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Appendix L: Manual

Please refer to the following pages for the Operator's Manual and the Installation Manual.



M/A-COM
M7300 Series
Digital Mobile Radio

MANUAL REVISION HISTORY

REV	DATE	REASON FOR CHANGE
-	May/08	Initial Release.

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1 SAFETY SYMBOL CONVENTION

The following conventions are used throughout this manual to alert the user to general safety precautions that must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. M/A-COM, Inc. assumes no liability for the customer's failure to comply with these standards.



The **WARNING** symbol calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a **WARNING** symbol until the conditions identified are fully understood or met.



The **CAUTION** symbol calls attention to an operating procedure, practice, or the like, which, if not performed correctly or adhered to, could result in a risk of danger, damage to the equipment, or severely degrade the equipment performance.



The **NOTE** symbol calls attention to supplemental information, which may improve system performance or clarify a process or procedure.



The **ESD** symbol calls attention to procedures, practices, or the like, which could expose equipment to the effects of **E**lectro-**S**tatic **D**ischarge. Proper precautions must be taken to prevent ESD when handling circuit modules.

2 RF ENERGY EXPOSURE INFORMATION

2.1 RF ENERGY EXPOSURE AWARENESS, CONTROL INFORMATION, AND OPERATION 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.



CAUTION

Changes or modifications not expressly approved by M/A-COM, Inc. could void the user's authority to operate the equipment.

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 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 websites 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>

2.1.1 Federal Communications Commission Regulations

Your M/A COM, Inc. M7300 mobile two-way radio is designed and tested to comply with the FCC RF energy exposure limits for mobile two-way radios before it can be marketed in the United States. 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 label directing users to specific user awareness information. Your M/A COM, Inc. M7300 two-way radio has an RF exposure product label. Also, your M7300 Installation and Operator's Manuals include information and operating instructions required to control your RF exposure and to satisfy compliance requirements.

2.2 COMPLIANCE WITH RF EXPOSURE STANDARDS

Your MA/COM, Inc. M7300 mobile two-way radio is designed and tested to comply with a number of national and international standards and guidelines (listed below) regarding human exposure to RF electromagnetic energy. This radio complies with the IEEE and ICNIRP exposure limits for occupational/controlled RF exposure environment at duty factors of up to 50% talk-50% listen and is authorized by the FCC for occupational use. In terms of measuring RF energy for compliance with the FCC exposure guidelines, your radio antenna radiates measurable RF energy only while it is transmitting (talking), not when it is receiving (listening) or in standby mode.

Your M/A COM, Inc. M7300 mobile two-way radio complies with the following RF energy exposure standards and guidelines:

- United States Federal Communications Commission (FCC), Code of Federal Regulations; 47 CFR §§ 2 sub-part J.
- American National Standards Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE) C95.1-2005.
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-2005.
- IC standard RSS-102, Issue 2, 2005: “Spectrum Management and Telecommunications Radio Standards Specification. Radiofrequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands).



CAUTION

Table 2-1 lists the recommended minimum lateral distance for a controlled environment and for unaware bystanders in an uncontrolled environment, from transmitting types of antennas (i.e., monopoles over a ground plane, or dipoles) at rated radio power for mobile radios installed in a vehicle. Transmit only when unaware bystanders are at least the uncontrolled recommended minimum lateral distance away from the transmitting antenna.

2.2.1 Mobile Antennas

Table 2-1: Rated Power and Recommended Minimum Safe Lateral Distance

MOBILE RADIO FREQUENCY SPLIT	ANTENNA PART NUMBER	DESCRIPTION	R _{SAFE} CONTROLLED ENVIRONMENT (CM)	R _{SAFE} UNCONTROLLED ENVIRONMENT (CM)
700/800 MHz	AN-025167-002	Dual Band 700/800, Elevated Feed, Roof Mount	28	69
700/800 MHz	AN-025167-005	Combined GPS/700/800, Elevated Feed, Roof Mount	28	69
700/800 MHz	AN-025167-015	Combined GPS/764-870, Roof Mount	39	87
700/800 MHz	AN-025167-010	Dual Band 700/800, Low Profile, Roof Mount	28	69
700/800 MHz	AN-025167-006	Dual Band 700/800, Magnetic Mount	29	72
700/800 MHz	AN-025167-011	Combined GPS/700/800, Low Profile, Roof Mount	28	69
700/800 MHz	AN-025167-001	Dual Band 700/800, Roof Mount	28	69
700/800 MHz	AN-025167-004	Combined GPS/764-870, Roof Mount	28	69

MOBILE RADIO FREQUENCY SPLIT	ANTENNA PART NUMBER	DESCRIPTION	R_{SAFE} CONTROLLED ENVIRONMENT (CM)	R_{SAFE} UNCONTROLLED ENVIRONMENT (CM)
700/800 MHz	AN-025167-014	Dual Band 764-870, Roof Mount	39	87

Install the radio's antenna (refer to Table 2-1 for applicable antenna part numbers) in the center of the vehicle's roof. These mobile antenna installation guidelines are limited to metal body motor vehicles or vehicles with appropriate ground planes. The antenna installation should additionally be in accordance with the following:

- The requirements of the antenna manufacturer/supplier included with the antenna.
- Instructions in the M7300 Radio Installation Manual, including minimum antenna cable lengths.
- The installation manual providing specific information of how to install the antennas to facilitate recommended operating distances to all potentially exposed persons.

Use only the M/A-COM approved/supplied antenna(s) or approved replacement antenna. Unauthorized antennas, modifications, or attachments could damage the radio and may violate FCC regulations.

2.2.2 Approved Accessories

This radio has been tested and meets the FCC RF guidelines when used with the M/A-COM accessories supplied or designated for use with this product. Use of other accessories may not ensure compliance with the FCC's RF exposure guidelines, and may violate FCC regulations.

For a list of M/A-COM approved accessories refer to the product manuals, M/A-COM's Products and Services Catalog, or contact M/A-COM at 1-800-368-3277.

2.2.3 Contact Information

For additional information on exposure requirements or other information, contact M/A-COM, Inc. at 1-800-528-7711 or at <http://www.macom-wireless.com>.

3 OPERATION SAFETY RECOMMENDATIONS

3.1 TRANSMITTER HAZARDS



The operator of any mobile radio should be aware of certain hazards common to the operation of vehicular radio transmitters. A list of several possible hazards is given:

- **Explosive Atmospheres** – Just as it is dangerous to fuel a vehicle with the motor running, similar hazards exist when operating a mobile radio. Be sure to turn the radio off while fueling a vehicle. Do not carry containers of fuel in the trunk of a vehicle if the radio is mounted in the trunk.

Areas with potentially explosive atmosphere are often, but not always, clearly marked. Turn OFF your radio when in any area with a potentially explosive atmosphere. It is rare, but not impossible that the radio or its accessories could generate sparks.
- **Interference to Vehicular Electronics Systems** – Electronic fuel injection systems, electronic anti-skid braking systems, electronic cruise control systems, etc., are typical electronic systems that can malfunction due to the lack of protection from radio frequency energy present when transmitting. If the vehicle contains such equipment, consult the dealer and enlist their aid in determining the expected performance of electronic circuits when the radio is transmitting.
- **Electric Blasting Caps** – To prevent accidental detonation of electric blasting caps, **DO NOT** use two-way radios within 1000 feet of blasting operations. Always obey the “**Turn off Two-Way Radios**” signs posted where electric blasting caps are being used. (OSHA Standard: 1926-900)
- **Liquefied Petroleum (LP) Gas Powered Vehicles** – Mobile radio installations in vehicles powered by liquefied petroleum gas with the LP gas container in the trunk or other sealed-off space within the interior of the vehicle must conform to the **National Fire Protection Association standard NFPA 58** requiring:
 - The LP gas container and its fittings.
 - Outside filling connections shall be used for the LP gas container.
 - The LP gas container shall be vented to the outside of the vehicle.

3.2 SAFE DRIVING RECOMMENDATIONS

(Recommended by AAA)

- Read the literature on the safe operation of the radio.
- Keep both hands on the steering wheel and the microphone in its hanger whenever the vehicle is in motion.
- Place calls only when the vehicle is stopped.
- When talking from a moving vehicle is unavoidable, drive in the slower lane. Keep conversations brief.
- If a conversation requires taking notes or complex thought, stop the vehicle in a safe place and continue the call.
- Whenever using a mobile radio, exercise caution.

4 OPERATING RULES AND REGULATIONS

Two-way FM radio systems must be operated in accordance with the rules and regulations of the local, regional, or national government.

In the United States, the M7300 mobile radio must be operated in accordance with the rules and regulations of the Federal Communications Commission (FCC). As an operator of two-way radio equipment, you must be thoroughly familiar with the rules that apply to your particular type of radio operation. Following these rules helps eliminate confusion, assures the most efficient use of the existing radio channels, and results in a smoothly functioning radio network.

When using your two-way radio, remember these rules:

- It is a violation of FCC rules to interrupt any distress or emergency message. As your radio operates in much the same way as a telephone “**party line**,” always listen to make sure that the channel is clear before transmitting. Emergency calls have priority over all other messages. If someone is sending an emergency message – such as reporting a fire or asking for help in an accident – **KEEP OFF THE AIR!**
- The use of profane or obscene language is prohibited by Federal law.
- It is against the law to send false call letters or false distress or emergency messages. The FCC requires that you keep conversations brief and confine them to business. To save time, use coded messages whenever possible.
- Using your radio to send personal messages (except in an emergency) is a violation of FCC rules. You may send only those messages that are essential for the operation of your business.
- It is against Federal law to repeat or otherwise make known anything you overhear on your radio. Conversations between others sharing your channel must be regarded as confidential.
- The FCC requires that you identify yourself at certain specific times by means of your call letters. Refer to the rules that apply to your particular type of operation for the proper procedure.
- No changes or adjustments shall be made to the equipment except by an authorized or certified electronics technician.



Under U.S. law, operation of an unlicensed radio transmitter within the jurisdiction of the United States may be punishable by a fine of up to \$10,000, imprisonment for up to two (2) years, or both.

4.1 OPERATING TIPS

The following conditions tend to reduce the effective range of two-way radios and should be avoided whenever possible:

- Operating the radio in areas of low terrain, or while under power lines or bridges.
- Obstructions such as mountains and buildings.
- In areas where transmission or reception is poor, some improvement can be obtained by moving a few yards in another direction or moving to a higher elevation.

5 PRODUCT DESCRIPTION

The M7300 mobile is a state-of-the-art radio that operates seamlessly between the 800 MHz frequency band and the 700 MHz frequency band. The M7300 is designed to meet the critical communications demands of public service users and complies with MIL-STD-810F specifications.

The M7300 is capable of supporting multiple operating modes, including OpenSky digital operation, EDACS or ProVoice trunked modes, P25 digital trunked mode, P25 digital conventional mode, and conventional analog mode.

The M7300 uses Time Division Multiple Access (TDMA) technology in the OpenSky mode to allow multiple users to share a single RF channel. In addition, a single RF channel can support simultaneous digital voice and data communications.

The M7300 provides integrated voice and data services. Voice operation is provided using a microphone and speaker included in the radio installation kit. For data transfers, the M7300 is constructed with an industry-standard RS-232 interface serial port for connecting an optional laptop PC.

A PC, not included with the M7300, provides network connectivity through the standard serial (DCE-type) interface.

The M7300 has an integrated Global Positioning System (GPS) receiver. This allows the M7300 to fully support the Automatic Vehicular Locator (AVL) for fleet management and dispatch applications.

The OpenSky M7300 benefits from a flexible, software-based digital radio design. Features and user profiles are software-defined and can be reprogrammed over the air. The optional over-the-air programming feature allows communication protocols to be changed easily and added at any time.

5.1 REMOTE CONTROL HEAD OPERATION

For remote mount installations configured with a CH721 control head, all normal radio operations and interfaces can be handled via the control head connected to the radio unit by a single twisted-pair connection routed through a vehicle. Up to six control units may be attached to a trunk mount radio. Each control head provides a serial access point for data and any one (only one at a time) can be connected to a data device such as a personal computer.




Where multiple control heads are connected or where a dash-mount radio is installed with additional remote control heads, the following features are available from each position:

- Outgoing voice calls can be initiated. Any control head can initiate a call but only one can talk at a time. All other connected control heads will hear both sides of the conversation.
- Incoming and outgoing audio can be heard. Outgoing audio is not broadcast at the source position.
- Independent audio control is available.
- Radio settings such as talk group, scan mode etc., can be controlled. Any connected control head can override the radio settings of other connected control heads.
- Comfort settings, such as volume and display brightness that are applicable to the individual control head can be adjusted and cannot be overridden by other control heads.
- An optional intercom function is available between control units. Audio will be broadcast to ALL connected control heads.


6 CHANGE OPERATING MODE

6.1 CHANGE FROM OTP MODE

To change from OTP operating mode to P25, EDACS, or Conventional:

1. Use  to cycle through the menu until the “Mode Menu” appears in the bottom line of the display.
2. Use  to choose an available mode. Press **MENU** and confirm (Y/N) with  and press **MENU** again.
3. Press the **MENU** button to confirm.

6.2 CHANGE TO OTP MODE

1. Use  to scroll through available systems until OpenSky is displayed.
2. The radio transitions to OTP mode.

7 OPENSKY OPERATION

7.1 CH721 FRONT PANEL COMPONENTS

The front panel of the control head includes a dot matrix display, controls for menu navigation, an emergency button, three pre-set buttons, a Power On-Off/Volume Control knob, and a microphone connector. In addition, the system model control head features a DTMF keypad. Table 7-1 lists all default front panel controls and their functions.

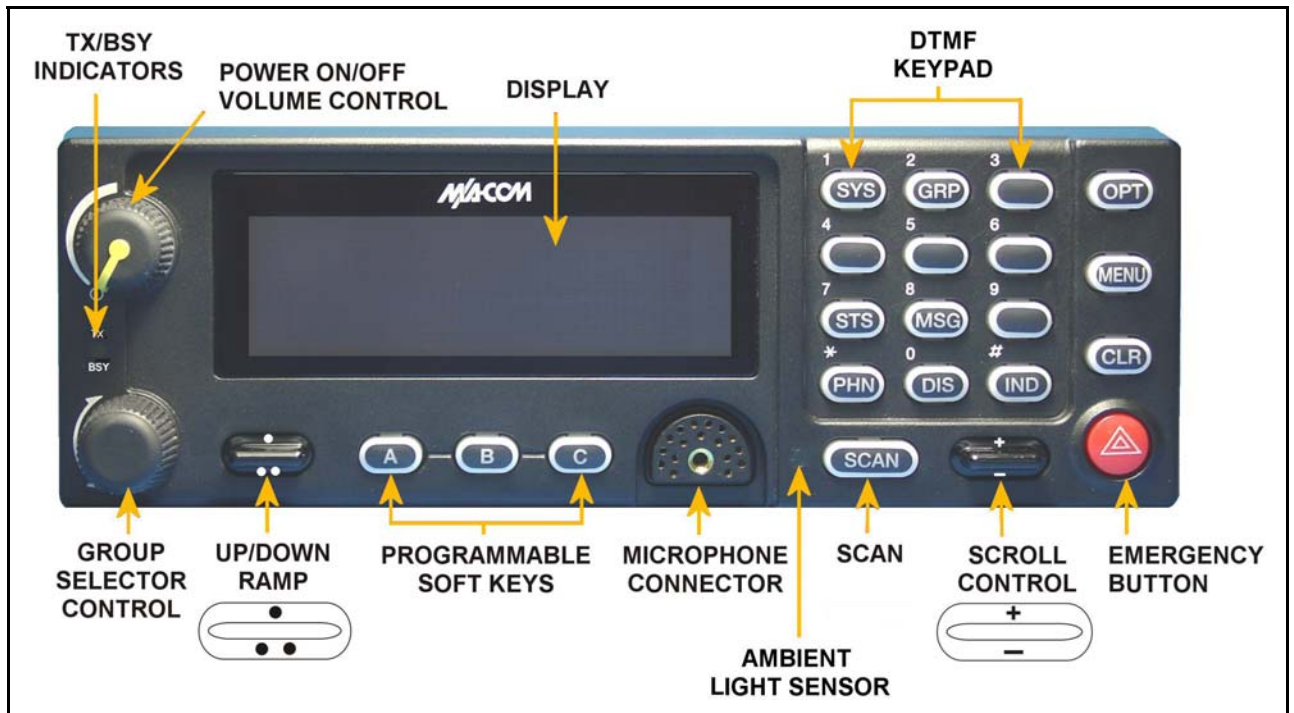


Figure 7-1: System Model







Figure 7-2: Scan Model

The buttons on the front panel are backlit for operation in a low ambient light level such as nighttime operation. Some buttons also flash to provide feedback of various operating conditions.

In addition, the front panel contains a light-level sensor that samples ambient light levels for automatic display and button backlight brightness adjustments. In other words, it automatically brightens the display and backlights when higher external light levels exist and it automatically dims the display and backlights during lower external light levels.

Table 7-1: Front Panel Default Controls and Functions

PART	FUNCTION
Power On-Off/Volume Control knob	Turn knob clockwise to power on the radio and increase volume. Turn counter-clockwise to decrease volume and power off the radio.
Mic Connection	Connection for hand-held, hands-free, speaker-mic, or headset.
	If enabled through programming, the emergency button sends an emergency alert and opens voice communication on the currently selected talk group or the default emergency talk group (depending upon how the system is defined).
Ambient Light Sensor	Radio automatically adjusts the display and button backlight brightness level based on ambient light. Do not block this sensor.
 or 	While in the dwell display, scrolls through available talk groups. Scrolls through selections within the active menu (available talk groups, pre-programmed speed dial numbers, canned alert messages, etc.).
	Scrolls through available menu items.
OPT/OPTION	
CLR/CLEAR	
MENU	Press to activate the current selection. In some cases, this is not necessary as the last selection will automatically activate after a short period.
Display Area	Menu selections and messages. Network Connectivity icon. Current Volume Level icon. Volume represented numerically within the display (0 = Muted, 40 = Loudest). User may select which one of several dwell displays the radio uses.
Pre-Set Buttons A, B, & C	These buttons are used to store and recall user-selectable parameters such as scan mode, selected profile, selected talk group, and priority talk group. Different parameters can be stored at each of the three different pre-set buttons. Preset button C can be configured via programming to reboot the radio into a particular application mode. Contact your system administrator to determine if this feature is enabled in your radio.
SCAN	Not functional in OpenSky systems.

7.2 POWER UP AND VOLUME CONTROL

7.2.1 Power Up

1. Rotate the Power On-Off/Volume Control knob clockwise to power on the radio. The display will illuminate when the radio powers up.

2. Wait for the power-up sequence to complete, which takes approximately ten (10) seconds.

During this time, if enabled for auto registration, the radio is provisioned with a customized user personality designed for the user's specific needs by the OpenSky network administrator.

If this personality contains encrypted talk groups or if the user is authorized for, and intends to use, manual encryption, User Login must be performed. This requires a system model control head so that the User ID and password can be entered.

3. When provisioning is complete, the radio will display the Dwell Display.

If User Login is required, the bottom line of the Dwell Display will flash the message “Pls Login.”

7.2.2 Volume Control

Turn the Power On-Off/Volume Control knob clockwise to increase the volume and counter-clockwise to decrease the volume.

7.3 SELF-TEST

After power-up, the M7300 radio undergoes a multi-function automatic registration procedure. As many as sixteen (16) possible radio profiles are downloaded to the radio from the network in response to the User's ID.

7.4 LOGIN TO THE NETWORK

Login occurs either automatically (auto registration) if the radio has a valid registration or, if enabled and authorized for encryption (Section 7.30), requires the user to enter a User ID and password.

If encryption is enabled and authorized on the radio, the user will be prompted to “Pls Login” with the *1 login command, a User ID, and password [System Model Control Head required].

1. Press *1 (Login command).
2. Enter the full 10-digit User ID.
3. Press the # key.
4. Enter the password.
 - If the radio is configured for alpha-numeric passwords and the password has consecutive duplicate numbers (“MES33” for example), enter # between the consecutive duplicate numbers so the radio will **not** interpret the entry as a letter (“D” in this example).
 - If the radio is configured for numeric-only passwords, do not enter # between duplicated numbers.
5. Press the # key twice.

The User ID may be remembered from the previous log-in. (Refer to Section 7.5 for further details regarding log-off commands.) The password will be established before the radio is put into operation. Contact the local OpenSky network administrator for more information.



If necessary, contact radio system administration personnel for log-in assistance and/or radio-specific log-in instructions.

7.5 LOG OFF THE NETWORK

The *0## command de-registers the radio. Typically, this is automatically performed when powering down the radio. Using this method, the User ID is remembered by the radio so only the password is needed at next log-in. Manually log-off by pressing *0## (requires System Model).

If a user is logged in using encryption features, it is necessary to log-off when encryption is no longer required.

7.6 TURNING THE RADIO OFF

To turn the radio off, rotate the **Power On-Off/Volume Control knob** counter-clockwise. In multiple control head installations, turning off the last powered-up control head will also automatically turn off the radio.


Several user-selected radio settings (i.e., scan mode, pre-set buttons, and side tone levels) are maintained for the next operational session. At the next radio power-up, maintained settings will automatically restore, along with the network personality settings. In multiple control head installations, settings are maintained for each control head position.



NOTE

If power is abruptly disconnected from the radio prior to executing the correct turn-off procedure, user-selected radio settings and last-tuned channel information will be lost. This can extend the time required for the radio to register with the network upon the subsequent power-up.

7.7 MENU DISPLAY AND CONTROL AREA

Following power-up, the radio display shows the default talk group (Figure 7-3). Pressing up or down with  changes the display to the next available menu. In many cases, the dwell display automatically re-appears after no menu buttons are pressed for a short period of time (between 10 and 30 seconds). For some menus such as the GPS and User ID menus, this does not occur until the user presses a front panel button.

When the dwell display is active, it will change dynamically to reflect the current profile, received talk group/caller ID (when available), or channel (when enabled).



The radio's display is highly interactive. It responds in the top and bottom text lines as the user presses the menu buttons (,  and **MENU**) to scroll through the menu loop and the entries for each menu. Table 7-4 outlines the basic menu structure.

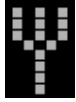



Figure 7-3: Typical Display


7.8 RADIO STATUS ICONS

Status Icons indicate the various operating characteristics of the radio. The icons show operating modes and conditions (see Table 7-2). The location of icons on the display may vary depending on configuration.

Table 7-2: Icons and Descriptions

ICON	DESCRIPTION
	Indicates data registration.
	Volume bars – indicates relative volume level.

7.9 DWELL DISPLAY

When not engaged in menu selection, the first two lines of the display default to the user-defined display, known as the “dwell display.” The top line indicates the currently selected talk group. The second line will display the currently selected profile, caller ID/alias¹, received talk group, and current channel name. Press the  ramp control to scroll through and view one of these second line options.

7.10 PERSONALITY

As illustrated in Figure 7-4, a personality defines the profiles and talk groups available to the user. It is the structuring of a collection of profiles and privileges established by the OpenSky network administrator to provide the user with a comprehensive set of profiles to communicate effectively with the necessary talk groups or individuals.

Personalities are stored on the network and downloaded over-the-air to the radio. This process is called “provisioning.” Provisioning occurs at radio power-up and at user log-in. Each personality can contain up to sixteen (16) profiles and each profile can contain up to sixteen talk groups.

7.10.1 Profiles

As stated above, each profile can contain up to sixteen (16) talk groups. A profile also defines the radio’s emergency behavior. All transmissions are made on the selected talk group (displayed on the top line of the dwell display). The user can change the selected talk group to any of the other talk groups within the profile.

¹ Alias is a logical ID name such as “J_Smith.” The name corresponds to a user ID such as 003-542-0001.

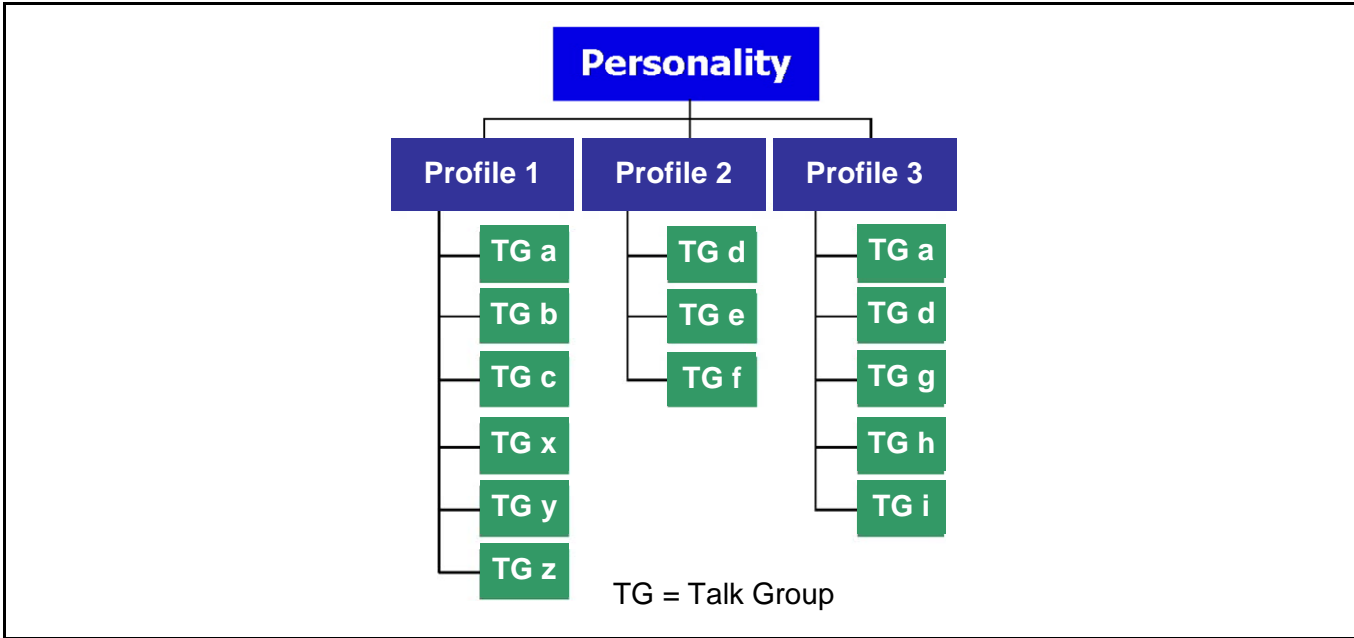


Figure 7-4: Personality Structure Example



NOTE

If Global Profile is enabled by the system administrator, the number of available talk groups to scan doubles.

7.10.2 Talk Groups

A talk group represents a set of users that regularly need to communicate with one another. There can be any number of authorized users assigned to a talk group. Talk groups are established and organized by the OpenSky network administrator. An OpenSky talk group is similar to a channel within a conventional FM radio system.

7.11 ALERT TONES

The M7300 radio also provides audible Alert Tones or “beeps” to indicate the various operating conditions (see Table 7-3).

Table 7-3: M7300 OpenSky Mode Alert Tones

NAME	STONE	DESCRIPTION
Call Queued	one low tone/two high tones	Call queued for processing.
Call Denied	three short beeps	Radio is out of coverage area or requested talk group is active.
Grant (or Go-Ahead)	single short beep	Sounded when resources become available for a call request placed in the queue (if enabled) upon channel access. If the radio roams to another site while transmitting, then it will auto rekey and begin transmitting on that tower. It gives a second grant tone to let the user know they have roamed.
Call Removed	single long low-pitched tone	Notifies the user access to the channel has been lost (out of coverage area or pre-empted by higher-priority call)
Selective Alert Received	four short tones	Only played once to indicate a selective alert has been received.
Emergency Alert Tone	three long tones	Sounds when an emergency alert is declared
Emergency Cleared Tone	one long low-pitched tone	Sounds when an emergency is cleared
Selective Call Ring Tone	a ringing tone similar to a telephone	Ringing is repeated every four seconds until the call is accepted or rejected by the radio being called or until the network drops the call if unanswered after one minute
PSTN Ring Tones	a single medium-pitch repeating tone	Two ring tone - one generated by the radio when there is an incoming telephone call or an outgoing telephone call attempt is waiting for the telephone interconnect gateway equipment to dial the Public Switched Telephone Network (PSTN). The second ring tone sounds when the gateway equipment has dialed the number.
Roam Tone	Two short tones, one high-pitched and one low-pitched	Sounds when the radio transitions from one radio base station site to another.
Out of Range Tone	three brief tones	If enabled via programming, sounds at a programmable interval while the radio is in a state of persistent deactivation.

7.12 BASIC MENU STRUCTURE

Table 7-4 illustrates the basic M7300 OpenSky menu structure. Menu items will vary depending upon system programming, radio hardware, and optional configurations. All menus except the dwell display menu can be turned off by network administration personnel.

Table 7-4: Basic Menu Structure

Menu Name	Radio Displays (top and bottom lines)	Usage Notes
	To/From Dwell Display 	
Engineering Display (Menu may not be available per programming.)	registration, RF sync and transceiver status codes bit-error rates and RSSI data 	Displays radio system connection data. For engineering use.
Silent Emergency	OFF/ON "SilentEmerg" 	Use to toggle Silent Emergency OFF/ON.
Operating Mode (e.g., OTP, EDACS, etc.)	available modes "Mode Menu" 	Use to choose an available mode. Press MENU and confirm (Y/N) with and press MENU again.
GPS Fix	current latitude and longitude "GPS Fix" 	Radio's current GPS latitude and longitude position scrolls across top line of the display. Applies to GPS-equipped radios only.
User ID	User ID # of user currently logged in "User ID" 	User's identification/name scrolls across top line of the display (if programmed).
IP Address	Radio's IP address "IP Address" 	Radio's Internet Protocol (IP) address scrolls across top line of the display.
Station Identification	station's call sign "Station ID" 	Station's identification/name scrolls across top line of the display (if programmed).
Stealth Mode	"OFF" "StealthMenu" 	Use to enable. Press any button to disable.
Treble Level	"LOW", "MEDIUM", "MEDHIGH", "HIGH" "Treble Menu" 	Use to choose speaker/headset treble level. Press Select to return to dwell display.
Display Brightness	"<< >>" "Bright Menu" 	Use to dim or brighten. Press MENU to return to dwell display.
Side Tone Level	"OFF", "LOW", "MED", "HIGH" "Side Menu" 	Use to choose side tone level. Press MENU to return to dwell display.
Intercom	"ON" or "OFF" "INTERCOM" 	Use to turn intercom on and off. Press MENU to return to dwell display.
Selected Channel (Menu may not be available per radio programming)	selected channel "ChannelMenu" 	Displays the current channel. Press MENU to return to dwell display.

See Next Page

Menu Name	Radio Displays (top and bottom lines)	Usage Notes
	See Previous Page 	
Scan Mode	 current scan mode "ScnModeMenu"	Use to turn scan on and off. Press MENU to return to dwell display.
Talk group Lock Out	 talk group "<" "LockOutMenu"	Use to choose a talk group for locking/unlocking. Press MENU to toggle "<" on (locked out) and off.
Priority 1 Talk group	 current priority talk group "Priority2"	Use to choose new priority talk group. Press MENU to return to dwell display.
Priority 2 Talk group	 current priority talk group "Priority1"	Use to choose new priority talk group. Press MENU to return to dwell display.
Emergency Dismiss	 alert received "EmgDismiss"	Use to choose emergency talk group. Press MENU to dismiss.
Alerts Received	 time/sender's name/ alias/message text "AlertsRcvd" or oldest message	"No alerts" or alert message text scrolls in display. Use to view messages.
Alert Destination	 current speed dial # "AlertDest"	Use to choose a speed-dial number. Press MENU to go to "AlertMsg" menu. Scroll through canned messages with . Press MENU to send message and return to dwell display.
Speed Dial	 current speed dial # "SpeedDial"	Use to choose a speed-dial number. Press MENU , then use to select canned message.
Profile Selection	 currently active profile "ProfileMenu"	Use to choose an available profile. Press MENU to return to dwell display.
Talk group Selection	 selected talk group "TalkGrpMenu"	Use to choose a talk group in current profile. Press MENU to return to dwell display.
Dwell Display	 Selected talk group (bottom line option)	Use to scroll top line through talk groups. Press MENU to change bottom line option.
Use , CLR , or OPT to scroll through menus.		



NOTE

Menus will vary depending upon system programming, radio hardware, and optional configurations.

7.13 DUAL-TONE MULTI-FREQUENCY

Dual-Tone Multi-Frequency (DTMF) is the system used by touch-tone telephones. DTMF assigns a specific tone frequency to each key so a microprocessor can easily identify its activation. The radio supports DTMF with a system model control head (Figure 7-1). This allows for specific tasks such as entering a user ID and password, or selective calling.

When a key on the DTMF keypad is pressed, the DTMF tone is played through the radio's speaker.

7.14 KEYPAD COMMANDS (SYSTEM MODEL CONTROL HEAD)

To perform a command from the keypad, press the * key followed by one of the pre-set function keys as follows:

Table 7-5: Keypad Function Commands

*0	Log-off command: *0## (logs the user off the system). See page 20 for additional information.
*1	Log-in command: *1<User ID> # <Password> ## (required for encryption). See page 19 for additional information.
*4	Enter Scene of Incident Mode (SOI) on specified channel and band: *4#<channel>#<Band>#
*4#	Exit SOI Mode.
*6	Go to default profile: Selects default profile if the radio is not voice registered.
*7	Initiate Selective Alert command: *7<Target ID>#[Choose Message]#. See page 35 for additional information.
*8	Radio-to-Radio Call command: Selective call number # (PTT to dial).
*9	Public Switched Telephone Network (PSTN) Call command: See page 36 for additional information.
*32	Begin Manual Encryption command: *32<Pre-Determined Encryption Key ># 1 – 16 digit encryption key for 128 bit encryption; 17 – 32 digit encryption key for 256 bit encryption. See page 40 for additional information.
*33	End Manual Encryption command.

7.14.1 Password Entry

Password entry requires a system model control head. Password characters are encrypted on the display using symbols to indicate the entry. The encryption symbols for each entry will appear in the display as they are scrolled through, for example: '-' and '+'. Press the # key twice to complete the entry process.






If the password is wrong, the radio will not successfully register with the network for wide area voice reception. The radio can still be used in single-site mode.

7.14.2 DTMF Overdial

Using the keypad on a System Model, the radio can transmit DTMF tones corresponding to numbers/characters 0 — 9, * and # on the keypad. To overdial numbers/characters, transmit by pressing and holding the PTT button and then, press the corresponding keys (one at a time) on the keypad.

7.15 CHANGING THE ACTIVE PROFILE



The radio can store up to sixteen (16) standard profiles, one of which is the currently active profile. To change the currently active profile:

1. Scroll through the menu with  until “ProfileMenu” is displayed.
2. Use  to scroll through the list of available profiles.
3. Profile becomes active when selected for longer than 2 seconds, when the **MENU** is pressed, or when the menu is changed using .


