile Data Peripheral (MDP) Interface cable.

8.2.3 Context Activation

For the radio to access data service on a trunking system, it must be a valid user on the system and it must be affiliated to an RF site. Once this is accomplished, the radio must request data services from the trunked system through the process of context activation, a data registration of the radio with the system. Context activation is initiated from the radio.

In the VM5000/VM6000/VM7000, context activation is automatically initiated when the user selects a P25 trunking system with either data registration enabled or OTAR enabled. During a context activation, the mobile radio attempts to access a packet data channel (PDCH) at the site and send it its request for data services. If the context activation is successful, the mobile radio will receive a response containing an IP address. This IP address will be used by the mobile radio as a source IP address for all inbound data messages sent, and is used by the host application as the destination IP address for all outbound data messages.

If for some reason the context activation fails, the mobile radio will not be allowed to use data services on the trunked system. If a PPP link is established between the portable computer and mobile radio without the radio context activated, any data transmitted by the computer to the radio is ignored.

8.2.4 PPP Link Establishment

To begin data transmissions from an application running on a portable computer, a data connection must first be established between the mobile computer and the radio (with data capability enabled). This is accomplished by creating a new connection using the Microsoft Windows Operating System.

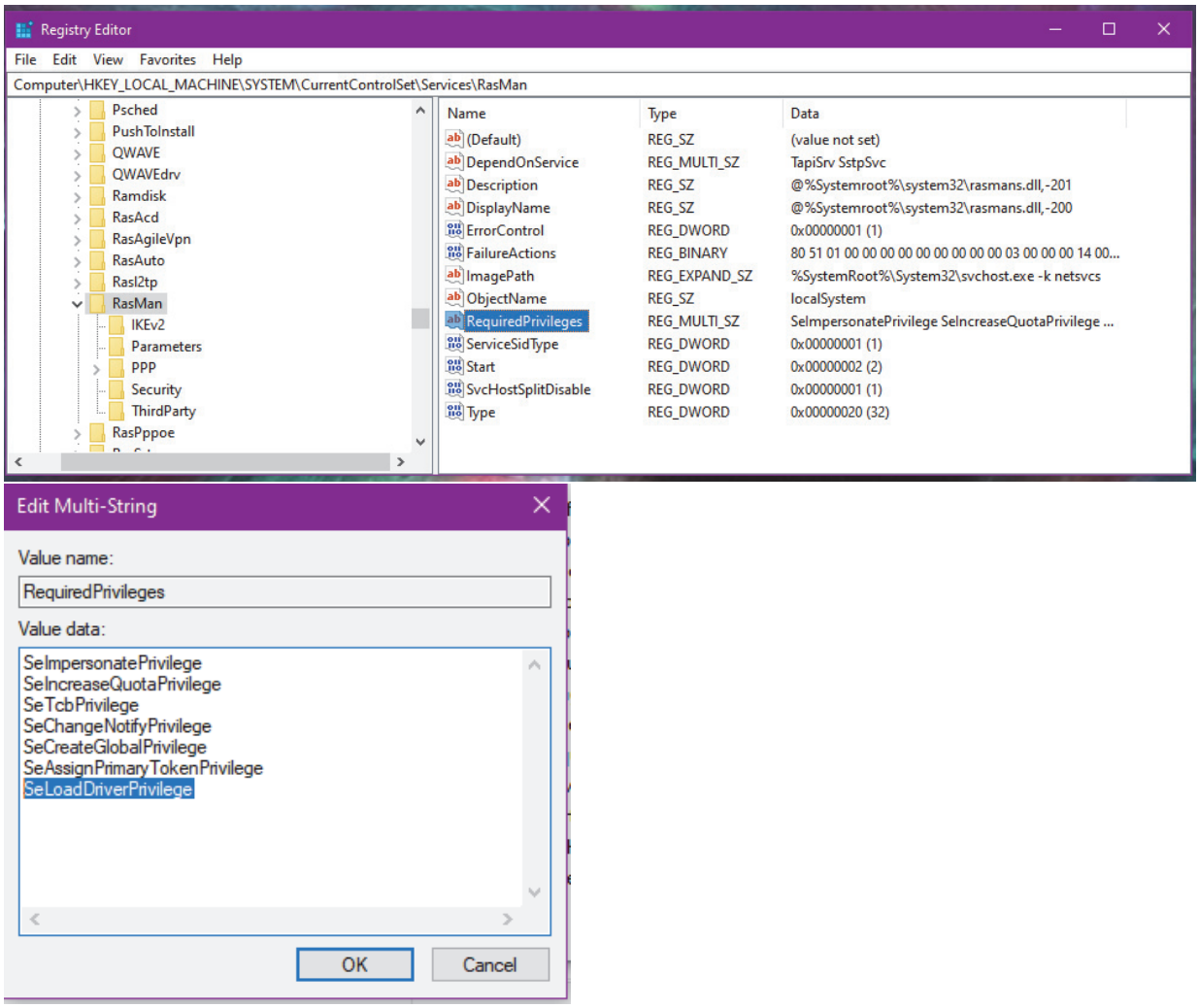
The following screen shots are derived from Windows 10.

Note *The first four steps below might already be setup by default, but verify this before you proceed with the later steps.*

Note *In the following examples, carefully observe items labeled "#2," such as "Dial-up Connection 2," "Communications cable between two computers #2," etc.*

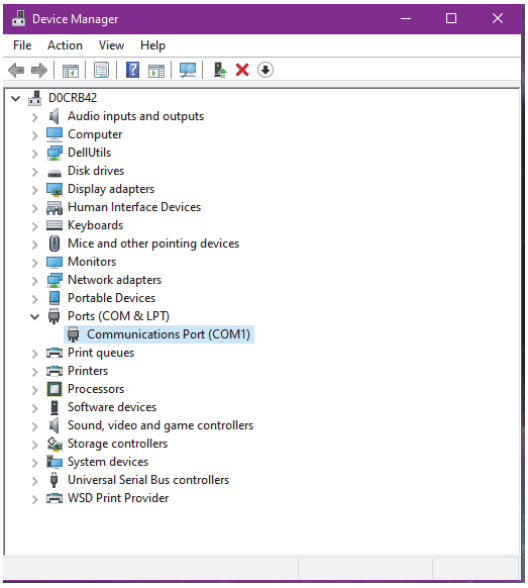
1 Open Regedit and navigate to `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Rasman` and in the *RequiredPrivileges* register ensure SeLoadDriverPrivilege is there (without the quotes) (Figure 8.1).

Figure 8.1 Configuring Regedit



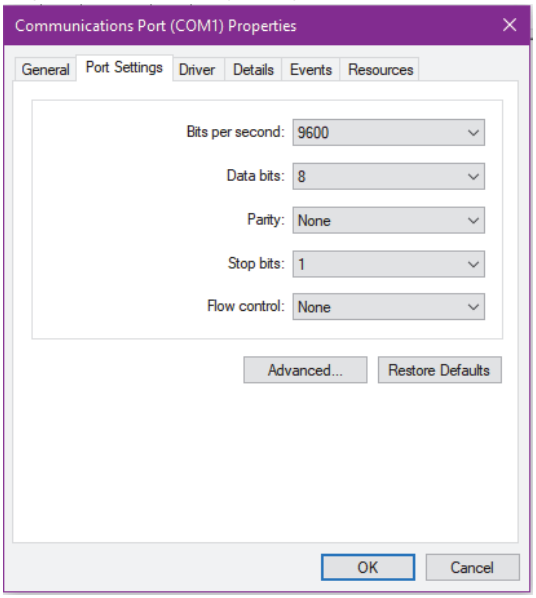
2 Open Device Manager, right-click, and enter the properties for COM port you are using (Figure 8.2).

Figure 8.2 Configuring COM Port



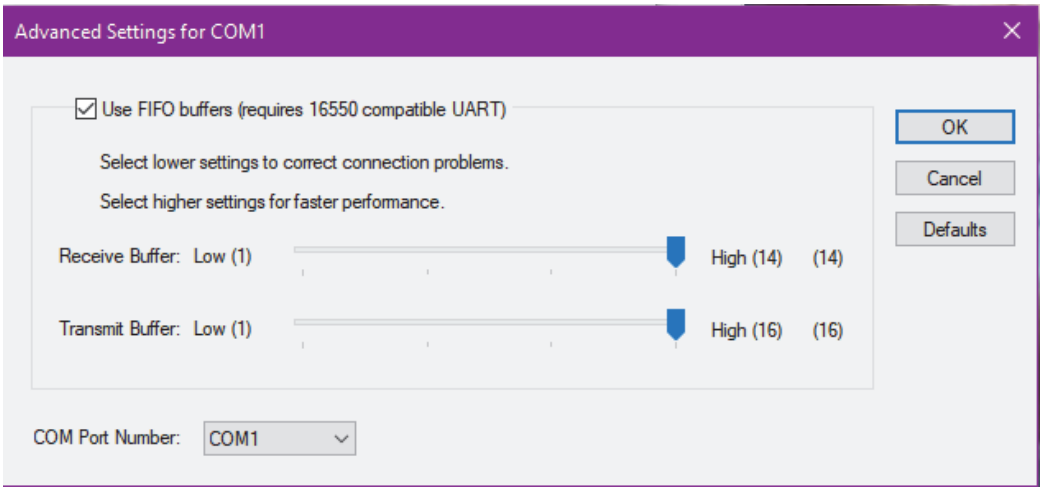
3 Set the **Bits per second** to 9600 and flow to **None** on the port settings tab (Figure 8.3).

Figure 8.3 Configuring Bits per Second



4 Click the **Advanced** button and ensure the COM port is pointing to the right number (especially important if using a USB-to-serial adapter rather than COM1 on the back of a computer) (Figure 8.4).

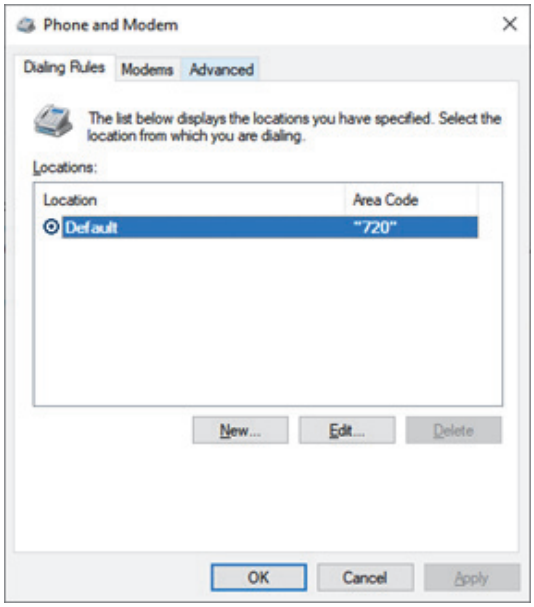
Figure 8.4 Verifying COM Port



5 Use Search bar to open **Phone and Modem** (Figure 8.5).

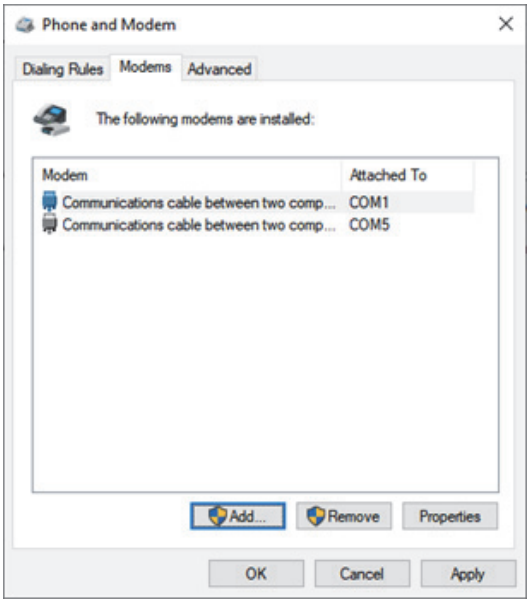
Note *If this operation has not been done before, you must set an Area Code, which you can do by pressing **Edit**. The Area Code is not important for the link; it can be any three digits. Then click **OK**.*

Figure 8.5 Opening Phone and Modem



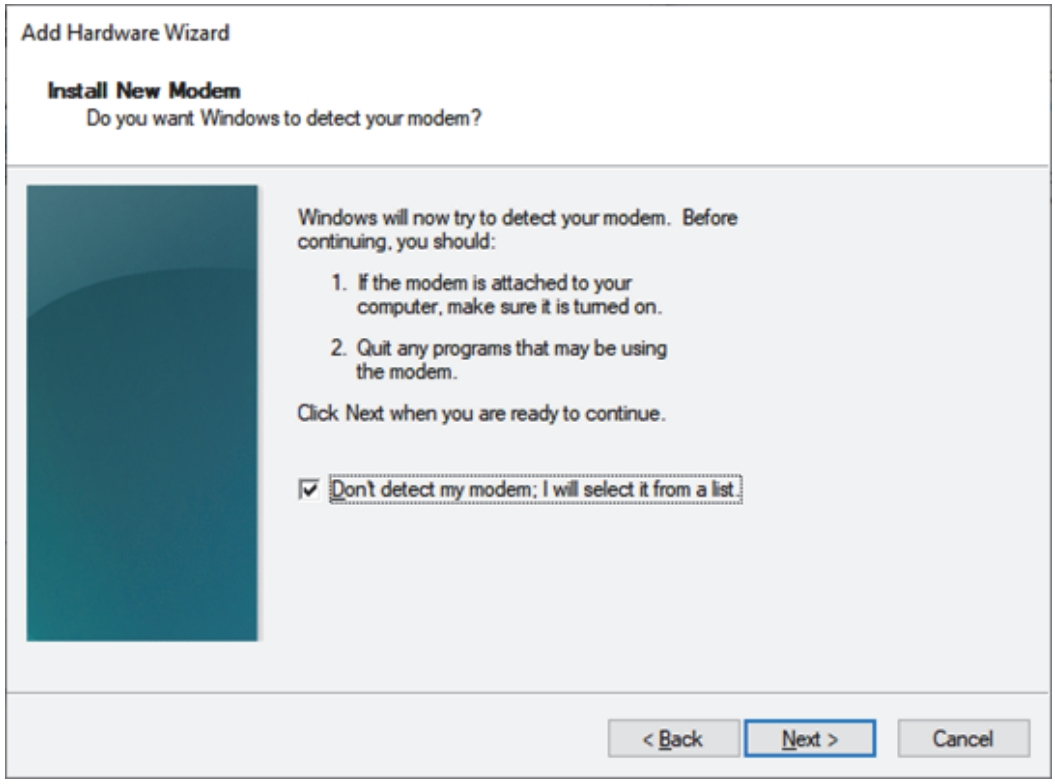
6 Set up a new modem by clicking the **Modems** tab. Under the **Modems** tab, click **Add** (Figure 8.6).

Figure 8.6 Adding Modem



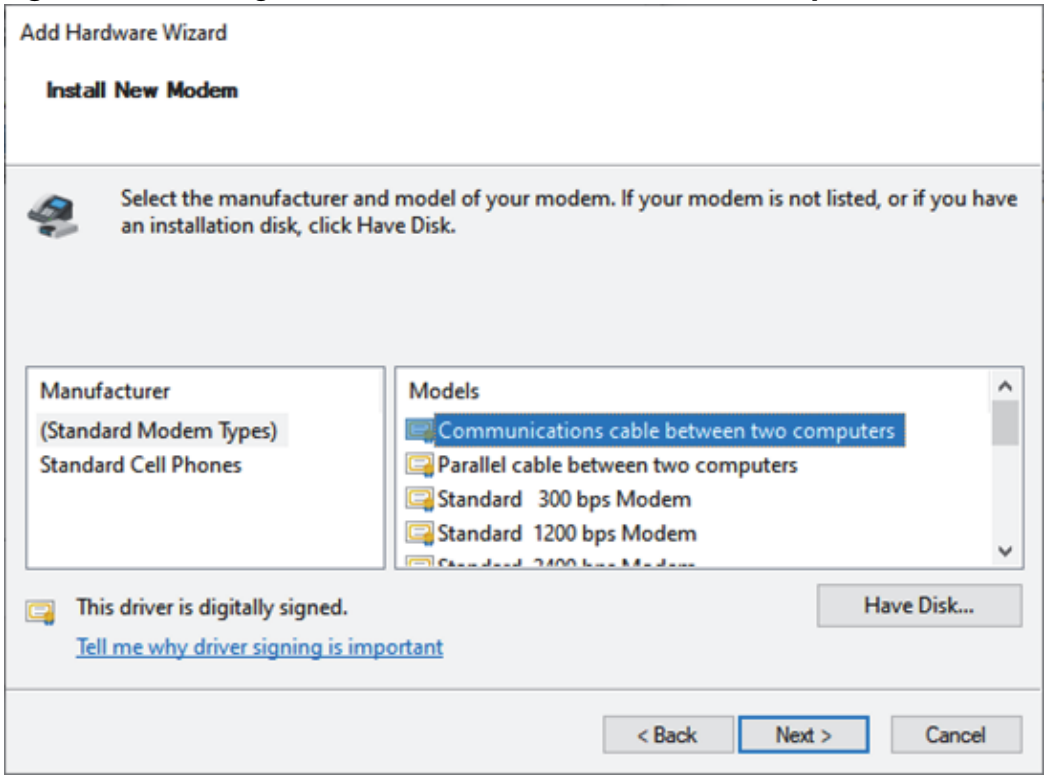
a Click **Add** and choose **Don't detect my modem; I will select it from a list**.Then, click **Next**.(Figure 8.7).

Figure 8.7 Selecting **Don't detect my modem**



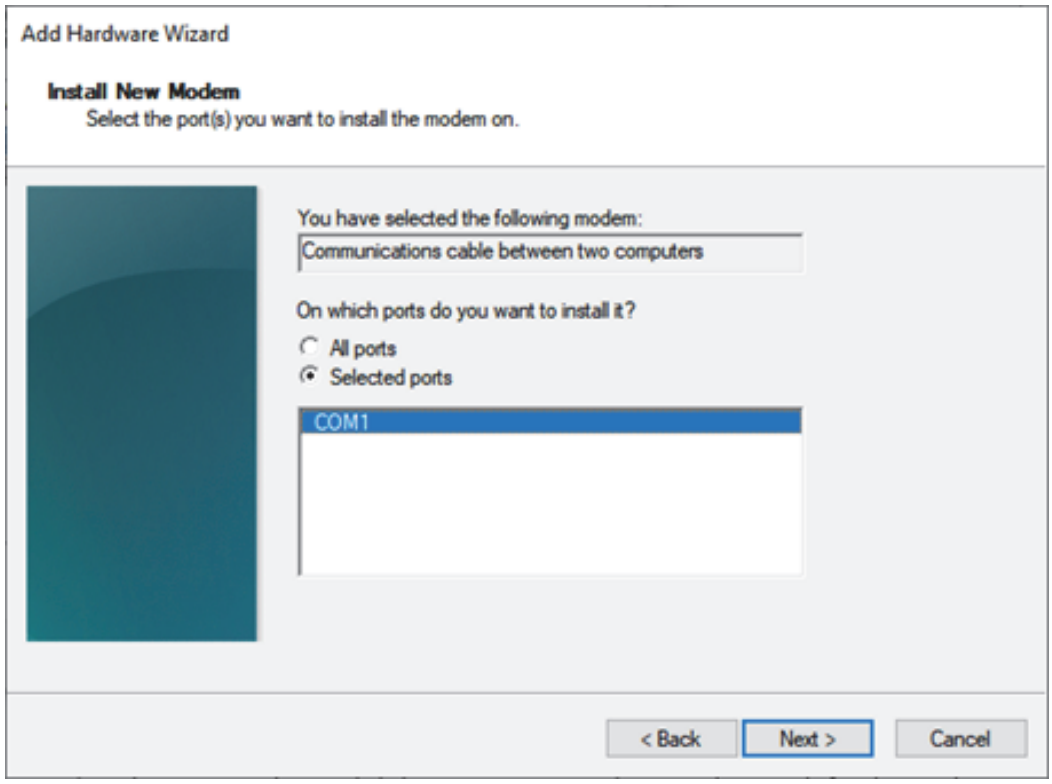
b Select **Communications cable between two computers** and click **Next** (Figure 8.8).

Figure 8.8 Selecting **Communications cable between two computers**



c Select desired Com port, click **Next** (Figure 8.9), then wait a few moments.

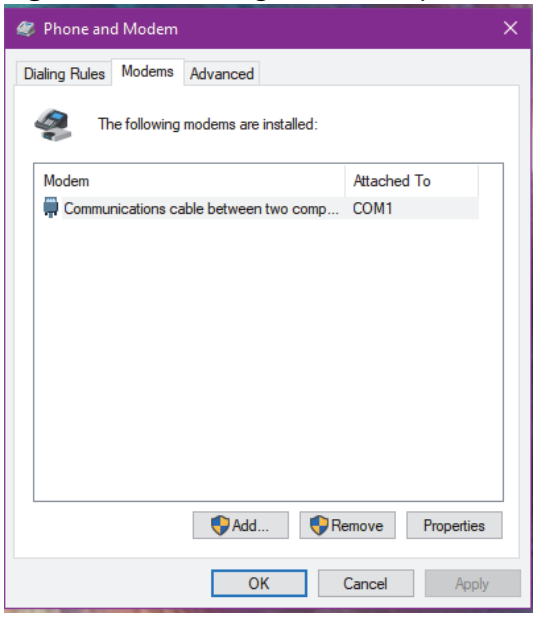
Figure 8.9 Selecting Desired Com Port



d Click **Finish** on the next screen.

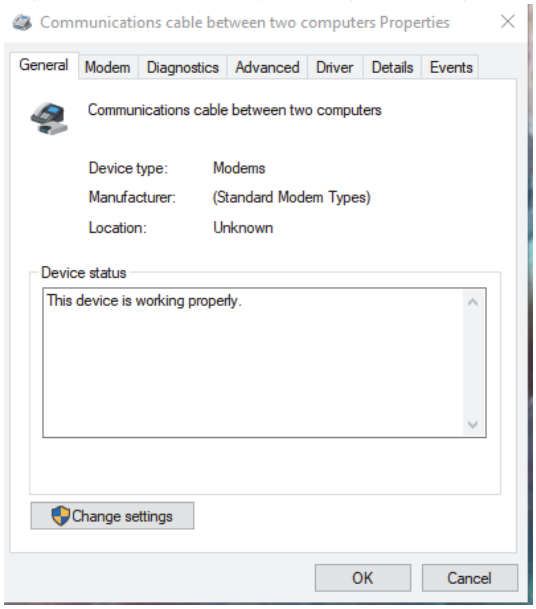
7 Select the new modem, then click **Properties** (Figure 8.10). Wait a few moments for the window to open.

Figure 8.10 Selecting Modem Properties



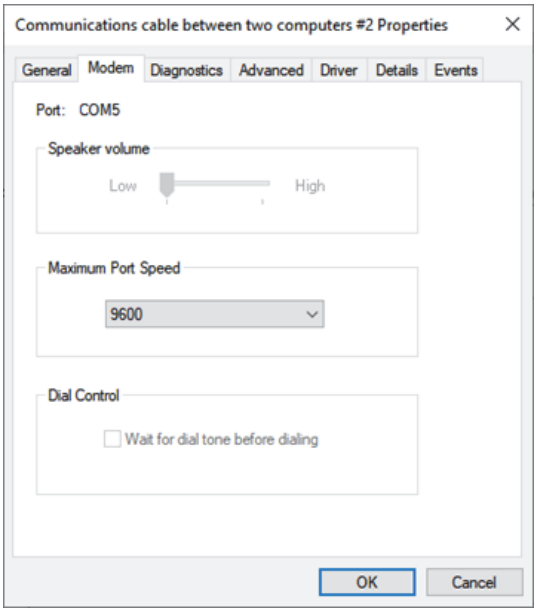
8 Click the **Change settings** button (Figure 8.11), which reopens the window to allow editing. Wait a few moments for the window to open.

Figure 8.11 Selecting **Change settings**



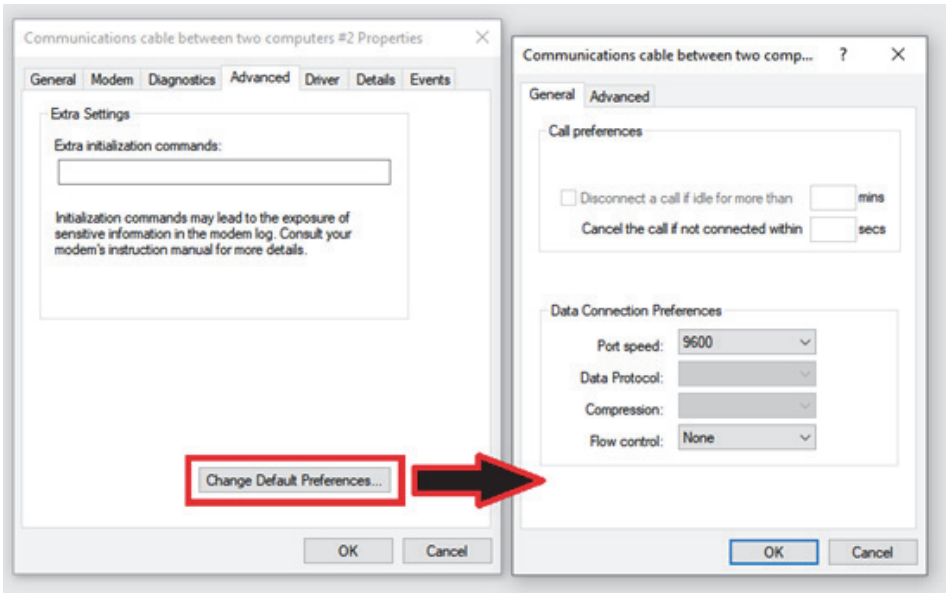
a When it reopens, go to **Modem** tab and set **Maximum Port Speed** to 9600 (Figure 8.12).

Figure 8.12 Configuring **Modem** Tab



b Click the **Advanced** tab and select **Change Default Preferences** (Figure 8.13). In the General tab of the new window, set **Port speed** to *9600* and **Flow control** to *None*

Figure 8.13 Selecting **Change Default Preferences**



9 Click **OK** on the three open windows.

10 Open **Dial-up Settings** (Figure 8.14).

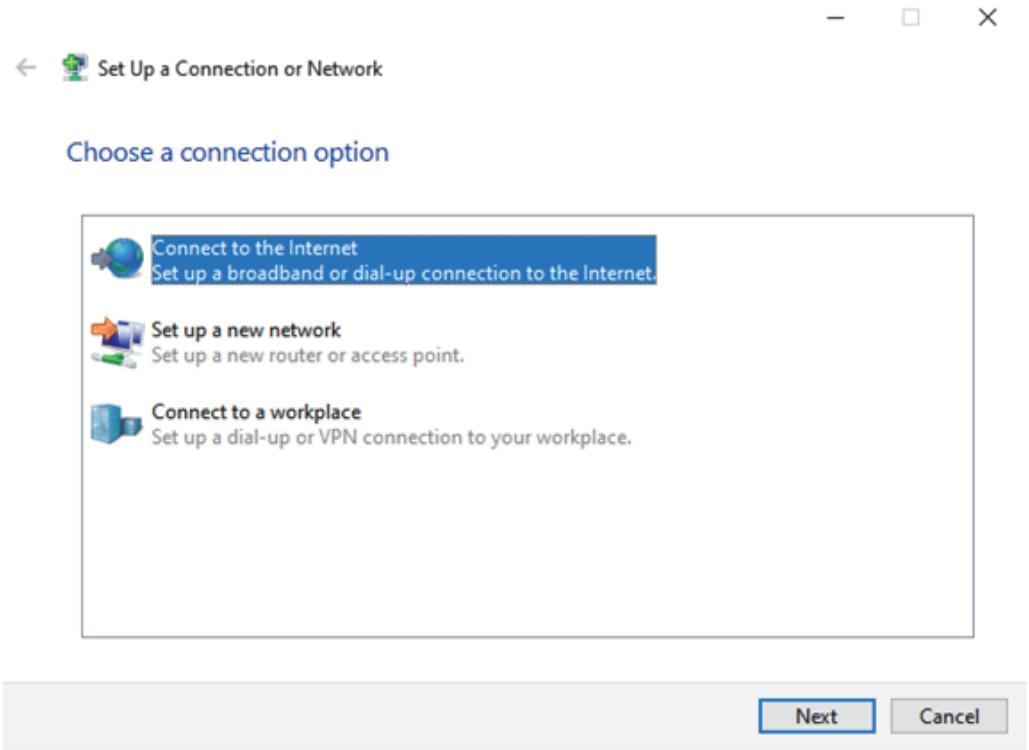
Tip *Using the Windows 10 search bar is fastest. Search for "Dial-up Settings".*

Figure 8.14 Selecting **Dial-up Settings**

11 Click **Set up a new connection**.

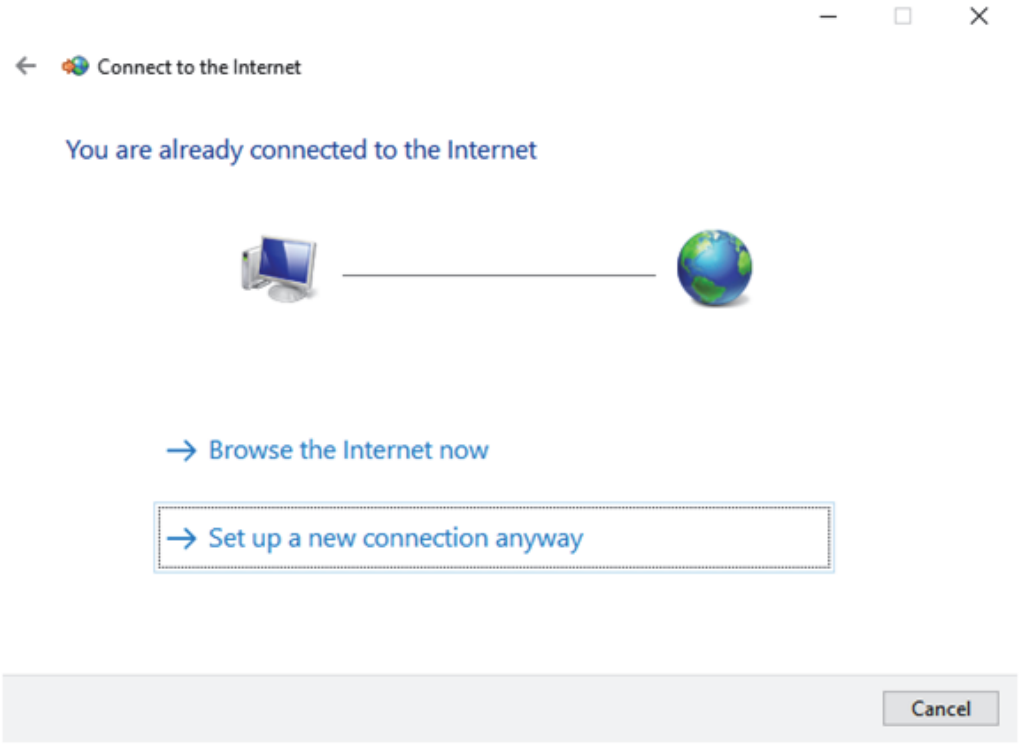
a Select **Connect to the Internet** (Figure 8.15).