7.16 CHECKING OR CHANGING THE SELECTED TALK GROUP

Each profile stored in the radio can have up to sixteen (16) talk groups. One talk group within the currently active profile is set as the “selected talk group.” For the radio user, the selected talk group is typically the focus of most voice transmissions and receptions. There are two ways to change the selected talk group:

First Method:



1. Use  to scroll through the menu until “TalkGrpMenu” appears on the bottom line of the display. The currently selected talk group appears in the top line of the display.
2. Use  to scroll through the available list of talk groups in the active profile. This list is determined by the OpenSky network administrator.

Second Method:

From the dwell display, use the talk group selection knob or  to scroll through the available list of talk groups in the active profile.

7.17 ADJUSTING DISPLAY AND BUTTON BACKLIGHT BRIGHTNESS

The radio uses a light sensor on the front panel to automatically adjust display brightness and button backlight brightness to ambient light conditions. The display and backlights automatically brighten at higher external light levels and automatically dim at lower external light levels. However, the “Bright Menu” gives the user some manual brightness control as follows:



1. Using , scroll through the menu until “Bright Menu” appears.
2. Use  to increase or decrease brightness. Display and button backlight brightness will immediately dim or brighten.

7.18 STEALTH MODE

For some users, it is important to be able to turn off the radio’s display lights, button backlighting, volume and side tones, but not the radio traffic. For example, in covert operations, lights and sounds could inadvertently expose an otherwise unobservable radio user. For this purpose, the radio has a Stealth feature that disables the radio display light, indicator light and audible side tones.

When stealth mode is on, the radio continues to scan the programmed list of talk groups and the user can key-up on the selected talk group.

7.18.1 Enabling Stealth Mode

1. Using , scroll through the menu until “StealthMenu” appears.
2. To immediately turn stealth mode on, press (+) or (-) with .
3. To turn stealth mode off, press any button on the radio’s front panel.

7.18.2 Disabling Stealth Mode

Pressing any radio button other than the mic’s PTT button or the emergency button on front panel will immediately turn stealth mode off. For example, pressing the **MENU** button on the front panel will turn stealth mode off.



With stealth mode on, pressing any radio button (other than the mic’s PTT button or the emergency button) on front panel will immediately turn stealth mode off.

7.19 ADJUSTING SIDE TONE AUDIO LEVEL



The radio sounds confirming tones called “side tones” when its buttons are pressed. Most users find this audible confirmation helpful when navigating the menus. Side tone audio level can be adjusted or turned completely off using the “Side Menu.”

For covert operations, it may be necessary to turn off side tones. For safety’s sake, turning off the radio during covert operations is not recommended.




To temporarily disable the side tones that could expose the user’s presence and position, use the menu buttons to access the “Side Menu” and select “Off” from the menu choices.

If the radio is operating properly but side tones are not heard when the menu buttons are pressed, the side tones are probably turned off. To turn them back on, access the “Side Tone” menu and select a setting other than “off.”

Use the following procedure set side tone level:

1. Use  to cycle through the menu until the “Side Menu” appears in the bottom line of the display.
2. Use  to change to the desired level (Off, Low, Medium, and High). To turn side tones completely off, use the “Off” setting.

7.20 CHANGE OPERATING MODE

4. Use  to cycle through the menu until the “Mode Menu” appears in the bottom line of the display.
5. Use  to choose an available mode. Press **MENU** and confirm (Y/N) with  and press **MENU** again.

7.21 RECEIVING AND TRANSMITTING VOICE CALLS

As soon as the radio completes the startup/log-on/provision/self-test sequence and registers on the OpenSky network, voice calls from talk groups in the active profile will be audible.

7.21.1 Receiving a Voice Call

No action is required to receive a voice call. The display responds to incoming voice calls as follows:

- When the dwell display is set to received talk group and the scan mode is Normal or Fixed:
 - a. If the received talk group matches the selected talk group, then the alias (if available) or user id of the incoming caller is displayed.
 - b. If the received talk group does not match the selected talk group, then the received talk group name is displayed
- When the dwell display is set to received talk group and the scan mode is None:
 - a. If the received talk group matches the selected talk group, then the alias (if available) or the user id of the incoming caller is displayed.
 - b. If the received talk group does not match the selected talk group, then None is displayed.
- When the dwell display is not set to received talk group, then there is no display indication of an incoming call.

Refer to Section 7.25 for detailed information on talk group scanning. Refer to Section 7.30 for detailed information regarding sending and receiving encrypted calls.

7.21.2 Transmitting a Voice Call



Transmit a voice call as follows:

1. Turn the radio on.
2. If required, log-in to the network using a user ID and password (see Section 7.4).
3. Select the desired talk group for transmitting on.
4. Press and hold the **Push-to-Talk (PTT)** button on the hand-held microphone, pause for a moment, and then speak normally. For maximum clarity, hold the microphone approximately 1 ½ inches from the mouth and do not shout or whisper into it. If the call is queued by the network, wait for the grant tone to sound before speaking.
5. Release the PTT button when finished speaking.

Refer to Section 7.30 for detailed information regarding sending and receiving encrypted calls.



7.22 ADJUSTING AUDIO TREBLE LEVEL

The tone of received signals can be adjusted using the radio's "Treble Menu" as follows:

1. Use  to scroll through the menu until "Treble Menu" appears. The radio's current treble level setting indicates in the top line of the display. There are four levels available: low, medium, medium-high and high.
2. Use  to increase or decrease.
3. Press the **MENU** button or wait a few seconds to return to the Dwell Display.

7.23 INTERCOM MODE

The optional intercom mode gives users at multiple control heads connected to the same radio the ability to communicate with each other without transmitting over-the-air. Turn intercom mode on and off using the “INTERCOM” menu as follows:

1. Use  to cycle through the available menu items until “INTERCOM” appears in the display.
2. Use  to toggle between “On” and “Off.”

When intercom mode is turned on:

- Incoming voice calls will override intercom communications for the duration of the voice call. The radio and associated control heads will remain in intercom mode and intercom communications will resume when the voice call ends.
- “TG: INTERCOM” appears in the control head’s display when talking on the intercom. This indicates microphone audio is not sent out on the selected talk group; rather, it remains localized between the radio control positions (i.e., the control heads connected to the mobile radio).
- If a call exists on the currently selected talk group when a PTT button is pressed at one of the control heads, “TG: in use” appears in the display to indicate intercom mic audio cannot preempt the call on the talk group.



A user at a radio with only one control head/front panel can turn intercom mode on. In this case, pressing the microphone’s PTT button will not send microphone audio anywhere.

7.24 TALK GROUP LOCK OUT

There are two ways of focusing voice communications by suppressing calls from talk groups in the currently active profile:

1. **No Scan.** By turning scan off (selecting “No Scan” via the “ScnModeMenu”), only the selected talk group is audible.
2. **Lock Out.** By locking out selected talk groups, the “chatter” of the locked-out talk groups cannot be heard. This focuses the user’s scanning resources to calls only on desired talk groups.

Talk group lock out is a scan-related feature. With lock out, one or more talk groups in the active profile can be temporarily disabled from being scanned. Calls are not received on locked-out talk groups. Lock out settings are not retained between profile changes or when the radio is power cycled.



Lock out is a listening (receive) function and only blocks received calls on locked out talk groups. Lock out does not affect transmit capability. The above methods do not apply to recent emergency lock outs.



Only talk groups in the active profile can be locked out, since they are the only talk groups whose voice calls can be heard on the radio.



P1 and P2 talk groups cannot be locked out.

The default emergency and emergency-capable talk groups can be locked out if they are NOT in an emergency state. If a talk group is locked out and is subsequently changed to the currently selected talk group, it will automatically be unlocked by the radio so the user can hear calls on the talk group. The radio may be configured so all talk groups are automatically locked out by default. In this case, they must be manually unlocked, if desired.



7.24.1 Lock Out a Talk Group

1. Use  to scroll through the menu until “LockOutMenu” appears in the bottom line of the display. The name of a talk group in the currently active profile will appear in the top line.
2. Use  to scroll through the list of talk groups, if any, until the desired talk group for lock out appears in the top line of the display.
3. Press the **MENU** button to lockout the displayed talk group. A less than symbol (<) appears next to the talk group’s name.
4. Repeat steps 2 and 3, as needed, to lockout additional talk groups.

The dwell display will re-appear a few seconds after button presses end.

While scrolling through talk groups in the active profile, the only talk groups that appear in the “LockOutMenu” are those in the active profile.

7.24.2 Unlock a Talk Group

1. Use  to scroll through the menu until “LockOutMenu” appears in the bottom line of the display. The name of a talk group in the currently active profile will appear in the top line.
2. Use  to scroll through the list of talk groups, if any, until the talk group desired for unlocking appears in the top line of the display. A less-than symbol (“<”) appears next to the name of a talk group that is currently locked out.
3. Press the **MENU** button to unlock the talk group. The less-than symbol (“<”) next to the name of the talk group disappears. The dwell display appears as soon as the radio acknowledges the selection.



NOTE

- Changing the active profile removes any lockouts you have made.
- Turning off the radio removes any lockouts you have made.

7.25 SCANNING

Three scanning modes are available for the radio, but only one can be active at any time. Changing the scanning mode changes the way the radio scans voice calls for all of profiles in the radio personality, no matter which profile is or becomes active.



As described in Table 7-6, the choice of scanning mode changes the span of communications with all the talk groups in the radio’s profiles, but does not affect interaction with the talk groups.

Table 7-6: Scan Modes

SCAN MODE	EXPLANATION
No Scan	<p>Eliminates distractions.</p> <p>Full communications (transmit and receive) on selected talk group.</p> <p>No calls received from other talk groups.</p>
Normal (Default)	<p>The user can scan all talk groups in the active profile that are not locked out as long as there is demand on the site.</p> <p>Priority (P1 and P2) groups are user selectable.</p> <p>Receive calls from more than one talk group, if available from the current site.</p> <p>Allows dragging of the selected talk group, P1, P2, and default emergency talk groups to the site on which the radio is registered. (If other calls are available at the site, they also can be heard but they will not be actively dragged.)</p> <p>The default emergency talk group, as well as any emergency-enabled talk groups, is only dragged if it is in emergency mode.</p>
Fixed	<p>Functions the same as Normal Scan Mode except the priority groups are fixed to the selected profile's pre-defined P1 and P2 groups (configured via the UAS). In this mode, P1 and P2 groups CANNOT be locked out.</p>

7.25.1 Checking or Changing Active Scan Mode

The currently active scan mode does not appear in the dwell display. To check it, access "ScnModeMenu" and observe it in the top line of the display. To change the active scan mode:

1. Use  to scroll through the menus until "ScnModeMenu" appears in the display.
2. Use  to scroll through the scan options until the desired mode appears. See Table 7-6.



7.25.2 Scanning Priority

The following lists the scanning priority order (from highest to lowest):

1. Selected talk group in emergency state.
2. Default emergency group in emergency state.
3. Selected talk group.
4. Emergency capable group in emergency state
5. Priority 1 talk group.
6. Priority 2 talk group.
7. Other (non-priority)

7.25.2.1 Changing Scanning Priority

Follow this procedure to set talk groups in the current profile as the Priority 1 or Priority 2 talk group:

1. Use  to scroll through the menu until “Priority1” or “Priority2” appears in the bottom line of the display (Priority1 group has higher priority than the Priority2 group. The talk group currently set as the priority talk group appears in the top line of the display.
2. Use  to select a new priority talk group.
3. Press the **MENU** button to set the newly selected talk group as the priority talk group.

7.26 MAKING SELECTIVE CALLS

Selective calling is a feature that allows two radio units to obtain and utilize an independent voice path for a private call. Radios can be configured to both initiate and receive selective calls or to only receive selective calls.

In the OpenSky system, a source radio can be configured to initiate selective calls through a pre-programmed list in memory. This method uses the “speed dial list” set up by the OpenSky network administrator and provisioned as part of the registration process.

In addition, a properly equipped source radio can initiate a selective call to any radio in the system by entering the ten-digit voice user ID (which looks like a telephone number) of the target device. Entering a selective call number without using the speed dial feature requires a system model control head (Figure 7-1). See Section 7.13 for more detail.



Selective calls are terminated if an emergency is declared. The network limits selective calls to ten (10) minutes maximum.

7.26.1 Manually Dialing a Selective Call (System Model Control Head)




1. Press *8 on the keypad.
2. Enter the number of the radio to be called (e.g., 027-001-0006). If the region number (first 3 digits; 027 in this example) is the same as this radio's region number, these digits do not need to be entered. Likewise, if the region and agency numbers (first 6 digits; 027-001 in this example) are the same as this radio's numbers, these digits do not need to be entered. Leading zeros can also be ignored.
3. Press and release the # key.
4. Wait approximately two (2) seconds.
5. Press and release the PTT button to initiate the selective call request. When the called party accepts the call, press the PTT again and begin speaking.

7.26.2 Speed Dialing a Selective Call




NOTE

Speed dial numbers are defined and provisioned by the OpenSky network administrator and cannot be manually entered into the radio by the user. Contact the administrator if changes to the speed dial list are required.

1. Scroll through the Menu options using  until "SpeedDial" appears in the bottom line of the display.
2. Using , scroll through the pre-programmed speed-dial numbers until the desired number appears in the display.
3. Press and release the PTT button to ring the other user.
 - a. The ring tone is sounded.
 - b. If the other user accepts the call, the called user's alias will appear in the initiating caller's display. The two are now in a private call until one ends the call, the call is terminated due to an initiated emergency, or the maximum time limit of ten (10) minutes is reached.
4. To end the call, press the # button or (-) using .


7.26.3 Receiving a Selective Call

When someone calls in from another radio using the selective call function, a ring sounds in the speaker and/or headset. Press up or down using  or any number key to accept an incoming Selective Call. Press the microphone's PTT button when speaking (transmitting) to the caller.

Press the # button or (-) using  to reject an incoming Selective Call.

A selective call will be interrupted if an emergency is declared on a monitored talk group.

7.26.4 Terminating a Selective Call

Press the # button or (-) using  to terminate an incoming Selective Call.

7.27 SELECTIVE ALERT

Selective alert messaging is an OTP feature allowing one of up to eight (8) pre-programmed text messages (refer to Section 7.27.3) to be sent from one radio to another. The user specifies a destination radio's User ID, selects one of the pre-programmed text messages, and then transmits it to the destination radio. The message delivery system adds time-of-day information and forwards the message to the destination (receiving) radio. The sending radio receives a brief message noting the status of the transmission. Refer to Table 7-7 for a list of possible status messages.



The first few characters of a message are part of the message text entered when the message is programmed. This programming is performed by the system or network administration personnel.

Messages successfully received by the destination radio are stored until deleted or until it is power cycled.

7.27.1 Sending Selective Alert Messages

The destination radio's User ID can be selected via the menu or via the keypad on the system model control head.

Menu Button Method:

1. Using , scroll through the menu until "AlertDest" (Alert Destination) appears in the bottom line of the display. The current speed dial number scrolls on the top line.
2. Use  to change to a different speed-dial number.
3. When the desired speed-dial number appears, press the **MENU** button to activate the selection.
4. Choose and send the message.

Keypad Method (System Model Control Head):

To select the destination radio's User ID using the keypad, perform the following:

1. Press *7 on the keypad. "AlertDest" appears in the display.
2. Enter the number of the destination radio (e.g., 027-001-0006) using the DTMF keypad. If the region number (first 3 digits; 027 in this example) is the same as this radio's region number, these digits do not need to be entered. Likewise, if the region and agency numbers (first 6 digits; 027-001 in this example) are the same as this radio's numbers, these digits do not need to be entered. Leading zeros can also be ignored. Refer to Section 7.13.
3. Press the # key to enter the number.

Choosing and Sending the Message

After specifying the destination radio's User ID (Section 7.27.1), the radio automatically allows you to choose a message. The current message scrolls across the top line of the display. To choose a message:


1. Scroll through the message list using . The next available message in the list is displayed. Pause between each arrow button press to observe the entire message as it scrolls across the top line of the display.
2. To select and send the displayed message, press the **Select** button, or press the # button on the keypad.
3. The status of the sent message will be momentarily displayed (Table 7-7).



Table 7-7: Status of Selective Alert

STATUS MESSAGE	DEFINITION
Delivering	Select Alert message transmit attempt
Busy	Too busy – Try again
Dest Down	Receiving radio not logged on – Not registered
Not Reg	Transmitting radio not logged on – Not registered
Delivered	Transmission complete
Unreachable	No response
Partial	Transmission interrupted

7.27.2 Receiving Messages

When a selective alert message is received by a radio, a four-beep tone (one low, two high, and one low) is heard and “NewAlert” flashes until the new message is read. Up to eight (8) received messages are stored. If another message is received, the first (oldest) message is automatically deleted to make room for new incoming messages.

Displaying Received Messages

1. Using , scroll through the menu until “AlertsRecvd” (Alerts Received) appears in the bottom line of the display. “No alerts” or the last received (newest) message appears in the display. It is preceded by the time the message was received, and the sender’s name/alias.
2. View other received messages using .
3. To delete the message currently being viewed, press the **MENU** button.

Deleting Received Messages

To delete a received message:

1. Display the message.
2. Delete the message by pressing the **MENU** button.
3. Confirm the deletion by pressing the **MENU** button again.


7.27.3 Defining Pre-Programmed Messages

All selective alert messages are pre-defined by the radio system’s maintenance personnel. These messages are sometimes referred to as “canned” messages. Custom selective alert messages cannot be created by the radio user. The entire selective alert message, including the abbreviation, can include up to 99 text characters.


7.28 TELEPHONE INTERCONNECT CALLS (SYSTEM MODEL CONTROL HEAD)

7.28.1 Placing an Interconnect Call

If the radio system is equipped with Public Switched Telephone Network (PSTN) interconnect equipment, telephone calls can be made from the M7300 using this procedure:

1. Press the *9 keys.
2. Enter the telephone number. Ignore dashes/spaces, and precede the number with any required access digits such as a 1 for long distance.
3. Press the # key.
4. Wait a few seconds and then press and release the mic's PTT button to initiate the call. An initial ring tone plays indicating call initiation. Once the gateway picks up the call, another ring tone sounds.
5. When the caller answers, press the PTT button when speaking and release it to listen to the caller.
6. To hang-up, press the # button or (-) using .

7.28.2 Receiving an Interconnect Call

When receiving an Interconnect Call, a ring sounds in the speaker and/or headset. Press up or down using  or any number key to accept an incoming Interconnect Call. Press the microphone's PTT button when speaking (transmitting) to the caller.

Press the # button or (-) using  to reject an incoming Interconnect Call.

7.29 EMERGENCY COMMUNICATIONS

The M7300 mobile radio can transmit both emergency voice calls and emergency alerts over the entire network. OpenSky handles emergency calls and alerts with the highest priority.

For critical voice communications, an emergency call can be raised on the default talk group or the currently selected talk group by “declaring” an emergency on the talk group. The exact talk group is determined by the currently active profile. After successfully declaring an emergency on a talk group, the declaring radio's microphone remains “hot” for a predetermined amount of time. In other words, the radio transmits audio for a period of time even when the microphone's PTT button is not pressed. An emergency talk group is provided greater priority and infinite hang-time by the radio system's infrastructure. Hang-time is the maximum duration of quiet time between transmissions on the talk group before the infrastructure assets are automatically taken away. Because an emergency call is handled on a talk group, it is received by all radios and consoles monitoring the talk group.

An emergency alert is a data message sent by the radio to the MIS console (or any console capable of receiving it). It identifies the radio declaring the emergency, and the radio's location (if the radio is equipped with a GPS receiver). Voice audio is not automatically transmitted during the emergency if the administrator configures the radio for alert notification only.

7.29.1 Declaring an Emergency Call or Alert

To declare an emergency call or emergency alert, press and release the orange Emergency button. This button is located just to the right of the 5-button Menu and Select keypad; see Figure 7-1 on page 17. The emergency is raised after the Emergency Raise Delay (default is one second).

- The OpenSky network administrator determines if the Emergency button is used to declare an emergency call or if it is used to declare an emergency alert. This is based upon the radio's currently active profile.
- The OpenSky network administrator also determines if the emergency is declared on the currently selected talk group or a “default” emergency talk group. Again, this is based upon the radio's currently active profile. A talk group upon which an emergency is declared on is considered an “emergency talk group.”

- Upon successful emergency declaration:
 - An emergency tone will sound in the radio’s speaker/headset if the radio is not in stealth mode.
 - At the declaring radio, the Emergency button flashes red if the radio is not in stealth mode. The administrator can configure the radio to automatically transmit upon successful emergency declaration, at which point the **MENU** button will flash red. However, the **MENU** button flashing red is not a requirement for successful emergency declaration.
 - On the declaring radio during an emergency call declaration, the talk group that the emergency is declared on is temporarily displayed and then the word “EMERGENCY” flashes on the second line of the display.
 - For an emergency alert declaration, “EMERG ALERT” appears in the bottom line of the display.
 - For an emergency call declaration, other radio users and/or dispatchers at consoles will hear the emergency signal, a distinctive 3-tone burst. They will also hear audio from the declaring radio’s “hot” microphone, if any.
 - For an emergency alert declaration, only dispatchers at consoles will hear the emergency signal and, if any, audio from the declaring radio’s “hot” microphone.
 - For an emergency call, the declaring radio’s microphone remains “hot” for a predetermined amount of time. In other words, the radio transmits audio for a period of time even when the microphone’s PTT button is not pressed. Audio is transmitted over the emergency talk group. When the microphone is “hot” for this initial period (typically ten seconds), simply speak into it for voice transmission.

If an emergency declaration is not successful, the radio will periodically re-attempt until it is successful. During this retry period, the radio will flash “EMERG PEND” on the bottom line of the display. It will display “EMERG RETRY” for each attempt.

7.29.2 Silent Emergency

When this feature is enabled and an emergency call or alert is declared by pressing the emergency button, the radio will not play a tone and will display an abbreviated emergency message (default is EBA). This feature is enabled or disabled via programming or via the menu.



If the Silent Emergency feature is enabled or disabled via programming, the setting will survive power cycle. Enable/Disable selection via the menu will NOT survive power cycle and the enable/disable state will revert to the programmed setting at power up.

7.29.3 Clearing an Emergency Call or Alert



Check with the system administrator to ensure that the radio is programmed to allow an emergency to be cleared.

If enabled via programming, clear an emergency by:

1. Pressing and holding the **CLR/CLEAR** button and simultaneously pressing the emergency button.
2. After the Emergency Cleared Tone sounds, release both buttons.



If the radio is in stealth mode, clearing the emergency will take the radio out of stealth mode.

7.29.4 Receiving an Emergency Call

Upon receiving an emergency call declared by another radio:

- An emergency tone sounds in the radio's speaker/headset (three short high-pitched beeps).
- "EMERGENCY" flashes in the display if the radio is not in stealth mode.
- On receiving radios with the emergency talk group selected, the alias of the sending party is displayed for 5 seconds during the open-mic period, then the word "Emergency" flashes on the second line of the display and continues until the emergency state ends.
- If scan mode is set to "No Scan" and the emergency was declared on the selected talk group, audio on the emergency talk group is heard in the speaker/headset. See page 31 for additional information on "No Scan" operation.
- If scan mode is set to "No Scan" and the emergency was declared on a talk group **other than** the selected talk group, the emergency talk group (identified by an "**") must be selected before audio on it is heard in the speaker/headset.
- If scan mode is set to "Normal" and the emergency was declared on the selected talk group, the selected/emergency talk group's name remains in the top line of the display. Audio on the emergency talk group is heard in the speaker/headset.
- If scan mode is set to "Normal" and the emergency was declared on a talk group **other than** the selected talk group, the emergency talk group's name appears in the bottom line of the display. Audio on the emergency talk group is heard in the speaker/headset.
- The declaring radio's alias appears in the bottom line of the display when the emergency talk group is selected.
- An emergency call can be dismissed as described in the following section.





A radio declaring an emergency on a talk group has a "hot" mic time period of typically ten (10) seconds just after it declares the emergency. This time period may be adjusted by system or network administration personnel on a per radio basis.

7.29.5 Dismissing an Emergency Call



An emergency is dismissed for a configurable amount of time only (default = 5 minutes).

To ignore an emergency call declared by another radio user:

1. Press  until "EmgDismiss" appears in the display.
2. Press  until the talk group in the emergency state appears, as indicated by an asterisk (*) following the talk group's name.
3. Press the **MENU** button.



The emergency dismiss timer is cleared when the emergency is cleared.

7.30 ENCRYPTION

In the OpenSky network, both data and voice use a 128-bit or 256-bit key encryption standard published by the Federal Information Processing Service (FIPS), called Advanced Encryption Standard (AES). AES is approved by the U.S. Department of Commerce for encryption of classified materials.

When encryption is enabled on the network, data is encrypted from the MDIS to the Mobile End System (MES) (e.g., M7300 mobile radio). This form of encryption provides air-link security.

Voice encryption is handled either automatically or manually. Automatic encryption is initiated through the Unified Administration Server (UAS) for a specific talk group and requires nothing from the user. Manual encryption is initiated by two or more radio users and requires system model control heads. Both methods of encryption are discussed in the following sections.

7.30.1 Automatic Encryption

For automatic encryption, a network administrator will select the talk group to be encrypted at the interface to the UAS. Once the talk groups have been selected and identified as secure, credentials for key generation are generated automatically by the system and provisioned to authorized users. This process requires that authorized users login to the network and be authenticated. Encryption keys require no manual handling and are never sent “in the clear” over any network interface or air-link.

1. “Pls Login” appears displayed in the bottom line of the dwell display.
2. Login normally using the keypad on a system model control head to enter User ID and Password.

If a user is engaged in a call on a talk group encrypted at the network administrator level, “Secure Call” will appear in the bottom line of the dwell display if the user is logged in to that talk group.

If a secure call is in progress elsewhere and the user has not logged in, the bottom of the dwell display will alternate between “No Access” and the alias of the radio that is currently engaged in the secure call.

7.30.2 Manual Encryption (System Model)

Two or more users can manually encrypt a call, if enabled, without an established encrypted talk group. A pre-determined key is required at each radio.



The key must be pre-determined by the users prior to making a manually encrypted call on a talk group and is entered into the radio using the keypad. For 128 bit encryption, this key is between 1 and 16 digits. For 256 bit encryption, this key is between 17 and 32 digits.

If two communicating radios have different (manually-defined) keys, receive audio at each radio will sound garbled.

With manual encryption enabled, unencrypted radio users on the talk group can still make standard voice (unencrypted) calls on the talk group. However, if an unencrypted user attempts to transmit on the talk group when one of the encrypted users is already transmitting on the talk group, the unencrypted radio will sound a deny tone and “No Access” will appear in the display. Also, the encrypted user can hear standard unencrypted calls, but cannot respond while still manually encrypted.



CAUTION

Do *not* set a talk group for manual encryption if it has been set for encryption by the network administration personnel.

Perform the following to transmit or receive manually encrypted calls:

1. Press *32 on the keypad.
2. Enter the key (1 – 16 digits for 128 bit encryption; 17 – 32 digits for 256 bit encryption).
3. Press the # key.
4. To end manual encryption, press *33#.

If a user is engaged in a call on a talk group that has been manually encrypted at the radio level, the user will see “Secure Call” on the bottom of the dwell display.

If a secure (encrypted) call is in progress, and the user has not entered the key, the bottom of the dwell display will alternate between “No Access” and the alias of the radio that is currently engaged in the secure call.

Once the user has terminated manual encryption, “UnSecure” appears temporarily in the bottom line of the dwell display.

7.31 PRESET BUTTONS

The front panel contains three buttons labeled A, B, and C. By holding one of these buttons down for approximately three (3) seconds, the following current information is saved to the function of that button:

- Selected talk group
- Selected profile
- Selected priority talk group
- Lockouts
- Scan mode
- Intercom mode

Presets are saved and restored to/from non-volatile memory. Changing the User ID (login in as a different user) will clear the presets since they are stored on a per-user basis. Changing control heads will not recall presets for the previous control head.



NOTE

Preset button C can be configured via programming to reboot the radio into a particular application mode. Contact your system administrator to determine if this feature is enabled in your radio.

7.32 DYNAMIC REGROUPING



Dynamic regrouping requires that the network administrator determine which radio users should be formed into an impromptu talk group to respond to particular emergency conditions.

The administrator will edit the personalities of the affected radios to include an emergency profile and then page the affected radios to re-register with the network to receive their edited personalities.

In response, affected radios automatically re-register to receive their edited personalities. During re-registration, subscriber equipment will default to the emergency profile selected by the administrator.

7.33 GPS COORDINATES

The radio's current latitude and longitude coordinates may be displayed using the "GPS" menu. The following procedure assumes a GPS antenna is connected to the radio and it is receiving adequate signals from GPS satellites:

1. Press  until the "GPS" menu appears in the bottom line of the display. Current GPS coordinate latitude and longitude data continuously scrolls in the top line of the display in a degrees:minutes:seconds format.
2. Use  to change to another menu.



If the internal GPS receiver's data is expired (30 minutes or more) or unavailable, the radio uses the serving base station's coordinates [GPS (Site) is displayed]. The GPS Menu will also indicate if the data is aged (2 minutes or more) [GPS (Aged) is displayed]

8 P25/EDACS/CONVENTIONAL COMMON OPERATION

8.1 CH721 FRONT PANEL COMPONENTS

The front panel of the control head includes a dot matrix display, controls for menu navigation, an emergency button, three pre-set buttons, a Power On-Off/Volume Control knob, and a microphone connector. In addition, the system model control head features a DTMF keypad.

Table 8-1 lists all default front panel controls and their functions. All functions and controls of the Scan radio operate the same as the corresponding functions and controls on the System radio.

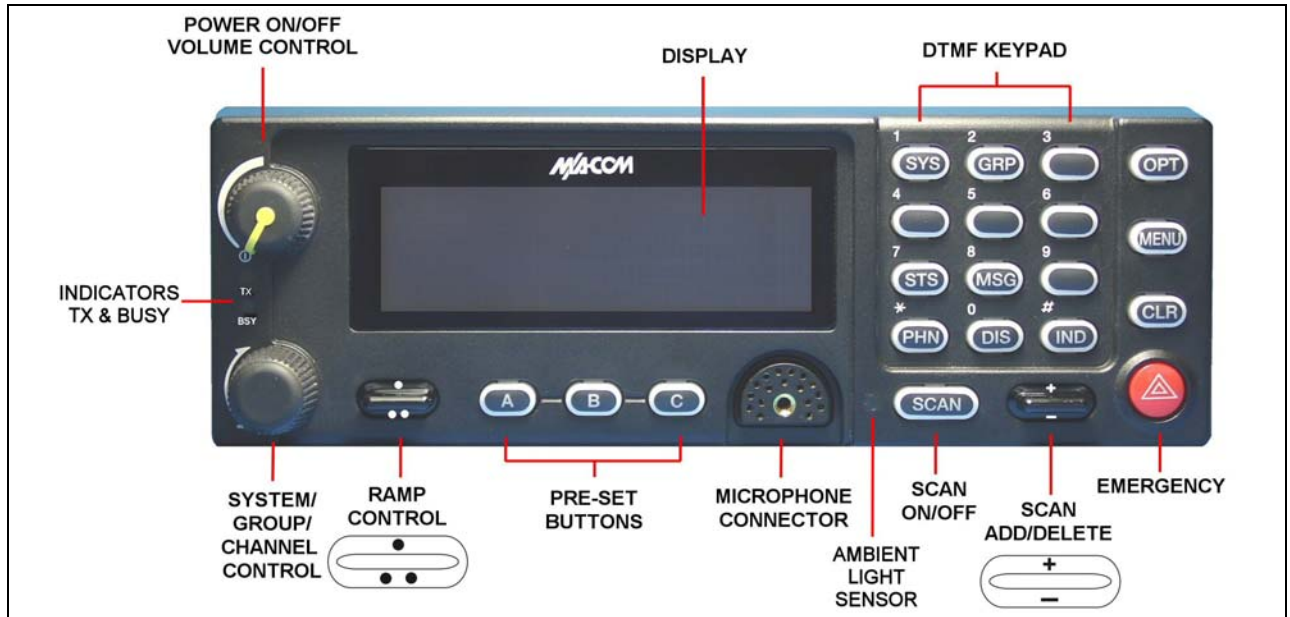


Figure 8-1: System Model







Figure 8-2: Scan Model



NOTE

Button function may vary depending upon system programming, radio hardware, and optional configurations. Complete the table in Section 14 if the keys have been remapped to provide new functions.

Table 8-1: Front Panel Default Controls and Functions

PART	FUNCTION
Power On-Off/Volume Control knob	Turn knob clockwise to power on the radio and increase volume. Turn counter-clockwise to decrease volume and power off the radio.
Mic Connection	Connection for hand-held, hands-free, speaker-mic, or headset.
	The Emergency button declares an emergency if enabled through programming.
Ambient Light Sensor	Radio automatically adjusts the display and button backlight brightness level based on ambient light. Do not block this sensor.
	This rotary switch selects the systems or groups/channels, depending upon programming.
	This rocker type button is used to display the current SCAN status for a group/channel and then add or delete the group/channel from the system scan list. Pressing the add/delete button twice while the radio is actively receiving or three times when the radio is not receiving selects the last scanned channel (Last Scanned Channel Recall).
	The primary function of this rocker type button is to scroll through the System list or the Group/Channel list depending upon programming. The secondary function is to increment or decrement items within a list (phone list for example).
OPT/OPTION	Toggle a PC programmable feature ON and OFF.
CLR/CLEAR	In Trunked mode, the CLR button exits the current operation and removes all displays associated with it. The radio and display then return to the group receive state. In Conventional mode, pressing this button unmutes the receiver so activity on the selected channel can be monitored. When pressed and held for approximately 3 seconds, this button toggles conventional channel decoding (Channel Guard, Digital Channel Guard, T99) ON and OFF if programmed for the selected channel.
MENU	Primary function - access the menu list. This is a list of additional features that are not available directly from the keypad. Secondary function - activate a selected item within a list, similar to an enter key.
SCAN	Primary function - toggle scan operation on and OFF. Secondary function - toggle the keypad buttons between their primary function and their secondary function.
Pre-Set buttons (A, B, & C)	Used to store and recall user-selectable parameters.
SYS	Used to enter the System select mode.
GRP	Used to enter the Group select mode.
STS	Permits the transmission of a pre-programmed status message to an EDACS site.
MSG	Permits the transmission of a pre-programmed message to an EDACS site.
PHN	Used to place telephone calls through the radio by selecting the interconnect special call function.

PART	FUNCTION
DIS	Used to adjust the current display intensity and the keypad backlight level.
IND	Used to call an individual or make an all-call by selecting the individual call function.

8.1.1 Primary Functions (Quick Access)


The secondary function of the **SCAN** button is to toggle the keypad buttons between their primary function and their secondary function. When the secondary keypad is active, i.e. entering phone digits for an interconnect call, the **SCAN** button can be used to toggle the keypad buttons back to their primary function, perform a task, and then toggle back to finish entering the digits for the phone number. **PRIMARY** is displayed when the **SCAN** button is used to toggle the keypad keys back to their primary functions. This provides quick access to the primary functions of the keypad. This is a programmable feature of the **SCAN** button only. Careful consideration should be given to possible operational conflicts before enabling this feature.