Figure 8.15 Selecting **Connect to the Internet**



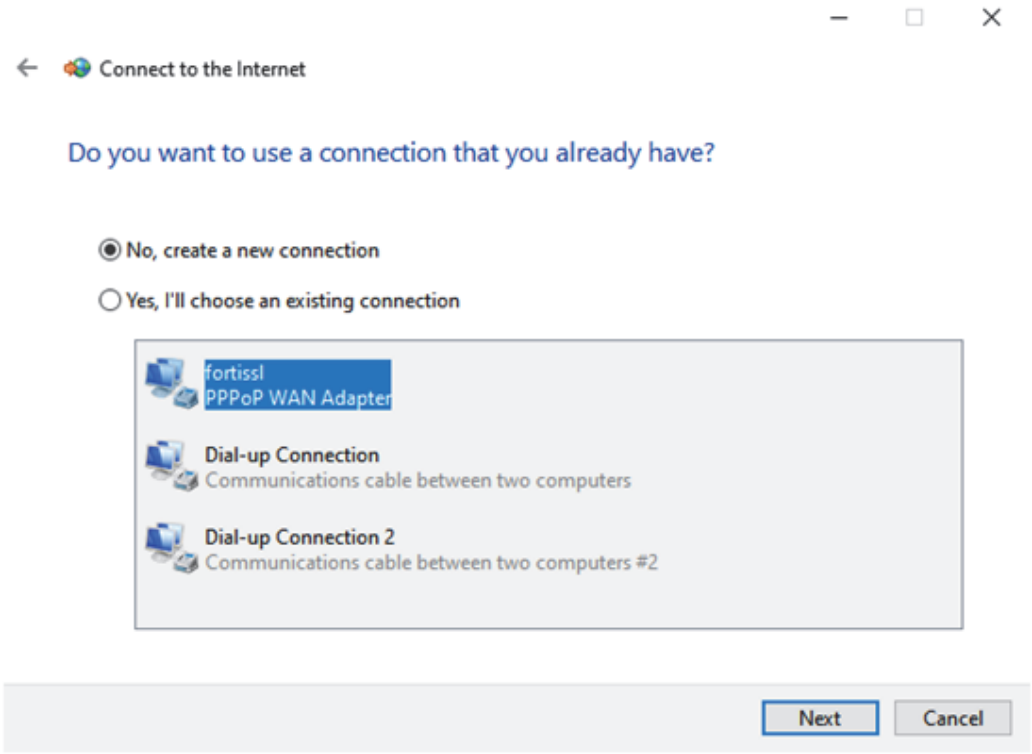
b When you get prompted that "You are already connected to the Internet," click **Set up a new connection anyway** (Figure 8.16).

Figure 8.16 Selecting **Set up a new connection anyway**



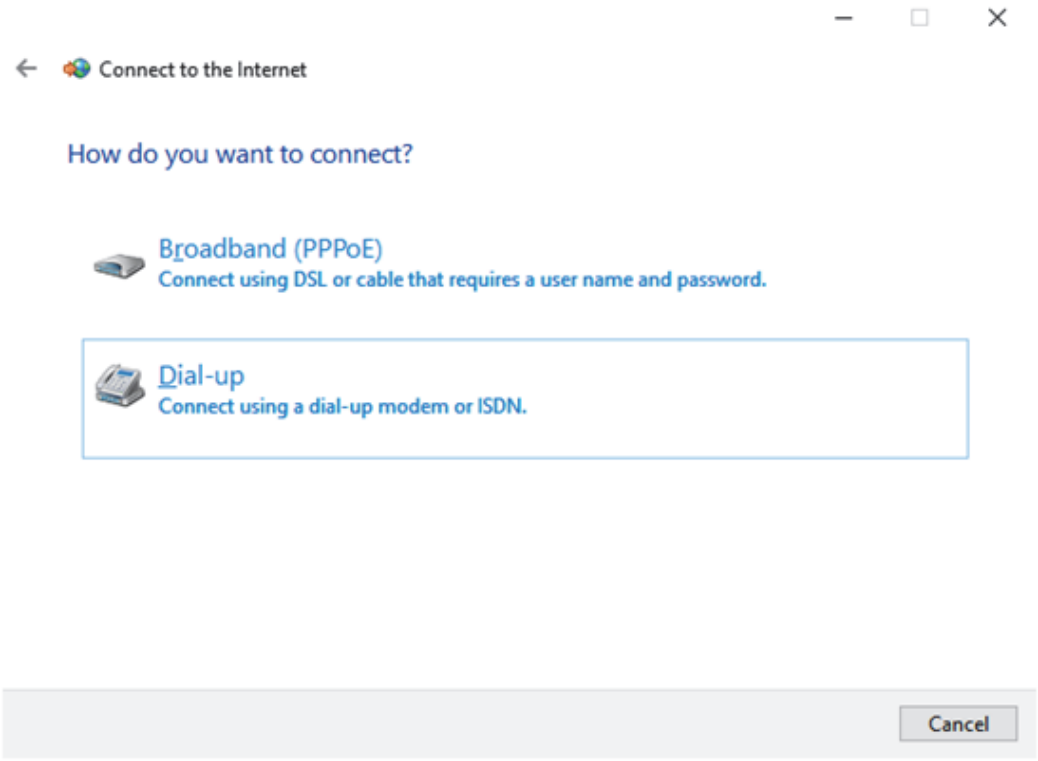
c When you get prompted “Do you want to use a connection that you already have?”, click **No, create a new connection** (Figure 8.17).

Figure 8.17 Selecting **No, create a new connection**



d Select **Dial-up** (Figure 8.18).

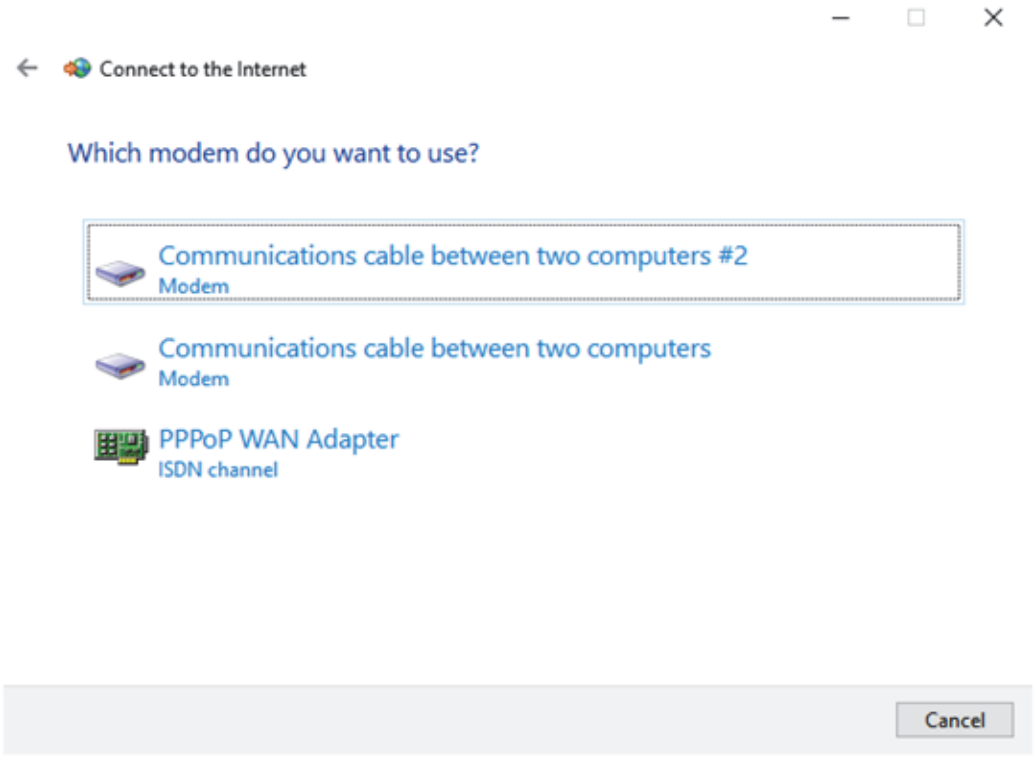
Figure 8.18 Selecting **Dial-up**



e Select **Communications cable between two computers** (Figure 8.19).

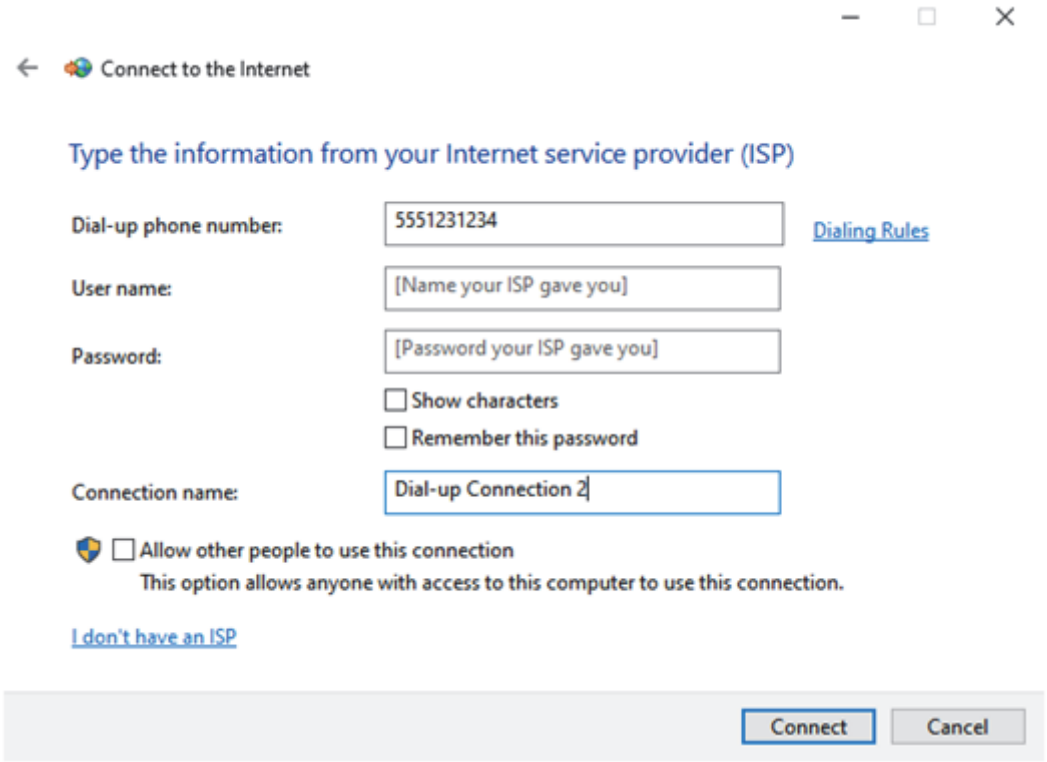
Note *This specific example shows a* second *modem connection being created.*

Figure 8.19 Selecting **Connect to the Internet > Communications cable between two computers**



f Create a "false" **Dial-up phone number** and **User name** to enter into the dialog. The number does not actually get used, so you can enter any number. Then click **Connect**. (Figure 8.20).

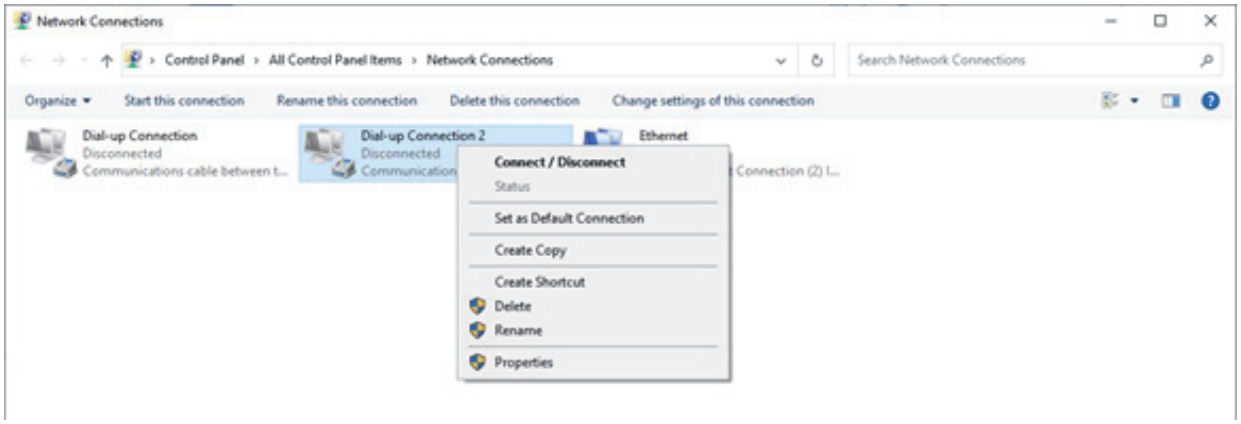
Figure 8.20 Entering "False" **Dial-up phone number** and **User name**



g In the **Connect to the Internet > Connecting to Dial-up Connection** dialog, select **Skip.** In the **Dial-up Settings** dialog shown in Figure 8.14, click **Change Adapter Options**.

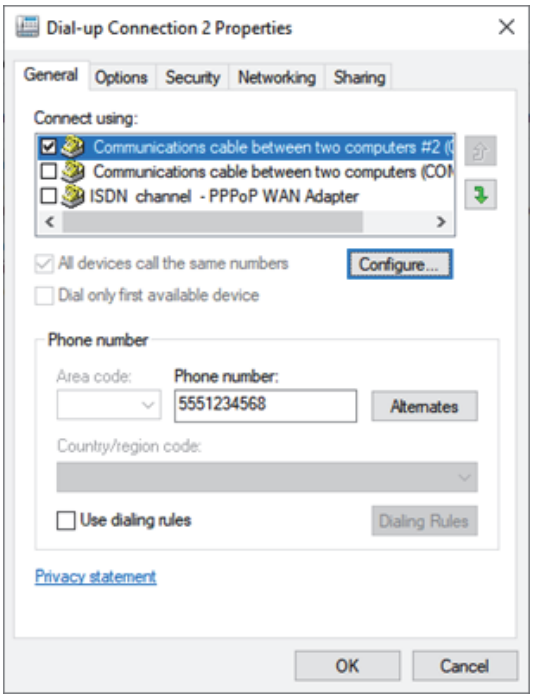
12 In the **Network Connections** window, right-click your dial-up connection and select **Properties** (Figure 8.21).

Figure 8.21 Selecting Your Dial-up Connection



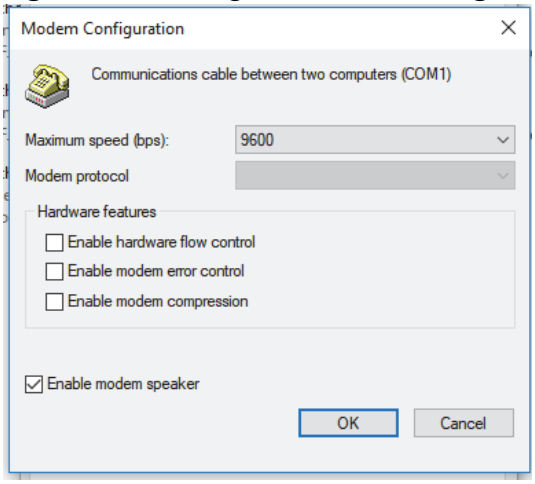
13 In the **General** tab select the modem connection, identified by the name you gave it (**Communications cable between two computers #2**), then click **Configure** (Figure 8.22).

Figure 8.22 Selecting Your Dial-up Connection's Properties



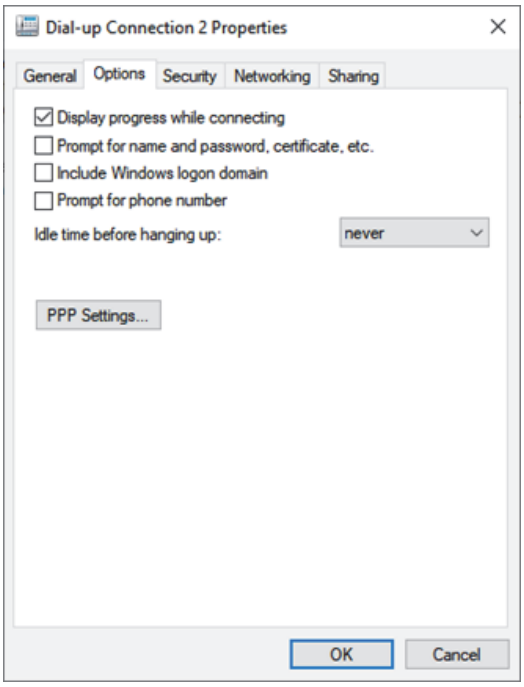
14 Set the **Modem Configuration** settings as shown (Figure 8.23).

Figure 8.23 Setting the **Modem Configuration** Settings



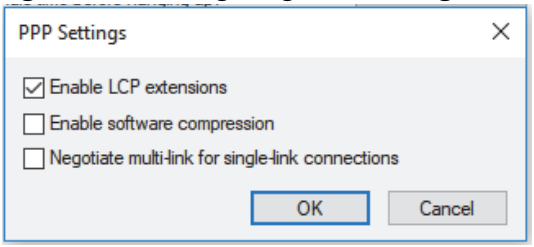
15 Click **OK**, then click the **Options** tab. Configure as shown in Figure 8.24.

Figure 8.24 Configuring Modem Options



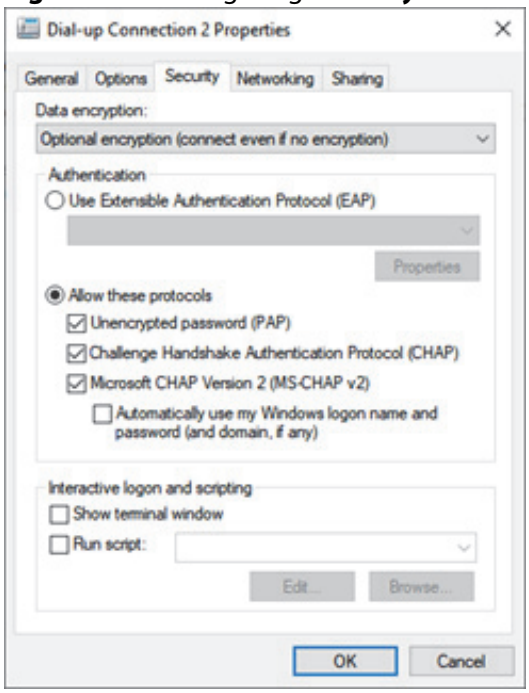
16 Click **PPP Settings** and configure as shown in Figure 8.25.

Figure 8.25 Configuring **PPP Settings**



17 Click **OK**, then click the **Security** tab. (Ignore errors such as the *Error60B* dialog if they appear.). Configure the **Security** tab as shown in Figure 8.26.

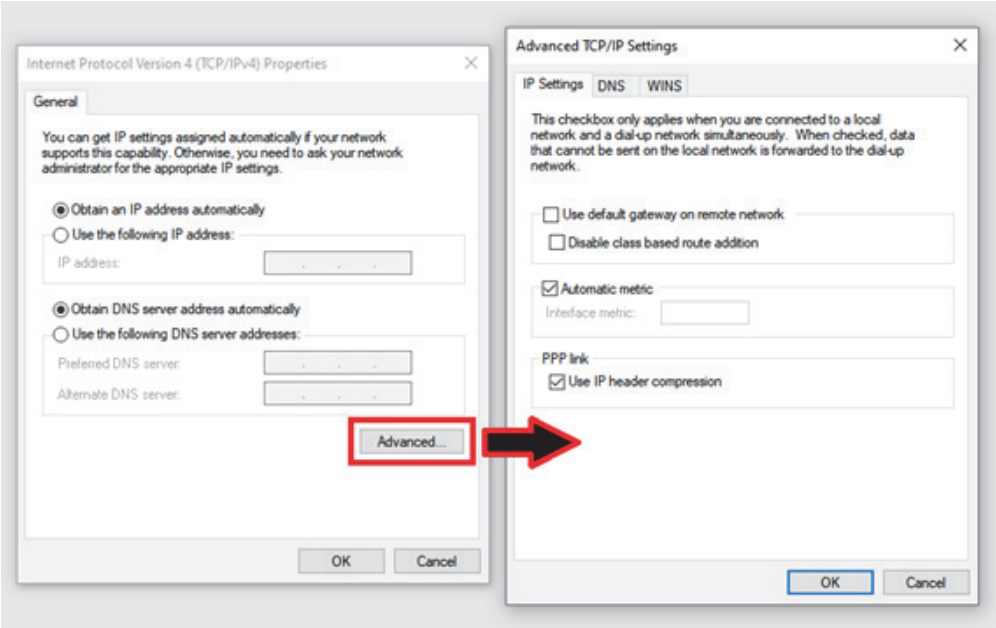
Figure 8.26 Configuring **Security** Tab



18 Click the **Networking** tab and un-check all options besides the IPv4 protocol. Then, select the IPv4 connection and select **Properties**.

19 Configure the IPv4 Properties as shown in Figure 8.27.

Figure 8.27 Configuring IPv4 Properties

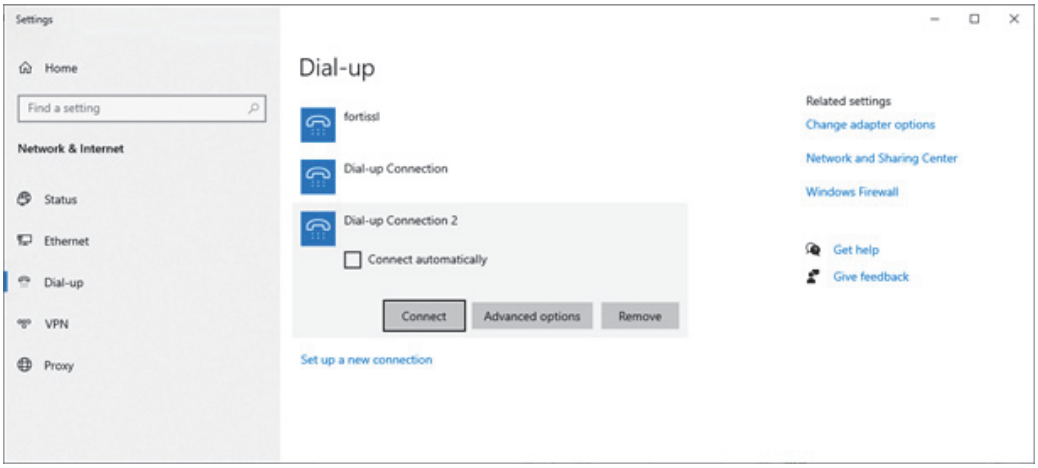


20 Close all applications and reboot the computer.

21 Connect the radio back port to the computer's Com port using an RS232 cable and connect the new Dial-up connection

Tip *You can quickly get to the Dial-up window if you navigate back to the **Dial-up** settings menu, select the new connection, and then click **Connect** (Figure 8.28).*

Figure 8.28 Connecting New Dial-up Connection



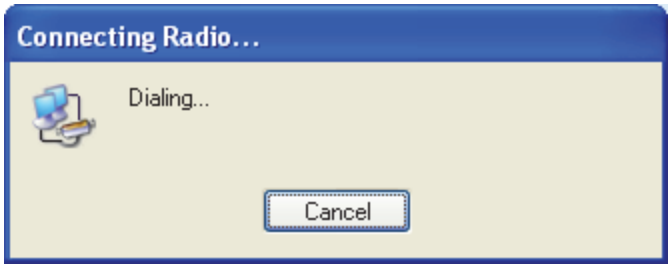
8.2.4.1 Connection and Testing

To connect the computer and radio and test the connection perform the following instructions.

8.2.4.1.1 Connection

To connect the computer and radio, right-click on the network icon. The Connecting Radio window (Figure 8.29) appears and remains until the connection is made.

Figure 8.29 Radio Connection Window

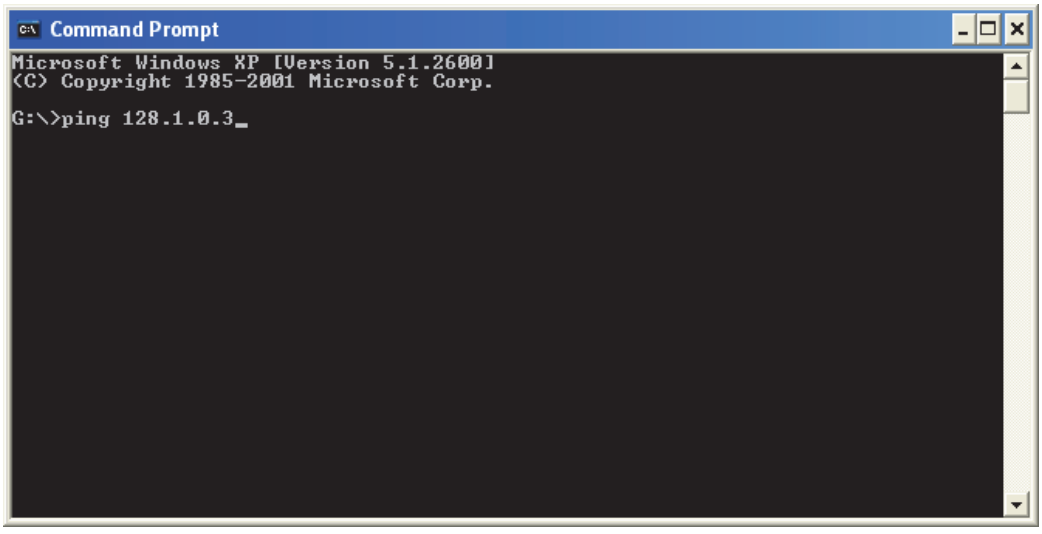


8.2.4.1.2 PPP Link Test

Further verification that the link is working correctly can be made by "pinging" the subscriber radio from the mobile computer:

1 Activate the Command Prompt screen from the **Accessories** pull-down list of the Start menu (see Figure 8.30).

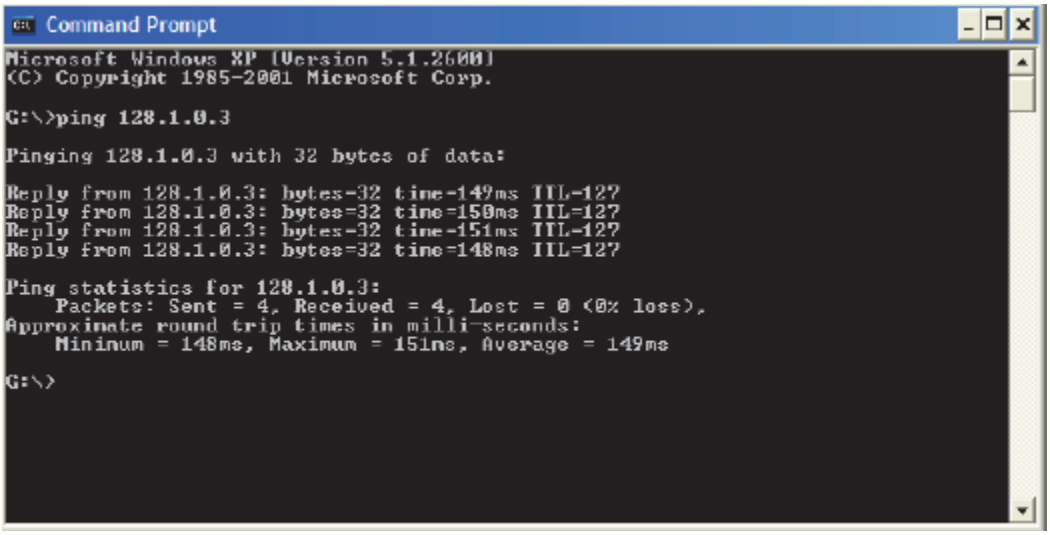
Figure 8.30 Command Prompt Screen: Sending "Ping"



2 At the prompt, type `ping` followed by the IP address of the radio. In the above example the IP address 128.1.0.3 s used, and the complete entry is `ping 128.1.0.3`.

3 Check for one or more replies to the “ping” as in the example of Figure 8.31. This indicates that the connection is working correctly.

Figure 8.31 Command Prompt Screen: Replies to Successful “Ping”



8.2.4.2 Extra Assistance

The following changes may already be in place on the Windows 10 computer. In case the radio is still unable to connect however, consider the following procedure:

1 Open Registry Editor through the search bar and navigate to Computer\HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\RasMan and in the **RequiredPrivileges** register, ensure “SeLoadDriverPrivilege” is in the data (without the quotes).

2 Open Device Manager and enter the properties for COM1, selecting it from the Ports (COM & LPT) section.

   a Set the **Rate** to *9600* and **Flow** to *None*.

Click the **Advanced** button and ensure the COM port is pointing to the right number (more of an issue if using a USB-to-Serial adapter rather than COM1 out the back of a computer).