Several keys on the Scan version have a secondary function. The **MENU** key is the SELECT secondary function with the **CLEAR** key remaining the same for the secondary function. On the System version, the **OPT** has a secondary function of DELETE, **MENU** is SELECT, and **CLR** retains its CLEAR functionality.

8.2 TURNING THE RADIO ON

Rotate the **POWER ON-OFF/VOLUME** knob clockwise, out of detent to turn the radio on. A short beep (if enabled through programming) indicates the radio is ready for operation. The display indicates, if programmed, the last selected system name on line 1 and the last selected group or channel name on line 2.

8.3 SELECTION MODE RULES

Many operations require selection from a list such as system, group or phone number. This selection process is handled in the same manner for all lists. The  ramp control, **MENU**, **0-9**, *****, **#**, and the **CLR** button are used during the selection process. The following example systems list is used to explain the process:



The hookswitch functions the same as the **CLR** key in I-Call, phone call, and menu modes.

SYSTEM

- 1 NORTH
- 2 SOUTH
- 3 EAST
- 4 WEST




After entering a selection mode, the following generic display format will appear:

X X X X X X X X
Y Y Y = Z Z Z

Line 1 shows the currently selected item name (XXXXXXXX) from the list. Line 2 indicates the list (YYY) that the selection is to be made from and the number of the selected item (ZZZ) within the list. (In some cases the information on lines 1 and 2 will be exchanged.) Enter the system selection mode by pressing the **SYS** key. If SYSTEM 2 is the current selection, the display appears as follows:

S O U T H
S Y S = 2

Line 1 contains the current system name, SOUTH; and line 2, SYS = 2, indicates that selection is from the system list and it is the second system within the list.

A new system from the list is selected by using the  ramp control or by directly entering the system number with the numeric keys. The  ramp control scrolls through the list in increasing and decreasing order. In the previous example, pressing up with the  ramp control selects the EAST system as shown in the next display.

E A S T
S Y S = 3

The radio can be programmed to wrap around from one end of a list to the other end or to stop at the ends.

8.4 DIRECT ACCESS

To directly access a selection, enter the corresponding number (e.g. 4) followed by **MENU** to activate the selection. The entered number is displayed on line 2 as shown below. Line 1 shows the current list being used for selection.

S E L S Y S
4

If a mistake is made while entering the number, press the **DEL** button to backspace once and correct the entry. If an invalid number is entered, a short low-pitched tone sounds when **MENU** is pressed.

To exit the selection mode, press the **CLR** button or wait for the time-out. If the selection mode is cleared while an entry is pending (i.e., numbers are entered on line 2, but **MENU** has not been pressed), the entry on line 2 will be disregarded and the previous selection will remain active. If the time-out activates while an entry is pending, the entry on line 2 will be selected if it is within the valid range; if it is out of range, the entry on line 2 will be disregarded and the previous selection will remain active.



NOTE

While in system, group or channel selection mode, the radio continues to receive calls normally and continues scanning, if it is enabled. If a call is received during the selection mode process the radio will return to the normal receive mode display. Continuing with the selection process will return the display to the same point in the selection process if the selection mode time out has not yet expired. Any press of the PTT button during the selection mode process will initiate transmission and exit the selection mode.

8.5 FEATURE ENCRYPTION DISPLAY

Feature Encryption Display is available through the menu function and, if programmed, appears in the menu as “**FEATURES.**” This data indicates current features programmed into the radio as well as information required to add features to the radio.

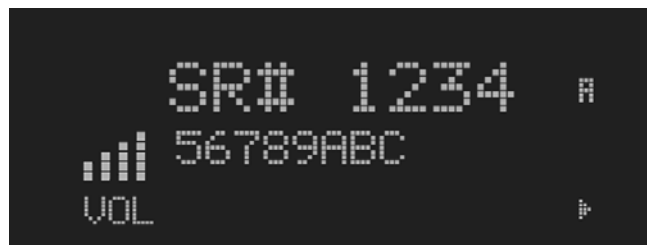
Once the feature has been accessed, all normal menu functions work. The user can scroll up or down through all of the entries.

Feature Encryption Display provides the ability to view, in the order displayed, the following:

- Serial number ROM data - serial number of the ROM
- Feature encryption data stream - used to enable features
- Number Fields - defines limits
- Features enabled - displays bit fields of enabled features

8.5.1 Serial Number ROM (12 Hex Digits)

Example:



When the user wants to enable a feature in his radio, he will need to call M/A-COM, Inc. They will ask for the ROM serial number. The serial number shown here is for example only.

8.5.2 Feature Encryption Data Stream

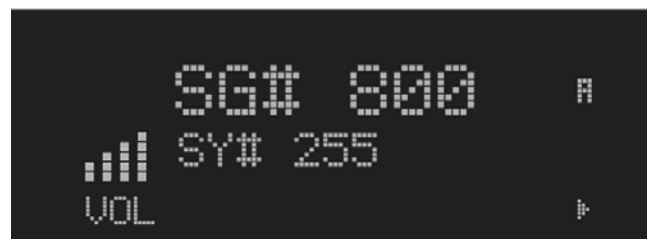
Example:



These data streams define the features the user has enabled in his radio and are required by M/A-COM, Inc. to enable other features. The data streams shown here are for example only. **Note:** There are three displays: FD1, FD2, and FD3. All three are required.

Number Fields

Example:



These number fields show the set limits of the of the user's radio as:

- SG# XXX - Maximum number of system/groups combination available
- SY# XXX - Maximum trunked system limit
- CH# XXX - Maximum number of conventional channels available

The user needs to know the limits of his radio before attempting to enable other features. The numbers shown here are for example only.

8.5.3 Features Enabled

These numbers indicate which features are enabled.

Example:

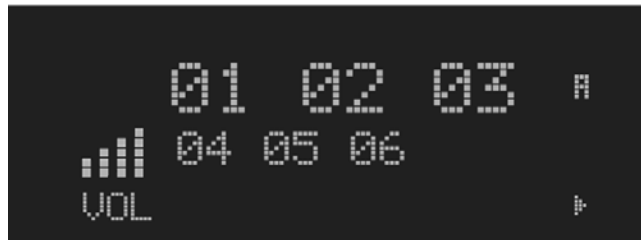


Table 8-2 lists possible features available in the user's radio.




Table 8-2: Available Feature Numbers


FEATURE NUMBER	POSSIBLE FEATURES	STANDARD OR OPTIONAL
01	Conventional Priority Scan	Standard
04	Group Scan (EDACS and P25 Trunked)	Standard
05	Priority System Scan (EDACS only)	Optional
06	WAscan/ProSound™/ProScan (EDACS only)	Optional
07	Dynamic Regroup	Standard
08	EDACS Emergency	Standard
09	Type 99 Encode	Standard
10	Conventional Emergency	Standard
12	Aegis™ Digital Voice Encryption	Optional
14	DES Encryption	Optional
16	Mobile Data	Optional
17	Status/Message (EDACS only)	Optional
21	EDACS Security Key (ESK)	Optional
22	ProFile™ (EDACS only)	Optional
23	Narrowband	Standard
29	ProVoice™	Optional
32	FIPS-140-2	Optional

FEATURE NUMBER	POSSIBLE FEATURES	STANDARD OR OPTIONAL
33	P25 Common Air Interface	Optional
34	Direct Frequency Entry	Optional
38	Radio TextLink	Optional

8.6 SYSTEM/GROUP/CHANNEL SELECTION

In the following description of **SYSTEM/GROUP/CHANNEL SELECTION**, the term group is used for both group and channel.


The M7300 **SYSTEM/GROUP/CHANNEL** knob and the  ramp control are programmable for maximum flexibility. If the **SYSTEM/GROUP/CHANNEL** knob is assigned to select groups, then the  ramp control is assigned to select systems. If the **SYSTEM/GROUP/CHANNEL** knob is assigned to select systems, then the  ramp control is assigned to select groups. System, group, and channel selection is the primary function for these controls.


Either systems or groups can also be selected by entering the select mode and following the selection mode rules described earlier. The system select or group select modes are entered by pressing **SYS** or **GRP**, respectively, from the standard receive mode. Using the  ramp control after entering a particular selection mode in this manner is the secondary function of these keys.

8.6.1 System Selection

Several methods, some of which depend on programming, can be used to select a new system. These procedures are presumed to be starting from the normal receive display.

METHOD 1: If system selection is programmed to the **SYSTEM/GROUP/CHANNEL** knob, select a system by turning the **SYSTEM/GROUP/CHANNEL** knob to the desired system position. The display registers the new system name on line 1. If the wrap option is OFF and the knob is moved to a position greater than the number of programmed systems, the highest programmed system will remain selected.



METHOD 2: If system selection is programmed as the primary function of the  ramp control, select a system by pressing up or down to scroll through the system list. The display registers the new system name on line 1.

METHOD 3: Press **SYS** to enter the system select mode and follow the selection mode rules detailed earlier. Use the  ramp control to scroll through the systems.

8.6.2 Group and Channel Selection

Several methods, some of which depend on programming, can be used to select a new group or channel. These procedures assume starting from the normal receive display.

METHOD 1: If group selection is programmed to the **SYSTEM/GROUP/CHANNEL** knob, select a group by turning the **SYSTEM/GROUP/CHANNEL** knob to the desired group. The display registers the new group name on line 2. If the wrap option is OFF and the knob is moved to a position greater than the number of programmed groups, the highest programmed group will remain selected.

- METHOD 2:** If group selection is programmed as the primary function of the  ramp control, select a group by pressing up or down, to scroll through the group list. The display registers the new group name on line 2.
- METHOD 3:** Press **GRP** to enter the group select mode and follow the selection mode rules detailed earlier. Use the  ramp control to scroll through different groups.

8.7 LAST SYSTEM/GROUP/CHANNEL RECALL

This feature, enabled through programming, allows the user to recall the last selected system/group after an emergency or home function or system/group key function. For example, if the Home button (pre-programmed) is pressed, the radio will go to the designated Home system/group or channel. If the Home button is pressed again, the radio returns to the previous system/group or channel. At this time, the user can toggle between the Home system/group or channel and the previous system/group or channel. The operation is the same for the SG1-SG5 buttons.

8.8 DIGITAL VOICE OPERATION (PROVOICE)

8.8.1 Voice Modes

Each system (trunked or conventional) in the radio is programmed for no digital voice operation (analog only) or digital voice format ProVoice. ProVoice programmed systems have three (3) different voice modes: clear (analog), digital, and private. The voice modes are programmed on a per-group basis within each trunked system and on a per-channel basis within each conventional system. A radio must be equipped with the encrypt/decrypt option before it will operate in private mode.



Current ProVoice Conventional operation is for talk-around mode only.

Table 8-3: Transmit/Receive Mode Compatibility for ProVoice Operation

GROUP/CHANNEL PROGRAMMING (TRANSMIT)	CLEAR RECEIVE	DIGITAL RECEIVE	PRIVATE RECEIVE
CLEAR	Yes	No	No
DIGITAL	Yes	Yes	No
PRIVATE	Yes	No	Yes

8.8.2 Clear Modes

In Clear Mode, the radio transmits and receives only clear (analog) voice signals. These analog signals are non-digitized and non-encrypted. Clear Mode transmissions can easily be monitored by unauthorized persons. Groups or channels programmed for clear operation cannot transmit or receive unencrypted digital or private messages.

8.8.3 ProVoice Digital Mode

ProVoice digital mode allows the radio to transmit and receive digitized voice signals. These digital signals provide improved weak signal performance and they cannot be easily monitored with a standard receiver. Groups and channels programmed for ProVoice digital operation transmit only digital signals. Private calls cannot be received or transmitted when the radio is in ProVoice digital mode because the radio does not know the cryptographic key used.

Message trunked group calls and individual calls will be answered back in the mode they were received, assuming the call or hang time is still active. Individual, phone, all and emergency calls will be transmitted clear if digital mode is disabled or inoperative.

- If receiving an analog message trunked call, the radio will respond in analog mode during the hang time on the working channel.
- If receiving an analog I-Call, the radio will respond in analog mode during the hang time.
- When using the "WHC" feature to respond to an I-Call (after the hang time has expired), the call will be transmitted in the mode defined by the system mode as programmed for the current system if the ID being called is not in the I-Call list. If the ID is in the I-Call list, then the call will be transmitted as defined by the I-Call mode programmed in the list for that ID.

DTMF

The overdial and hot keypad features for transmitting DTMF tones are not available while in ProVoice Digital Mode.

ERROR Messages

If any of the following error messages are displayed, the radio was either programmed incorrectly or needs servicing:

DSP ERR ERR=xxxx

DSP ERR

DIGV ERR

Power Up Only

If the ProVoice circuit board is not responding, correctly, one of the following error messages will be displayed and the radio needs servicing:

HARDWARE ERR= 3X

3X will be a number between 30 and 38

8.8.4 ProVoice Private Mode

ProVoice private mode allows the radio to transmit encrypted messages and receive clear or private transmissions. The radio will transmit private if the group/channel is programmed for private operation and forced operation is pre-programmed.

If the radio was pre-programmed for auto-select, the radio will transmit in the following modes;

- If Private mode is enabled, transmissions are always in private mode.

- If Private mode is disabled and a private call is received, the Reply transmission will be in Private mode if the transmission is made during the scan hangtime. If the reply transmission occurs after the scan hangtime, the transmission will be in Clear mode.

When operating on a group or channel programmed for private mode, all transmissions will be private transmissions and the radio will receive clear and private signals. If the selected group or channel is programmed for auto-select capability, the mode can be toggled between private and clear with the **OPT** or **OPTION** button. Radios programmed for forced private operation do not allow a change of the transmit mode; therefore, the **OPT** or **OPTION** has no effect.

8.8.4.1 Displaying the Currently Used Cryptographic Key Number

To display the cryptographic key currently in use for either the system encryption key (for special call such as individual, phone, all, agency or fleet) or the group/channel key (for group or conventional calls), perform the following procedure (Not Available on Conventional radios):



1. Press the **MENU** button.
2. Use  to select **DISP KEY**. Then press the **MENU** button.
3. Then use  to toggle between displaying the system key or the group/channel key.

Table 8-4: Current Cryptographic Key Display

ENCRYPTION KEY DISPLAYED	MESSAGE DISPLAYED
System	"SYS KEY" "KEY = 1"
Group/Channel	"GRP KEY"/"CHN KEY" "KEY = 2"/"KEY = 2"

8.8.4.2 Key Zero

All cryptographic keys can be zeroed (erased from radio memory) by pressing the **CLR** button (System Model) or **CLEAR** (Scan Model) and while still pressing this button, press and hold the **OPT** button (System Model) or **OPTION** (Scan Model). Press both buttons for 2 seconds. A series of warning beeps will begin at the start of this 2-second period and then switch to a solid tone after the keys have been zeroed. The display will indicate **KEY ZERO**.

If the cryptographic key(s) are zeroed, one or more keys must be transferred from the Key Loader into the radio before private communications can continue. (Refer to Key Manager TQS3416 Administration and Software Release Notes for further information.)

8.8.5 Private Operation

8.8.5.1 Receiving an Encrypted Call

When receiving, the radio automatically switches between clear or private operation. If the transmission being received is an encrypted transmission, it will be decrypted, the receiver will unsquelch and the message will be heard in the speaker. The selected group or channel must be programmed for private operation and the correct cryptographic key must be loaded into the radio for this to occur.

8.8.5.2 Transmitting an Encrypted Call

1. Select the desired group or channel.
2. Place the radio in private mode by pressing the **OPT** button (System Model) or **OPTION** (Scan Model).

If the last state of the radio was private mode, the private mode will be enabled on power up. In addition, the private mode will be enabled if forced operation has been programmed in the radio

If a group or channel is not programmed for private mode operation, **PVT DIS** will be displayed if an attempt is made to enable private transmit mode. It is not possible to operate on this group/channel in private mode.

If the radio is programmed for forced private transmit operation, **FRCD PVT** will be displayed if an attempt is made to disable private transmit mode. It is not possible to transmit on this group/channel in clear mode.

If the radio does not have the correct encryption key loaded, **NO KEY #** will be displayed and the call will not be transmitted.

3. Continue with standard transmission procedures. A private mode access tone will be heard when the PTT button is pressed.

8.8.5.3 Scanned Group Calls

Receiving a scanned group call is the same as receiving a selected group call. During the scan hang time, if the radio was programmed for auto-select, it will transmit back in the same mode it received the call. For example, if a clear group is entered in the scan list, it will only receive clear calls. If the same group was available in private and entered in the scan list, it can receive clear and private calls, provided auto-select was programmed in the radio. The user can select transmitting on the scanned or selected group. If a group is entered in the scan list more than once in different modes (clear, digital, private), only the first occurrence of the group will be used.

8.8.6 Conventional Operation

8.8.6.1 Outside Address

The same outside address (works similar to Channel Guard operation) must be programmed in the transmitting and receiving radios when ProVoice digital or private operation is enabled. If address is not correct, the radios will not communicate.

8.8.6.2 Channel Guard

Channel Guard encode is transmitted on analog clear channels only. Channel Guard decode will operate on either a clear or private channel. The exception is when G-STAR signaling is used (see G-STAR paragraph).

8.8.6.3 G-STAR

When G-STAR is programmed on a private channel, the radio will transmit G-STAR in clear mode and then switch to private for the voice portion of the call. If G-STAR is sent with Channel Guard, then both are sent in clear mode and the radio switches to private mode. Emergency G-STAR data burst is transmitted in clear mode.

8.9 MACRO KEY OPERATION

Macro key operation permits the user to accomplish a series of keystrokes with a single "macro" keystroke. Up to ten (10) macro keys can be defined, each capable of executing up to twenty (20) keystrokes, to any pushbutton input (i.e., keypad keys, buttons, etc.). Each macro key can be pre-programmed to activate when pressed or when released.

A macro key can also be pre-programmed to change the keystroke sequence the next time the macro key is activated.

For detail operation and assignment of macro keys, contact your communications supervisor or administrator.

9 EDACS AND P25 TRUNKED OPERATION

9.1 RADIO STATUS ICONS

Status icons are indicators that show the various operating characteristics of the radio.



Figure 9-1: Typical Display

Table 9-1: Icons and Descriptions

ICON	DESCRIPTION
	Indicates the EDACS system is in Failsoft™ mode (if enabled through programming).
	Indicates selected group or channel is in scan list.
	Indicates selected group or channel is programmed as Priority 1 in scan list.
	Indicates selected group or channel is programmed as Priority 2 in scan list.
	Scan mode enabled.
	Volume bars – indicates relative volume level.
	Indicates the current channel is set up as an analog channel.
	Indicates the current channel is set up as a ProVoice channel.
	Receiving or transmitting Encrypted Calls.
	Special call mode (individual or telephone).

9.2 MESSAGES

During radio operation, various messages are displayed on either line 1 or line 2. Typical messages include control channel status information, such as system busy or call denied, or messages associated with the radio's operation, (i.e. volume adjust). These messages are described as follows:

Table 9-2: Display Messages

MESSAGE	NAME	DESCRIPTION
QUEUED	Call Queued	Indicates the system has placed the call in a request queue.
SYS BUSY	System Busy	Indicates the system is busy, no channels are currently available, the queue is full or an individual call is being attempted to a radio that is currently transmitting.
DENIED	Call Denied	Indicates the radio is not authorized to operate on the selected system.
CC SCAN	Control Channel Scan	Indicates the control channel is lost and the radio has entered the Control Channel Scan mode to search for the control channel.
WA SCAN	Wide Area Scan	Indicates the control channel is lost and the radio has entered the Wide Area Scan mode to search for a new system (if enabled through programming).
RXEMER	Receive Emergency	Indicates an emergency call is being received. This message will be flashing on line 2.
TXEMER	Transmit Emergency	Indicates an emergency call has been transmitted. This message will be flashing on line 2.
VOL=31	Volume Level	Indicates the current volume level. The volume level display ranges from OFF (silent) to 31 (loudest).
UNKNOWN	Caller's ID Not Received	Indicates that an individual call is being received, but the caller's ID was not received.
TX DATA	Transmit Data	Indicates the radio is transmitting a data call.
RX DATA	Receive Data	Indicates the radio is receiving a data call. Displayed on line 2.
DATA OFF	Data OFF	Indicates the radio is in the data disabled state. Displayed on line 1.
DATA ON	Data ON	Indicates the radio has been toggled to the data enable state. Displayed for two seconds on line 1 when toggled to enable state.
SYSC ON	System Scan Features ON	Indicates the System Scan features are enabled.
SYSC OFF	System Scan Features OFF	Indicates the System Scan features are disabled.
PA ON	Public Address ON	Indicates that the public address function of the radio is enabled.
PA OFF	Public Address OFF	Momentary (2 seconds) indicates that public address function of the radio was disabled.
ALRM ON	External Alarm Enabled	Indicates that the external alarm function of the radio is enabled.
ALRM OFF	External Alarm Disabled	Momentary (2 seconds) indicates that the external alarm function of the radio was disabled.
PVT DIS	Private Mode Disabled	Indicates that private mode is disabled or no encryption key has been programmed for the selected group/channel or special call.
FRCD PVT	Forced Private Operation	Indicates that forced private operation has been pre-programmed into radio.
NO KEY #	Encryption Key Missing	Flashing indicator indicates that no encryption key or an incorrect encryption key is programmed into the radio.
BCKL=1-6	Backlight	Indicates the display intensity and keypad backlight level.
GR	Group ID	Indicates that the call is a group call and is followed by the GID of the caller.
ID	Individual ID	Indicates the call is an individual call and the ID number of the caller, example "ID 2725."

MESSAGE	NAME	DESCRIPTION
WHC=1	Who Has Called	This display indicates the number from the <i>Who Has Called</i> list. Individual calls received but not responded to are stored in a <i>Who Has Called</i> list. This list is accessible by pressing the # key and then the INDV key after the Individual call has timed out or the Clear button is pressed. This display is on line 2 and the LID of the caller is displayed on the top line. Currently the list is not implemented and the display will always be WHC=1.
PHONE	Phone Call	Displayed when a phone call is received from the site. It is displayed in line 1 of the display. Line 2 of the display will contain the display *INDV* when line 1 contains this message. The radio interprets a received phone call as an individual call.
CONV FS	Conventional Failsoft	Displayed when a failure of the EDACS system occurs. All communication will be in conventional mode.
MENU		Displayed when the menu key is pressed and remains displayed in line 1 until a menu item is selected.
SYS=1-64	System = 1 - 64	The system number for the current base station of the system displayed in line 1. It is displayed in line 2 of the display. Press the system key to obtain this display.
GRP=1-64	Group = 1 - 64	The group number of the group displayed in line 2 of display. It is displayed in line 1 of the display. Press the group key to obtain this display. There are up to 48 groups available (i.e. 3 banks of 16). The maximum number of groups programmed in a radio is determined by the personality.
INDV=1-99	Individual = 1 - 99	Indicates which item in the individual call list is being displayed. It is displayed in line 2 of the display. The name or ID of the item in the list is displayed in line 1 of the display.
PHN=1-99	Phone = 1 - 99	Indicates which item in the phone list is being displayed. It is displayed in line 2 of the display. Line 1 of the display will be the last 3 characters of the list item contents.
SEL PHN	Select Phone	After pressing the PHN key, selecting an entry from the phone list by typing the entry number will display this message on Line 1.
SEL INDV	Select Individual ID	Displayed on line 1 when an entry from the individual ID list is selected after pressing the INDV key. The entry is a number between 1 and 32 inclusive.
SYS ALL	System All Call	Displayed on line 1 to indicate a system all-call has been received.
Ggg-v.vv	Code Group and Revision Number	This is code group and revision number that is displayed in line 2 when the menu item "REVISION" is selected. The 'gg' is the group number of the software. The first 'v' is the hardware version and 'vv' is the revision of the software.
PHONE	Phone Call	Displayed when an initiated phone call is in progress. This is displayed on line 2 of the display.
NO ENTRY		Indicates that there is no data stored in one of the programmable items in either the phone list or individual call list. The user programmable items are items 1 through 10 in each list.
INV SYS	Invalid System	Displayed when the current system is an invalid type.
CHN=1-99	Channel = 1 - 99	Displayed on line 1 of the display. This is a conventional channel index displayed when the group key is pressed.
FIX LIST	Fixed List	The Priority scan list is fixed and cannot be changed using the add or delete keys.
FIXED P1	Fixed Priority 1	The Priority 1 scan channel is fixed and cannot be changed using the add or delete keys.
(c) 2004		Displayed in line 2 when the message 'M/A-COM' is displayed in line 1 while displaying different items under the menu when "REVISION" is selected by the operator.
EM	Emergency	Indicates an emergency has been declared by the LID that follows the display, "EM." An example of this is "EM 01201."
INDV	Individual Call	Displayed in line 2 of the display when an individual call is in progress (trunked and T99 modes only).
GROUP	Group Call	Indicates a group call is in progress and is displayed on line 1 of the display (trunked and T99 modes only).
SPKR ON	External Speaker ON	Displayed when the external speaker is enabled.
SPKR OFF	External Speaker OFF	Displayed when the external speaker is disabled.

MESSAGE	NAME	DESCRIPTION
BANK=1-8		The bank of keys that are going to be loaded when the keyloader loads encryption keys. This is only valid for radios that support VGS, VGE, or DES encryption. It is displayed on line 2 of the display when the encryption keyloader is connected.
REGR_0x	Dynamic Regroup	Indicates which group in the dynamic regroup operation has been enabled, where "x" is a digit of 1 to 8.
KEY LOAD		Displayed on line 1 of the display when the encryption keyloader is connected.
KEY ZERO		Displayed on line 2 of the display when the reset and option buttons are pressed simultaneously for approximately two seconds. The encryption keys are zeroed.
SYS KEY	System Key	Displayed on line 1 of the display in the display key mode of the menu. It is followed in the second line with a key number "KEY = <1..7>".
GRP KEY	Group Key	Displayed on line 1 of the display in the display key mode of the menu for trunked systems only. It is followed in the second line with a key number "KEY = <1..7>."
KEY=1-7		Displayed on line 2 of the display in the display key mode of the menu for conventional systems when the "SYS KEY" or "CHN KEY" is displayed in line 1 and for trunked systems when the "SYS KEY" or "GRP KEY" is displayed in line 1.
PRIMARY		Displayed on line 1 of the display when the primary keys are enabled.
PRS NAME	Personality Name	Displayed on line 1 of the display under the revision selection of the menu. The personality name is displayed on line 2 at the same time.
M/A-COM		Displayed on line 1 of the display under the revision selection of the menu. The copyright year is shown in line 2 of display at the same time "(c) 2007."

9.3 ALERT TONES


The M7300 series mobile radio also provides audible alert tones or "beeps" to indicate the various operating conditions. These alert tones can be enabled or disabled through programming.


Table 9-3: Alert Tones

NAME	STONE	DESCRIPTION
Call Originate	A short mid-pitched tone.	Sounds after keying the radio (Push-To-Talk button is pressed). Indicates the radio has been assigned a working channel
Autokey	A mid-pitched tone.	After being placed in a queue or releasing the PTT button prior to a working channel assignment, the site calls the radio when a channel becomes available. At this point, the radio automatically keys the transmitter (autokey) for a short period to hold the channel. The radio sounds a mid-pitched tone when it is clear to talk. Immediately press the PTT button to keep the assigned channel.
Call Queued	A high-pitched tone.	Sounds after pressing the PTT button indicating the system has placed the call request in the queue. The receiving unit(s) also sound(s) the tones to indicate they will receive a call shortly.
System Busy	Three low-pitched beeps.	Sounds if the radio is keyed when the system is busy, if no channels are available for sending the message, if the call queue is full, or if an individual call is being attempted to a radio that is transmitting.
Call Denied	A low-pitched tone.	Indicates the radio is not authorized on the system that has been selected.

NAME	STONE	DESCRIPTION
Carrier Control Timer	Five short high-pitched warning tones followed by a long low-pitched tone.	Sounds if the programmed time for continuous transmission is exceeded. The transmitter will shut down shortly after the alert, interrupting communications. Release and re-key the PTT button to maintain communications. This will reset the carrier control timer and turn the transmitter back on.
Key Press Alert	A short tone.	Indicates a key has been pressed. A short low-pitched tone indicates no action was taken because the key is not active in the current mode.
Page (P25 T Only)	Three high-pitched tones.	In P25 trunked mode, if the receiving radio accepts a page, both the receiving and transmitting radios emit three high-pitched tones.
Out of Range	One low pitched.	Indicates the radio is in Wide Area Scan. Radio will periodically beep when in Wide Area Scan.

9.4 MENU

The menu function accesses features that are not available directly from the keypad. The order and specific number of menu items available is configurable through programming. Upon radio power up, the menu item at the beginning of the menu list will always be displayed first. Subsequent access to the menu function will return the last menu item that was shown in the display. To enter the menu mode, press **MENU**. The  ramp control, and **CLR** are used during the selection process. All of the selection mode rules previously detailed apply to the menu item selection process with the exception of direct access. The radio will continue to receive and transmit normally while in the menu function.


A new item is displayed by using the  ramp control to scroll through the list in increasing and decreasing order. The displayed menu item is made active by pressing **MENU**.

After entering the menu selection mode, the following generic display format will appear.

M E N U
Y Y Y Y Y Y Y Y

Line 1 indicates the radio is in the menu selection mode. Line 2 indicates the menu item (YYYYYYYY) that is to be viewed or changed (some menu items provide radio information and do not have changeable parameters).

An example of the menu item selection process and menu item parameter change is detailed below for the contrast menu item.

1. Press **MENU** to enter the menu mode.
2. Press the  ramp control until the display shows:

M E N U C O N T R A S T

3. Press **MENU**. The contrast menu item is activated and the display will be similar to the following:

CNTRST = X Y Y Y Y Y Y Y Y

Line 1 shows the active menu item and its current parameter setting (XXX). Line 2 shows the currently selected system or group name (YYYYYYYY).



4. The menu item's parameter setting shown in the display can now be changed by using the  ramp control to scroll through the list of parameter values. Once the desired setting is reached, press **MENU** to store the value and return to the normal display. For menu items that display radio information, use  to scroll through a list of informational displays. The menu items are listed in Table 9-4.

Table 9-4: Menu Item Information

FEATURE	DISPLAY	PARAMETER SETTINGS	COMMENT
Contrast Adjust	Menu Item: CONTRAST Once selected: CNTRST=	1, 2, 3, 4, 5, 6, 7, 8	Selects the Contrast level.
Radio Revision Information	Menu item: REVISION	Informational displays only (see radio); no user selectable settings.	Selects the information display to view.
Phone Call	Menu item: PHN CALL Once selected: See Telephone Interconnect Call Section		Allows access to the Phone Call Feature.
Individual Call	Menu Item: IND CALL Once Selected: See Individual Call Section		Allows access to the Individual Call Feature.
External Alarm	Menu Item: EXTALARM Once Selected: EXTALARM	ON, OFF	EXTALARM replaces the system name on the display as long as the external alarm feature is enabled.
Public Address	Menu item: PUB ADDR Once selected: PA ON or PA OFF	ON, OFF	Public Address is toggled ON and OFF.
External Speaker	Menu item: EXT SPKR Once selected: SPKR ON or SPKR OFF	ON, OFF	External Speaker is toggled ON and OFF.

FEATURE	DISPLAY	PARAMETER SETTINGS	COMMENT
Encryption Key Loading	Menu item: KEYLOAD Once selected: KEY LOAD BANK = N	Up to 8 banks of 7 keys	Enables the radio to accept the loading of encryption keys.
Display Current Encryption Key(s)	Menu item: DISP KEY Once selected: SYS KEY, GRP KEY or CHN KEY and KEY = N		Displays current encryption key number.
Scan	Menu item: SCAN	ON, OFF	Toggles scan function ON or OFF.
Private Mode	Menu Item: PRIVATE Once selected: PVT or key light.	ON, OFF	Toggles private function ON or OFF.
Scan Add	Menu item: SCAN ADD Once selected: Proper scan icon displayed.	S, 2 or 1	Adds group or channel to scan list.
Scan Delete	Menu item: SCAN DEL Once selected: Scan icon goes out.		Deletes group or channel from scan list.
Scan Add/Delete	Menu item: SCAN A/D When selected: Toggles through scan selections	Toggle sequence S, 2, 1, S, ...	Changes present group or channel to next scan choice in scan list.
Last Scanned Channel Recall	Menu Item: SCAN ADD Press twice when actively receiving; three times when not receiving. Scan icon displayed.		Changes the selected channel to the last scanned channel.
Home group or channel selection	Menu item: HOME Once selected: Home group or channel displayed.		Changes to the group or channel defined for Home function.
System select	Menu item: SYS SEL Once selected: SYS = n	1-64 = (n)umber of desired system	Displays the system selected.
External alarm #2	Menu item: EXTALRM2	ON, OFF	Toggles external alarm #2 feature ON or OFF.
System and group selection	Menu item: SYSGRP 1 Menu item: SYSGRP 2 Menu item: SYSGRP 3 Menu item: SYSGRP 4 Menu item: SYSGRP 5		Changes to the System & Group/Channel programmed for SYSGRP 1-5.
Mute	Menu item: MUTE	ON, OFF	Toggles the mute function ON or OFF to control the audio output from the selected radio.
Mute #1	Menu item: MUTE 1	ON, OFF	Toggles the mute 1 function ON or OFF on radio #1.
Mute #2	Menu item: MUTE 2	ON, OFF	Toggles the mute 2 function ON or OFF on radio #2.
Multiple radio operation	Menu item: RADIO	ON, OFF	Toggles the currently selected radio.
Radio selection	Menu item: RADIO 1	ON, OFF	Changes to radio #1.
	Menu item: RADIO 2	ON, OFF	Changes to radio #2.
No Data	Menu item: NO DATA	ON, OFF	Toggles data feature ON or OFF.
EDACS Conventional Priority 1 Scan	Menu item: ECP1SCAN	ON, OFF	Toggles this feature ON or OFF.
Group selection	Menu item: GRP SEL Once selected: GRP = n	1-64 = (n)umber of desired group	Displays the group selected.
Status Condition	Menu item: STATUS Once selected: ST =n	0-9 = (n)umber of pre-programmed status	Transmits the pre-programmed status message.
Message Condition	Menu item: MESSAGE Once selected: MSG =n	0-9 = (n)umber of pre-programmed messages	Transmits the pre-programmed message.
Feature Encryption Display	Menu Item: FEATURES Once selected: See Feature Encryption Display section	Informational displays only; no user selectable settings	Indicates current features program- med into the radio as well as certain information required to add features to the radio (refer to the Table of Contents for Feature Encryption Display).

FEATURE	DISPLAY	PARAMETER SETTINGS	COMMENT
System Scan Enable	Menu Item: SYS SCAN Once selected: SYSC ON or SYSC OFF	ON, OFF	System Scan features like ProScan are toggled ON and OFF.