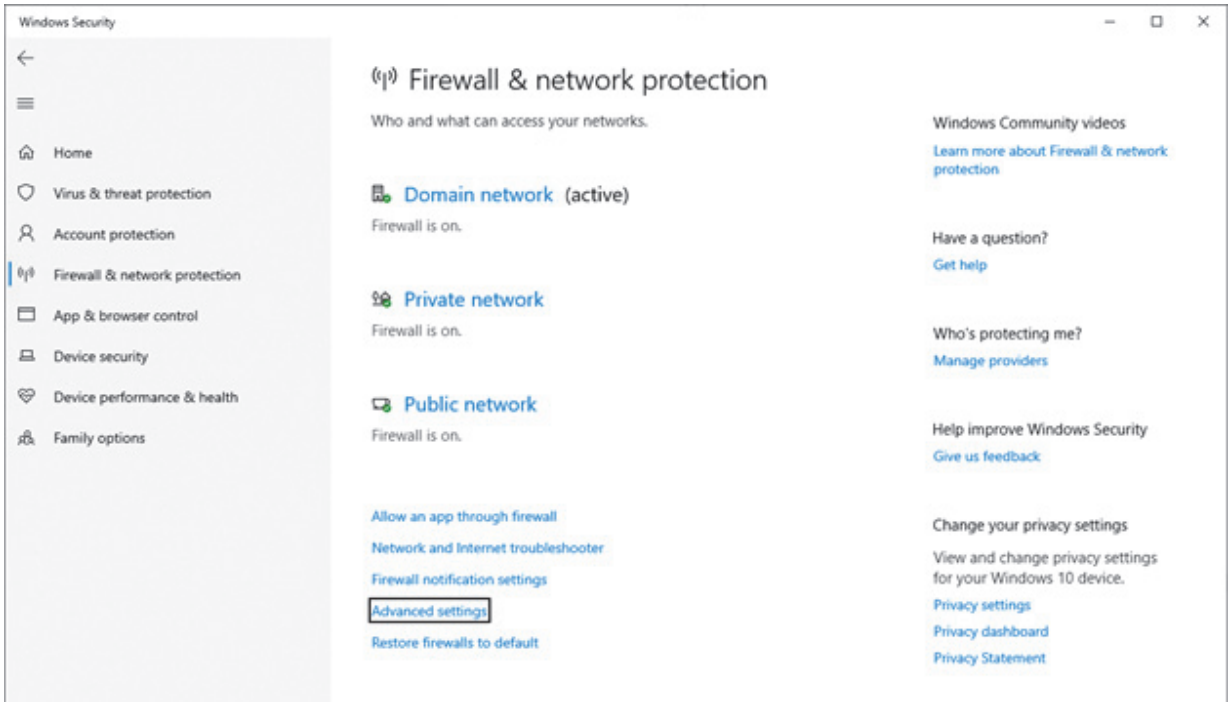
8.2.4.3 Best Practices for Windows 10

When using a Windows 10 computer as part of the PPP link, the connection may appear less responsive. If the operator encounters this, you can try to perform the following procedure on the computer:

1 Open the **Windows Security** menu and select **Firewall & network protection**.

   a Click the **Advanced settings** link in the bottom center list (Figure 8.32).

Figure 8.32 Menu: Windows Security > Firewall & network protection



2 The firewall rules menu appears. On the left, an outline with the entry “Outbound Rules” appears. Right-click the **Outbound Rules** and select **New Rule** from the list

(Figure 8.33), The Rule Wizard appears. Select a **Custom** rule for the **Rule Type,** then click **Next** (Figure 8.34).

Figure 8.33 Menu: Outbound Firewall Rules

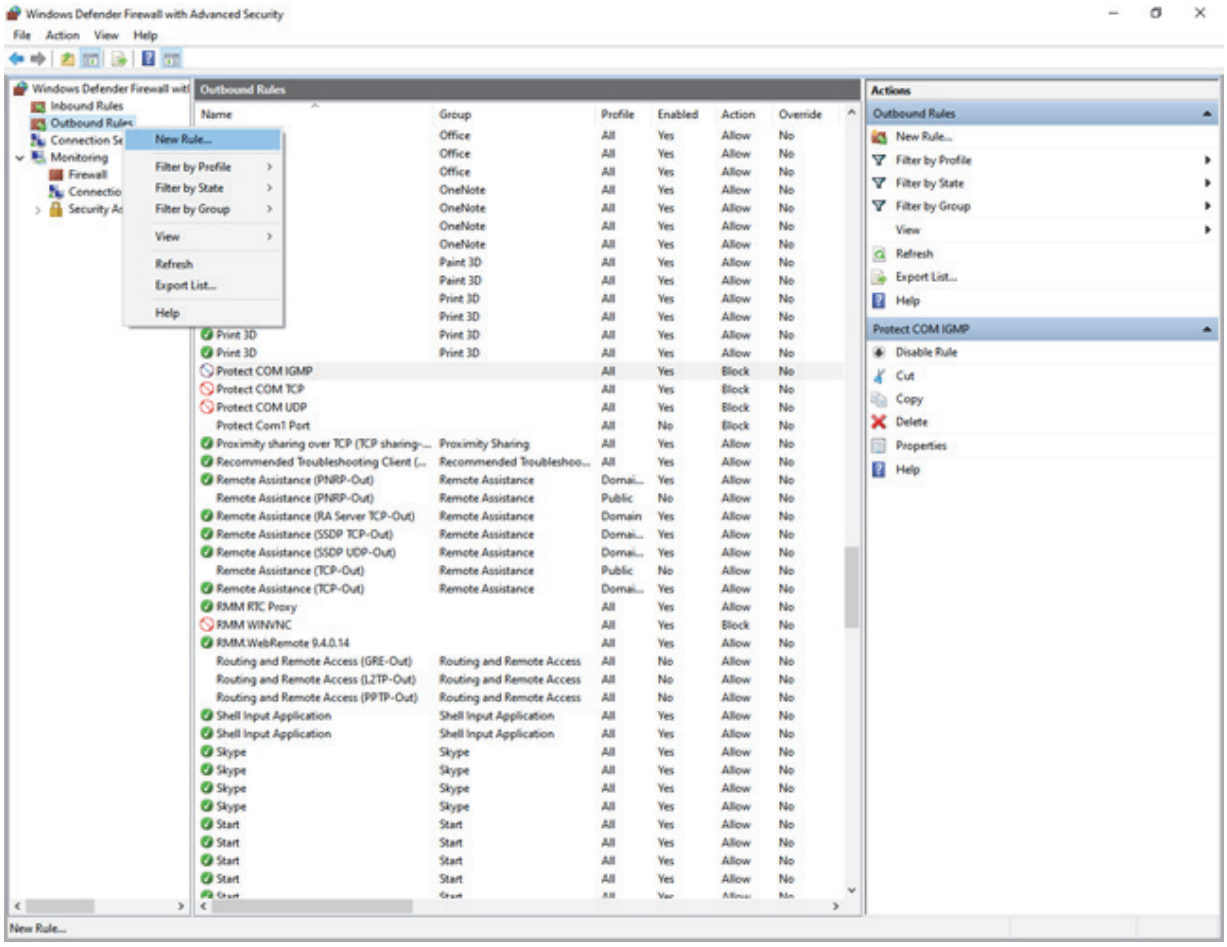
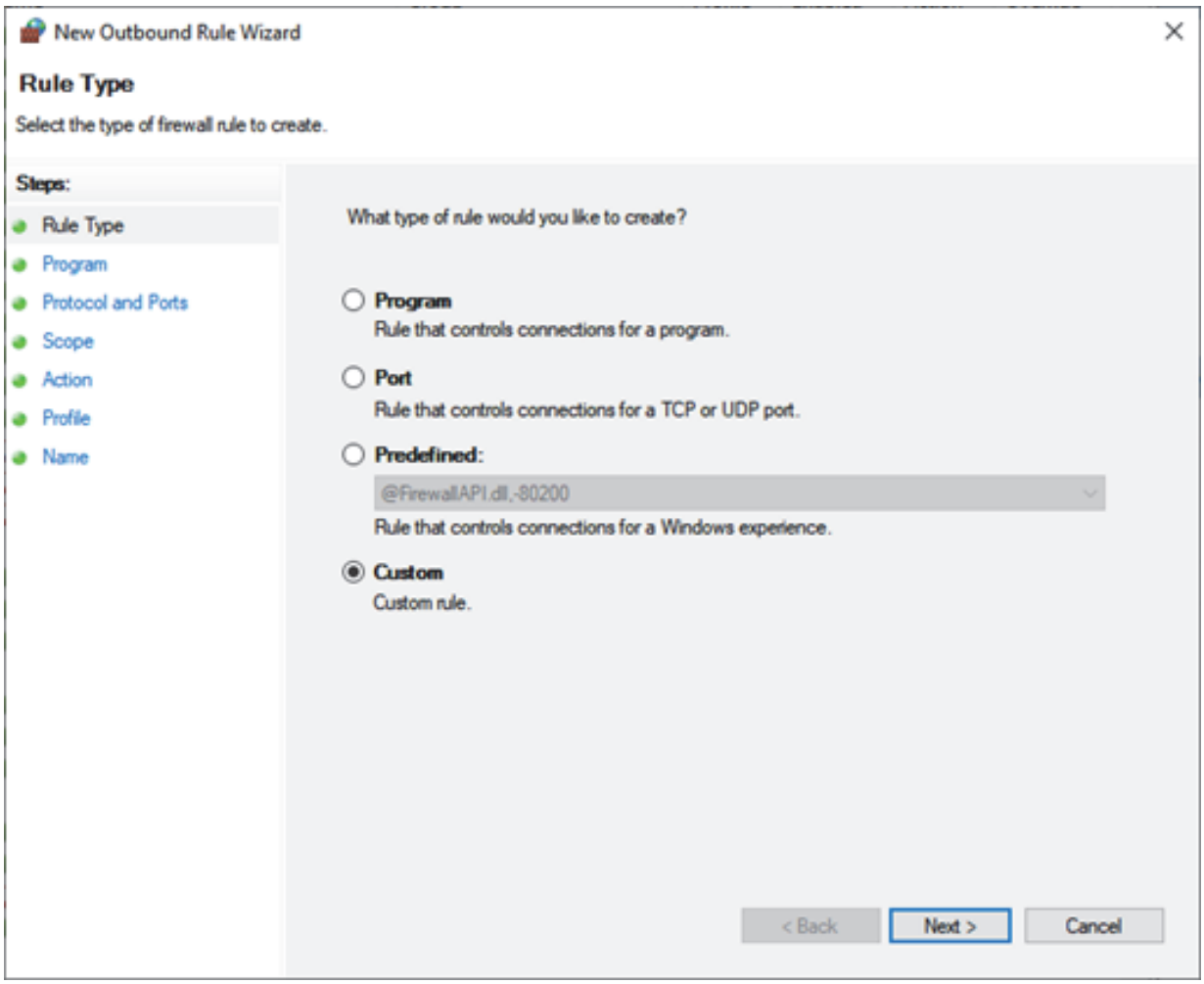
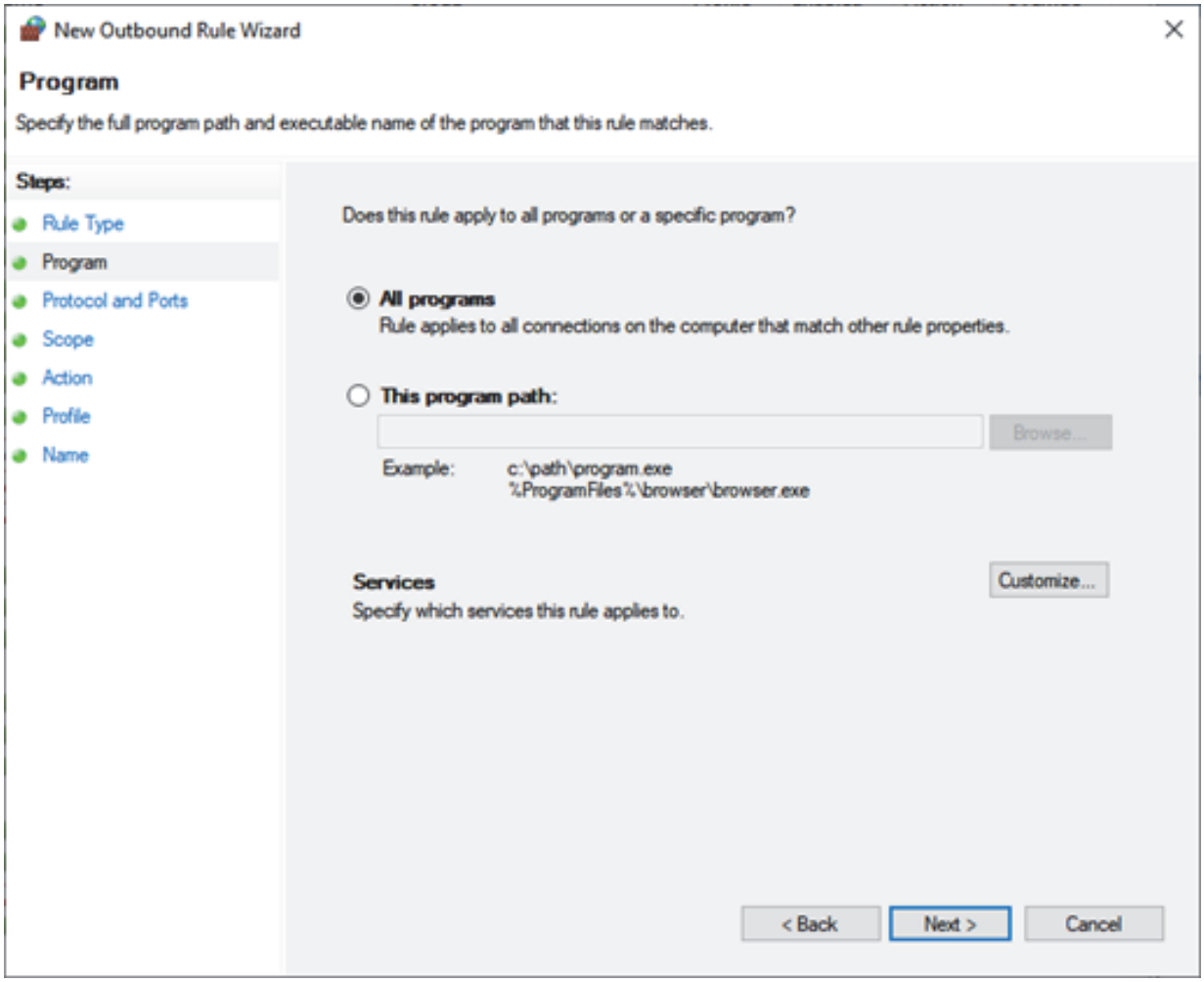


Figure 8.34 Window: New Outbound Rule Wizard



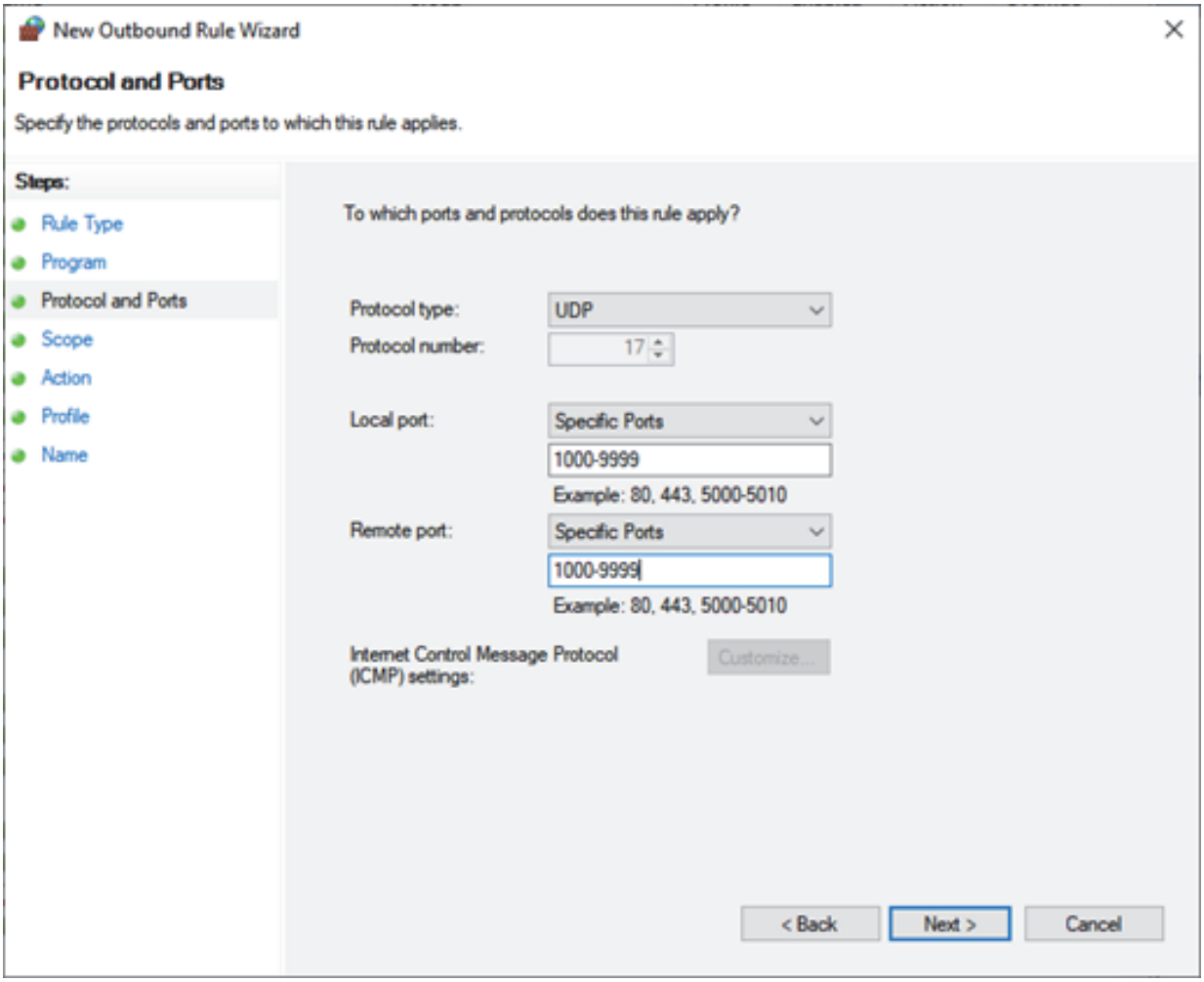
a Select **All Programs** and click **Next** (Figure 8.35).

Figure 8.35 Selecting **All Programs**



b In the **Protocol and Ports** step, select “UDP”, then for each of the dropdown menus select “Specific Ports” and in the text box below each, indicate every port besides the ports that will be used. Then click **Next** (Figure 8.36).

Figure 8.36 Selecting **Protocol and Ports**



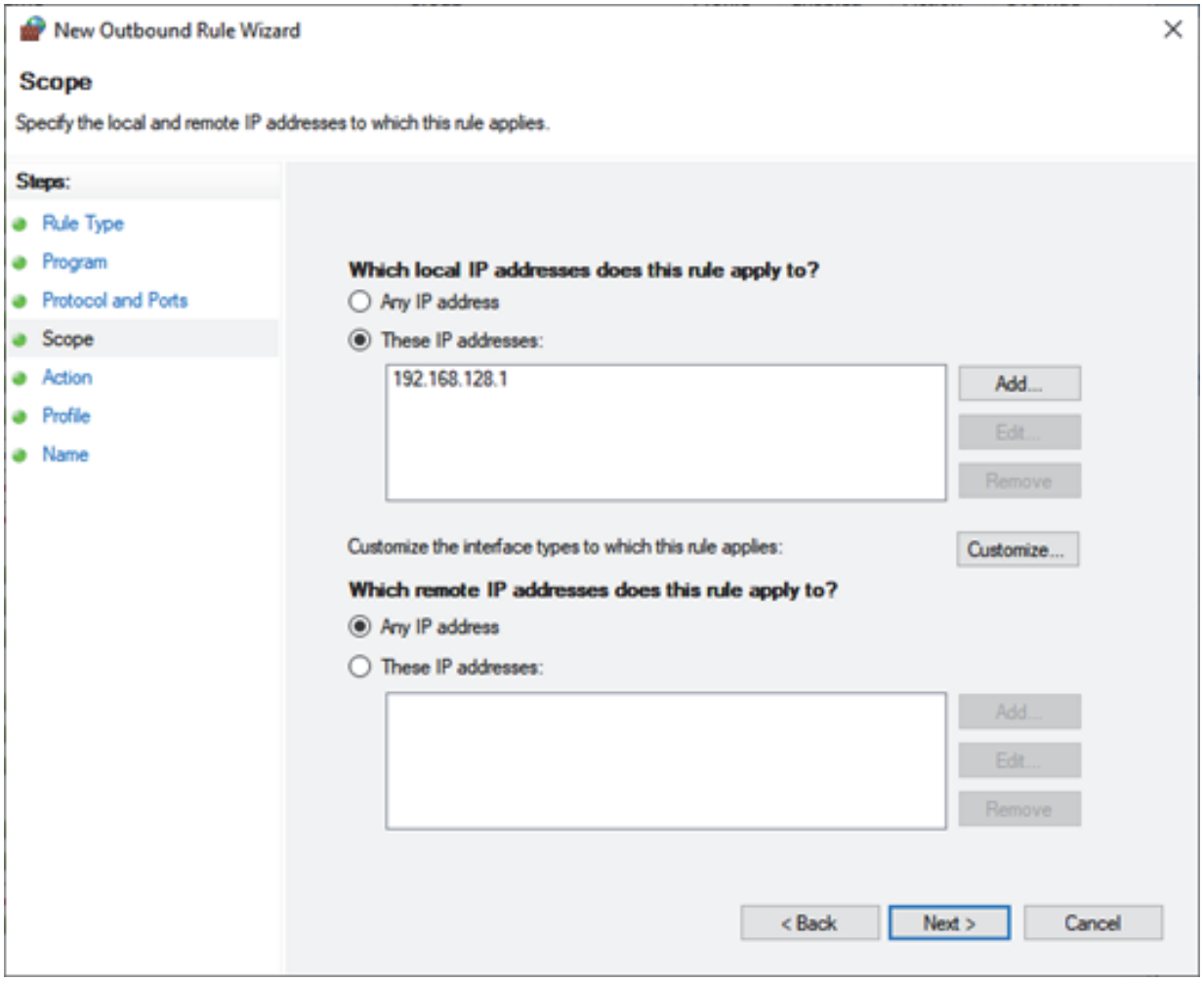
c In the **Scope** step, in the **Which local IP addresses does this rule apply to?** area select **These IP addresses**.

- Add the “Mobile Computer IP Address” as it appears in the Armada codeplug in General Settings > General Settings 2 > P25 Packet Data.
- Click **Add**.

Note *This is the address the by which the mobile computer refers to itself when connecting to the radio. When you add this address to the block list, all outgoing packets to the radio get filtered by this rule.*

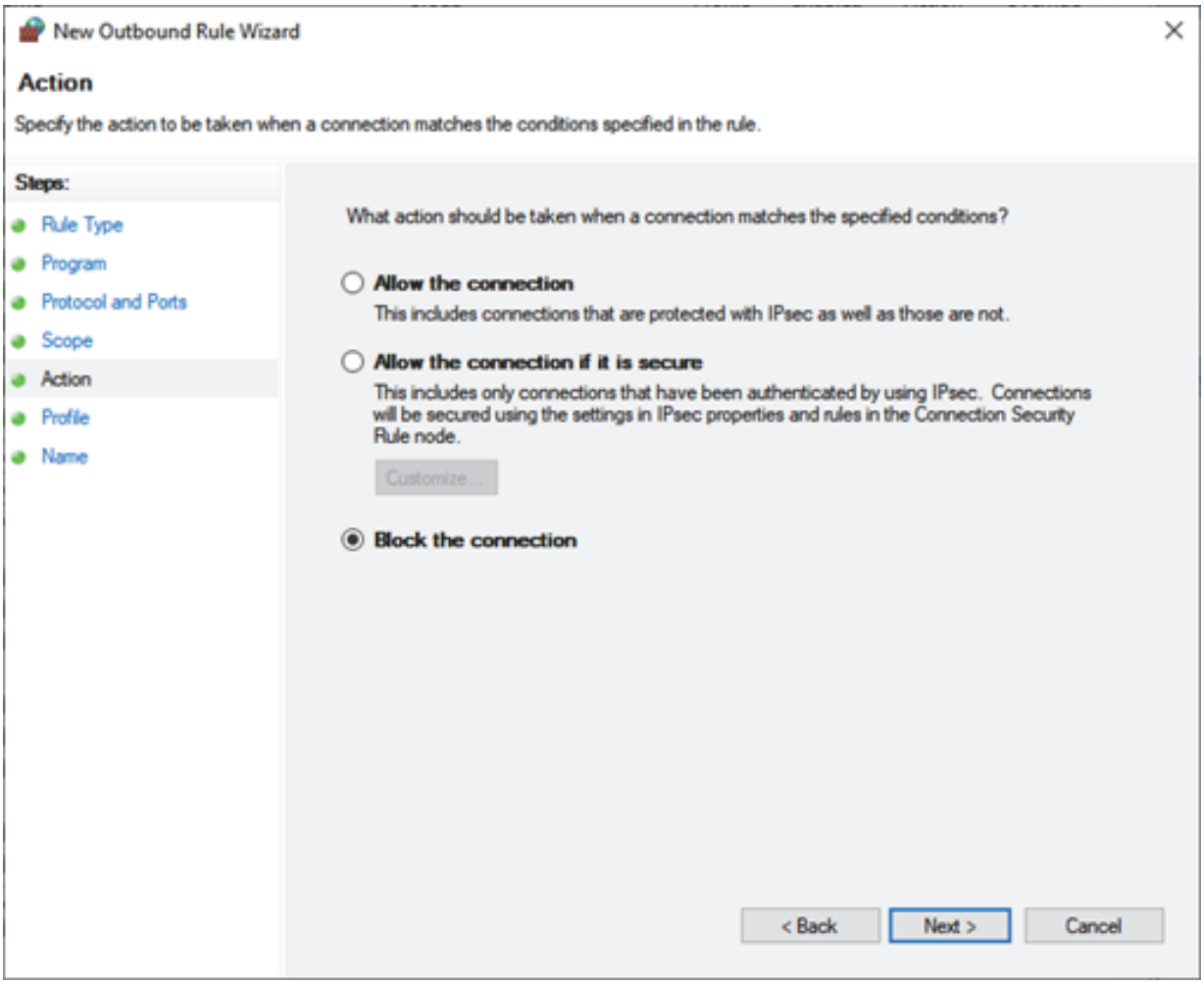
- Make sure **Any IP address** is selected in the **Which remote IP addresses does this rule apply to?** area. Then click **Next** (Figure 8.37).

Figure 8.37 Selecting **Scope**



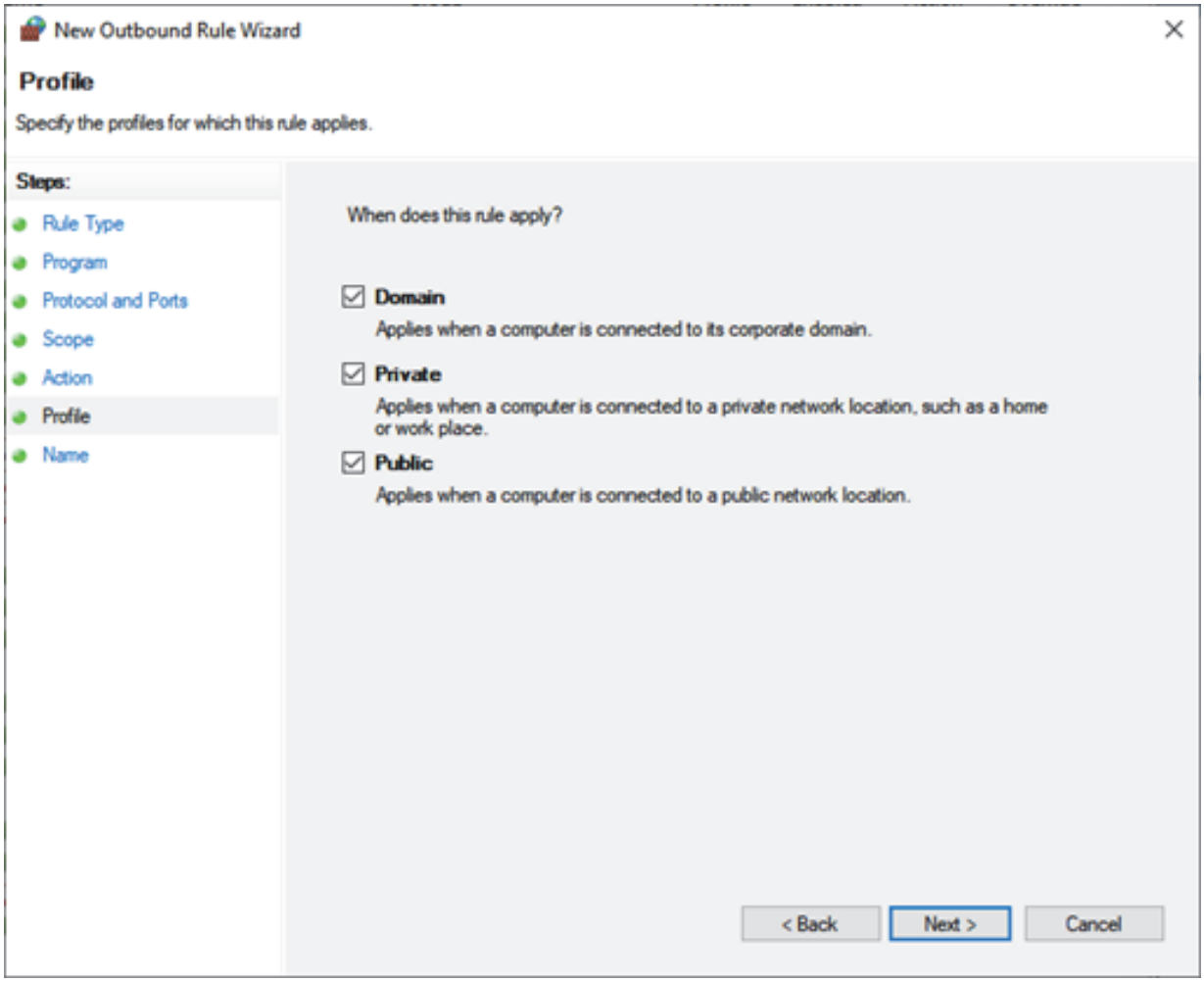
d In the **Action** step. select **Block the connection**. Then click **Next** (Figure 8.38).