9.5 RECEIVING A CALL

1. Turn the radio on by rotating the POWER ON-OFF/VOLUME knob clockwise (out of detent). A short alert signal (if enabled through programming) indicates the radio is ready to use.
2. The display shows the last selected or the power up (depending on programming) system and group names. If the radio is unable to obtain a control channel, line 2 shows **CC SCAN**.
3. Adjust the POWER ON-OFF/VOLUME knob to the desired volume level.
4. Select the desired system and group. The display indicates the current system and group names.
5. The radio is now ready to receive calls.
6. When the radio receives a group call, it unmutes on the assigned working channel and the **BSY** indicator comes on. Line 1 shows **GR** followed by the logical ID number (if received) of the unit sending the message, or the associated name if the ID number is found in the individual call list.

9.6 SENDING A CALL

1. Turn the radio on and set the POWER ON-OFF/VOLUME knob to the desired volume level. Select the desired system and group.
2. Press and hold the PTT button. The radio will display the system and group names and perform the necessary signaling required to obtain a communication channel.
3. When the working channel is assigned, **TX** and **BSY** indicators are turned ON and a short beep is sounded indicating communication can begin.



NOTE

If two or more tones, or a high-pitched tone is heard, the system may be busy and the call request has been placed in queue or the request has been denied for some reason. Refer to the Section 9.3 for more details.

4. Hold the microphone approximately three inches from the mouth and speak in a normal voice.
5. Release the PTT button when the transmission is complete and listen for a reply.

9.7 CONVENTIONAL FAILSOFT

In the unlikely event of a failure of the EDACS system, communications can take place in conventional failsoft mode. The radio will be automatically directed to a communications channel set up for this purpose. During this mode of operation, the control unit will display **CONV FS** in the alphanumeric display. An increase in activity on the channel during conventional failsoft operation may be noticed, so be careful not to transmit until the channel is clear.

Operation during conventional failsoft will be the same as operation on a conventional system, except that it will not be possible to select a communications channel, or use emergency and special call. When trunking is restored, the radio will automatically be returned to normal operation.



NOTE

Emergency and Special Call are not operational during conventional failsoft. In addition, the **GRP** control will not operate.

9.8 EMERGENCY OPERATION

The radio's ability to declare an emergency, clear an emergency, remain locked on an emergency and group, and the emergency audio and display freeze can each be enabled or disabled through programming. When an emergency is declared scanning will stop and will restart only after the emergency has been cleared.

9.8.1 Receiving an Emergency Call

When receiving an emergency call from the selected group and system, an alert beep is heard and the **BSY** indicator lights. The message ***RXEMER*** flashes in the display on line 2 until the emergency condition is cleared. Follow standard emergency procedures.

9.8.2 Declaring an Emergency

To send an emergency call to the selected system and group (or on an optionally pre-programmed emergency group), proceed as follows:

1. Press and hold the red emergency button for approximately one second. (This time is programmable and therefore could be longer or shorter. Check with the system administrator.) The radio will transmit an emergency call request with the radio ID until an emergency channel assignment is received.
2. When the working channel assignment is received, the radio sounds a single beep (Autokey alert tone) indicating it is ready for voice transmission. ***TXEMER*** flashes on line 2 in the display until the emergency is cleared.
3. Press PTT and speak into the microphone in a normal voice.
4. Release PTT when the transmission is complete and listen for a reply.
5. The emergency can be cleared by pressing and holding the **CLR** button followed by pressing the red emergency button then releasing both buttons.

9.9 SYSTEM SCAN OPERATION

The radio can be programmed with the following System Scan features. These features are automatically enabled upon radio power up. A key or menu option is also defined to allow the System Scan features to be toggled during radio operation. This is covered in the Menu Selection and Pre-Programmed Keypad Key sections. The System Scan state will be maintained through system changes but will default to ON at power up.

9.9.1 Wide Area System Scan

The M7300 Series mobile radio can be programmed for wide area system scan operation for multi-site applications. Upon the loss of the currently selected system's control channel, radios can be programmed to automatically scan the control channels of other systems. If a new control channel is found, the radio will switch to the new system and sound an alert tone.

9.9.2 ProScan

The radio can be programmed for ProScan™ system scan operation for multi-site applications depending on the version of radio flash code. ProScan provides the radio with the ability to select a new system for the radio to communicate on, when the selected system drops below a predefined level. This is accomplished by enabling each radio to analyze the signal quality of its current control channel and compare it with the signal quality of the control channel for each site in its adjacency scan list. (The signal quality metric used for the ProScan algorithm is based on a combination of both Received Signal Strength Indicator [RSSI] and Control Channel Verification [CCV] measurements.) When the selected system's signal quality level degrades below a pre-programmed level, the radio will begin to look for a better control channel. Once a control channel that exceeds the pre-programmed parameters is found, the radio will change to the new system and emit a tone. If the control channel is completely lost the radio, will enter Wide Area System Scanning and search the programmed adjacent systems until a suitable control channel is found.

9.9.3 Priority System Scan

The radio can also be programmed for Priority System Scan. (To ensure that this feature operates correctly, the control channel of the priority system must be located on channel one unless you are using the ProScan algorithm.) The priority system is the desired or preferred system. While receiving the control channel of the selected system, the radio will periodically leave the selected system and search for the control channel of the priority system at a programmable rate. The programmable rate is defined by the value in the Priority Scan Time control, (unless the ProSound/ProScan algorithm is enabled as explained below). This priority scan timer is reset each time the PTT button is pressed or when a call is received. If the priority system control channel is found, or meets the predefined ProScan criteria, the radio will automatically switch to the priority system.


9.9.4 When Wide Area System Scan Is Enabled

If the radio cannot find the control channel of the selected system and begins Wide Area System Scan (WA Scan), the radio will only scan for the priority system control channel if the priority system is in the WA Scan list.

9.9.5 When ProScan Is Enabled

The radio monitors the priority system and will switch to the priority system if the priority system meets the criteria defined in the "ProSound/ProScan Options" dialog box. If ProScan is enabled, the rate at which the radio will scan for the priority system is defined by the System Sample Time control.

9.9.6 Menu Selection

Press **MENU** and then use the  ramp control to scroll through the selections until **SYS SCAN** is displayed. Then press **MENU** to toggle the System Scan state. The **SYSC ON** or **SYSC OFF** display message is displayed for two seconds to show the new state.

9.9.7 Pre-Programmed Keypad Key

Press the pre-programmed key and the **SYSC ON** or **SYSC OFF** display message is displayed for two seconds to show the new state.

9.10 GROUP SCAN OPERATION

Only Groups that are part of the radio's scan list will be scanned. Groups are added to the scan list on a per system basis through programming, the radio keypad, or both, dependent upon programming. This scan list can be changed by the user from the keypad unless programmed otherwise. Each system's group scan list is retained in memory when the radio is turned off. The M7300 Series mobile radio can also be programmed to provide Trunked Priority Group Scan capability, which operates similar to priority scan in Conventional mode.

The following is a description of programmable scan features that should be helpful in understanding the Group Scan Operation of the radio:

Scan Hang Time - the delay time the radio waits before resuming scan after the push-to-talk is released or after the carrier has dropped a channel.

TX Select - the group the radio will transmit on while scanning. The radio is programmed to transmit on either the scanned group or the selected group.








Scan List (privileges) - this feature allows or prohibits scan list changes by the user.

PI Programming - priority group programming is accomplished by one (and only one) of three methods:

- From the keypad, where the Priority programming is not fixed and does not follow the selected channel,
- Priority 1 group programming follows the selected channel, or
- Priority 1 group programming is fixed during PC programming and cannot be changed by the user.






PI Always Scan - determines if the Priority 1 Group will always be scanned, regardless of the scan state set by the user.

9.10.1 Adding Groups to a Scan List


1. With scan operation turned off, select the desired group to add to the selected Trunked system group scan list.
2. Press (+) or (-) with  to display the current priority status of the group on line 1 for a time-out period.
3. While the status is displayed, press (+) with  to add the group to the scan list.  is displayed.
4. Press (+) with  a second time to set the group to Priority 2.  is displayed.
5. Press (+) with  a third time to set the group to Priority 1.  is displayed in column 1, line 1. The priority level selection sequence only advances the group to next higher priority level and stops at priority level 1. To select a lower priority level, the group must be deleted from the scan list and then added back to the scan list. Each new group added to the scan list starts at the lowest priority. If the Priority 1 and Priority 2 groups are already set and a new group is assigned as Priority 1 or Priority 2, the previously assigned group will change to non-priority scanning.

9.10.2 Deleting Groups from a Scan List

1. With scan operation turned off, select the desired group to delete from the selected trunked system's group scan list.

2. Press (+) or (-) with . The current scan status of the group is displayed for a time-out period.
3. Press (-) with  to delete the group from the scan list. ,  or  turns off. Any group that is not in a trunked system group scan list will show a “**blank**” when it is the selected channel.

9.10.3 Nuisance Delete

A group can also be deleted from the scan list, if it is not the currently selected group by pressing (-) with  during scan operation while the radio is displaying the unwanted group. The group will be deleted from the system's group scan list in the same manner as if done using the steps above. Deletions performed in this manner will not remain deleted if the radio is turned off and then back on.


9.10.4 Turning Scan On

1. Toggle scan operation by pressing **SCAN**. The SCAN indicator turns on when the radio is scanning.



NOTE

The **SCAN** key light blinks when temporarily disabled. Scanning will stop while microphone is off-hook if the hookswitch feature is enabled through programming.

2. When a group on the scan list receives a channel assignment, the radio unmutes on the assigned channel, the **BSY** indicator comes on and the received scan group is displayed.
 - The radio will continue scanning if a new group is selected when scan is on.
 - Pressing the PTT button when scan is on will cause the radio to transmit on the displayed group or on the currently selected group depending on programming.
 - Pressing up with  when scan is on will cause the radio to recall the scanned group that was last received. This group is recalled for a period equal to the scan hang time.

9.10.5 Priority Group Scanning

When scan is enabled and the Priority 1 and Priority 2 groups have been identified, the radio will listen to calls on those groups and the selected group. While receiving a scanned group call, the radio will continue to monitor the selected Priority 1 and Priority 2 groups and will drop the call if the selected group or other higher priority call becomes active. During a Priority 2 call the radio will continue to monitor for a Priority 1 group call.

The radio will monitor for Agency and Fleet calls that correspond to the Agency and Fleet associated with the Priority 1 and Priority 2 groups. Priority Agency and Fleet calls will be indicated by displaying **AGENCY** or **FLEET** on the System line of the display and associated Priority 1 or 2 group on the Group line of the display.

9.10.6 Turning Scan Off

Toggle scan operation off by pressing **SCAN**. The radio will resume operation on the selected group.

9.11 INDIVIDUAL CALLS

9.11.1 Receiving and Responding to an Individual Call

When the radio receives an individual call (a call directed only to the user's radio), it unmutes on the assigned working channel and turns on the **BSY** indicator. Line 1 shows "ID" followed by the logical ID number of the radio sending the message, or the associated name if the ID number is found in the individual call list. The individual call indicator will display ***INDV*** on line 2. The radio can be programmed to ring when an individual call is received. If enabled, the ring begins five seconds after the caller unkeys and will continue until the PTT button, the **CLR** button, or **IND** is pressed.



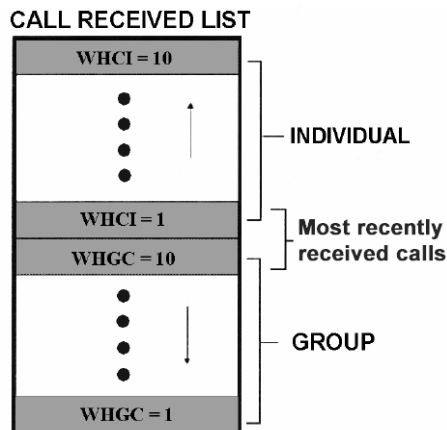
NOTE


Hookswitch functions the same as **CLR** key in I-CALL, phone call, and menu modes.

If a response is made to the call prior to the programmed call-back time-out, the call will automatically be directed to the originating unit. If a response is not made before the call-back time-out, the radio will return to normal receive mode, but *** WHC *** will be displayed. If the caller's ID is not received, **UNKNOWN** will display for the duration of the call and there will be no call-back hang time.

To respond after the call-back time-out, press the **IND** key. The radio's display will show the callers ID on the first line and **WHCI=1** on the second line. Pressing the PTT button at this point will initiate an individual call back to the original caller. (If the last call was a group call, the display will show **WHCG=1**. Pressing the PTT button will place the call as an individual call.)

The radio stores the IDs of the last 10 callers in the Calls Received List as shown. Individual calls are stored in the top half of the list (1-10) and group calls are stored in the bottom half of the list (1-10). The most recent call is stored in position 1, the second most recent call is stored in position 2, etc.

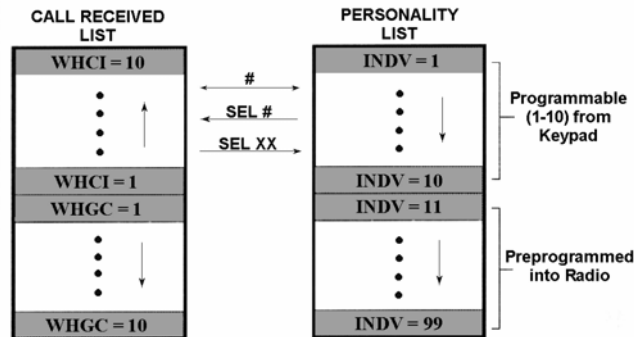


To access the list, press the **IND** key twice. Use  to scroll through the list. Press the **MENU** key to display the time elapsed since the call was received.

9.11.2 Call Storage Lists

There are two lists available for call storage in the radio, the calls received list (1-10) and the personality list (1-99 as defined by the user). When the individual call mode is entered by pressing **IND**, the calls received list is available. The user can toggle to the personality list by selecting any key other than **DIS** or

toggle between the two lists by pressing the **IND** key. If wrap is enabled, the calls received list wraps on itself and not into the other list.




The saved call list shows all ten storage locations. If no calls have been received, the saved call list will be empty and the pre-stored list will be available upon entering the individual call mode.

When in the saved call list, pressing **MENU** toggles the time stamp ON and OFF. The time stamp indicates how long ago the call was received. The display indicates this information as HH:MM:SS where HH = hours, MM = minutes and SS = seconds.

When in the pre-stored list, pressing **MENU** toggles the Logical **ID**entification (LID) ON and OFF.

9.11.3 Sending an Individual Call

The following procedures describe how to initiate and complete an individual call.

1. To select a previously stored individual, select the I-Call mode from the menu or press **IND** followed by the  ramp control to scroll through the list of stored individuals. The selection mode rules apply. While in the individual call list, the menu key will toggle the display between the call name and the unit ID number. If the individual is not stored in this list but the individual's unit ID is known, it can be entered directly from the keypad.
2. Press the PTT button; the radio performs the necessary signaling to obtain a communication channel. When the signaling is complete and the radio is clear to transmit, **TX** indicator turns ON and the channel access tone sounds. Line 1 shows the called individual's name if found in the list of stored individuals or ID followed by the logical ID number of the unit being called. The message ***INDV*** displays on line 2. Proceed with the message.

9.12 SCAT OPERATION

A SCAT™ (Single Channel Autonomous Trunking) System operates with the same set of features as a standard EDACS system. The only significant user change relates to the **BSY** indicator. Since only one channel, operating as both control and working channel, exists in a SCAT System, the **BSY** indicator will be ON when the SCAT channel is in the working channel mode. When the transmission on the channel is completed, the indicator turns OFF and indicates the return of SCAT control channel signaling.


9.13 TELEPHONE INTERCONNECT CALLS

9.13.1 Receiving a Telephone Interconnect Call (Trunked Mode Only)

Receiving a telephone interconnect call is identical to receiving an individual call. See the DTMF Overdial Operation section if access to services requiring "over-dial" is needed. Overdial operations are available for any special call whether it is an individual call or a telephone interconnect call.

9.13.2 Sending a Telephone Interconnect Call (Trunked Mode Only)

Use the following procedures to initiate and complete a Telephone Interconnect call:

1. To select a previously stored phone number, select phone call mode from the menu, press **PHN** and use the  ramp control to scroll through the list of stored phone numbers. The selection mode rules apply. While in the phone call list, the **MENU** key will toggle the display between the phone call name and the phone call number. If the phone number is not stored in this list but the phone number is known, it can be entered directly from the keypad. If necessary, a pause can be entered by pressing and holding **0-9**, *****, or **#** until an underscore appears in the display.
2. Press and release the PTT button; the radio performs the necessary signaling to obtain a communication channel. When the signaling is complete and the radio is clear to transmit, **TX** indicator turns on and the channel access tone sounds. Line 1 shows the accompanying name if selected from the list of stored numbers or the phone number if entered directly. The message ***PHONE*** is displayed on line 2. The radio then automatically transmits the programmed number stored in the special call queue.
3. Telephone ringing will be heard. When someone answers the phone, press the PTT button and speak into the microphone. Release the PTT button to listen to the caller. Unsuccessful interconnect signaling returns the radio to the normal receive mode and the number remains displayed until the special call is cleared by pressing the **CLR** button or the time-out expires or another group or system is selected.
4. To terminate the call, momentarily press the **CLR** button.



NOTE

The M7300 Series mobile radio is capable of half-duplex conversation only. The caller's message can only be sent if the PTT button is pressed (the radio is transmitting) and the caller can only be heard by the person being called when the PTT is released (the radio is receiving).

9.13.3 DTMF Overdial/Conventional Mode Telephone Interconnect

Once the radio has established a connection to the public telephone system, it may be necessary to "over-dial" more digits to access banking services, answering machines, credit card calls or other types of systems that require DTMF (Dual-Tone Multi-Frequency) access digits. Overdial operation can also be used to initiate a telephone interconnect call via DTMF signaling if a dial tone has already been accessed on the system. This is the method that is used for making a telephone interconnect call while operating in the conventional mode but will also function in trunked mode if a dial tone is directly accessible. Telephone numbers and other number sequences for overdialing can be stored in the phone list when programming the radio or stored by the operator in the first ten phone list entries. These numbers are accessed by pressing **PHN** then following the selection mode rules.

The following steps are required to dial these numbers:

1. Follow the procedure in **Sending a Telephone Interconnect Call (Trunked Mode Only)** to establish a connection to the telephone system or consult the system administrator for the procedure to access a dial tone on the trunked or conventional system.
2. Overdial numbers are transmitted using either method as follows:

METHOD 1: Press and hold **PTT** while entering the overdial number sequence from the keypad. This method sends DTMF tones during individual, telephone interconnect, trunked group, or conventional channel calls. Anytime the **PTT** button is pressed and held, the keypad is enabled for DTMF entry.


METHOD 2: Press **PHN** to enter the overdial select/entry mode and follow the selection mode rules to call up a stored number from the phone list or to directly enter the overdial digits. Press **PTT** to send the overdial sequence once. If the number needs to be transmitted again it must be selected or entered again (this prevents unwanted numbers from being sent the next time the **PTT** button is pressed during the call).

This overdial select/entry mode remains active until the call is dropped, cleared, or **MENU** is pressed. The overdial select/entry mode can be re-entered if the call is still active by pressing **PHN**.

9.13.4 Programmable Entries

Individual call ID numbers, telephone numbers and other number sequences for overdialing are stored in the special call lists when programming the radio. The first ten entry locations of these lists can be changed by the radio operator. The keypad is used when adding, changing and storing numbers in these entry locations.

Use the following procedure to store a number in one of the first ten entries of a special call list:

1. Press **IND** or **PHN** to enter the individual call list or the phone call list. The selection mode rules apply.
2. Scroll through the list using the  ramp control until one of the first ten entries is reached. **NO ENTRY** is displayed if the location is empty.
3. Enter the desired number. If necessary, a pause can be entered by pressing and holding **0-9**, **(*)**, or **(#)** until an underscore appears in the display. The individual call list entries will accept up to 5 digits. The phone call list entries accept a combination of up to 31 digits and pauses.
4. Press and hold **MENU** until the display changes indicating that the number has been stored.
5. Repeat the steps above if the number stored in an entry location needs to be changed.

9.14 MOBILE DATA

The M7300 Series mobile radios, when operating in the EDACS configuration, permit either voice or data calls to be transmitted or received. The radio can handle only one type of call at a time; however, selection of either data or voice is selected transparently by the operator through normal usage of the radio. Data communications is not supported in the conventional mode.

The mobile radios can be connected to Mobile Data Terminals (MDT) or to a host computer. Any RS-232 compatible device that supports the Radio Data Interface (RDI) protocol (Version 1.91 or greater) can be connected to the mobile radio. Support for MDTs or host computers is a programmable option per radio. Additionally, radios programmed for host computers can also be programmed for data only operation (no voice calls transmitted or received).



NOTE

Turn power to the radio OFF before connecting or disconnecting any cables, including the data cable. Also, turn power to the radio OFF when docking or undocking a connected laptop computer. Failure to turn the power OFF can damage the radio, requiring service by a M/A-COM approved service center.

9.14.1 Displays

The following will be displayed on the control unit during the various states of data mode of operation.

- TX DATA** Displayed on bottom line of display when the radio is transmitting a data call.
- RX DATA** Displayed on bottom line of display when the radio is receiving a data call.
- DATA OFF** Displayed on top line of display when the radio is in the data disabled state.
- DATA ON** Displayed for two seconds on top line of display when the radio is toggled to the data enabled state.

9.14.2 DATA OFF Operation

The radio can be placed in the data disable state by any of the following methods. When the data state is disabled, the control unit displays "**DATA OFF**" on the top line. An ongoing data call is allowed to complete except when an emergency is declared.

- Removing the microphone from the hookswitch (hookswitch option must be enabled by pre-programming).
- Declaring an emergency (not to be used unless an actual emergency condition exists). Alert tone will sound.
- Pressing the **OPT** button (System Model) or **OPTION** (Scan Model) (pre-programmed). Alert tone will sound.
- Selecting the function using the **MENU** button (pre-programmed).

9.14.3 DATA ON Operation

The data state is enabled by one of the following (depending on how it was disabled). "**DATA ON**" will be displayed top line of display for 2 seconds then the display returns to normal.

- Replacing the microphone into the hookswitch (going on-hook). Only valid if the "**DATA OFF**" operation was entered by removing the microphone from the hookswitch (going off-hook).
- Clearing an emergency, but valid only if an emergency caused "**DATA OFF**" operation.

9.14.4 Exiting Data Calls

Under normal conditions, the radio enters the scan lockout mode and returns to the control channel after completion of a data call (transmit or receive). If, during a data call, one of the following conditions occurs, the data call is immediately terminated and the radio performs the desired function:

- The PTT is activated.
- The PTT is in Public Address mode.
- An emergency is declared by pressing the pre-programmed emergency button.
- A group or system change is made.

9.14.5 Scan Lockout Mode

Following the transmission or reception of a data call, if scan is enabled, scanning will stop temporarily (duration pre-programmed). During this time the scan LED will flash to indicate that scan is enabled but temporarily suspended. This mode is normally exited when the pre-programmed time expires; however, the following actions will terminate the scan lockout mode before the timeout is completed.

- The **CLR** (System Model) or **CLEAR** (Scan Model) button is pressed.
- The PTT is pressed.
- A group or system change is made.
- Enter phone call mode.
- Enter individual call mode.
- A new emergency assignment has been received.
- The PTT is pressed in Public Address Mode.
- An emergency is declared or cleared.
- Microphone is removed from hookswitch (OFF-hook).
- Receiving an individual or phone call.
- Receiving an Agency, Fleet or System All Call.
- Pressing the **SCAN** button to turn scan ON or OFF.

9.14.6 Data Lockout Mode

The data lockout mode is a pre-programmed mode when the radio will not respond to any data channel assignments and prevents receive data calls from interrupting voice calls. Transmit data calls will still be initiated when needed by the operator. After a pre-programmed time, the radio will respond to receive data calls; however, the following conditions will clear the data lockout mode:

- The **CLR** (System Model) or **CLEAR** (Scan Model) button is pressed.
- Transmitting a data call.
- Changing a system.
- An emergency is declared.
- Pressing the PTT while in Public Address mode.
- Turning scan ON with the SCAN button.

9.15 STATUS/MESSAGE OPERATION

Status and message operation is possible with either the Scan or System version of the M7300 Series mobile radio unit. The following procedure is applicable for the System version. For operation with the Scan version, the four primary keycaps must be reconfigured and pre-programmed for status/message operation.

9.15.1 Status Operation

Status operation permits the transmission of a pre-programmed status condition to the EDACS site.

To send a status condition, press the **STS** button (keylight comes on) then press one of the number buttons (**0-9**) to select the pre-programmed status. If no status has been programmed for the selected number button, the radio will display **NO ENTRY** and the radio will sound a low tone. A valid selection will permit the status text to appear in the display for a pre-programmed time. After the time-out expires or the **MENU** button has been pressed (the **MENU** button will override the time-out period), the status is selected and will be transmitted to the site or stored in the radio memory where it can be polled by the site at a future time. If the site receives the status properly, when transmitted or polled by the site, a high-pitched tone sounds and the keylight associated with that status will remain lit. If the site does not receive the status properly, a low-pitched tone sounds and the keylight associated with the status will blink.

If an incorrect status was selected or the incorrect number button was pressed, the status can be changed during the pre-programmed time-out period by pressing another number button. The status selection can also be cancelled by pressing the **CLR** button prior to the time-out period.

To view the currently selected status after it has been transmitted, press the **STS** button. If the status was not sent successfully to the site, the text associated with the status will flash in the display.

The radio can also be pre-programmed to redesignate the keypad buttons for **ST0** thru **ST9** to send status condition. In this configuration the radio status operation will operate as previously described except the **STS** button is not required. The keylight associated with **ST0** thru **ST9** will indicate which status is selected.

9.15.2 Message Operation

Message operation permits the transmission of a pre-programmed message text to an EDACS site.

To send a message, press the **MSG** button (keylight comes on) then press one of the number buttons (**0-9**) to select the pre-programmed message text. If no message text has been programmed for the selected number button, the radio will display **NO ENTRY** and a low-pitched tone sounds. A valid selection will permit the message text to appear in the display for a pre-programmed time. After the time-out expires or the **MENU** button has been pressed (the **MENU** button will override the time-out period), the message text is selected and will be transmitted to the site. If the site receives the message properly when transmitted, a high pitched tone sounds and the **MSG** keylight remains lit. If the site does not receive the message properly, a low-pitched tone sounds and the **MSG** keylight will blink.

If an incorrect message text was selected or the incorrect number button was pressed, the message text can be changed during the pre-programmed time-out period by pressing another number button. The message text selection can also be cancelled by pressing the **CLR** button prior to the time-out period.

To view the currently selected message text after it has been transmitted, press the **MSG** button and then the **CLR** button prior to the time-out period. If the message text was not sent successfully to the site, the text associated with the message will flash in the display.

9.16 EDACS CONVENTIONAL P1 SCAN

This feature permits the radio user to scan a pre-programmed conventional system and channel as a Priority 1 (P1) channel while the radio is selected for EDACS trunked system. If activity is detected on the conventional P1 channel, the radio will unmute and remain on this conventional channel for the programmable hang time.

The radio must be pre-programmed to designate a button for scan ON/OFF operation.

9.17 DYNAMIC REGROUP OPERATION

Dynamic regroup operation permits multiple talk groups (up to eight) to be added to a radio via the Communications Systems Director (CSD). The radio must be pre-programmed to respond to regrouping. Dynamic regrouping will not be activated in a radio until an activation message is sent by the system manager. Each radio that receives and acknowledges regrouping instructions is successfully regrouped.

Pressing and holding the **CLEAR** (Scan Model) or **CLR** (System Model) button for 2.5 seconds toggles the user into and out of the dynamic regroup group set. A double beep will sound for entry or exit. The display will indicate **REGR_0x** where "x" is a digit of 1 to 8 indicating the group when dynamic regroup has been enabled by the user. If the radio is in dynamic regroup and the user selects a group that has not been regrouped, the display will show **NO ENTRY**. The radio will be prevented from transmitting and receiving calls in this condition except for scanned groups.


9.17.1 Emergency Operation

If the pre-programmed group set on the currently selected system contains an EMER/HOME group and the radio is in dynamic regroup, the radio will exit dynamic regroup and declare the emergency on the HOME group. If no EMER/HOME group is present, the radio will declare the emergency on the currently selected dynamic regroup group.

9.18 PAGE (P25 TRUNKED ONLY)

Page sends a PING message to a radio and functions similar to Individual Call.

The following procedures describe how to initiate and complete a Page.

1. To select a previously stored individual, select the Page mode from the menu followed by the  ramp control to scroll through the list of stored individuals. The selection mode rules apply. While in the individual call list, the menu key toggles the display between the call name and the unit ID number. On System model radios, the individual's unit ID can also be entered directly from the keypad.
2. Press the PTT button; the radio performs the necessary signaling on the control channel. On the calling radio, line 1 shows the called individual's name if found in the list of stored individuals or ID followed by the logical ID number of the unit being called. If the receiving radio receives the Page and responds, both radios will emit three high-pitched tones. The receiving radio will also display PAGE and the ID of the calling radio.

10 CONVENTIONAL OPERATION

10.1 RADIO STATUS ICONS

Status icons are indicators that show the various operating characteristics of the radio. The icons appear on the first line of the display.



Figure 10-1: Typical Display

Table 10-1: Icons and Descriptions

ICON	DESCRIPTION
	Indicates selected group or channel is in scan list.
	Indicates selected group or channel is programmed as Priority 1 in scan list.
	Indicates selected group or channel is programmed as Priority 2 in scan list.
	Indicates a conventional channel enabled with Channel Guard Function.
	Indicates the current channel is set up as an analog channel.
	Volume bars – indicates relative volume level.
	Scan mode enabled.

10.2 MESSAGES

During radio operation, various messages are displayed on either line 1 or line 2. Typical messages include control channel status information, such as system busy or call denied, or messages associated with the radio's operation, (i.e. volume adjust). These messages are described as follows:

Table 10-2: Display Messages

MESSAGE	NAME	DESCRIPTION
TALKARND	Talk-around	Indicates the radio is operating on conventional channels in talk-around mode (no repeater).
VOL=31	Volume Level	Indicates the current volume level. The volume level display ranges from OFF (silent) to 31 (loudest).
UNKNOWN	Caller's ID Not Received	Indicates that an individual call is being received, but the caller's ID was not received.

MESSAGE	NAME	DESCRIPTION
T99 ON	Type 99 Decode ON	Indicates the Type 99 Decode feature is enabled.
T99 OFF	Type 99 Decode OFF	Indicates the Type 99 Decode feature is disabled.
PA ON	Public Address ON	Indicates that the public address function of the radio is enabled.
PA OFF	Public Address OFF	Momentary (2 seconds) indicates that public address function of the radio was disabled.
ALRM ON	External Alarm Enabled	Indicates that the external alarm function of the radio is enabled.
ALRM OFF	External Alarm Disabled	Momentary (2 seconds) indicates that the external alarm function of the radio was disabled.
NO KEY #	Encryption Key Missing	Flashing indicator indicates that no encryption key or an incorrect encryption key is programmed into the radio.
BCKL=1-6	Backlight	Indicates the display intensity and keypad backlight level.
GR	Group ID	Indicates that the call is a group call and is followed by the GID of the caller.
MENU		Displayed when the menu key is pressed and remains displayed in line 1 until a menu item is selected.
SYS=1-64	System = 1 - 64	The system number for the current base station of the system displayed in line 1. It is displayed in line 2 of the display. Press the system key to obtain this display.
SEL PHN	Select Phone	After pressing the PHN key, selecting an entry from the phone list by typing the entry number will display this message on Line 1.
Ggg-v.vv	Code Group and Revision Number	This is code group and revision number that is displayed in line 2 when the menu item "REVISION" is selected. The 'gg' is the group number of the software. The first 'v' is the hardware version and 'vv' is the revision of the software.
NO ENTRY		Indicates that there is no data stored in one of the programmable items in either the phone list or individual call list. The user programmable items are items 1 through 10 in each list.
INV SYS	Invalid System	Displayed when the current system is an invalid type.
CHN=1-99	Channel = 1 - 99	Displayed on line 1 of the display. This is a conventional channel index displayed when the group key is pressed.
FIX LIST	Fixed List	The Priority scan list is fixed and cannot be changed using the add or delete keys.
FIXED P1	Fixed Priority 1	The Priority 1 scan channel is fixed and cannot be changed using the add or delete keys.
(c) 2004		Displayed in line 2 when the message 'M/A-COM' is displayed in line 1 while displaying different items under the menu when "REVISION" is selected by the operator.
EM	Emergency	Indicates an emergency has been declared by the LID that follows the display, "EM." An example of this is "EM 01201."
INDV	Individual Call	Displayed in line 2 of the display when an individual call is in progress (trunked and T99 modes only).
GROUP	Group Call	Indicates a group call is in progress and is displayed on line 1 of the display (trunked and T99 modes only).
SPKR ON	External Speaker ON	Displayed when the external speaker is enabled.
SPKR OFF	External Speaker OFF	Displayed when the external speaker is disabled.
BANK=1-8		The bank of keys that are going to be loaded when the keyloader loads encryption keys. This is only valid for radios that support VGS, VGE, or DES encryption. It is displayed on line 2 of the display when the encryption keyloader is connected.
KEY LOAD		Displayed on line 1 of the display when the encryption keyloader is connected.
KEY ZERO		Displayed on line 2 of the display when the reset and option buttons are pressed simultaneously for approximately two seconds. The encryption keys are zeroed.
SYS KEY	System Key	Displayed on line 1 of the display in the display key mode of the menu. It is followed in the second line with a key number "KEY = <1..7>".
KEY=1-7		Displayed on line 2 of the display in the display key mode of the menu for conventional systems when the "SYS KEY" or "CHN KEY" is displayed in line 1 and for trunked systems when the "SYS KEY" or "GRP KEY" is displayed in line 1.
PRIMARY		Displayed on line 1 of the display when the primary keys are enabled.
PRS NAME	Personality Name	Displayed on line 1 of the display under the revision selection of the menu. The personality name is displayed on line 2 at the same time.

MESSAGE	NAME	DESCRIPTION
M/A-COM		Displayed on line 1 of the display under the revision selection of the menu. The copyright year is shown in line 2 of display at the same time "(c) 2007."


10.3 ALERT TONES


The M7300 series mobile radio also provides audible alert tones or “beeps” to indicate the various operating conditions. These alert tones can be enabled or disabled through programming.

Table 10-3: M7300 EDACS Mode Alert Tones

NAME	TO NE	DESCRIPTION
Call Originate	A short mid-pitched tone.	Sounds after keying the radio (Push-To-Talk button is pressed). Indicates the radio has been assigned a working channel
Carrier Control Timer	Five short high-pitched warning tones followed by a long low-pitched tone.	Sounds if the programmed time for continuous transmission is exceeded. The transmitter will shut down shortly after the alert, interrupting communications. Release and re-key the PTT button to maintain communications. This will reset the carrier control timer and turn the transmitter back on.
Key Press Alert	A short tone.	Indicates a key has been pressed. A short low-pitched tone indicates no action was taken because the key is not active in the current mode.

10.4 MENU

The menu function accesses features that are not available directly from the keypad. The order and specific number of menu items available is configurable through programming. Upon radio power up, the menu item at the beginning of the menu list will always be displayed first. Subsequent access to the menu function will return the last menu item that was shown in the display. To enter the menu mode, press **MENU**. The  ramp control, **MENU**, and **CLR** are used during the selection process. All of the selection mode rules previously detailed apply to the menu item selection process with the exception of direct access. The radio will continue to receive and transmit normally while in the menu function.


A new item is displayed by using the  ramp control to scroll through the list in increasing and decreasing order. The displayed menu item is made active by pressing **MENU**.

After entering the menu selection mode, the following generic display format will appear.

M E N U
Y Y Y Y Y Y Y Y

Line 1 indicates the radio is in the menu selection mode. Line 2 indicates the menu item (YYYYYYYY) that is to be viewed or changed (some menu items provide radio information and do not have changeable parameters).

An example of the menu item selection process and menu item parameter change is detailed below for the contrast menu item.

1. Press **MENU** to enter the menu mode.
2. Press the  ramp control until the display shows:

M E N U
C O N T R A S T

3. Press **MENU**. The contrast menu item is activated and the display will be similar to the following:

C N T R S T = X
Y Y Y Y Y Y Y Y

Line 1 shows the active menu item and its current parameter setting (XXX). Line 2 shows the currently selected system or group name (YYYYYYYY).



4. The menu item's parameter setting shown in the display can now be changed by using the  ramp control to scroll through the list of parameter values. Once the desired setting is reached, press **MENU** to store the value and return to the normal display. For menu items that display radio information, use  to scroll through a list of informational displays. The menu items are listed in Table 9-4.

Table 10-4: Menu Item Information

FEATURE	DISPLAY	PARAMETER SETTINGS	COMMENT
Contrast Adjust	Menu Item: CONTRAST Once selected: CNTRST=	1, 2, 3, 4, 5, 6, 7, 8	Selects the Contrast level.
Radio Revision Information	Menu item: REVISION	Informational displays only (see radio); no user selectable settings.	Selects the information display to view.
Phone Call	Menu item: PHN CALL Once selected: See Telephone Interconnect Call Section		Allows access to the Phone Call Feature.
External Alarm	Menu Item: EXTALARM Once Selected: EXTALARM	ON, OFF	EXTALARM replaces the system name on the display as long as the external alarm feature is enabled.
Public Address	Menu item: PUB ADDR Once selected: PA ON or PA OFF	ON, OFF	Public Address is toggled ON and OFF.
External Speaker	Menu item: EXT SPKR Once selected: SPKR ON or SPKR OFF	ON, OFF	External Speaker is toggled ON and OFF.
Encryption Key Loading	Menu item: KEYLOAD Once selected: KEY LOAD BANK = N	Up to 8 banks of 7 keys	Enables the radio to accept the loading of encryption keys.
Display Current Encryption Key(s)	Menu item: DISP KEY Once selected: SYS KEY, GRP KEY or CHN KEY and KEY = N		Displays current encryption key number.
Front Panel Squelch Adjust	Menu item: SQUELCH Once selected: SQLCH=xx	1-16	Allows setting of squelch.
Scan	Menu item: SCAN	ON, OFF	Toggles scan function ON or OFF.

FEATURE	DISPLAY	PARAMETER SETTINGS	COMMENT
Scan Add	Menu item: SCAN ADD Once selected: Proper scan icon displayed.	S, 2 or 1	Adds group or channel to scan list.
Scan Delete	Menu item: SCAN DEL Once selected: Scan icon goes out.		Deletes group or channel from scan list.
Scan Add/Delete	Menu item: SCAN A/D When selected: Toggles through scan selections	Toggle sequence S, 2, 1, S, ...	Changes present group or channel to next scan choice in scan list.
Last Scanned Channel Recall	Menu Item: SCAN ADD Press twice when actively receiving; three times when not receiving. Scan icon displayed.		Changes the selected channel to the last scanned channel.
Home channel selection	Menu item: HOME Once selected: Home group or channel displayed.		Changes to the group or channel defined for Home function.
System select	Menu item: SYS SEL Once selected: SYS = n	1-64 = (n)umber of desired system	Displays the system selected.
External alarm #2	Menu item: EXTALRM2	ON, OFF	Toggles external alarm #2 feature ON or OFF.
System selection	Menu item: SYSGRP 1 Menu item: SYSGRP 2 Menu item: SYSGRP 3 Menu item: SYSGRP 4 Menu item: SYSGRP 5		Changes to the System & Group/Channel programmed for SYSGRP 1-5.
Mute	Menu item: MUTE	ON, OFF	Toggles the mute function ON or OFF to control the audio output from the selected radio.
Mute #1	Menu item: MUTE 1	ON, OFF	Toggles the mute 1 function ON or OFF on radio #1.
Mute #2	Menu item: MUTE 2	ON, OFF	Toggles the mute 2 function ON or OFF on radio #2.
Multiple radio operation	Menu item: RADIO	ON, OFF	Toggles the currently selected radio.
Radio selection	Menu item: RADIO 1	ON, OFF	Changes to radio #1.
	Menu item: RADIO 2	ON, OFF	Changes to radio #2.
Talkaround feature	Menu item: TALKARND Once selected: TALKARND on line 1	ON, OFF	Toggles talkaround ON or OFF (transmit frequency changed to receive frequency).
Channel selection	Menu item: CHN SEL Once selected: CHN = n	1-99 = (n)umber of desired channel	Displays the conventional channel selected.
Feature Encryption Display	Menu Item: FEATURES Once selected: See Feature Encryption Display section	Informational displays only; no user selectable settings	Indicates current features program- med into the radio as well as certain information required to add features to the radio (refer to the Table of Contents for Feature Encryption Display).
Type 99 Decode Enable	Menu Item: T99 ENAB Once selected: T99 ON or T99 OFF	ON, OFF	Type 99 Decode is toggled ON and OFF.
System Scan Enable	Menu Item: SYS SCAN Once selected: SYSC ON or SYSC OFF	ON, OFF	System Scan features like ProScan are toggled ON and OFF.

10.5 RECEIVING A CALL

1. Turn the radio on by rotating the **POWER ON-OFF/VOLUME** knob clockwise (out of detent). A short alert signal (if enabled through programming) indicates the radio is ready to use.
2. Adjust the **POWER ON-OFF/VOLUME** knob to the desired volume level.
3. Select the desired conventional system and channel. The display indicates the current conventional system and channel names.

4. The radio is now ready to receive calls.
5. When the radio receives a call (and the correct encoding is decoded, if programmed and enabled), it unmutes on the channel and the **BSY** indicator comes on.

10.6 SENDING A CALL

1. Turn ON the radio and set the **POWER ON-OFF/VOLUME** knob to the desired volume level. Select the desired conventional system and channel.
2. Ensure that the channel is not busy by pressing the **CLR** button to briefly disable any channel decoding and unmute the receiver or observe the unlit **BSY** indicator. If the Channel Busy Lockout feature is programmed for the selected channel, the radio will not transmit when the channel is busy.
3. Press and hold the PTT button. The **TX** indicator will turn on and a short beep sounds (if programmed) indicating that communication can begin.
4. Hold the microphone approximately three inches from the mouth and speak in a normal voice.
5. Release the PTT button when the transmission is complete and listen for a reply.

10.7 EMERGENCY OPERATION

If enabled, G-STAR emergency signaling can be transmitted when operating in the conventional mode. This G-STAR signaling will transmit 5 times with a delay between each transmission. To send an emergency call on the selected conventional system and channel (or on an optionally pre-programmed conventional emergency system and channel), proceed as follows:

Press and hold the red Emergency button for approximately one second (this time is programmable and, therefore, could be longer or shorter; check with the system administrator). The radio turns on the **TX** indicator and proceeds to transmit the pre-programmed G-STAR emergency signaling sequence.

G-STAR is programmed to transmit in one of the following methods:

- METHOD 1:** G-STAR is transmitted on the selected channel. If the channel is changed the emergency signaling will continue to be transmitted on the newly selected channel.
- METHOD 2:** Same as METHOD 1 but the radio will lock on to the currently selected channel. Any attempts to change the system or channel will be disabled.
- METHOD 3:** G-STAR is transmitted on a pre-programmed conventional emergency system and channel regardless of the selected channel. In this case the selected channel is available for voice transmission and the radio will periodically change to the pre-programmed emergency system and channel to send the emergency signaling and then change back to the selected channel.
- METHOD 4:** Same as METHOD 3 but the radio will lock on to the pre-programmed emergency system and channel. Any attempts to change the system or channel will be disabled.

The emergency state can be cleared by turning the radio OFF and then back ON.

10.7.1 Using 5-Tone Signaling to Declare an Emergency

If 5-Tone signaling is defined for emergency declaration in place of G-STAR emergency signaling, a pre-programmed tone sequence will be transmitted instead of the G-STAR sequence. This emergency declaration functions as the G-STAR emergency in all other respects.

10.7.2 Tone Encode Transmission

In conventional mode, two keys can be defined to be tone encode triggers. If either one of the pre-programmed tone encode triggers is pressed, a pre-programmed tone sequence will be transmitted on the current system and channel. (See Section 10.7 if the emergency key is used.) The **TX** indicator will light during tone transmission and a beep will sound at the end of the transmission. If enabled, audible side tones will be heard in the radio speaker as well. If PTT is pre-programmed as one of the triggers, the microphone will become active for voice communication after the tone sequence is complete.

Tone encode will be transmitted with Channel Guard if one is defined, and tones are always transmitted in clear voice mode, even if the channel is set for digital or private (see **VOICE MODES**). Digital or private voice transmission will resume normally after the tone transmission.




10.8 SCANNING CONVENTIONAL CHANNELS





Channels, which have been previously added to the scan list on a per system basis, can be scanned. The selected channel is scanned (if enabled through programming) whether or not it is in the scan list. Each conventional system's channel scan list is retained in memory when the radio is turned OFF.

The scan rate will vary depending upon the number of channels in the scan list and whether or not the radio is programmed to scan for channels with decoding enabled. Fewer channels will result in a faster scan rate. If programmed for dual-priority scan operation, the priority-one, priority-two and the remaining scan list channels are scanned. Once a signal is detected and the correct encoded squelch signal is decoded (if programmed), the radio receives the message and displays the received scan channel. At the same time, scanning continues on the priority-one and priority-two channels. If a priority-one or priority-two channel carrier, regardless of encoded squelch decoding, is detected while a non-priority channel is being received, the display name is updated and the received channel is switched to the priority channel. Scanning of the priority-one channel will continue if a message is being received on the priority-two channel.






While receiving a call on a non-priority or a priority two channel, the radio periodically checks the priority one and two channels. If Scan with Channel Guard is enabled, the radio will use Channel Guard to decide whether to unmute on a priority channel. The radio will stop, on squelch detection, on a priority channel. In normal operation, the radio will unmute only on detecting the correct Channel Guard; otherwise, it will remain muted until the priority channel call and hang time have ended. An optional feature allows the radio to continue scanning upon the detection of the wrong Channel Guard on a priority channel. The user can then select the rate at which this channel is scanned until the call ends.

10.8.1 Adding Channels to a Scan List

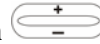
1. With scan operation turned OFF, select the desired channel to add to the selected conventional system channel scan list.
2. Press (+) or (-) with  to display the current scan status on line 1 of the display for a time-out period.
3. While current scan status is displayed, press (+) to add the channel to the scan list.  is displayed. This sets the selected channel for non-priority scanning.
4. Press (+) again to set the channel for Priority 2 (P2) scanning and  is displayed.

5. A third press of (+) sets the channel for Priority 1 (P1) scanning and  is displayed on line 1. If the P1 or P2 channels are already set and a new channel is then assigned as the P1 or P2 channel, the previously assigned priority channel will change to non-priority scanning. The priority setting selection sequence is set and stops at P1, therefore the channel must be deleted from the scan list by pressing (-) before the channel is set to a previous priority setting. Any channel that is in a system's channel scan list will show , , or  when it is the selected channel.

10.8.2 Deleting Channels From A Scan List

1. With scan operation turned OFF select the desired channel to delete from the selected conventional system's channel scan list.
2. Press (+) or (-) with . The current status is displayed for a time-out period. Press - with  to delete the channel from the scan list. , , or  will turn OFF.

10.8.3 Nuisance Delete


A channel can also be deleted from the scan list, if it is not the currently selected channel, by pressing down with  twice during scan operation while the radio is displaying the unwanted channel. The channel will be deleted from the conventional system's channel scan list in the same manner as if done using the steps above. Deletions done in this manner will not remain deleted if the radio is turned OFF and then back ON.

10.9 TURNING SCAN ON

1. Toggle the scan operation ON by pressing **SCAN**. The SCAN indicator will turn ON when the radio is scanning.



Scanning will stop while the microphone is off-hook if the hookswitch feature is enabled through programming.

2. When a channel on the scan list receives a channel assignment, the radio unmutes on the assigned channel, **BSY** indicator comes ON and the received scan channel is displayed.
 - The radio will continue scanning if a new channel is selected when scan is ON.
 - Pressing the PTT button when scan is ON will cause the radio to transmit on the displayed channel or to the currently selected channel depending on programming.
 - Pressing (+) with  when scan is ON causes the radio to recall the scanned channel that was last received. This channel is recalled for a period equal to the scan hang time.

10.10 TURNING SCAN OFF

Toggle the scan operation OFF by pressing **SCAN**. The radio will resume operation on the selected channel.

10.11 SQUELCH ADJUST

In the conventional mode of operation, the squelch can be re-adjusted in the MENU selection mode or from a front panel key on the keypad that has been pre-programmed. A default value of 9, or any user level between 1 and 16, can be selected using programming software. The user can change this setting either of two ways from the front panel keys.





A value of 16 requires a strong signal to open squelch, a value of 2 requires a very weak signal to open squelch, and a value of 1 is open squelch.




When the squelch adjust feature is activated, Channel Guard, T99 decode, and Scan are disabled. When the squelch adjust feature is exited, Channel Guard, T99 decode, and Scan are restored to their previous states.

10.11.1 Menu Selection

1. Press the **MENU** key and then use the RAMP control  to scroll through the selections until **SQUELCH** is displayed. Then press **MENU** (select) again.
2. The display will show **SQLCH=xx**, where "xx" is the value between 1 and 16.
3. Use the RAMP control  to scroll through the values. Then press the **MENU** (select) key to save the new value after the display time-out (2 seconds). The displayed value will be selected and saved.
4. If the **MENU** or **CLR** key is pressed before the time-out, the menu feature will exit and the squelch level will not be updated. The original value will be restored.

10.11.2 Pre-Programmed Keypad Key

1. Press the pre-programmed key and the display will indicate **SQLCH=xx**, where "xx" is the value between 1 and 16.
2. Use the RAMP control  to scroll through the values. Then press **MENU** to save the new value or wait for the display time-out (2 seconds). The displayed value will be selected and saved.
3. If the **CLR** key is pressed before the time-out, the squelch level will not be updated and the original value will be restored.


10.12 TYPE 99 DECODE

If the Type 99 Decode Option has been pre-programmed, individual selective calling is possible. The radio can now decode individual, group or supergroup paging calls. Two sets of Type 99 paging codes must be pre-programmed into the radio. When the radio decodes an appropriate Type 99 code sequence, an alert tone and visual indicator is provided to the user. The receiver then operates as a noise squelched unit until Type 99 is reset. Type 99 decode continues to operate during this noise squelched period. The appropriate Type 99 alert tone will sound again if it detects a valid two-tone sequence.

Type 99 operation can be reset manually or automatically (pre-programmed). Manual reset is achieved by briefly pressing **CLR**, if programmed. Automatic reset, if enabled, occurs after a 30 second interval following the most recent decode of a Type 99 tone sequence. Hookswitch (pre-programmed) can also

enable or disable Type 99 decode. The pre-programmed key light will blink when Type 99 is disabled by the hookswitch.

Type 99 decode will continue to be active while the radio's **CLR** button is pressed. This allows the user to monitor calls and still be alerted when a call is directed to the user. While the user continues to press **CLR**, the user will hear both calls and all Type 99 tone signals. If **CLR** is pressed for longer than two (2) seconds, Type 99 decode will either be disabled or re-enabled depending upon its present state.


To check the Type 99 enable status, press the Scan Add/Delete  ramp control. The current status of Type 99 decode will be displayed for a time-out period.

If a Horn Alert Option is installed and enabled with the Type 99 Decode Option, the radio can beep the vehicle horn when a Type 99 call is received. This option permits alerting persons out of the vehicle when a call is received.



Type 99 is automatically disabled when Scan is enabled.

10.12.1 Menu Selection

Press **MENU** and then use the  ramp control to scroll through the selections until **T99 ENAB** is displayed. Then press **MENU** to toggle the Type 99 decode state. The **T99 ON** or **T99 OFF** display message is displayed for two seconds to show the new state.

10.12.2 Pre-Programmed Keypad Key

Press the pre-programmed key and the **T99 ON** or **T99 OFF** display message is displayed for two seconds to show the new state.

10.13 DIRECT MODE OPERATION

The direct mode (or talk-around) provides short range, line of sight communications. One of the buttons on the control unit must be pre-programmed for this feature to function.

1. Make sure the radio is ON and then select the desired conventional system and channel.
2. Press the pre-programmed button to toggle the talk-around function ON.
3. Ensure that the channel is not busy by pressing the **CLR** (System version) or **CLEAR** (Scan version) to briefly disable any channel decoding and unmute the receiver or observe the unlit **BSY** indicator. If the Channel Busy Lockout feature is programmed for the selected channel, the radio will not transmit when the channel is busy.
4. Press and hold the PTT button. The **TX** indicator will light and a short beep sounds (if pre-programmed) indicating that communication can begin.
5. Release the PTT button when the transmission is complete and listen for a reply.
6. When the communications is completed, press the pre-programmed button to toggle the talk-around function OFF.

11 P25 CONVENTIONAL OPERATION

11.1 RADIO STATUS ICONS

Status icons are indicators that show the various operating characteristics of the radio. The icons appear on the first line of the display.



Figure 11-1: Typical Display

Table 11-1: Icons and Descriptions

ICON	DESCRIPTION
	Indicates selected group or channel is in scan list.
	Indicates selected group or channel is programmed as Priority 1 in scan list.
	Indicates selected group or channel is programmed as Priority 2 in scan list.
	Indicates a conventional channel enabled with Channel Guard Function.
	Transmitting or receiving in encrypted mode.
	Indicates the current channel is set up as an analog channel.
	Indicates the current channel is set up as a ProVoice channel.
	Scan mode enabled.
	Indicates the current channel is set up as a Project 25 (P25) channel.

11.2 MESSAGES

During radio operation, various messages are displayed on either line 1 or line 2. Typical messages include control channel status information, such as system busy or call denied, or messages associated with the radio's operation, (i.e. volume adjust). These messages are described as follows:

Table 11-2: Display Messages

MESSAGE	NAME	DESCRIPTION
TALKARND	Talk-around	Indicates the radio is operating on conventional channels in talk-around mode (no repeater).
VOL=31	Volume Level	Indicates the current volume level. The volume level display ranges from OFF (silent) to 31 (loudest).
UNKNOWN	Caller's ID Not Received	Indicates that an individual call is being received, but the caller's ID was not received.
T99 ON	Type 99 Decode ON	Indicates the Type 99 Decode feature is enabled.
T99 OFF	Type 99 Decode OFF	Indicates the Type 99 Decode feature is disabled.
PA ON	Public Address ON	Indicates that the public address function of the radio is enabled.
PA OFF	Public Address OFF	Momentary (2 seconds) indicates that public address function of the radio was disabled.
ALRM ON	External Alarm Enabled	Indicates that the external alarm function of the radio is enabled.
ALRM OFF	External Alarm Disabled	Momentary (2 seconds) indicates that the external alarm function of the radio was disabled.
PVT DIS	Private Mode Disabled	Indicates that private mode is disabled or no encryption key has been programmed for the selected group/channel or special call.
FRCD PVT	Forced Private Operation	Indicates that forced private operation has been pre-programmed into radio.
NO KEY #	Encryption Key Missing	Flashing indicator indicates that no encryption key or an incorrect encryption key is programmed into the radio.
BCKL=1-6	Backlight	Indicates the display intensity and keypad backlight level.
GR	Group ID	Indicates that the call is a group call and is followed by the GID of the caller.
WHC=1	Who Has Called	This display indicates the number from the <i>Who Has Called</i> list. Individual calls received but not responded to are stored in a <i>Who Has Called</i> list. This list is accessible by pressing the # key and then the INDV key after the Individual call has timed out or the Clear button is pressed. This display is on line 2 and the LID of the caller is displayed on the top line. Currently the list is not implemented and the display will always be WHC=1.
PHONE	Phone Call	Displayed when a phone call is received from the site. It is displayed in line 1 of the display. Line 2 of the display will contain the display *INDV* when line 1 contains this message. The radio interprets a received phone call as an individual call.
MENU		Displayed when the menu key is pressed and remains displayed in line 1 until a menu item is selected.
SYS=1-64	System = 1 - 64	The system number for the current base station of the system displayed in line 1. It is displayed in line 2 of the display. Press the system key to obtain this display.
INDV=1-99	Individual = 1 - 99	Indicates which item in the individual call list is being displayed. It is displayed in line 2 of the display. The name or ID of the item in the list is displayed in line 1 of the display.
PHN=1-99	Phone = 1 - 99	Indicates which item in the phone list is being displayed. It is displayed in line 2 of the display. Line 1 of the display will be the last 3 characters of the list item contents.
SEL PHN	Select Phone	After pressing the PHN key, selecting an entry from the phone list by typing the entry number will display this message on Line 1.
Ggg-v.vv	Code Group and Revision Number	This is code group and revision number that is displayed in line 2 when the menu item "REVISION" is selected. The 'gg' is the group number of the software. The first 'v' is the hardware version and 'vv' is the revision of the software.
PHONE	Phone Call	Displayed when an initiated phone call is in progress. This is displayed on line 2 of the display.
NO ENTRY		Indicates that there is no data stored in one of the programmable items in either the phone list or individual call list. The user programmable items are items 1 through 10 in each list.
INV SYS	Invalid System	Displayed when the current system is an invalid type.

MESSAGE	NAME	DESCRIPTION
CHN=1-99	Channel = 1 - 99	Displayed on line 1 of the display. This is a conventional channel index displayed when the group key is pressed.
FIX LIST	Fixed List	The Priority scan list is fixed and cannot be changed using the add or delete keys.
FIXED P1	Fixed Priority 1	The Priority 1 scan channel is fixed and cannot be changed using the add or delete keys.
(c) 2004		Displayed in line 2 when the message 'M/A-COM' is displayed in line 1 while displaying different items under the menu when "REVISION" is selected by the operator.
EM	Emergency	Indicates an emergency has been declared by the LID that follows the display, "EM." An example of this is "EM 01201."
INDV	Individual Call	Displayed in line 2 of the display when an individual call is in progress (trunked and T99 modes only).
GROUP	Group Call	Indicates a group call is in progress and is displayed on line 1 of the display (trunked and T99 modes only).
SPKR ON	External Speaker ON	Displayed when the external speaker is enabled.
SPKR OFF	External Speaker OFF	Displayed when the external speaker is disabled.
BANK=1-8		The bank of keys that are going to be loaded when the keyloader loads encryption keys. This is only valid for radios that support VGS, VGE, or DES encryption. It is displayed on line 2 of the display when the encryption keyloader is connected.
KEY LOAD		Displayed on line 1 of the display when the encryption keyloader is connected.
KEY ZERO		Displayed on line 2 of the display when the reset and option buttons are pressed simultaneously for approximately two seconds. The encryption keys are zeroed.
SYS KEY	System Key	Displayed on line 1 of the display in the display key mode of the menu. It is followed in the second line with a key number "KEY = <1..7>".
KEY=1-7		Displayed on line 2 of the display in the display key mode of the menu for conventional systems when the "SYS KEY" or "CHN KEY" is displayed in line 1 and for trunked systems when the "SYS KEY" or "GRP KEY" is displayed in line 1.
PRIMARY		Displayed on line 1 of the display when the primary keys are enabled.
PRS NAME	Personality Name	Displayed on line 1 of the display under the revision selection of the menu. The personality name is displayed on line 2 at the same time.
M/A-COM		Displayed on line 1 of the display under the revision selection of the menu. The copyright year is shown in line 2 of display at the same time "(c) 2007."


11.3 ALERT TONES


The M7300 series mobile radio also provides audible alert tones or "beeps" to indicate the various operating conditions. These alert tones can be enabled or disabled through programming.

Table 11-3: M7300 EDACS Mode Alert Tones

NAME	STONE	DESCRIPTION
Call Originate	A short mid-pitched tone.	Sounds after keying the radio (Push-To-Talk button is pressed). Indicates the radio has been assigned a working channel
Carrier Control Timer	Five short high-pitched warning tones followed by a long low-pitched tone.	Sounds if the programmed time for continuous transmission is exceeded. The transmitter will shut down shortly after the alert, interrupting communications. Release and re-key the PTT button to maintain communications. This will reset the carrier control timer and turn the transmitter back on.
Key Press Alert	A short tone.	Indicates a key has been pressed. A short low-pitched tone indicates no action was taken because the key is not active in the current mode.

11.4 MENU

The menu function accesses features that are not available directly from the keypad. The order and specific number of menu items available is configurable through programming. Upon radio power up, the menu item at the beginning of the menu list will always be displayed first. Subsequent access to the menu function will return the last menu item that was shown in the display. To enter the menu mode, press **MENU**. The  ramp control, **MENU**, and **CLR** are used during the selection process. All of the selection mode rules previously detailed apply to the menu item selection process with the exception of direct access. The radio will continue to receive and transmit normally while in the menu function.

A new item is displayed by using the  ramp control to scroll through the list in increasing and decreasing order. The displayed menu item is made active by pressing **MENU**.


After entering the menu selection mode, the following generic display format will appear.

```

M E N U
Y Y Y Y Y Y Y Y
    
```

Line 1 indicates the radio is in the menu selection mode. Line 2 indicates the menu item (YYYYYYYY) that is to be viewed or changed (some menu items provide radio information and do not have changeable parameters).

An example of the menu item selection process and menu item parameter change is detailed below for the contrast menu item.

1. Press **MENU** to enter the menu mode.
2. Press the  ramp control until the display shows:

```

M E N U
C O N T R A S T
    
```

3. Press **MENU**. The contrast menu item is activated and the display will be similar to the following:

```

C N T R S T = X
Y Y Y Y Y Y Y Y
    
```

Line 1 shows the active menu item and its current parameter setting (XXX). Line 2 shows the currently selected system or group name (YYYYYYYY).



4. The menu item's parameter setting shown in the display can now be changed by using the  ramp control to scroll through the list of parameter values. Once the desired setting is reached, press **MENU** to store the value and return to the normal display. For menu items that display radio information, use  to scroll through a list of informational displays. The menu items are listed in Table 9-4.

Table 11-4: Menu Item Information

FEATURE	DISPLAY	PARAMETER SETTINGS	COMMENT
Contrast Adjust	Menu Item: CONTRAST Once selected: CNTRST=	1, 2, 3, 4, 5, 6, 7, 8	Selects the Contrast level.

FEATURE	DISPLAY	PARAMETER SETTINGS	COMMENT
Radio Revision Information	Menu item: REVISION	Informational displays only (see radio); no user selectable settings.	Selects the information display to view.
Phone Call	Menu item: PHN CALL Once selected: See Telephone Interconnect Call Section		Allows access to the Phone Call Feature.
External Alarm	Menu Item: EXTALARM Once Selected: EXTALARM	ON, OFF	EXTALARM replaces the system name on the display as long as the external alarm feature is enabled.
Public Address	Menu item: PUB ADDR Once selected: PA ON or PA OFF	ON, OFF	Public Address is toggled ON and OFF.
External Speaker	Menu item: EXT SPKR Once selected: SPKR ON or SPKR OFF	ON, OFF	External Speaker is toggled ON and OFF.
Encryption Key Loading	Menu item: KEYLOAD Once selected: KEY LOAD BANK = N	Up to 8 banks of 7 keys	Enables the radio to accept the loading of encryption keys.
Display Current Encryption Key(s)	Menu item: DISP KEY Once selected: SYS KEY, GRP KEY or CHN KEY and KEY = N		Displays current encryption key number.
Scan	Menu item: SCAN	ON, OFF	Toggles scan function ON or OFF.
Private Mode	Menu Item: PRIVATE Once selected: PVT or key light.	ON, OFF	Toggles private function ON or OFF.
Front Panel Squelch Adjust	Menu Item: SQUELCH Once selected: SQLCH=xx	1-16	Allows setting of squelch.
Scan Add	Menu item: SCAN ADD Once selected: Proper scan icon displayed.	S, 2 or 1	Adds group or channel to scan list.
Scan Delete	Menu item: SCAN DEL Once selected: Scan icon goes out.		Deletes channel from scan list.
Scan Add/Delete	Menu item: SCAN A/D When selected: Toggles through scan selections	Toggle sequence S, 2, 1, S, ...	Changes present group or channel to next scan choice in scan list.
Last Scanned Channel Recall	Menu Item: SCAN ADD Press twice when actively receiving; three times when not receiving. Scan icon displayed.		Changes the selected channel to the last scanned channel.
Home channel selection	Menu item: HOME Once selected: Home group or channel displayed.		Changes to the group or channel defined for Home function.
System select	Menu item: SYS SEL Once selected: SYS = n	1-64 = (n)umber of desired system	Displays the system selected.
External alarm #2	Menu item: EXTALRM2	ON, OFF	Toggles external alarm #2 feature ON or OFF.
System and Channel selection	Menu item: SYSGRP 1 Menu item: SYSGRP 2 Menu item: SYSGRP 3 Menu item: SYSGRP 4 Menu item: SYSGRP 5		Changes to the System & Channel programmed for SYSGRP 1-5.

FEATURE	DISPLAY	PARAMETER SETTINGS	COMMENT
Mute	Menu item: MUTE	ON, OFF	Toggles the mute function ON or OFF to control the audio output from the selected radio.
Mute #1	Menu item: MUTE 1	ON, OFF	Toggles the mute 1 function ON or OFF on radio #1.
Mute #2	Menu item: MUTE 2	ON, OFF	Toggles the mute 2 function ON or OFF on radio #2.
Multiple radio operation	Menu item: RADIO	ON, OFF	Toggles the currently selected radio.
Radio selection	Menu item: RADIO 1	ON, OFF	Changes to radio #1.
	Menu item: RADIO 2	ON, OFF	Changes to radio #2.
Talkaround feature	Menu item: TALKARND Once selected: TALKARND on line 1	ON, OFF	Toggles talkaround ON or OFF (transmit frequency changed to receive frequency).
Feature Encryption Display	Menu Item: FEATURES Once selected: See Feature Encryption Display section	Informational displays only; no user selectable settings	Indicates current features programmed into the radio as well as certain information required to add features to the radio (refer to the Table of Contents for Feature Encryption Display).
System Scan Enable	Menu Item: SYS SCAN Once selected: SYSC ON or SYSC OFF	ON, OFF	System Scan features like ProScan are toggled ON and OFF.
Type 99 Decode Enable	Menu Item: T99 ENAB Once selected: T99 ON or T99 OFF	ON, OFF	Type 99 Decode is toggled ON and OFF.

11.5 GROUP CALLS IN P25 MODE

11.5.1 Transmitting a Group Call

1. Select the desired P25 system.
2. Select the Talk Group/Conventional Channel. (Selected simultaneously using either the system/group/channel knob or the group key.)
3. Press and hold the PTT.
4. When a grant tone is received (if enabled through programming), speak into the microphone.
5. Release PTT and wait for response.

11.5.2 Receiving a Group Call

The radio will unmute according to the squelch mode defined in the radio personality (monitor, normal, selective).

1. Select the desired P25 system and Talk Group/Channel or turn scan on and make sure the desired channel is in the scan list.
2. When the radio receives a P25 call, the radio will unmute and the channel name will appear in the display.
3. Press the PTT button to respond.

11.6 INDIVIDUAL CALLS IN P25 MODE

11.6.1 Transmitting an Individual Call

1. Select the desired P25 system.
2. Select the radio unit to call (callee source ID) from the pre-programmed individual call list or enter the ID number on the radio keypad.
3. Press and hold the PTT.
4. When grant tone is received (if enabled through programming) speak into the microphone.
5. Release the PTT.

11.6.2 Receiving an Individual Call

The radio will unmute according to the squelch mode defined in the radio personality (monitor, normal, selective).

1. Select the desired P25 system and Talk Group/Channel or turn scan on and make sure the desired channel is in the scan list.
2. When the radio receives a P25 call, the radio will unmute and the ID of the transmitting radio will appear in the display.
3. Press the PTT button to respond.

Unanswered calls will appear in the Who Has Called (WHC) list.

11.7 EMERGENCY GROUP CALLS IN P25 MODE



NOTE

There is no method available for a system-wide Emergency clear. An emergency group call must be cleared on each individual radio.

11.7.1 Declaring an Emergency Group Call

1. Select the desired P25 system and Talk Group/Channel.
2. Press the red emergency button on the top of the radio. The radio will broadcast a short emergency transmission with the emergency bit set. “TXEMER” will appear in the display of the transmitting radio.
3. To send a voice message, press the PTT and speak into the microphone.
4. To clear an emergency from the transmitting radio, perform one of the following steps:
 - a. Change systems.
 - b. Change channels (if not prohibited by programming).
 - c. Cycle power by turning radio off and then back on.
 - d. Press the Clear and Emergency buttons simultaneously, providing the Clear Emergency option is enabled in the Supervisory Options in the personality.

11.7.2 Receiving an Emergency Group Call

1. Select the desired P25 System and Talk Group/Channel.
2. When the radio detects an incoming Emergency Group Call, the radio will sound an alert tone and “**RXEMER**” will appear in the display.
3. Voice or emergency transmissions will be heard at the receiving radio.
4. To clear an emergency from the receiving radio, perform one of the following steps:
 - a. Change systems.
 - b. Change channels (if not prohibited by programming).
 - c. Cycle power by turning radio off and then back on.
 - d. Press the Clear and Emergency buttons simultaneously, providing the Clear Emergency option is enabled in the Supervisory Options in the personality.

12 BASIC TROUBLESHOOTING

If the radio is not operating properly, check Table 12-1 for likely causes. For additional assistance, contact a qualified service technician.