Figure 8.38 Selecting **Action**



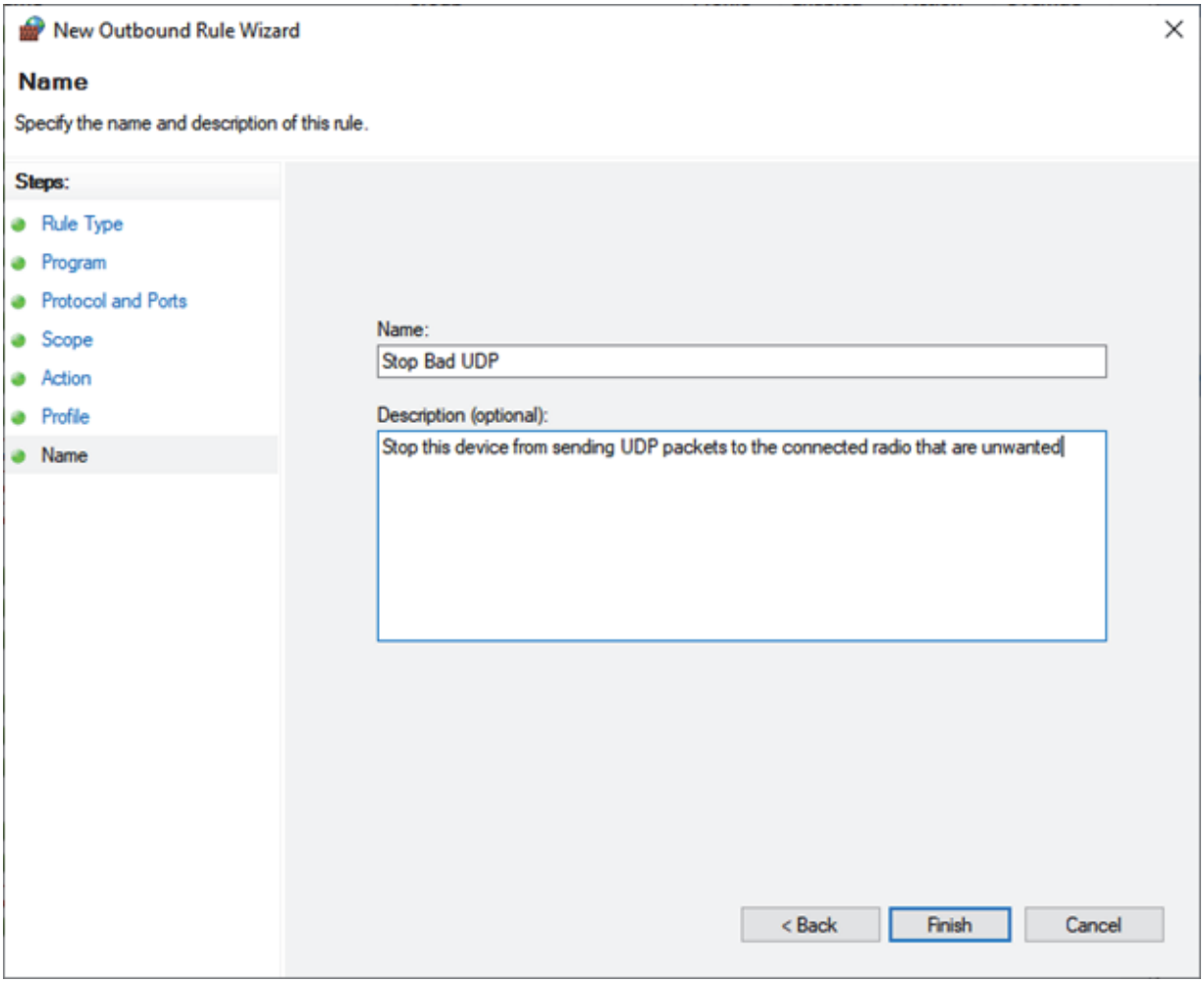
e In the **Profile** step, ensure all boxes are checked. Then click **Next** (Figure 8.39).

Figure 8.39 Selecting **Profile**



f In the **Name** step, give the rule a distinctive name, which can be any description that helps distinguish the rule, Then click **Finish** (Figure 8.40).

Figure 8.40 Selecting **Name**



g Repeat Steps a through f. However, in Step b, choose “TCP” instead of “UDP”. Then, repeat once again selecting “IGMP”.

h The new rules should be in effect. Test the computer’s network connectivity with an Internet search.

i Test the radio connection and check for remaining latency.

SECTION

9

Tones and Error Messages

This chapter contains the following sections:

9.1 Supervisory Tones

Supervisory Tones are described as follows:

Single Beep (Alert Tone)

- Power was turned ON and a successful power-up sequence occurred (Section 3.1.1).
- The time-out timer is about to expire or the penalty timer has expired (Section 4.3).
- The conversation timer is about to expire (Section 5.7).
- The system received your page, but the paged radio is not on the air (Section 6.6).
- Telephone interconnect is not operational (Section 6.5).

Continuous Tone (Invalid Condition)

- A transmission is being attempted on a conventional channel programmed as receive-only.
- The transmitter has been disabled by the transmit disable on busy feature (Section 5.3).
- The transmitter has been disabled by the time-out timer feature (Section 4.3).
- The transmitter has been disabled by the conversation timer (Section 5.7).
- An out-of-range condition exists (Viking16 only).
- A transmission is being attempted before the penalty timer has expired (Section 4.3).
- Dynamic regrouping has been exited but the dynamic regrouping channel is still selected (Section 6.12).

Single Short Medium-Pitch Tone

- A valid button has been pressed.

Single Short Low-Pitch Tone

- An invalid button has been pressed.

Medium Tone (No Acknowledge)

- The paged radio did not acknowledge the page (Section 6.6).
- The message that was sent has not been acknowledged (Section 6.7).
- The status condition that was sent has not been acknowledged (Section 6.8).

Five Beeps (Recurring)

- The page was received (Section 6.6).

Two Short Tones

- A unit-to-unit call was received (Section 6.6).

Five Beeps

- The paged radio received the page and acknowledged it (Section 6.6).
- The message that was sent has been received and acknowledged (Section 6.7).
- The status condition that was sent has been received and acknowledged (Section 6.8).

Four Beeps

- The emergency alarm condition was acknowledged (Section 6.9).
- Four low beeps indicate the call back mode (the system is no longer busy).

Alternating Tone

- Dynamic regrouping has occurred (Section 6.12).
- Dynamic regrouping has occurred but the regrouping channel is not selected (Section 6.12).

Busy Signal

- The radio system is busy or a busy condition exists when making a telephone call.

Three Medium Pitch Tones

- A channel is available after a busy condition occurred (Viking16 only).

9.2 Error Messages

Table 9.1 Error Messages

Message Enumerations	Mobile Strings	Description
AFFILIATION_FAILED	“Affiliatn Failed”	This error indicates that a group affiliation attempt has received a FAILED response from the system. The precise reason for a FAILED response is manufacturer dependent
AFFILATION_REFUSED	“Affiliatn Refused”	This error indicates that a group affiliation attempt has received a REFUSED response from the system. The precise reason for a REFUSED response is manufacturer dependent.
ANALOG	“Analog”	This error indicates than an operation was attempted that is not allowed on analog channels.
ANSWER_ONLY	“Answer Only”	This error indicates that the user has attempted to initiate a unit call or interconnect call and the feature is programmed for answer only.
AUTHENTICATION_FAILED	“Authent Failed”	This error indicates the radio failed P25 Trunking Authentication, which occurs during Unit Registration on supported systems.
BAD_BAND	“Bad Band”	The radio band in the parameter file does not match the radio band in the tuning parameters. You will see this message if a parameter file for the wrong band is downloaded to the radio. This error is also indicated with 4 orange blinks of the LED.
BAD_ESN	“Bad ESN”	This error indicates that the ESN of the radio is not valid. This error is usually only seen in the factory when first programming brand new logic boards. This error is also indicated with 12 orange blinks of the LED.
BAD_FILE_FORMAT	“Bad File Format”	The parameter file has a newer file format version than what matches the software in the radio. This error is indicated with 2 orange blinks of the LED.
BUSY	“Busy”	This error indicates that a call has been attempted and the system has responded that no channels are available for assignment.
BUSY_TIMEOUT	“Busy Timeout”	This error indicates that the radio previously received a busy response from the system and it has not received a channel grant before the busy timeout timer has expired.
CLEAR_ONLY	“Clear Only”	This error indicates that the selected channel or group is strapped clear only and that a secure call cannot be made.
CONTROL_HEAD_CONFLICT	“CH Address Conflict”	There are two control heads connected to the mobile that are assigned the same address.
CORRUPT_PARMS	“Corrupt Parm”	The parameters checksum or other data is corrupted. This error will also be indicated with 5 orange blinks of the LED.
CYCLE_POWER	“Cycle Power”	There is a communication failure between the DSP and the back end ADC on the RF deck. This error will also be indicated with 8 orange blinks of the LED.
DATA_DENIED	“Data Denied”	The Radio received a “Deny” response when trying to acquire packet data service.

Table 9.1 Error Messages (Continued)

Message Enumerations	Mobile Strings	Description
DENIED	“Denied”	This error indicates that a group call attempt has received a DENIED response from the system.
DENY	“Deny”	This error indicates that a unit or interconnect call attempt has received a DENIED response from the system.
DISABLED	“Disabled”	This error indicates that the feature that the user is attempting to use has been disabled on the radio either by programming or by factory options.
DSP_FAILED	“DSP Failed”	This error indicates that the DSP failed to complete its startup procedure at powerup. This is also indicated with 7 orange blinks of the LED.
ENCRYPTION_FAIL	“Encryption Bad”	This error indicates that the main processor and the encryption module have failed to complete their startup procedure at powerup. This error is also indicated with 11 orange blinks of the LED.
FIXED_AUTO	“Fixed Auto”	This error indicates that the selected channel or group is strapped to auto power and thus high/low power cannot be selected.
FIXED_HIGH	“Fixed High”	This error indicates that the selected channel or group is strapped to high power and thus low power cannot be selected.
FIXED_LOW	“Fixed Low”	This error indicates that the selected channel or group is strapped to low power and thus high power cannot be selected.
INVALID_USER	“Invalid User”	This error indicates that the user’s radio ID was rejected by the system. This message is primarily related to data registrations.
KEY_FAIL	“Key Fail”	This error indicates that the encryption key required by the current selected group / channel is not valid or does not exist.
KEYPAD_LOCKED	“Keypad Locked”	This error indicates that the keypad lock function is active and key presses are not accepted in this mode.
KEYSET_FAIL	“Keyset Fail”	This error indicates that the radio was not able to activate the encryption keyset chosen by the user.
LIST_FULL	“List Full”	This error occurs during Scan Edit when a user attempts to add too many channels to the scan list.
LIST_ONLY	“List Only”	This error occurs when the user attempts to do direct entry of a unit ID/phone number for Call Alert/Unit Calls/Interconnect Calls but the call setting is set for list only.
LOCKED	“Locked”	This error indicates that the dynamic regrouping selector lock command has been received and zone and channel changes are not accepted.
LOSS_OF_SIGNAL	“Signal Loss”	This error indicates that signal from the infrastructure has been lost during an interconnect call or a P25 Trunking unit call.
MESSAGE_FAILED	“Message Failed”	This error indicates that the message the user was trying to send failed. This applies to conventional messaging.
NEVER_SITE	“Never Site”	This error indicates that the user tried to site lock to a site which was assigned a preference of “Never”.

Table 9.1 Error Messages (Continued)

Message Enumerations	Mobile Strings	Description
NO_ANSWER	"No Answer"	This error occurs when the user initiates a trunking unit call/interconnect call but the call was not answered before being canceled by the system.
NO_GPS_DATA	"No GPS Data"	This error occurs when the user attempts to use the GPS feature but the radio is not receiving GPS data.
NO_EDIT	"No Edit"	This error indicates that the current list is not able to be edited. Applies to conventional and radio wide scan edit.
NO_ENCRYPT	"No Encrypt"	This error occurs when attempting to use or load keys but the radio is not optioned for encryption.
NO_IP_REG	"No IP Reg"	This error occurs when the user attempts to send GPS data without being IP registered.
NO_ITEMS	"Menu Empty"	The menu the user tried to access does not have any items.
NO_KEYS	"No Keys"	This error indicates that no keys are available for the key select function.
NO_LIST	"No List"	This error indicates that no list is programmed for the selected feature.
NO_MESSAGE	"No Message"	This error occurs when attempting to activate the Message feature but no messages are programmed.
NO_PRIORITY	"No Priority"	This error occurs when attempting to use the conventional Priority feature on a non-priority scan list.
NO_SD_CARD	"No SD Card"	This error occurs when there are storage related issues during transfers and no SD card is present.
NO_SERVICE	"No Service"	This error indicates that OTAR service is not available.
NO_SITE	"No Site"	This error indicates that no site with a verified ID is yet on the dynamic site list. This applies to the Site Lock feature.
NO_UKEKS	"No UKEK"	This error occurs when attempting to rekey with no UKEK.
NUM_CHNL_FAIL	"Channel Limit"	If seen upon startup, this error indicates that the radio has been programmed with more channels than what it is optioned for. This error is also indicated with 10 orange blinks of the LED.
OUT_OF_RANGE	"Out Of Range"	This error indicates no control channel has been found for trunking operation.
PARMS_FAILED	"Parms Fail"	There is no parameter file in the radio. This error will also be indicated with 3 orange blinks of the LED.
RECEIVE_ONLY	"Receive Only"	This error indicates that the selected channel is Rx only. This can occur if transmit disabled is selected or a conventional channel is configured with talkgroup 0.
REGISTRATION_DENY	"Reg Deny"	This error indicates that a unit registration attempt has received a DENY response from the system. The precise reason for a DENY response is manufacturer dependent. One common cause is that the unit ID is disallowed on the site/RFSS that the radio is attempting to register on.
REGISTRATION_FAILED	"Reg Failed"	This error indicates that a unit registration attempt has received a FAILED response from the system. The precise reason for a FAILED response is manufacturer dependent.

Table 9.1 Error Messages (Continued)

Message Enumerations	Mobile Strings	Description
REGISTRATION_REFUSED	"Reg Refused"	This error indicates that a unit registration attempt has received a REFUSED response from the system. The precise reason for a REFUSED response is manufacturer dependent.
REKEY_FAIL	"Rekey Failed"	This error indicates a failure in a rekeying process.
RESPONSE_ONLY	"Response Only"	This error indicates that the Unit Call/Call Alert setting to set to Response Only.
SECURE_ONLY	"Secure Only"	The user is attempting to transmit Clear on a Strapped Secure channel.
SECONDARY_SCAN	"Secondary Scan"	If a conventional scan list is secondary to the current zone, this error will occur if the user attempts to select or edit another conventional scan list.
STATUS_FAILED	"Status Fail"	This error indicates that no acknowledgment was received while sending a status report.
TEMP_HOT	"Hot"	This error indicates that the mobile has passed the HOT temperature threshold. When the radio reaches its overheat threshold, it significantly reduces power to approximately 2 W. The radio restores power when the radio cools. The cycle continues throughout the transmission.
TX_TIMEOUT	"Tx Timeout"	This error indicates that the transmit timeout timer has expired and transmit has been terminated.
VOLTAGE_HIGH	"Voltage High"	The mobile's voltage source is too high. Transmit is not allowed in this condition.
VOLTAGE_LOW	"Voltage Low"	The mobile's voltage source is too low. Transmit is not allowed in the condition.
ZONE_FAIL	"Zone Fail"	If Site Trunking and Display Site Trunking are enabled, this will be displayed if the zone controller goes down.