Table 12-1: Basic Troubleshooting

SYMPTOM	CAUSE	SOLUTION
Radio will not turn on.	No power.	Test the connection to the vehicle power supply.
Radio will not turn off.	If in multiple control head configuration, one of the attached control heads is still powered up.	Power off all control heads.
Radio will not register or does not receive provisioning data.	Bad logon credentials.	Check logon and password.
No audio.	Speaker volume is muted.	Increase the volume level.
Poor audio.	Transmitting or receiving in a poor coverage area or subject to interference.	Check network connectivity and move to a better coverage area if possible. Report the area without coverage to an authorized network technician.
Poor display visibility.	Ambient Light Sensor is obstructed.	Clear the obstruction and give the sensor a clear path to ambient light.
No network connectivity icon in display.	Radio is out-of-range or cannot connect with the OpenSky network. Base station network connection has failed.	Return to coverage area if possible and wait for condition to clear. Use single-site trunking or switch to an alternate channel.
Radio will not transmit.	Radio may be out of coverage area or may be overheated.	Return to coverage area if possible. If overheated, let radio cool before retrying transmission. Report this failure to an authorized technician.
“Warning: No MRU” Message.	Radio control head is unable to communicate with mobile radio unit (radio transceiver).	Have the radio connections checked by an authorized technician.
Control head randomly changes display.	In multiple control head configurations, another user is operating the radio from another control head.	None
Encrypted calls cannot be made.	Not authorized to use.	Contact system administrator to request encryption privileges.
Screen displays: UNAUTH3	The radio network ID has not been added to the network.	Contact system administrator.
Screen displays: NOAUTHV	Radio authentication of the VNIC failed.	Contact system administrator.

SYMPTOM	CAUSE	SOLUTION
Screen displays: NOAUTHM	VNIC authentication of the radio failed.	Contact system administrator.
Screen displays: NOSUPRT	The voice authentication security policy is set to only allow authenticated users.	Contact system administrator.
Encrypted calls cannot be made.	User not logged in.	Log in (refer to Section 7.14.1).

13 TECHNICAL ASSISTANCE

The Technical Assistance Center's (TAC) resources are available to help with overall system operation, maintenance, upgrades and product support. TAC is the point of contact when answers are needed to technical questions.

Product specialists, with detailed knowledge of product operation, maintenance and repair provide technical support via a toll-free (in North American) telephone number. Support is also available through mail, fax and e-mail.

For more information about technical assistance services, contact your sales representative, or call the Technical Assistance Center at:

North America: 1-800-528-7711

International: 1-434-385-2400

Fax: 1-434-455-6712

E-mail: tac@tycoelectronics.com

14 KEYPAD REMAPPING

If the keys have been remapped to provide new functions, fill in the following template for future reference.

Button	Function	Button	Function
Emergency		1	
Preset A		2	
Preset B		3	
Preset C		4	
Rocker •		5	
Rocker ••		6	
Rocker +		7	
Rocker -		8	
MENU		9	
OPT/OPTION		*	
CLR/CLEAR		0	
SCAN		#	

16 WARRANTY

- A. M/A-COM, Inc. (hereinafter "Seller") warrants to the original purchaser for use (hereinafter "Buyer") that Equipment manufactured by or for the Seller shall be free from defects in material and workmanship, and shall conform to its published specifications. With respect to all non-M/A-COM Equipment, Seller gives no warranty, and only the warranty, if any, given by the manufacturer shall apply. Rechargeable batteries are excluded from this warranty but are warranted under a separate Rechargeable Battery Warranty (ECR-7048).
- B. Seller's obligations set forth in Paragraph C below shall apply only to failures to meet the above warranties occurring within the following periods of time from date of sale to the Buyer and are conditioned on Buyer's giving written notice to Seller within thirty (30) days of such occurrence:
1. for fuses and non-rechargeable batteries, operable on arrival only.
 2. for parts and accessories (except as noted in B.1) sold by Seller's Service Parts Operation, ninety (90) days.
 3. for P7200, P7100^{IP}, P5400, P5300, P5200, P5100, P3300, PANTHER™ 405P and 605P, M7300, M7200 (including V-TAC), M7100^{IP}, M5300 and M3300 radios, two (2) years.
 4. for all other equipment of Seller's manufacture, one (1) year.
- C. If any Equipment fails to meet the foregoing warranties, Seller shall correct the failure at its option (i) by repairing any defective or damaged part or parts thereof, (ii) by making available at Seller's factory any necessary repaired or replacement parts, or (iii) by replacing the failed Equipment with equivalent new or refurbished Equipment. Any repaired or replacement part furnished hereunder shall be warranted for the remainder of the warranty period of the Equipment in which it is installed. Where such failure cannot be corrected by Seller's reasonable efforts, the parties will negotiate an equitable adjustment in price. Labor to perform warranty service will be provided at no charge during the warranty period only for the Equipment covered under Paragraph B.3 and B.4. To be eligible for no-charge labor, service must be performed at a M/A-COM factory, by an Authorized Service Center (ASC) or other Servicer approved for these purposes either at its place of business during normal business hours, for mobile or personal equipment, or at the Buyer's location, for fixed location equipment. Service on fixed location equipment more than thirty (30) miles from the Service Center or other approved Servicer's place of business will include a charge for transportation.
- D. Seller's obligations under Paragraph C shall not apply to any Equipment, or part thereof, which (i) has been modified or otherwise altered other than pursuant to Seller's written instructions or written approval or, (ii) is normally consumed in operation or, (iii) has a normal life inherently shorter than the warranty periods specified in Paragraph B, or (iv) is not properly stored, installed, used, maintained or repaired, or, (v) has been subjected to any other kind of misuse or detrimental exposure, or has been involved in an accident.
- E. The preceding paragraphs set forth the exclusive remedies for claims based upon defects in or nonconformity of the Equipment, whether the claim is in contract, warranty, tort (including negligence), strict liability or otherwise, and however instituted. Upon the expiration of the warranty period, all such liability shall terminate. The foregoing warranties are exclusive and in lieu of all other warranties, whether oral, written, expressed, implied or statutory. NO IMPLIED OR STATUTORY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE SHALL APPLY. IN NO EVENT SHALL THE SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL, INDIRECT OR EXEMPLARY DAMAGES.

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M7300**

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Dual-Band Half-Duplex
Front and Remote-Mount Mobile Radios
with CH-721 Scan and System
Control Heads

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REV.	DATE	REASON FOR CHANGE
-	May/08	PRELIMINARY manual (5/27/2008).

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1 REGULATORY AND SAFETY INFORMATION

1.1 SAFETY SYMBOL CONVENTIONS

The following conventions are used in this manual to alert the user to general safety precautions that must be observed during all phases of operation, installation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere violates safety standards of design, manufacture, and intended use of the product. M/A-COM, Inc. assumes no liability for the customer's failure to comply with these standards.



The **WARNING** symbol calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a **WARNING** symbol until the conditions identified are fully understood or met.



The **CAUTION** symbol calls attention to an operating procedure, practice, or the like, which, if not performed correctly or adhered to, could result in damage to the equipment or severely degrade equipment performance.



The **NOTE** symbol calls attention to supplemental information, which may improve system performance or clarify a process or procedure.

1.2 RF ENERGY EXPOSURE AWARENESS AND CONTROL INFORMATION FOR FCC OCCUPATIONAL USE REQUIREMENTS

Before using the two-way mobile radio, read this important RF energy awareness and control information and operational instructions to ensure compliance with RF exposure guidelines.



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 remain below RF exposure limits. This radio is **NOT** authorized for general population, consumer, or any other use.



Changes or modifications not expressly approved by M/A-COM, Inc. could void the user's authority to operate the equipment.

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 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. Refer to the following websites for more information on what RF energy exposure is and how to control 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>

1.2.1 **Federal Communications Commission Regulations**

Before it was marketed in the United States, the M7300 two-way mobile radio was tested to ensure compliance with FCC RF energy exposure limits for mobile two-way radios. 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 label directing users to specific user awareness information. The radio has an RF exposure product label. Also, this Installation and Product Safety Manual and the applicable Operator's Manual include information and operating instructions required to control RF exposure and to satisfy compliance requirements.

1.3 COMPLIANCE WITH RF EXPOSURE STANDARDS

The M7300 two-way mobile radio is designed and tested to comply with a number of national and international standards and guidelines regarding human exposure to RF electromagnetic energy. This radio complies with the IEEE and ICNIRP exposure limits for occupational/controlled RF exposure environment at duty-cycle times of up to 50% (50% transmit, 50% receive), and it is authorized by the FCC for occupational use. In terms of measuring RF energy for compliance with the FCC exposure guidelines, the radio's antenna radiates measurable RF energy only while it is transmitting (talking), not when it is receiving (listening), or in a standby mode.

The M7300 mobile two-way radio complies with the following RF energy exposure standards and guidelines:

- United States Federal Communications Commission (FCC), Code of Federal Regulations; 47 CFR § 2 sub-part J.
- American National Standards Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE) C95.1-2005.
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-2005.
- IC Standard RSS-102, Issue 2, 2005: "Spectrum Management and Telecommunications Radio Standards Specification. Radiofrequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands).



Table 1-1 lists the recommended minimum safe lateral distances for a controlled environment and for unaware bystanders in an uncontrolled environment, from transmitting antennas (i.e., monopoles over a ground plane, or dipoles) at rated radio power for mobile radios installed in a vehicle. Transmit only when unaware bystanders are at least the uncontrolled recommended minimum safe lateral distance away from the transmitting antenna. Based on the highest radiated RF power and with respect to the cables supplied with the antennas, the distances listed in Table 1-1 are considered as safe distances for controlled and uncontrolled environments for the listed antennas.

Based on the highest radiated RF power and the highest antenna gain in antennas to be used with M7300, the following distances are considered as safe distances for controlled and uncontrolled environments with the M7300 mobile radio transmitting at a maximum 50% duty cycle:

Table 1-1: Recommended Minimum Safe Lateral Distance from Transmitting Antenna

ANTENNA PART NUMBER (Catalog Number)	ANTENNA DESCRIPTION	RECOMMENDED MINIMUM LATERAL HUMAN BODY DISTANCE FROM TRANSMITTING ANTENNA	
		CONTROLLED ENVIRONMENT (Centimeters)	UNCONTROLLED ENVIRONMENT (Centimeters)
AN-025167-001 (Cat. No. MAMW-AN3J)	700/800 MHz Standard Rooftop-Mount; 3 dBd Gain	28	69
AN-025167-002 (Cat. No. MAMW-AN3K)	700/800 MHz Elevated-Feed Rooftop-Mount; 3 dBd Gain	28	69
AN-025167-004 (Cat. No. MAMW-AN3V)	700/800 MHz GPS Combo Rooftop-Mount; 3 dBd Gain	28	69
AN-025167-005 (Cat. No. MAMW-NAN3W)	700/800 MHz GPS Combo Elevated-Feed Rooftop-Mount; 3 dBd Gain	28	69
AN-025167-006 (Cat. No. MAMW-NAN3X)	700/800 MHz Magnetic-Mount; 3 dBd Gain	29	72
AN-025167-010 (Cat. No. MAMW-NAN5B)	700/800 MHz Low-Profile Rooftop-Mount; 2 dBd Gain	28	69
AN-025167-011 (Cat. No. MAMW-NAN5C)	700/800 MHz GPS Combo Low-Profile Rooftop-Mount; 2 dBd Gain	28	69
AN-025167-014 (Cat. No. MAMW-NAN5U)	700/800 MHz Standard Rooftop-Mount; 5 dBd Gain	39	87
AN-025167-015 (Cat. No. MAMW-NAN5V)	700/800 MHz GPS Combo Rooftop-Mount; 5 dBd Gain	39	87

1.3.1 Mobile Antennas

The antenna(s) for the radio must be installed in accordance with Section 6 in this manual. Refer to Figure 6-1 on page 25 for applicable antenna part numbers. Installation guidelines presented in Section 6 are limited to metal-body motor vehicles or vehicles with appropriate ground planes.

Use only the M/A-COM approved/supplied antenna(s) or an approved replacement antenna. Unauthorized antennas, modifications, or attachments can cause the FCC RF exposure limits to be exceeded.

1.3.2 Approved Accessories

The radio has been tested and meets FCC RF guidelines when used with M/A-COM accessories supplied or designated for use with it. Use of other accessories may not ensure compliance with the FCC’s RF exposure guidelines, and may violate FCC regulations. For a list of approved accessories refer to Section 4 in this manual (begins on page 17) and/or M/A-COM’s Products and Services Catalog.

1.3.3 Contact Information

For additional information on RF exposure and other information, contact M/A-COM using one of the contact links listed in Section 3.4 on page 16.

1.4 OCCUPATIONAL SAFETY GUIDELINES AND SAFETY TRAINING INFORMATION

To ensure bodily exposure to RF electromagnetic energy is within the FCC allowable limits for occupational use. Always adhere to the following basic guidelines:

1. The push-to-talk button should only be depressed when intending to send a voice message.
2. The radio should only be used for necessary work-related communications.
3. The radio should only be used by authorized and trained personnel. It should never be operated by children.
4. Do not attempt any unauthorized modification to the radio. Changes or modifications to the radio may cause harmful interference and/or cause it to exceed FCC RF exposure limits. Only qualified personnel should service the radio.
5. Always use M/A-COM authorized accessories (antennas, control heads, speakers/mics, etc.). Use of unauthorized accessories can cause the FCC RF exposure compliance requirements to be exceeded.

The information listed above provides the user with information needed to make him or her aware of a RF exposure, and what to do to assure that this radio operates within the FCC exposure limits of this radio.

1.5 COMMON HAZARDS



The operator of any mobile radio should be aware of certain hazards common to the operation of vehicular radio transmissions. Possible hazards include but are not limited to:

- **Explosive Atmospheres** — Just as it is dangerous to fuel a vehicle while its motor running, be sure to turn the radio **OFF** while fueling the vehicle. If the radio is mounted in the trunk of the vehicle, **DO NOT** carry containers of fuel in the trunk.

Areas with potentially explosive atmosphere are often, but not always, clearly marked. Turn the radio **OFF** when in any area with a potentially explosive atmosphere. It is rare, but not impossible that the radio or its accessories could generate sparks.
- **Interference To Vehicular Electronic Systems** — Electronic fuel injection systems, electronic anti-skid braking systems, electronic cruise control systems, etc., are typical of the types of electronic devices that can malfunction due to the lack of protection from radio frequency (RF) energy present when transmitting. If the vehicle contains such equipment, consult the dealer for the make of vehicle and enlist his aid in determining if such electronic circuits perform normally when the radio is transmitting.
- **Electric Blasting Caps** — To prevent accidental detonation of electric blasting caps, **DO NOT** use two-way radios within 1000 feet (305 meters) of blasting operations. Always obey the “**Turn Off Two-Way Radios**” (or equivalent) signs posted where electric blasting caps are being used. (OSHA Standard: 1926.900).

- **Radio Frequency Energy** — To prevent burns or related physical injury from radio frequency energy, do not operate the transmitter when anyone outside of the vehicle is within the minimum safe distance from the antenna as specified in Table 1-1. Refer to Section 1.2 for additional information.
- **Vehicles Powered By Liquefied Petroleum (LP) Gas** — Radio installation in vehicles powered by liquefied petroleum gas, where the LP gas container is located in the trunk or other sealed-off space within the interior of the vehicle, must conform to the **National Fire Protection Association** standard **NFPA 58**. This requires:
 - The space containing the radio equipment must be isolated by a seal from the space containing the LP gas container and its fittings.
 - Outside filling connections must be used for the LP gas container.
 - The LP gas container space shall be vented to the outside of the vehicle.
- **Vehicles Equipped with Airbags** — For driver and passenger safety, avoid mounting the radio's control head (or any other component) above or near airbag deployment areas. In addition to driver-side and passenger-side front-impact airbags, some vehicles may also be equipped with side-impact airbags. For occupant safety, verify the location of all airbags within the vehicle before installing the radio equipment.

1.6 SAFE DRIVING RECOMMENDATIONS

The American Automobile Association (AAA) advocates the following key safe driving recommendations:

- Read the literature on the safe operation of the radio.
- Keep both hands on the steering wheel and the microphone in its hanger whenever the vehicle is in motion.
- Place calls only when the vehicle is stopped.
- When talking from a moving vehicle is unavoidable, drive in the slower lane. Keep conversations brief.
- If a conversation requires taking notes or complex thought, stop the vehicle in a safe place and continue the call.
- Whenever using a mobile radio, exercise caution.

1.7 OPERATING RULES AND REGULATIONS

Two-way FM radio systems must be operated in accordance with the rules and regulations of the local, regional, or national government.

In the United States, the M7300 mobile radio must be operated in accordance with the rules and regulations of the Federal Communications Commission (FCC). Operators of two-way radio equipment, must be thoroughly familiar with the rules that apply to the particular type of radio operation. Following these rules helps eliminate confusion, assures the most efficient use of the existing radio channels, and results in a smoothly functioning radio network.

When using a two-way radio, remember these rules:

- It is a violation of FCC rules to interrupt any distress or emergency message. The radio operates in much the same way as a telephone "party line." Therefore, always listen to make sure the channel is clear before transmitting. Emergency calls have priority over all other messages. If someone is

sending an emergency message – such as reporting a fire or asking for help in an accident, do not transmit unless assistance can be offered.

- The use of profane or obscene language is prohibited by Federal law.
- It is against the law to send false call letters or false distress or emergency messages. The FCC requires keeping conversations brief and confine them to business. To save time, use coded messages whenever possible.
- Using the radio to send personal messages (except in an emergency) is a violation of FCC rules. Send only essential messages.
- It is against Federal law to repeat or otherwise make known anything overheard on the radio. Conversations between others sharing the channel must be regarded as confidential.
- The FCC requires self-identification at certain specific times by means of call letters. Refer to the rules that apply to the particular type of operation for the proper procedure.
- No changes or adjustments shall be made to the equipment except by an authorized or certified electronics technician.



Under U.S. law, operation of an unlicensed radio transmitter within the jurisdiction of the United States may be punishable by a fine of up to \$10,000, imprisonment for up to two (2) years, or both.

1.8 OPERATING TIPS

The following conditions tend to reduce the effective range of two-way radios and should be avoided whenever possible:

- Operating the radio in areas of low terrain, or while under power lines or bridges.
- Obstructions such as mountains and buildings.



In areas where transmission or reception is poor, communication improvement may sometimes be obtained by moving a few yards in another direction, or moving to a higher elevation.

2 SPECIFICATIONS¹

2.1 GENERAL

Dimensions, Front-Mount Mobile Radio: (Height x Width x Depth)	2.4 x 6.9 x 11.3 inches (6.1 x 17.5 x 28.7 centimeters) (Includes knobs but <u>not</u> space required for mounting bracket and cables at rear of radio)
Dimensions, Remote-Mount Mobile Radio: (Height x Width x Depth)	2.0 x 6.9 x 9.2 inches (5.1 x 17.5 x 23.4 centimeters) (Does <u>not</u> include space required for mounting bracket and cables at rear of radio)
Dimensions, Control Head: (Height x Width x Depth)	2.4 x 6.9 x 3.9 inches (6 x 17.5 x 10 centimeters) (Does <u>not</u> include bracket and mounting screws)
Weight, Front-Mount Mobile Radio:	5.9 pounds (2.68 kilograms), less bracket
Weight, Remote-Mount Mobile Radio:	5.25 pounds (3.69 kilograms), less bracket
Weight, Control Head:	1.25 pounds (0.57 kilograms), less bracket
Operating Ambient Temperature Range:	-22 to +140° Fahrenheit (-30 to +60° Celsius)
Storage Temperature Range:	-40 to +185° Fahrenheit (-40 to +85° Celsius)
Altitude:	15,000 feet (4572 meters) maximum
DC Supply Voltage Operating Range:	+13.6 Vdc ±10% (Normal range per TIA-603)
DC Supply Current Requirements:	
Receive (includes control head):	
With Speaker Muted:	1.1 amps maximum
With 0.5-Watt Speaker Output Power:	1.5 amps maximum
With 10-Watt Speaker Output Power:	3.5 amps maximum
With 15-Watt Speaker Output Power:	4.0. amps maximum
Transmit (includes control head):	
With 12-Watt RF Output Power:	8 amps maximum, 6 amps typical
With 30-Watt RF Output Power:	15 amps maximum, 12 amps typical
Quiescent/Off Current:	
Mobile Radio:	100 microamps maximum
Control Head:	100 microamps maximum

2.2 TRANSCEIVER

Frequency Ranges:

Receive:	
700 MHz Narrow Bands:	764 to 767 MHz, 769 to 775 MHz and 773 to 776 MHz
800 MHz Band:	851 to 869 MHz
Transmit:	
700 MHz Narrow Bands:	794 to 797 MHz, 799 to 805 MHz and 803 to 806 MHz
800 MHz Band:	806 to 824 MHz

¹ These specifications are primarily intended for the use of the installation technician. See the appropriate Specifications Sheet for the complete specifications.

Transmit Output Power:	
OpenSky Trunking Protocol (OTP) Mode:	15 watts
EDACS/ProVoice/Conventional Modes:	35 watts
Channel Spacing:	12.5 kHz or 25 kHz (mode dependent)
Voice and Data Communications Modes:	Half-Duplex
Frequency Stability:	±1.5 ppm with AFC disabled; ±0.5 ppm with AFC
Receiver Sensitivity:	
700 MHz OTP Mode:	-111 dBm minimum at 1% BER (static)
800 MHz OTP Mode:	-111 dBm minimum at 1% BER (static)
700 MHz P25 Mode (TIA-102 Method):	-116 dBm minimum at 5% BER (static)
800 MHz P25 Mode (TIA-102 Method):	-116 dBm minimum at 5% BER (static)
700 MHz EDACS Mode:	-119 dBm minimum at 12 dB SINAD
800 MHz EDACS Mode:	-118 dBm minimum at 12 dB SINAD
Receiver Intermodulation Rejection:	77 dB minimum at 12.5 kHz
Audio Frequency Response:	300 to 3000 Hz
Audio Output Power (Control Head):	15 watts RMS maximum into 4-ohm external speaker; 1 watt into 4-ohm headset
Voice-Coding Method:	
OTP Mode:	Advanced Multi-Band Excitation (AMBE™)
EDACS, ProVoice and P25 Modes:	Improved Multi-Band Excitation (IMBE™)
P25 Phase 1 Mode:	Advanced Multi-Band Excitation Plus (AMBE+™)
OpenSky Data Rate:	9.6 kbps
OpenSky Compressed Voice Relative Data Rate:	2400 bps
2.3 REGULATORY	
FCC Type Acceptance:	OWDTR-0051-E
Applicable FCC Rules:	Part 15 and Part 90
Industry Canada Certification:	3636B-0051
Applicable Industry Canada Rules:	RSS-119

3 INTRODUCTION

3.1 GENERAL DESCRIPTION

The M7300 mobile radio is a high-performance dual-band digital mobile radio. Shown in Figure 5-3 on page 23, the M7300 radio provides standard and advanced mobile radio communication functions. It can operate with the following radio systems/standards:

- 700 MHz and 800 MHz OpenSky trunked radio networks using the OpenSky Trunking Protocol (OTP);
- 800 MHz Enhanced Digital Access Communications System (EDACS) trunked radio networks;
- 800 MHz ProVoice trunked radio networks;
- 800 MHz APCO Project 25 Phase I compliant Common Air Interface (P25 CAI) trunked radio networks;
- 700 MHz talk-around communications in accordance with the APCO Project 25 Phase I standard; and,
- Conventional FM repeater-based and FM talk-around voice communications in 700 and 800 MHz bands in accordance with the TIA/EIA-603 conventional land-mobile radio standard.

The M7300 is designed to operate in a mobile environment, typically within a motor vehicle. It must be connected to an external transmit/receive antenna such as one mounted to the vehicle's rooftop or trunk lid. In high-power mode, the radio's 800 MHz RF transmit output power is rated at 15 watts maximum when operating in OpenSky mode, and 35 watts maximum when operating in an EDACS, conventional or P25 mode. Several different types of external-mount antennas are approved and available for use with the radio, as listed in Table 1-1 and Table 4-3.

Front-mount and remote-mount configurations are available. In the front-mount configuration, the control head is an integral part of the mobile radio. In the remote-mount configuration of the M7300, the control head is located near the radio operator's position and the radio is mounted remotely from the control head, typically in the vehicle's trunk. The remote-mount radio is shown in Figure 5-3 on page 23.

Control heads used with the M7300 radio include the CH-721 Scan and the CH-721 System model control heads. See Figure 8-4 (page 44) through Figure 8-6. Both heads feature a large 3-line graphical vacuum-florescent display, front panel controls and buttons for user control of the mobile radio, an internal high-power audio amplifier to drive an externally-connected speaker, and a front panel microphone connector. The CH-721 System control head also has a 12-button numeric keypad that provides Dual-Tone Multi-Frequency (DTMF) functionality and easier operator system/group selection control at the control head's front panel.

The remote-mount M7300 radio is designed for remote mounting in a motor vehicle's trunk, or some other preferably unoccupied section in a vehicle, such as a fire truck's equipment shelf. Up to four (4) control heads can be connected to a front-mount M7300, and up to five (5) control heads can be connected to a remote-mount M7300. The radio is remotely controlled by a control head(s) connected to it via 3-wire Controller Area Network (CAN) cables. Between the radio and control head(s), the CAN link carries digitized microphone and speaker audio, controlling data such as button presses and radio messages, and user data such as that for a mobile data terminal connected to the serial port of the radio or control head. For proper operation, the CAN link must be terminated appropriately on each end. In multiple control head installations, two or more control heads are interconnected to the mobile radio in a series ("daisy-chain") fashion via CAN link cables.

As shown in Figure 8-6 on page 45, the CH-721 Scan and System model control heads used in remote-mount radio installations have several connectors located on the head's rear panel. These connectors include a DC power connector, two (2) CAN port connectors used for CAN link interconnections, an

external speaker connector, a 9-pin serial port connector for connecting optional equipment such as a mobile data terminal, and a 25-pin accessory connector. Both CH-721 models can interface to an optional Federal Signal Electronic siren/light control system for broadcasting via a public address (PA) speaker.

The radio must be powered by an external +13.6-volt (nominal) DC power source. In mobile applications, the motor vehicle's electrical system is utilized as the source of DC power. In a remote-mount radio installation, the control head(s) connected to the radio is also powered by the same DC power source, but separately fused. When the control head is powered-up by the operator, it "wakes up" the radio by transmitting data to the radio via the CAN link.

The radio provides half-duplex voice and data communications. Voice communications are accomplished via a "push-to-talk" (PTT) type microphone and a speaker connected to the control head.

For data communications, the radio has an industry-standard 9-pin serial interface port for connecting optional data-type equipment, such as a Mobile Data Terminal (MDT), a laptop PC, an external display, or a key-entry device. This port works seamlessly with equipment from popular manufacturers and off-the-shelf applications. OpenSky employs User Datagram Protocol over Internet Protocol (UDP/IP) data packet transfers, providing "plug and play" connectivity for data-type devices.

700 MHz operating bands of the radio include the repeater output bands (mobile receive) from 764 to 767 MHz, 769 to 775 MHz and 773 to 776 MHz, and the repeater input bands (mobile transmit) from 794 to 797 MHz, 799 to 805 MHz and 803 to 806 MHz.

800 MHz operating bands of the radio include 806 to 824 MHz repeater input band (mobile transmit) and the 851 to 869 MHz band used for repeater output and talk-around communications.

The radio has an optional built-in Global Positioning System (GPS) tracking receiver. GPS provides quick and accurate unit location information to dispatchers via the radio network. The GPS receiver determines the unit's location and the radio transmits it to the radio network. The GPS antenna can be integrated into the mobile transmit/receive antenna (i.e., a "combination" antenna). Alternately, the GPS antenna can be located/mounted completely separate from the mobile transmit/receive antenna.

The radio and control head exceed tough environmental specifications included within military standard MIL-STD-810F, the radio industry standard TIA/EIA-603, and the radio standard established by the U.S. Forest Service.

An M7300 radio operating on an OpenSky radio network uses Time-Division Multiple-Access (TDMA) digital modulation technology on the radio frequency link. TDMA allows multiple radio users to share a single RF channel. In addition, a single RF channel can support simultaneous digital voice and data communications.

OpenSky employs Advanced Multi-Band Excitation (AMBE) speech and data compression technology developed by Digital Voice Systems, Inc. When operating on an OpenSky radio network, AMBE gives an M7300 the ability to provide exceptional voice quality via the limited bandwidth of the radio frequency path, even when the received RF signal is weak (i.e., even in "fringe" areas). AMBE is performed by a Digital Signal Processor (DSP) integrated circuit within the radio programmed to perform an AMBE compression algorithm during mobile transmissions, and an AMBE expansion algorithm during mobile reception.

Speech compression electronic circuitry—be it AMBE or another type such as IMBE—is sometimes referred to as "vocoding" circuitry for voice coding, or simply a "vocoder" circuit.

Future M7300 radio upgrades will also support radio operation on 800 MHz APCO Project 25 phase I compliant Common Air Interface (P25 CAI) trunked radio networks, and operation in a talk-around mode in accordance with the APCO Project 25 phase I standard. P25 radio systems utilize Improved Multi-Band Excitation Plus (IMBE) speech and data compression technology, also developed by Digital Voice Systems, Inc.

This manual contains installation procedures for the M7300 mobile radio and the CH-721 control heads. The procedures cover the mounting and cabling of the equipment as well as the basic testing of the radio and control head.



M/A-COM recommends the buyer use only a M/A-COM authorized representative to install and service this product. The warranties provided to the buyer under the terms of sale shall be null and void if this product is installed or serviced improperly, and M/A-COM shall have no further obligation to the buyer for any damage caused to the product or to any person or personal property.

3.2 RELATED PUBLICATIONS

The following publications contain additional information about the M7300 mobile radio:

- Quick Guide for OpenSky: MM-014368-001
- Operator's Manual for OpenSky: MM-014716-001 (available at www.macom-wireless.com via a Wireless Information Center login and Tech Link)
- Maintenance Manual: MM-014718-001

3.3 REPLACEMENT PARTS

Replacement parts can be ordered through M/A-COM's Customer Resource Center. To order replacement parts through the Customer Resource Center, call, fax or email our ordering system:

United States and Canada:

- Phone Number: 1-800-368-3277 (toll free)
- Fax Number: 1-800-833-7592 (toll free)
- E-mail: customerfocus@tycoelectronics.com

International:

- Phone Number: 1-434-455-6403
- Fax Number: 1-434-455-6676
- E-mail: InternationalCustomerFocus@tycoelectronics.com

3.4 CONTACTING M/A-COM FOR TECHNICAL ASSISTANCE

Should the mobile radio or control head require repair, or if there are questions or concerns about the installation of this equipment, contact M/A-COM's Technical Assistance Center (TAC) using the following telephone numbers or email address:

- U.S. and Canada: 1-800-528-7711 (toll free)
- International: 1-434-385-2400
- Fax: 1-434-455-6712
- Email: tac@tycoelectronics.com

4 UNPACKING AND CHECKING THE EQUIPMENT

4.1 MATERIALS

A typical set of materials for a front-mount M7300 mobile radio installation includes:

- **M7300 Mobile Radio, part number RU-144750-061**
with:
- **CH-721 Scan Control Head, part number CU23218-0001**
or
CH-721 System Control Head, part number CU23218-0003
- **Standard Microphone, part number MC-101616-040**
- **Installation Kit MAMW-NZN6W for Front-Mount M7300** (Contents listed in Table 4-1 below)
- **One or Two Antennas** as listed in Table 4-3 (page 18)

A typical set of materials for a remote-mount M7300 mobile radio installation includes:

- **M7300 Mobile Radio, part number RU-144750-061**
- **CH-721 Scan Control Head, part number CU23218-0002**
or
CH-721 System Control Head, part number CU23218-0004
- **Standard Microphone, part number MC-101616-040**
- **Installation Kit MAMW-NZN7R for Remote-Mount M7300 and CH-721** (Contents listed in Table 4-2)
- **One or Two Antennas** as listed in Table 4-3 (page 18)

Table 4-2 lists the contents of Installation Kit MAMW-NZN7R available for a remote-mount M7300 mobile radio installation. Table 4-3 on page 18 lists part numbers for radio-related options and accessories. Table 4-4 on page 20 lists options and accessories available for the CH-721 Scan and System model control heads.

**Table 4-1: Installation Kit MAMW-NZN6W
for Front-Mount M7300 Mobile Radio**

ITEM	QTY.	PART NUMBER	DESCRIPTION
1	1	KT101533V1	Kit, Front-Mount Mounting Bracket. Includes M5300/M7100/-M7300 Mounting Bracket FM101319V1 (marked KTB0310), M5 stainless-steel hardware to attach radio to bracket, self-tapping hardware to attach bracket to mounting surface, ½-inch rubber grommet, and 7-inch cable ties. See Figure 7-1 on page 30.
2	1	CA-012365-001	Cable, M5300/M7300 DC Power. Includes 10-AWG, 20-Foot DC Power Cable with straight connector, (2) waterproof HFB fuse holders, (1) 15-amp AGC fuse and (1) 3-amp AGC fuse.
3	2	CD-014027-001	Terminator, CAN; 3-Pin, Straight Body.
4	1	LS102824V10	Speaker, External Mobile; 20-Watt (with 4.6-foot cable).
5	1	CA-012349-001	Cable, M5300/M7300 Option. See Section 11.1 (page 55).
6	1	FM-104859-001	Cap, Waterproof (For CH-721's DB-9 serial port connector).

**Table 4-2: Installation Kit MAMW-NZN7R
for Remote-Mount M7300 Mobile Radio with CH-721 Control Head**

ITEM	QTY.	PART NUMBER	DESCRIPTION
1	1	KT23117	Kit, Remote-Mount Mobile Radio Mounting Bracket. Includes M5300/M7100/M7300 Mounting Bracket FM103111V1 and M5 stainless-steel hardware to attach radio to bracket. See Figure 8-2 on page 38.
2	1	KT-008608	Kit, CH-721 Mounting Bracket. Includes (1) U-Shaped Mounting Bracket and #8 stainless-steel hardware to attach control head to bracket.
3	1	CA-012365-001	Cable, M5300/M7300 DC Power. Includes 10-AWG, 20-Foot DC Power Cable with straight connector, (2) waterproof HFB fuse holders, (1) 15-amp AGC fuse and (1) 3-amp AGC fuse.
4	1	CA-012616-001	Cable, CH-721 DC Power. Includes 12-AWG, 10-foot DC Power Cable with straight connector, (2) waterproof HFB fuse holders, (1) 3-amp AGC fuse, and (1) 5-amp AGC fuse.
5	2	CD-014027-001	Terminator, CAN; 3-Pin, Straight Body.
6	1	CA-009562-030	Cable, CAN; 30 feet, Right-Angle-to-Straight Connectors.
7	1	LS102824V10	Speaker, External Mobile; 20-Watt (with 4.6-foot cable).
8	1	MAMROS0034-NN006	Cable, Speaker; 6-Inch, Straight Connector.
9	1	FM-104859-001	Cap, Waterproof (For CH-721's DB-9 serial port connector).
10	1	FM-104859-002	Cap, Waterproof (For CH-721's DB-25 accessory connector).

Table 4-3: Additional Options and Accessories for M7300 Mobile Radios

PART NUMBER	DESCRIPTION
AN-025167-001 (Cat. No. MAMW-NAN3J)	Antenna, 700/800 MHz, Standard Rooftop-Mount, 3 dB Gain, NMO Mounting Base, 15-foot (4.6-meter) RG-58 A/U (or equivalent) Low-Loss RF Cable, Male TNC and Mini-UHF RF Connectors; Factory-Tuned
AN-025167-002 (Cat. No. MAMW-NAN3K)	Antenna, 700/800 MHz, Elevated-Feed, Rooftop-Mount, 3 dB Gain, NMO Mounting Base, 15-foot (4.6-meter) RG-58 A/U (or equivalent) Low-Loss RF Cable, Male TNC and Mini-UHF RF Connectors; Factory-Tuned
AN-025167-004 (Cat. No. MAMW-NAN3V)	Antenna, 700/800 MHz GPS Combo, Rooftop-Mount, 3 dB Gain, NMO Mounting Base, 15-foot (4.6-meter) RG-58 A/U (or equivalent) Low-Loss RF Cable, Male TNC and Mini-UHF RF Connectors, 16.5-foot (5-meter) RG174/U (or equivalent) GPS RF Cable with Male SMA RF Connector (attached); 2.7 to 3.3 Vdc or 4.8 to 5.2 Vdc Bias; Factory-Tuned
AN-025167-005 (Cat. No. MAMW-NAN3W)	Antenna, 700/800 MHz GPS Combo, Elevated-Feed Rooftop-Mount, 3 dBd Gain, NMO Mounting Base, 15-foot (4.6-meter) RG-58 A/U (or equivalent) Low-Loss RF Cable, Male TNC and Mini-UHF RF Connectors, 16.5-foot (5-meter) RG174/U (or equivalent) GPS RF Cable with Male SMA RF Connector (attached); 2.7 to 3.3 Vdc or 4.8 to 5.2 Vdc Bias; Factory-Tuned
AN-025167-006 (Cat. No. MAMW-TBD)	Antenna, 700/800 MHz, Magnetic-Mount, 3 dBd Gain, 15-foot (4.6-meter) RG-58 A/U (or equivalent) Low-Loss RF Cable, Male TNC and Mini-UHF RF Connectors; Factory-Tuned

Table 4-3: Additional Options and Accessories for M7300 Mobile Radios

PART NUMBER	DESCRIPTION
AN-025167-010 (Cat. No. MAMW-NAN5B)	Antenna, 700/800 MHz, Low-Profile, Rooftop-Mount, 2 dBd Gain, NMO Mounting Base, 15-foot (4.6-meter) RG-58 A/U (or equivalent) Low-Loss RF Cable, Male TNC and Mini-UHF RF Connectors, Factory-Tuned
AN-025167-011 (Cat. No. MAMW-NAN5C)	Antenna, 700/800 MHz GPS Combo, Low-Profile, Rooftop-Mount, 2 dBd Gain, NMO Mounting Base, 15-foot (4.6-meter) RG-58 A/U (or equivalent) Low-Loss RF Cable, Male TNC and Mini-UHF RF Connectors, 16.5-foot (5-meter) RG174/U (or equivalent) GPS RF Cable with Male SMA RF Connector (attached); 2.7 to 3.3 Vdc or 4.8 to 5.2 Vdc Bias; Factory-Tuned
AN-025167-014 (Cat. No. MAMW-NAN5U)	Antenna, 700/800 MHz, Standard Rooftop-Mount, 5 dBd Gain, NMO Mounting Base, 15-foot (4.6-meter) RG-58 A/U (or equivalent) Low-Loss RF Cable, Male TNC and Mini-UHF RF Connectors, Factory-Tuned
AN-025167-015 (Cat. No. MAMW-NAN5V)	Antenna, 700/800 MHz GPS Combo, Rooftop-Mount, 5 dBd Gain, NMO Mounting Base, 15-foot (4.6-meter) RG-58 A/U (or equivalent) Low-Loss RF Cable, Male TNC and Mini-UHF RF Connectors, 16.5-foot (5-meter) RG174/U (or equivalent) GPS RF Cable with Male SMA RF Connector (attached); 2.7 to 3.3 Vdc or 4.8 to 5.2 Vdc Bias; Factory-Tuned
AN-025187-001 (Cat. No. MAMW-NAN5F)	Antenna, GPS Receive Only, Roof-Mount, 17-foot (5.2-meter) RG174/U (or equivalent) RF Cable with Male SMA RF Connector (attached); 2.7 to 3.3 Vdc or 4.8 to 5.2 Vdc Bias.
AN-025187-003 (Cat. No. MAMW-NAN3L)	Antenna, GPS Receive Only, Magnetic-Mount, 17-foot (5.2-meter) RG174/U (or equivalent) RF Cable with Male SMA RF Connector (attached); 2.7 to 3.3 Vdc or 4.8 to 5.2 Vdc Bias.
CA-012349-001	Cable, M5300/M7300 Option. See Section 11.1 (page 55).
MAMROS0055	Cable, TIA/EIA-232 Serial Programming (6 feet).
CN-014756	Connector, RF; TNC Male Crimp-Type for RG58U, RG58A/U and RGU400 Coaxial Cable.
KT-012350-001 (Cat. No. MAMW-NMK5F)	Kit, GPS Receiver for M5300/M7300.
KT-014494-001	Kit, Remote-Mount to Front-Mount Conversion.
CD-014027-001	Terminator, CAN; 3-Pin, Straight Body.

Table 4-4: Additional Options and Accessories for CH-721 Control Heads

PART NUMBER	DESCRIPTION
CA-009562-006	Cable, CAN; 6 feet, Right-Angle-to-Straight Connectors
CA-009562-030	Cable, CAN; 30 feet, Right-Angle-to-Straight Connectors
CA-009562-090	Cable, CAN; 90 feet, Right-Angle-to-Straight Connectors
CA-009562-250	Cable, CAN; 250 feet, Right-Angle-to-Straight Connectors
CA-011854-001	Cable, CH-721 Option
CA-104861	Cable, CH-721 Programming
MAMROS0075-N1210	Cable, DC Power; 12-AWG, 10-Foot, Straight Connector
MAMROS0075-N1220	Cable, DC Power; 12-AWG, 20-Foot, Straight Connector
MAMROS0075-R1210	Cable, DC Power; 12-AWG, 10-Foot, Right-Angle Connector
MAMROS0075-R1220	Cable, DC Power; 12-AWG, 20-Foot, Right-Angle Connector
MACDOS0012	Kit, Control Head Pedestal Mounting. Includes Pedestal Mount and Mounting Screws
MACDOS0013-CN004	Kit, Speaker; 20-Watt, Straight Connector
MACDOS0013-CR004	Kit, Speaker; 20-Watt, Right-Angle Connector
MC-101616-040	Microphone, Standard with Conxall Flush-Mount Connector (Included with catalog number MAMW-NMC7Z)
MC-103334-040	Microphone, DTMF with Conxall Flush-Mount Connector
MC-103334-050	Microphone, Noise-Canceling with Conxall Flush-Mount Connector
344A4678P1	Microphone Hanger. (Included with catalog number MAMW-NMC7Z)
MACDOS0010	Terminator, CAN; 3-Pin, Right-Angle Body

4.2 MATERIAL INSPECTION



CAUTION

After removal from the carton, examine the radio, control head and other components for broken, damaged, loose or missing parts. If any are noted, contact M/A-COM's Customer Resource Center (see page 16) immediately to discuss and arrange the return of the equipment to M/A-COM for replacement. Any unauthorized attempts to repair or modify this equipment will void the warranty and could create a safety hazard.

Upon removing items from the carton and verifying that all equipment is accounted for, proceed with the installation.



CAUTION

Mounting of the radio, control head, and/or antenna in ways other than those described in this manual may adversely affect performance, violate FCC rules on RF exposure, and even damage the unit, posing a potential safety hazard.

5 PLANNING THE INSTALLATION

5.1 GENERAL INFORMATION

Figure 5-1 on page 22 illustrates a typical front-mount radio installation, and Figure 5-2 on page 22 illustrates a typical remote-mount radio installation. Before starting, plan the installation carefully so it will meet the following requirements:

- The installation is safe for the operator and passengers within the vehicle.
- The equipment is installed away from the airbag deployment areas.
- The installation allows for convenient access by the operator, as applicable (i.e., the control head).
- The equipment is protected from water damage.
- The installation is neat and allows easy service access.
- The mobile radio is mounted in a location assuring the vehicle occupant's safety and out of the way of passengers and auto mechanics.



A professional radio installer should perform the installation!

5.2 TOOLS REQUIRED

The following tools are recommended to complete the installation. Where specific vendor names and model or part numbers are given, equivalent substitutes may be used:

- Non-Insulated Crimp Tool: Thomas & Betts WT-111-M
- Insulated Terminal Crimp Tool: Klein 1005
- Fuse Holder Crimp Tool: Thomas & Betts – WT-112M or California Terminal Products No. 1250 or Channelock No. 909
- Ratcheting Coaxial Crimp Tool: Cambridge 24-9960P
- Non-Metallic Fish Tape, 25-Foot: Klein-Lite 50156
- Various Socket and Driver Sets
- Soft-Jaw Pliers: Tessco 450520 or equivalent
- Various Fasteners (e.g., machine screws and nuts, Tek screws, etc.)
- Tie Wraps: 6-inches or larger
- Phillips-Head Screwdrivers, #1 and #2
- Flat-Blade Screwdrivers, #1 and #2
- 4-Millimeter Hex Key Wrench
- 1/8-Inch Hex Key Wrench (Allen Wrench)
- Two ⁵/₁₆-Inch Combination or Open-End Wrenches (Needed for GPS Receiver Option)
- ³/₄-Inch Hole Saw with Depth Protection: Ripley HSK 19 or Antenex HS34
- Clutch-Type Screw Cordless Gun/Drill with Driver Bits: Makita #6096DWE
- Cordless Electric Drill with Bits
- Deburring Tool (for ³/₈-inch and smaller holes)
- Flush-Cut and Large Wire Cutters



A separate list of test equipment is included in Section 14.2 on page 64.

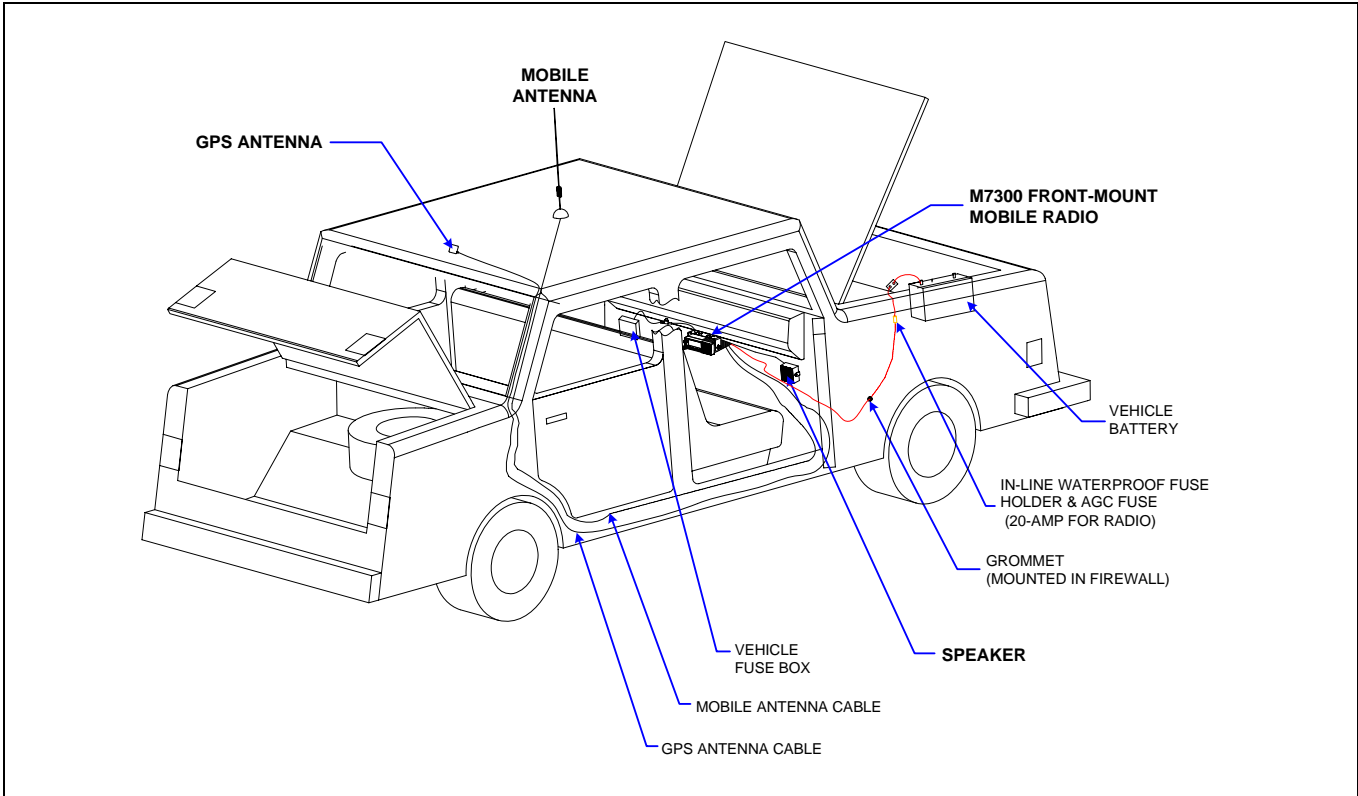


Figure 5-1: Typical Front-Mount Mobile Radio Installation in a Standard Passenger Vehicle

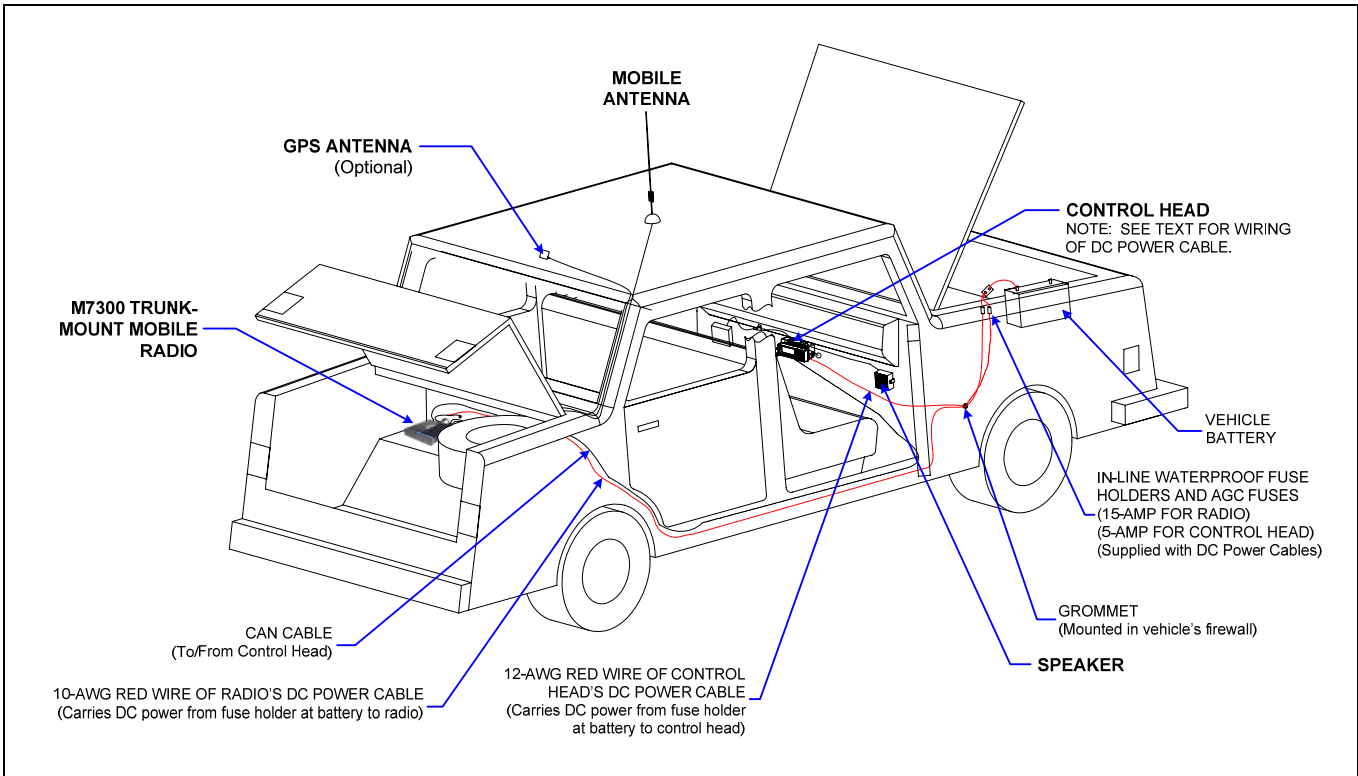


Figure 5-2: Typical Remote-Mount Mobile Radio Installation in a Standard Passenger Vehicle

FRONT VIEWS

Front-Mount M7300 Mobile Radio
(With Scan Control Head)



Remote-Mount M7300 Radio

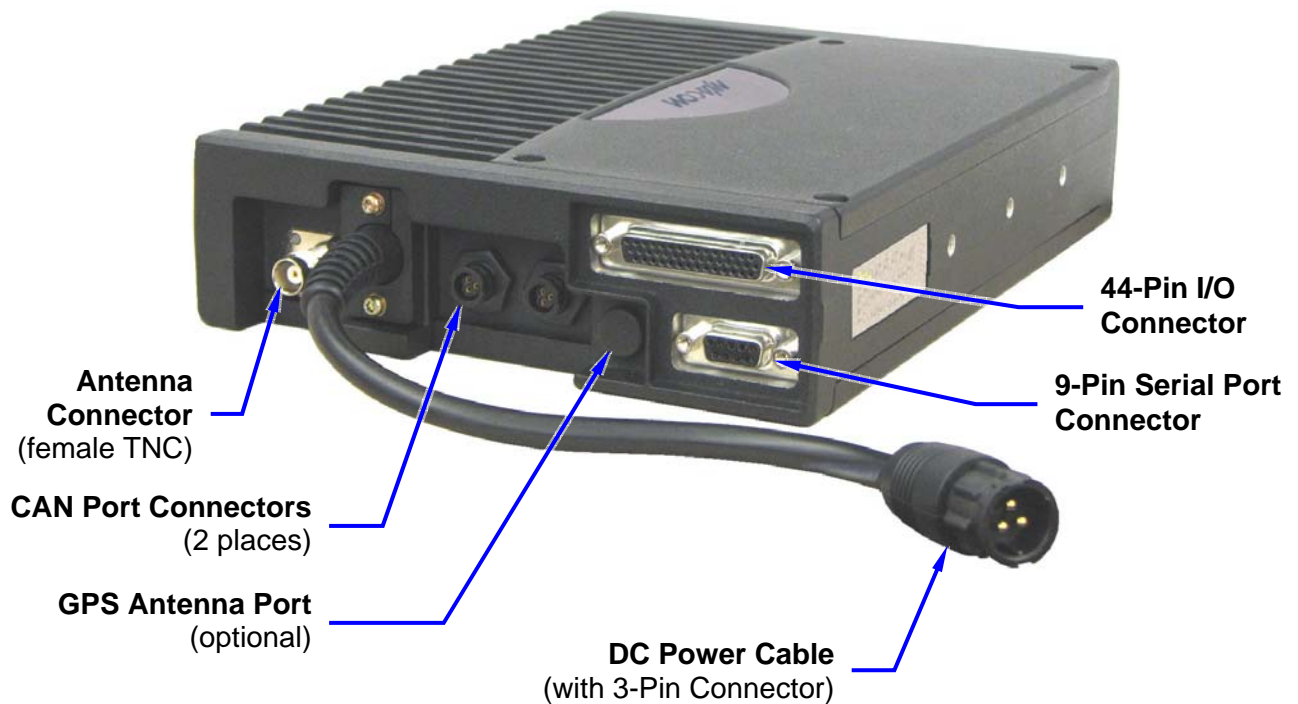
REAR VIEW
(Enlarged)

Figure 5-3: M7300 Front-Mount and Remote-Mount Mobile Radios — Front and Rear Views

5.3 LOCATING COMPONENTS

Plan the mounting locations of all components (radio, control head, antenna, and cables) and determine the routes for all wiring and cables. Particularly consider the connection of the radio for planning purposes.

- Determine the customer's preferences, if any, for location of components. Comply with these preferences as long as they are consistent with safety recommendations and guidelines presented in this manual, and other generally accepted professional radio installation practices.
- For a front-mount installation, the radio is typically located under the vehicle's dash panel. However, it may be mounted above the dash, or at some other location per customer requirements, available space, and/or mounting surface strength. Radio and control head dimensions are listed in Section 2.1 on page 12. As noted in that section, these dimensions do not include space required at the rear of the radio for cables. Several inches of clearance space is required.
- For a remote-mount radio installation, the radio is typically located in the motor vehicle's trunk, or some other preferably unoccupied section in a vehicle, such as a fire truck's equipment shelf, and the control head is typically located under the vehicle's dash panel. Radio and control head dimensions are listed in Section 2.1 on page 12. As noted in that section, these dimensions do not include space required at the rear of the radio and control head for cables. Several inches of clearance space is required at the back of the control head, and at least six (6) inches is recommended at the back of the radio. In addition, several inches of clearance space is required at each side of the radio for access to the screws that secure the radio to its mounting bracket.
- When selecting a mounting location, verify sufficient clearance behind the radio can be maintained so cables will not be stressed, crushed, twisted, or bent at severe angles. This also applies to the control head in a remote-mount radio installation. Also, the front and sides of the units must have clearance for air circulation, access to mounting screws, mounting hardware, etc.
- Verify the drilling of holes and the insertion of screws will not damage or interfere with any existing vehicle components (for example, a fuel tank, fuel lines, the transmission housing, etc.), or any existing vehicle wiring.
- For antenna location and installation-related information, refer to Section 6.



The radio must be kept out of direct sunlight and away from heat sources. Adequate free-air ventilation must be provided to its rear fins. The radio will automatically reduce its transmit RF output power when its ambient temperature exceeds approximately +140° Fahrenheit (+60° Celsius).



All cables should have a service loop near each connector end. Do not bend the cables at severe angles near the connector end. Above all, after all components are installed, verify no cable is under any tension. Failure to do so may lead to damaged cables, causing intermittent radio operation or complete radio failure.

6 ANTENNA INSTALLATION

6.1 ANTENNA MOUNTING LOCATIONS



At this time, review all information presented in the REGULATORY AND SAFETY INFORMATION section of this manual (see page 6). A transmitting antenna must be installed in accordance with the guidelines presented in the REGULATORY AND SAFETY INFORMATION section. Use Table 1-1 on page 8 and Figure 6-1 below as a guide for determining the best possible mounting configuration/location in order to reduce human exposure to radio frequency (RF) electromagnetic energy during transmit mode.

Antennas must be mounted in one of three possible locations on the vehicle as described in the following subsections. Figure 6-1 shows the recommended locations and antenna part numbers for each location. Also, see Table 4-3 for additional information. Always follow the antenna manufacturer's instructions when mounting an antenna.

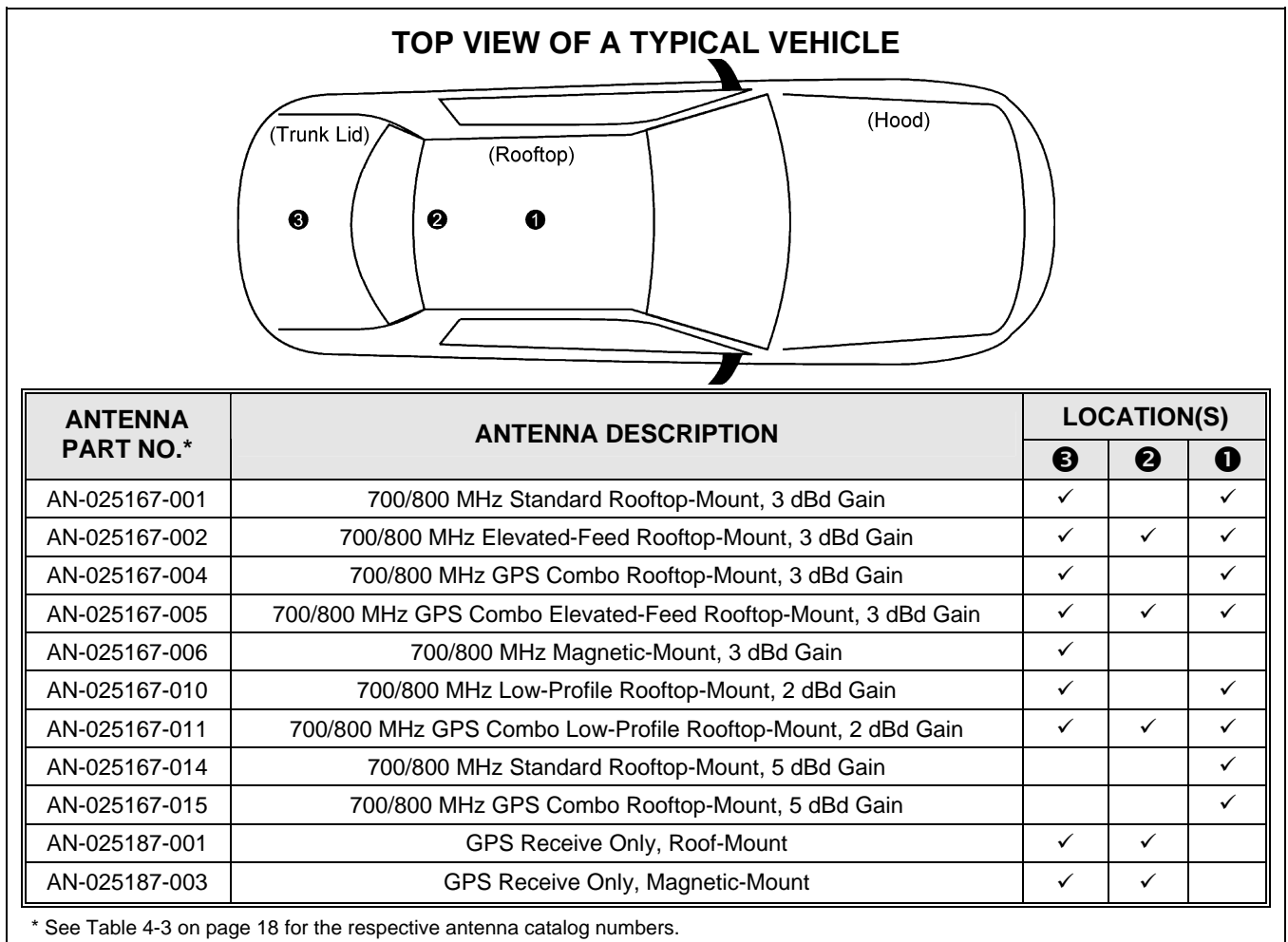


Figure 6-1: Recommended Antenna Mounting Locations with Antenna Part Numbers

6.1.1 Direct Center or Center-Rear of Rooftop

The center of the vehicle's roof is the best location for a rooftop-mount antenna (location ❶ in Figure 6-1). For optimal performance, the mounting area under the antenna must be a flat with a minimum radius of six (6) inches of metal ground plane. It must be located directly in the center of the roof to minimize human exposure to RF electromagnetic energy. Other obstructions such as a light bar or another antenna may prevent the antenna from being mounted in the direct center of the roof. In this case, the antenna should be mounted a minimum of one foot away from and behind the obstruction but in the middle of the roof with respect to the left and right sides of the vehicle (location ❷ in Figure 6-1).

6.1.2 Center of Trunk Lid

Certain vehicles do not allow for the antenna to be placed in the center or center-rear of the roof. In this case, the next best location for the antenna is in the direct center of the trunk lid (location ❸ in Figure 6-1). In this case, an elevated-feed-point antenna is recommended. Although this type of antenna does not require a metal ground plane, it must be located directly in the center of the trunk lid to minimize human exposure to RF electromagnetic energy.

6.2 ANTENNA INSTALLATION PROCEDURE



NOTE

An antenna **must** be installed before completing the radio installation.

6.2.1 Install the Mobile Antenna

Table 4-3 (page 18) and Figure 6-1 (page 25) list the mobile radio antennas available for use with the radio. As presented in the previous section, various mounting locations exist. Optimal performance is achieved via a rooftop antenna mounted in the direct center of the motor vehicle's roof. The following mobile antenna installation procedure is recommended:

1. Once the mounting location is selected, refer to the antenna manufacturer's mounting and testing instructions included with the antenna kit for installation guidance. Install the antenna in accordance with these instructions. If necessary, contact M/A-COM's Technical Assistance Center. See page 16 for TAC contact information.



WARNING

The antenna cable of M/A-COM approved antennas should never be cut to a shorter length. Instead, excess cable must be tied and stowed. This not only prevents the antenna from radiating above its intended or configured power, but it also allows for future installation considerations such as a relocation of the mobile radio within the vehicle. Installations requiring longer cables are treated as custom and separately specified.

2. Route the cable from the antenna base to the location of where the mobile radio will be installed. Remove headliner panel, interior panels, etc., as necessary. The cable must be kept out of casual contact from persons within the vehicle. Tie and stow the cable as necessary to protect it from possible chafing.
3. Using an appropriate crimp tool, crimp the supplied TNC RF connector to the end of the antenna cable. For crimping instructions, see Figure 6-2 or the instructions supplied with antenna.

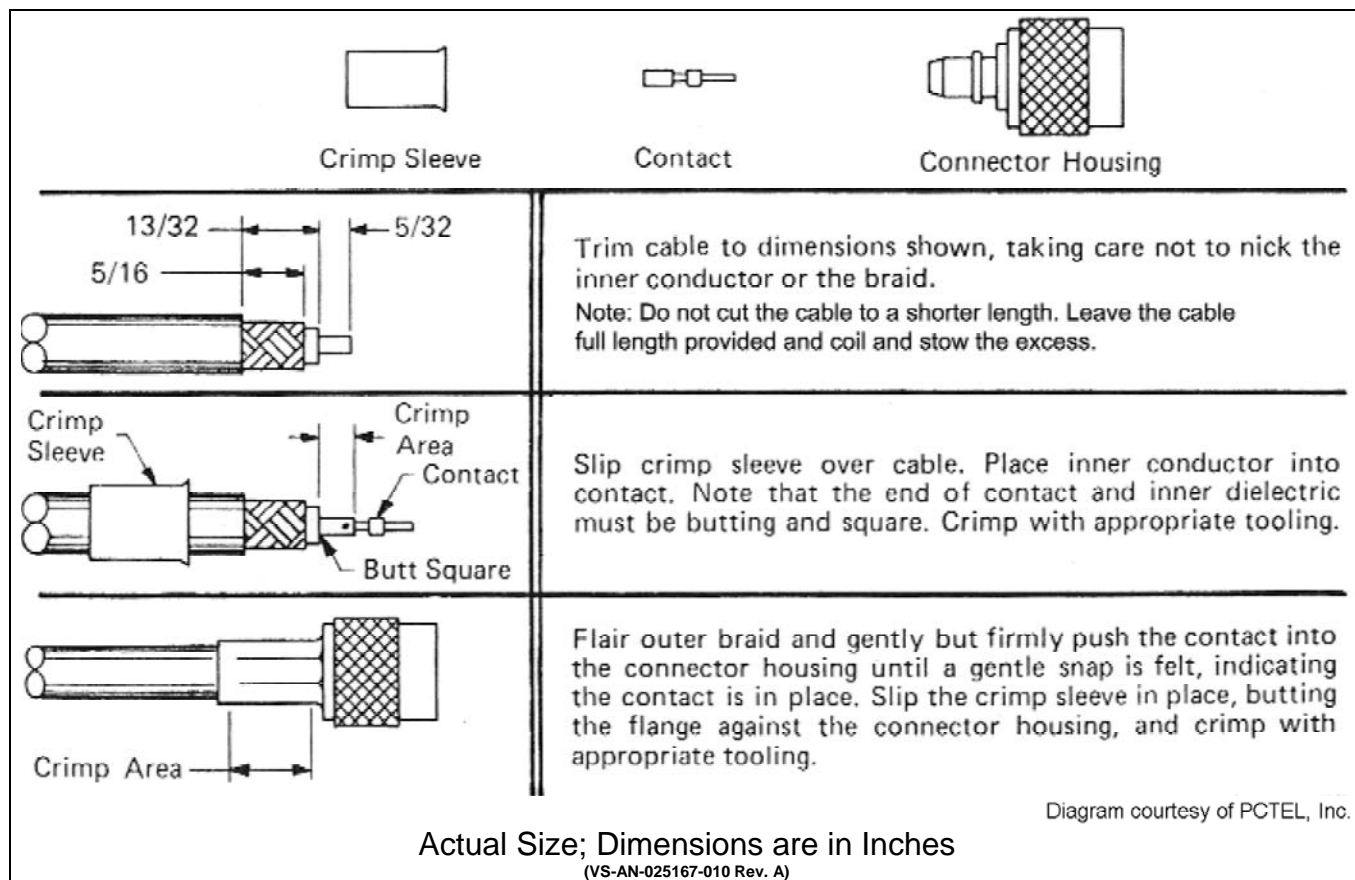


Diagram courtesy of PCTEL, Inc.

Figure 6-2: Crimping Instructions for TNC RF Connector

- The antenna cable is connected to the radio's TNC receptacle-type (female) RF connector per a procedure presented later in this manual. The cable and its TNC connector must be protected from damage, dirt, and/or metal shavings which may be generated during the mechanical and electrical installation of the radio. Temporarily tying the connector and cable-end within a small plastic bag is recommended.

6.2.2 Install the GPS Antenna (Required Only if Radio has GPS Receiver Option)

If the M7300 radio is equipped with the GPS receiver option, the GPS receiver requires connection to an externally-mounted GPS antenna. The GPS antenna must be kept at least six (6) inches away from any other antenna mounted on the vehicle and it must have at least six inches of surface ground plane beneath it. The following antenna installation procedure is recommended:



A combination ("combo") antenna kit includes a GPS antenna built into the base of the mobile antenna. Refer to Table 4-3 (page 18) and/or Figure 6-1 (page 25) for available combo antennas.

- Once the mounting location is selected, refer to the antenna manufacturer's mounting and testing instructions for installation guidance. Install the antenna in accordance with these instructions. If necessary, contact M/A-COM's Technical Assistance Center. See page 16 for TAC contact information. **Do not alter the GPS antenna cable length; tie and stow excess cable as necessary.**

2. Route the cable from the antenna base to the location of where the radio will be installed. Remove headliner panel, interior panels, etc., as necessary. The cable must be kept out of casual contact from persons within the vehicle. Tie and stow it as necessary to protect it from possible chafing.
3. The antenna cable is connected to the radio's SMA receptacle-type (female) RF connector per a procedure presented later in this manual. The cable and its (male) SMA connector must be protected from damage, dirt, and/or metal shavings which may be generated during the mechanical and electrical installation of the radio. Temporarily tying the connector and cable-end within a small plastic bag is recommended.