9.3 Viking LED Failure Codes

Table 9.2 Failure Codes

Orange LED Blinks	Startup Failure	Description
2	Bad File Format	The parameter file has a newer file format version than what matches the software in the radio.
3	Parms Fail	There is no parameter file in the radio.
4	Bad Band	The radio band in the parameter file does not match the radio band in the tuning parameters. You will see this message if a parameter file for the wrong band is downloaded to the radio.
5	Corrupt Parms	The parameters checksum or other data is corrupted.
6	Unused	

Table 9.2 Failure Codes (Continued)

Orange LED Blinks	Startup Failure	Description
7	DSP Fail	This error indicates that the DSP failed to complete its startup procedure at powerup.
8	RX Backend Fail	There is a communication failure between the DSP and the back end ADC on the RF deck.
10	Channel Fail	The radio has been programmed with more channels than it optioned for.
11	Encryption Fail	This error indicates that the main processor and the encryption module have failed to complete their startup procedure at powerup.
12	Bad ESN	This error indicates that the ESN of the radio is not valid. This error is usually only seen in the factory when first programming brand new logic boards.
13	Bad Firmware	This error indicates that the firmware on the radio was not meant for this specific radio's ESN.
14	No SD Card	This error indicates that the required SD card is not detected.
15	Band Option Violation	This error indicates that the radio is programmed for a band that has been disabled in its options.
16	Option Failure	This error indicates that the radio's option file has options set that are not recognized by the radio firmware. The user needs to either install the correct firmware version or be issued a valid option file for their firmware version.
17	Control Head Option Failure	This error indicates that the radios option file does not support the control head configuration of the radio. The user needs to either install the correct control head or be issued a valid option file for their control head configuration.

9.4 V16M System Reject Messages

The following messages are defined in the radio. Other messages will be displayed as a number. Contact EFJ engineering for more information on a "numbered" reject message.

Table 9.3 V16M System Reject Messages

Error String	Description
"ID Invalid"	The ID of the subscriber is invalid.
"Target Invalid"	The ID of the target is invalid.
"ID Disabled"	The ID of the subscriber is disabled or not allowed to access the system.
"Target Disabled"	The target ID is disabled or not allowed to access the system.
"Invalid Group"	The talkgroup is not valid.

Table 9.3 V16M System Reject Messages (Continued)

Error String	Description
"Disabled Group"	The talkgroup is disabled or not allowed on the system.
"Feature Disabled"	The attempted feature is not allowed on the system.
"Clear Only"	Secure calls are not allowed for the target ID or are not allowed for the current group.
"Secure Only"	Clear calls are not allowed for the target ID or are not allowed for the current group.
"Over Budget"	Interconnect dollar limit exceeded by user.
"Not Allowed Site"	The subscriber's ID is not allowed or the current talkgroup is not allowed on the site.
"Override Invalid"	There is not call busy override.
"Analog ID"	The user tried to use a radio with an analog ID on a digital talkgroup.
"Trespass Denied"	A site has rejected the subscribers request to trespass.

SECTION

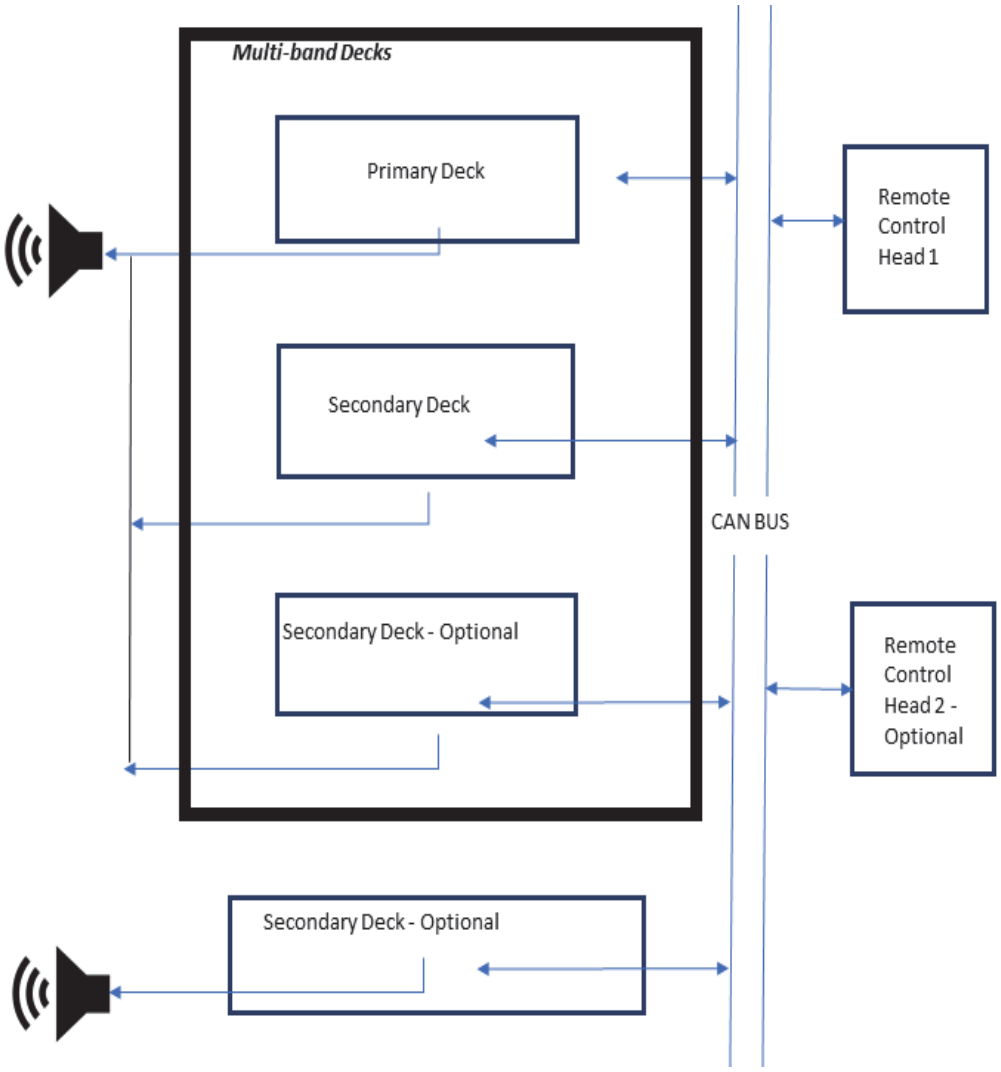
10

Configuring VM7000 Multiband Multideck

The VM7000 Multiband configuration combines multiple radio units of different bands to form a multiband radio. The combined decks operate the same way a dual band or a tri-band radio would.

As Figure 10.1 shows, the multiband configuration consists of a primary deck, and a maximum of 2 secondary decks, and 1 or 2 remote control heads. Other secondary decks outside of the multiband configuration can be added to form a multiband multideck configuration, but the total number of decks cannot exceed 4. The multiband configuration operates as a single primary deck.

Figure 10.1 Multiband Multideck Configuration



This chapter contains the following sections:

- Primary Deck
- Secondary Deck
- Multiband Multideck Option and Band Disable Options
- Band Verification
- Audio Configuration
- DB25 Connector
- Encryption
- Vehicular Repeater Support
- Ignition Sense Settings
- Multiband Feature Support

For information on the following, refer to the Armada Programming Software online help topic “Multideck Configuration”:

- Armada Support
  - Primary Radios

  - Secondary Radios
- Migrating Multideck Radios to Multiband Radios

10.1 Primary Deck

The primary deck provides all user interface and protocol functions for the multiband configuration. The primary deck is the only deck in the multiband configuration that contains a codeplug.

10.2 Secondary Deck

The secondary decks that are part of the multiband configuration do not operate independently as they do in the multideck configuration. The secondary decks are essentially RF decks with no user interface or protocol functionality. Secondary decks in the multiband configuration are not selectable. They get selected when the primary deck gets selected.

10.3 Multiband Multideck Option and Band Disable Options

The multiband multideck option must be set for all decks in the multiband configuration. The disable band options are used to disable any bands unused in the multiband configuration. Setting the disable band options is only required on the primary deck.

10.4 Band Verification

At power-up, the primary deck verifies whether all bands are present based on programmed options. All multiband secondary decks register with the primary indicating the band of the deck. If not all bands are present, the primary displays “Band Band”.

10.5 Audio Configuration

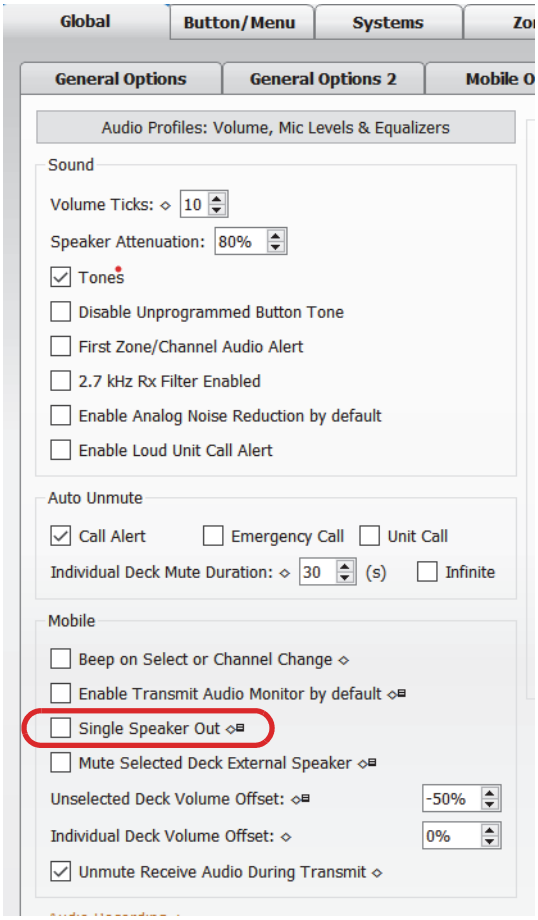
Audio output for all decks in the multiband configuration is through an external speaker connected to the primary deck or through control head speakers, regardless of the programmed audio mode.

The multiband multideck configuration continues to support both audio modes supported for the multideck configuration.

- If the normal speaker configuration is enabled, all decks in the multiband configuration output audio to an external speaker connected to the primary deck. All decks not in the multiband configuration output audio to an external speaker connected to the deck. Audio from the selected deck is output on the control head speakers.
- If the **Single Speaker Out** configuration is enabled, audio from all decks (including decks not in the multiband configuration) output on the primary deck's external speaker. The audio mode is selected on the Armada **Global > Audio > Mobile** section as shown in Figure 10.2.

Note *If all decks are in the multiband configuration, both audio modes are identical in operation.*

Figure 10.2 Armada Audio Mode Selection



10.6 DB25 Connector

The DB25 connector is disabled for all secondary decks in the multiband configuration. All external audio is input and output on the primary's DB25 connector.

10.7 Encryption

All decks are responsible for encryption/decryption of audio. Therefore, a Secure Cryptographic Module (SCM) is required to be installed on each deck. The Key Fill Device (KFD) interface is supported on the primary deck.

10.7.1 Key Sync

To work properly, all decks in the multiband configuration must have the same encryption keys. Keys can be loaded with a KFD through the control head or with OTAR. Key information gets forwarded to all deck SCMs. If the decks in the Multiband Configuration don't have identical keys, a message appears asking to reload the keys or erase them.

10.8 Vehicular Repeater Support

Multiband supports vehicular repeater. The vehicular repeater must be connected to the primary deck DB25 only. If there are other individual decks, a multiplexer box is required.

10.9 Ignition Sense Settings

Ignition sense settings programmed in the primary radio codeplug get shared with the secondary decks in the multiband configuration.

10.10 Multiband Feature Support

Multiband supports all multideck features, except the following:

- Audio recording
- Instant Recording Replay
- Crossband Repeat
- Auto-tune test equipment
- Radio console interfaces
- Bluetooth accessories
- Firmware update over OTIP

SECTION

11

Obtaining Technical Support

This chapter describes how to obtain authorized support and service for the VM5000/VM6000/VM7000 radio, in accordance with your existing support agreement. This chapter contains the following sections:

11.1 Contacting EFJohnson

If EFJohnson technical personnel are not on site, and are needed for assistance, contact the EFJohnson representative for your site. Check with your site engineer or site manager for contact information.

11.1.1 Gather Information before Calling EFJohnson

When contacting EFJohnson for technical support, collect and have available all pertinent information such as specific site identification, equipment models, and any other relevant information that may be needed by technical support.

11.1.2 Contact Information

The EFJohnson Customer Service Department provides customer assistance on technical problems and the availability of local and factory repair facilities. Regular customer service hours are 8:00 am to 5:00 pm US Central Time, Monday through Friday.

Note *A technical support subscription service is available or support can be purchased on an as-needed basis. Contact warranty@efji.com for more information.*

The Customer Service Department can be reached as described in Table 11.1.

Table 11.1 Customer Service Contact Information

To get assistance with this...	...Call (800) 328-3911 and select this option...	...Or send an e-mail message to this address
Orders and parts	1	orders@efji.com
Technical support	3	techsupport@efji.com
Repair depot support	4	depot@efji.com
Warranty support	5	warranty@efji.com
Sales	6	sales@efji.com

You may also contact the Customer Service Department by mail. Please include all information that may be helpful in solving your problem.

Customer Service Department
EFJohnson Technologies
1440 Corporate Drive
Irving, TX 75038-2401

11.2 Product Warranty

The warranty statement for EFJohnson equipment is available from your product supplier or from:

Warranty Department
EFJohnson Technologies
1440 Corporate Drive
Irving, TX 75038-2401
(800) 328-3911 Extension 5
warranty@efji.com

This information may also be requested from the Warranty Department by phone (Refer to Table 11.1). The Warranty Department may be contacted for warranty service reports, claim forms, or any other questions concerning warranties or warranty service.

11.3 Returns for Repairs

Before returning equipment for repair, contact the EFJohnson Technologies Customer Service Department at the appropriate number shown in the preceding table. They may be able to suggest a solution to the problem, making return of the equipment unnecessary.

Repair service is normally available through local authorized EFJohnson service centers. If local service is not available, the equipment can be returned to the EFJohnson Repair Depot. However, before returning equipment, contact the Customer Service Department Repair Depot for the correct "Ship To" address.

11.4 Replacement Parts

Replacement parts can be ordered directly from the Orders & Parts Department. To order parts by phone, dial the toll-free number and select the Orders and Parts extension specified in the preceding table. When ordering, please supply the part number and quantity of each part ordered. EFJohnson Technologies dealers also need to give their account number. If there is uncertainty about the part number, include the designator (C512, for example) and the model number of the equipment the part is from.

11.5 Internet Home Page

EFJohnson Technologies has an Internet site that you can access for current company information on products, systems, and regulations. The address is

www.efjohnson.com