7 FRONT-MOUNT RADIO INSTALLATION



NOTE

This section includes detailed instructions for mechanically installing and wiring a front-mount M7300 mobile radio. For remote-mount M7300 mobile radio installation procedures, refer to Section 8 which begins on page 36.

7.1 MOUNTING THE FRONT-MOUNT RADIO

The Mounting Bracket Kit for the front-mount M7300 mobile radio includes a heavy-gauge steel U-shaped mounting bracket. The radio should be attached to a mounting surface using this bracket. The bracket can be mounted above or below the radio. Kit contents are shown in Figure 7-1, and bracket dimensions are shown in Figure 7-2.

Both the radio and the mounting bracket have multiple holes in both sides for adjusting the radio within the bracket. The design allows for both front-to-rear tilting of the radio within the bracket for best viewing angle, and a front-to-rear position offset. The radio has six (6) threaded mounting holes, three (3) per side, and the mounting bracket has ten (10) corresponding holes, five (5) per side. The radio must be secured to the bracket using at least four of the six M5 socket-head screws included in the Mounting Bracket Kit (2 screws per side).

Typically, the radio is front-to-rear centered within the bracket. However, it can be front-to-rear offset by approximately 2 inches (5.1 centimeters), if required. Also, the radio can be positioned straight in the bracket (i.e., parallel with the bottom surface of the bracket), or it can be tilted up or down at an angle of between approximately 10 to 20 degrees. When positioned straight and centered front-to-rear within the bracket, the radio extends approximately 2.5 inches (6.4 centimeters) from the front and rear edges of the bracket. In the rear, additional clearance must be included for cables. The area directly at the front of the radio must be completely clear of all objects (e.g., gear shift, other radio equipment, etc.) so the operator can easily access and visualize the radio's control head.

The mounting bracket must be attached to a secure metal surface that meets or exceeds the minimum 1/16-inch-thick steel sheet metal requirement in accordance with the following **WARNING**. For example, it can be attached directly to the bottom of the dash if the gauge of the sheet metal is high and the surface is firm and flat, or it can be attached to the transmission hump, etc., if a mounting wedge (not included) is utilized. The front-mount M7300 radio weighs approximately 9.2 pounds (4.17 kilograms).



WARNING

At a minimum, the mounting surface should be 16-gauge (approximately 1/16-inch thick) steel sheet metal. Mounting to plastic or other material with low tensile and shear strength could lead to an unsafe and/or failed mounting condition, turning the radio and its mounting bracket into a projectile during a high-shock incident such as a motor vehicle accident. If the selected mounting surface does not meet the minimum 16-gauge steel sheet metal requirement, the surface should be reinforced with a metal backing plate (not supplied) or it should be reinforced using some other approved mounting method.



CAUTION

In addition to improving safety of the installation, firm mounting also prevents unreasonable vibration that could damage the radio, adversely affect transceiver performance and/or cause its cable connections to loosen. An improperly mounted M7300 radio may experience degradation in the quality of voice and data communications.

7.1.1 Mounting Bracket Installation

The front-mount M7300 radio's mounting bracket is included with the Remote-Mount Mounting Bracket Kit KT101533V1. Kit contents are shown in Figure 7-1. This kit is Item 1 listed in Table 4-1 (page 17).

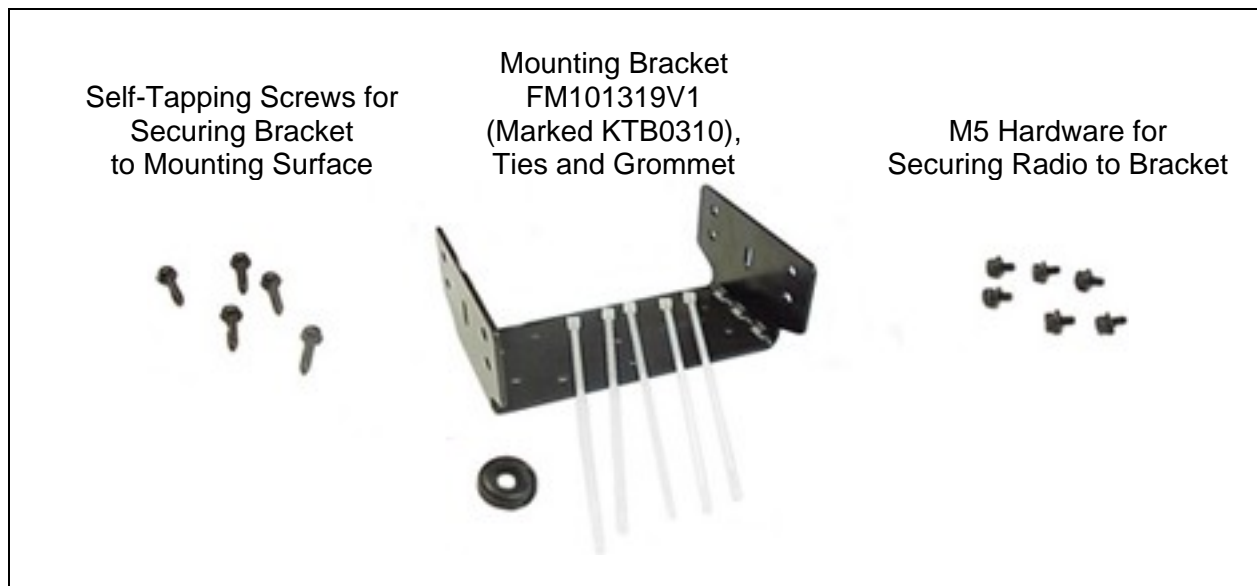


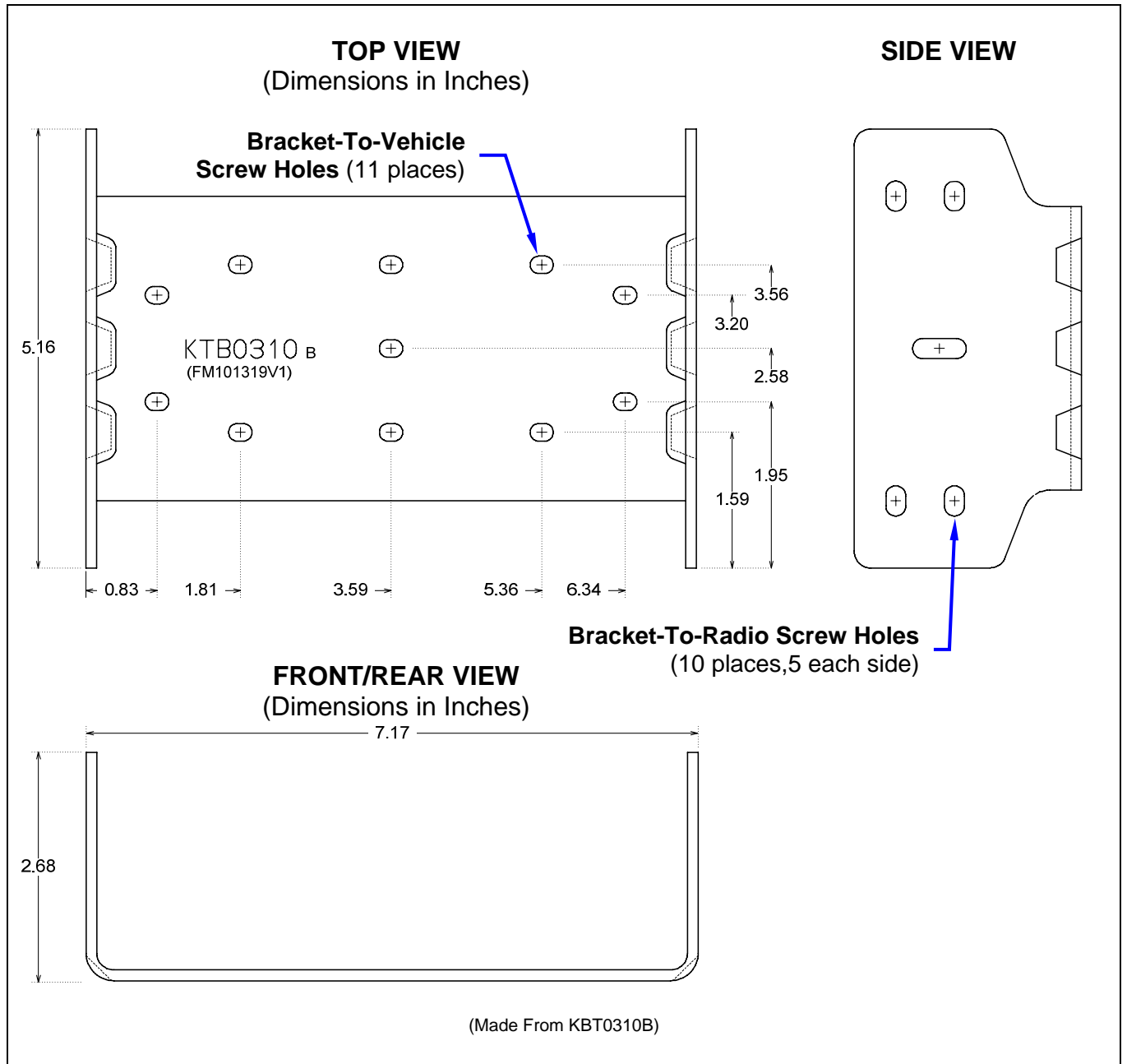
Figure 7-1: Front-Mount Mounting Bracket Kit KT101533V1

When selecting a mounting location for the radio, verify sufficient clearance can be maintained around the radio for installation and service access. A minimum clearance of approximately 4 inches (10 centimeters) is recommended at the rear, left and right sides of the radio. As previously stated, the area directly at the front of the radio must be completely clear of objects so the operator can easily access and visualize the radio's control head.

As illustrated in Figure 7-2, the bracket is both left-to-right and front-to-rear symmetrical. It has eleven (11) holes for securing it to a mounting surface. At least four (4) of these holes must be used to secure the bracket to the mounting surface. Five 20-millimeter-long self-tapping screws are included in the Mounting Bracket Kit for this purpose. However, some other type of hardware (not supplied) may be used, such as #10-32 stainless-steel self-locking hardware (i.e., machine screws with washers and locking nuts), or self-drilling screws. Self-drilling screws such as "TEK" screws do not require drilling of a pilot hole prior to installation. Do **not** use common self-threading sheet metal screws because they will loosen over time with vehicle vibrations.

The following mounting procedure is recommended:

1. Determine the best radio-to-bracket position and angle by test-fitting the radio into the mounting bracket at the selected vehicle mounting location. Slide the radio between the sides of the bracket and temporarily secure it to the bracket with several of the M5 socket-head screws from the bracket kit. When positioned straight and centered front-to-rear within the bracket, the radio extends approximately 2.5 inches (6.4 centimeters) from the front and rear edges of the bracket. In the rear, additional clearance must be included for cables. The area directly at the front of the radio must be completely clear of all objects (e.g., gear shift, other radio equipment, etc.) so the operator can easily access and visualize the radio's control head.
2. At the rear of the radio, verify sufficient clearance is available for cables and service access.



**Figure 7-2: Mounting Bracket FM101319V1 (Marked KTB0310) Dimensions
[for Front-Mount M7300 Mobile Radio (Radio Not Shown)]**

3. If the mounting surface is not flat (such as the top of a transmission hump), construct a suitable mounting wedge as necessary, and attach the wedge to the surface using an approved attachment method. Never mount the bracket directly to a non-flat surface.
4. On the mounting surface, mark the selected location for the bracket, and then remove the radio from the bracket.
5. Clean and remove any foreign material from the mounting surface.

- Using the bracket as a template, and/or the dimensional information shown in Figure 8-3, mark and drill at least four (4) mounting holes into the mounting surface as required per the type of hardware used.



Before drilling holes and/or installing mounting screws, verify these operations will not damage or interfere with any existing vehicle component (the fuel tank, a fuel line, the transmission housing, existing vehicle wiring, etc.). Always check to see how far the mounting screws will extend below the mounting surface prior to installation. Always deburr drilled holes before installing screws.

- Temporarily remove the bracket and deburr all of the newly drilled holes.
- If necessary, apply an approved paint or rust-inhibitor at the holes in the mounting surface.
- Set the bracket back into place.
- Install and tighten the mounting screws/hardware.
- Verify the bracket is firmly secured to the mounting surface. A secure mount prevents unreasonable vibration, which could damage the radio and/or cause its cable connections to loosen.
- If the rear of the radio is easily accessible when the radio is positioned in the selected position within the bracket, it is recommended that the radio be temporarily inserted into the bracket. Otherwise, do not mount the radio into the bracket at this time, because several cable connections must be made at the rear of the radio.

7.1.2 Inserting the Radio into the Mounting Bracket

The radio should now be inserted into the mounting bracket according to this procedure:

- Lay the radio into the mounting bracket with the front of the radio facing in the correct direction (usually towards the rear of the vehicle).
- Secure the radio to the bracket using at least four (4) of the six (6) M5 x 10 mm stainless-steel socket-head screws included with the Mounting Bracket Kit. These screws have captive lockwashers. Kit contents are shown in Figure 7-1. This kit is Item 1 listed in Table 4-1 (page 17).
- Tighten all screws using a 4-millimeter hex key wrench until each lockwasher is fully compressed and the radio is firm and flush in between the brackets.
- Check the mounting area for proper clearance for cable service looping and for air circulation, plus an area to secure and rest the excess cable lengths.



Proper mounting is one factor that ensures optimal radio performance. An improperly mounted radio may experience degradation in the quality of voice and data communications.

7.2 FRONT-MOUNT RADIO'S DC POWER INSTALLATION

7.2.1 Overview of On/Off Power Wiring Configurations

The following power wiring configurations are supported:

- Radio turns on and off automatically with vehicle's ignition switch/key** — This configuration allows the on/off state of the vehicle's ignition switch/key to control the on/off power state of the

radio. The white wire of the radio's DC Power Cable is connected to a fused switched power source, typically identified as vehicle "Accessory" power. This source must switch on (up to positive (+) battery voltage potential) when the vehicle's ignition switch/key turns on, and it must switch off (to near zero volts) when the ignition switch/key turns off. The required fuse rating is 3 amperes. When using this configuration, the on/off/volume control must be left in the on position for automatic power-up/down to function properly.



NOTE

In a front-mount M7300 radio installation, to fuse the white wire of the radio's DC Power Cable, a waterproof (HFB type) fuse holder and a 3-amp AGC fuse are included with the cable.

- **Radio turns on and off with a manual switch** — This configuration is used when, for example, the radio must remain on even when the ignition key must be removed from the vehicle and a separate on/off switch is acceptable. The white wire of the radio's DC Power Cable is connected to one side of a manually-controlled switch, and the other side of this switch is connected to unswitched and fused vehicle power. The required fuse rating is 3 amperes. When using this configuration, the on/off/volume control must be left in the on position for automatic power-up/down to function properly.
- **Radio turns on with its on/off/volume control ("hot wired")** — This configuration allows radio on/off power control only via its on/off/volume control. It may be desired if, for example, the radio must remain on even when the ignition key must be removed from the vehicle and a separate on/off switch is not desired and/or not acceptable. The white wire of the radio's DC Power Cable must be connected to unswitched and fused vehicle power. The required fuse rating is 3 amperes.

In all of the above cases, the radio's main DC power input (red wire) must be connected through an in-line fuse to unswitched vehicle DC power. The red wire must be connected to raw battery power (positive battery terminal) via the supplied fuse.

7.2.2 DC Power Cable and Main Fuse Holder Installation

The radio's DC Power Cable has a 3-pin connector, a 20-foot red wire (for the main power connection), a 20-foot white wire (for the switched power source connection), and a 4-foot black wire (for the ground connection). It is supplied with waterproof fuse holders, two AGC-type fuses, and non-insulated ring terminals. The following installation procedures are recommended:

7.2.2.1 **Black Wire Connection (Ground Wire)**

1. Connect the radio's DC Power Cable to the radio by mating its 3-pin connector to the radio's 3-pin power cable connector as follows: Visually align the key and firmly push and turn the outer locking ring clockwise until it stops. A click will be sensed to confirm proper mating.
2. Prepare to connect the cable's black wire to vehicle ground by locating an area of vehicle metal within approximately two (2) feet of the radio. This surface **must** have a solid and stable connection to vehicle ground. If not, add grounding strap(s) as necessary.
3. Strip the area of any paint or dirt to expose a bare metal surface, approximately $\frac{3}{4}$ -inch square.
4. Drill a hole in the approximate center of the bare metal surface, and deburr it. A $\frac{3}{8}$ -inch non-insulated ring terminal is supplied with the cable to make this ground connection. Therefore, hole diameter should be appropriate for the utilized grounding screw/bolt size and type used to connect the ring terminal to the bare metal surface. This hardware is not supplied.
5. Cut the black wire to the required length plus some additional length for a service loop, then strip insulation back approximately $\frac{1}{4}$ -inch.

6. Crimp a $\frac{3}{8}$ -inch non-insulated ring terminal (supplied with the cable) to the end of the black wire.
7. Attach the ring terminal and black wire to the bare metal surface using stainless-steel self-locking hardware (i.e., machine screws with washers and locking nuts) or other appropriate hardware to ensure a reliable terminal-to-metal contact. Tighten securely.
8. Apply an approved paint or rust-inhibitor over the remaining exposed bare metal surface and around the ring terminal.

7.2.2.2 Red Wire and Main Fuse Holder Connection (Radio's Main Power Wire)

1. Continue installation of the radio's DC Power Cable by routing its 20-foot 10-AWG red wire to the location of the vehicle's battery (or its main DC bus bar or stud). Remove interior panels, door kick panels, etc., and route the wire through existing channels in the vehicle body as necessary. Protect the wire from possible chafing where necessary. Tie and stow the wire as necessary.



CAUTION

Plan the routing of the 10-AWG red wire carefully, using an existing access hole in the vehicle's firewall if possible. Alternately, drill a new hole approximately $\frac{1}{2}$ -inch in diameter and install a small rubber grommet (one supplied with the bracket kit) to protect the wire from chafing at the hole's sharp metal edge. **To prevent fumes from entering the passenger compartment, this hole/grommet/wire combination must also be sealed with a silicon-based sealer before completing the installation.**



CAUTION

Do **not** install any wiring or fuse holder over or in the near vicinity of the vehicle's engine. Excessive engine heat can cause permanent damage to these components and can lead to intermittent electrical connection to the battery.



WARNING

Before making connections to the battery's positive post, carefully disconnect the battery's negative (ground) cable(s). This will prevent tools or other metallic objects which come in contact with the battery's positive terminal from shorting to vehicle ground, causing sparks or even a fire or an explosion! When disconnecting the negative cable(s), cover/insulate the positive post(s) if it is not already so a tool cannot short between the posts. Some vehicles, such as those with diesel engines have more than one battery; in this case, disconnect the negative cables at all batteries.

Radio and control head fuses should not be installed until all wiring is complete. This will prevent the radio from powering up prematurely and/or causing an in-rush of current that could lead to shorting of the battery, sparks, or even fire.

2. Obtain one of the waterproof (HFB type) fuse holders included with the DC Power Cable.
3. **Observe and follow the previously presented WARNING!**
4. Cut the red wire to the required length for connection to the battery's positive (+) battery terminal (or the main DC bus bar or stud).
5. Prepare to splice the waterproof fuse holder into the red wire by cutting it again, at approximately three (3) to six (6) inches from the end.
6. Strip all three (3) wire ends back approximately $\frac{3}{8}$ -inch, place a fuse holder shell on each wire, and securely crimp a fuse holder terminal to each wire end. Before crimping, verify fuse holder shells are oriented in the correct directions (i.e., with each large end towards the wire end).

7. Label this fuse holder and red wire appropriately (e.g., “M7300 Main Power: 15-AMP FUSE”)
8. **Do NOT install a fuse into the fuse holder at this time.**
9. Crimp an appropriate electrical terminal to the short red wire. A corrosion-resistant $\frac{3}{8}$ -inch ring terminal is included with the cable for this purpose, but another size corrosion-resistant terminal type (not supplied) may be used if required.
10. Connect the ring terminal directly to the battery’s positive post (or if present, to a stud on the battery’s main/non-switched power distribution terminal block).
11. Continue with the speaker installation procedures presented in Section 9.1 on page 53.



A front-mount M7300 mobile radio installation may be equipped with additional CH-721 control heads in a multi-head installation. In this case, refer to Section 8.3 (begins on page 43 for control head installation procedures).

8 REMOTE-MOUNT RADIO INSTALLATION



This section includes detailed instructions for mechanically installing and wiring a remote-mount M7300 mobile radio. For front-mount M7300 mobile radio installation procedures, refer to Section 7 which begins on page 29.

8.1 MOUNTING THE REMOTE-MOUNT RADIO

This section provides details on mounting a remote-mount M7300 mobile radio in the vehicle. Control head installation procedures are included in Section 8.3 which begins on page 43.

As an assembled unit, the radio weighs approximately 8 pounds (3.63 kilograms). The preferred mounting of the radio is on top of a firm, flat surface. Radio dimensions are shown in Figure 8-1.



Installation Kit MAMW-NZN7R (contents listed in Table 4-2 on page 18) contains the most complete set of materials for installing the remote-mount M7300 mobile radio. Therefore, the following instructions make repeated reference to this kit. Item numbers given in parenthesis refer to items in the kit.



Prior to beginning the installation, verify the radio has the proper version of software and verify it has been configured properly for customer usage. Consult with the radio system network administration personnel as necessary.



Though generally mounted in a trunk or remote location, the remote-mount mobile radio must be kept away from heat sources. Mounting it in a location which is out of direct sunlight is recommended but not required. Adequate ventilation space must be provided to the rear and side fins. The radio reduces its RF output power when its ambient temperature exceeds approximately +140° Fahrenheit (+60° Celsius).



At a minimum, the mounting surface should be 16-gauge (approximately 1/16-inch thick) steel sheet metal. Mounting to plastic or other material with low tensile and shear strength could lead to an unsafe and/or failed mounting condition, turning the radio and its mounting bracket into a projectile during a high-shock incident such as a motor vehicle accident. If the selected mounting surface does not meet the minimum 16-gauge steel sheet metal requirement, the surface should be reinforced with a metal backing plate (not supplied) or it should be reinforced using some other approved mounting method.



Before drilling holes and/or installing mounting screws, verify these operations will not damage or interfere with any existing vehicle component (the fuel tank, a fuel line, the transmission housing, existing vehicle wiring, etc.). Always check to see how far the mounting screws will extend below the mounting surface prior to installation. Always deburr drilled holes before installing screws.

8.1.1 Mounting Bracket Installation

The remote-mount radio's mounting bracket is included with the Remote-Mount Mounting Bracket Kit KT23117. Kit contents are shown in Figure 8-2. This kit is Item 1 listed in Table 4-2 (page 18).

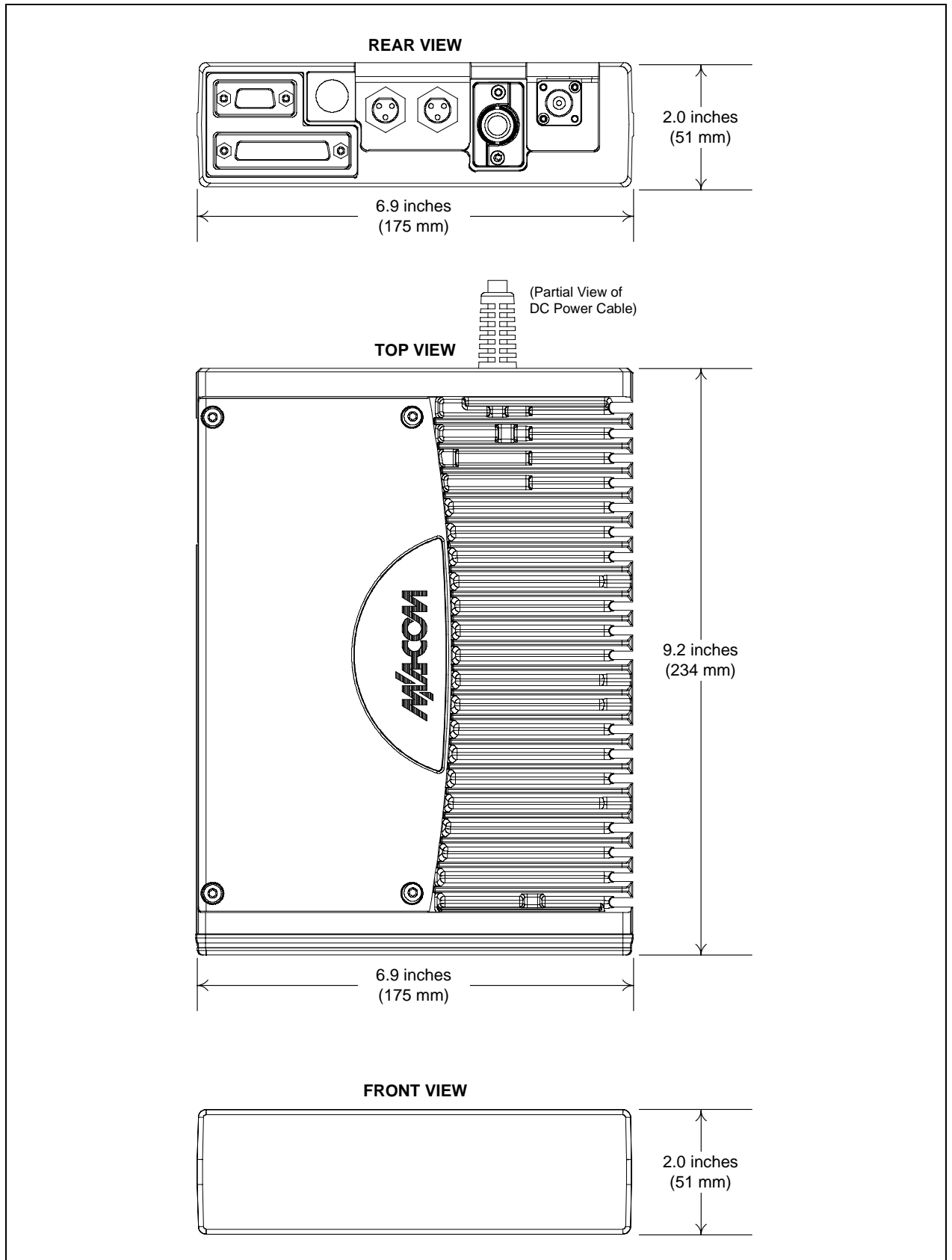


Figure 8-1: Remote-Mount Radio Dimensions

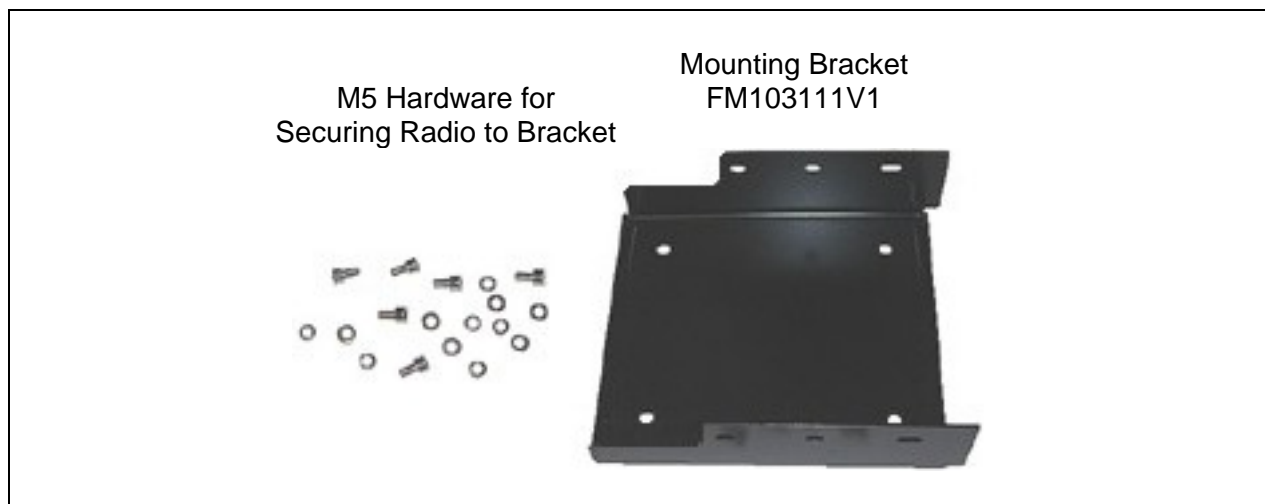


Figure 8-2: Remote-Mount Mounting Bracket Kit KT23117

Typically, the radio's mounting bracket is mounted in the vehicle's trunk, on the top surface of the trunk tray or the trunk floor. However, it can be suspended from the trunk's rear deck if the surface is completely flat and the thickness of deck's sheet metal is adequate.

When selecting a mounting location for the radio, verify sufficient clearance can be maintained around the radio for installation and service access. A minimum clearance of 4 inches (approximately 10 centimeters) is recommended at the rear, left and right sides of the radio, and at least 2 inches (approximately 5 centimeters) of clearance is recommended at the front of the radio.

As illustrated in Figure 8-3, the bracket is left-to-right symmetrical and the shortest portion of its side rails are at the rear.

As all installations differ, bracket-to-vehicle mounting screws are not included. Utilization of ¼-inch-diameter, 28-thread-per-inch (¼-28) stainless-steel self-locking hardware (i.e., machine screws with washers and locking nuts) is highly recommended. However, ¼-inch stainless-steel self-drilling screws may be employed to speed installation time. Self-drilling screws such as "TEK" screws do not require drilling of a pilot hole prior to installation. Do **not** use common self-threading sheet metal screws because they will loosen over time with vehicle vibrations.

The bracket has four (4) available mounting holes. All four must be used to secure the bracket to its mounting surface.

The following mounting procedure is recommended:

1. Using the mounting bracket as a template, and/or the dimensional information shown in Figure 8-3, mark and drill four (4) mounting holes into the mounting surface as required per the type of hardware used. When the radio is installed in the bracket, it will extend approximately one (1) inch past the front edge bracket, and at the rear, it will extend approximately ½-inch past the rear edge of the bracket. This distance at the rear does not include space required for cable connections at the rear of the radio. As previously stated, a clearance of least 4 inches (approximately 10 centimeters) at the rear of the radio is recommended.
2. Temporarily remove the bracket and deburr all of the newly drilled holes.
3. If necessary, apply an approved paint or rust-inhibitor at the holes in the mounting surface.
4. Set the bracket back into place, and verify front-to-rear orientation.

5. Install and tighten the mounting screws/hardware.
6. Verify the bracket is firmly secured to the mounting surface. A secure mount prevents unreasonable vibration, which could damage the radio and/or cause its cable connections to loosen.

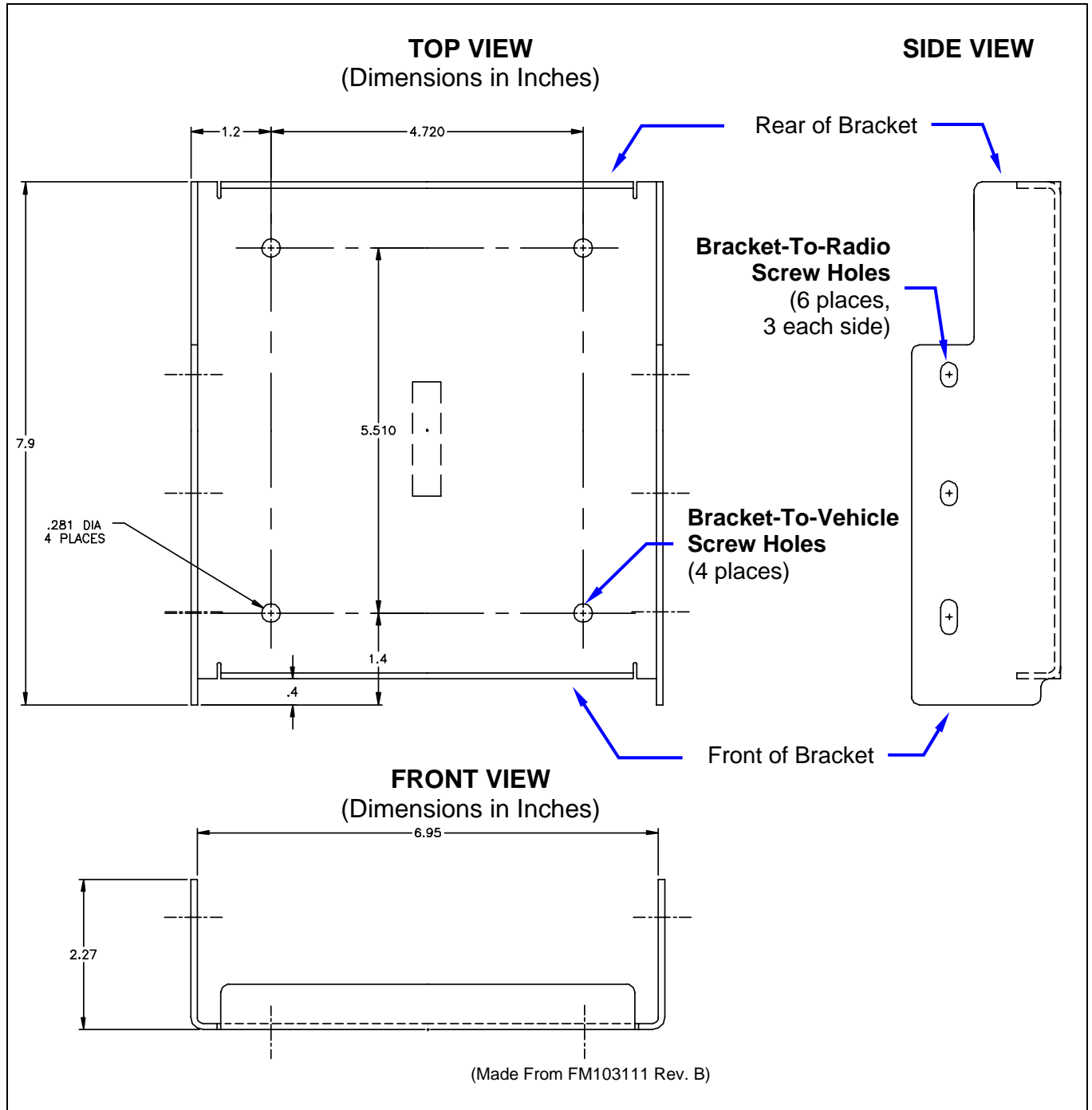


Figure 8-3: Mounting Bracket FM10311V1 Dimensions
[for Remote-Mount M7300 Mobile Radio (Radio Not Shown)]

8.1.2 Inserting the Radio into the Mounting Bracket

The radio should now be inserted into the bracket according to this procedure:

1. Lay the radio down into the mounting bracket with the front of the radio at the front of the mounting bracket.
2. Attach the radio into the mounting bracket using the six (6) Torx[®] drive M5 x 10 mm stainless-steel socket-head screws, and flatwashers and lockwashers included with the Mounting Bracket Kit (item 1 in Table 4-2). Tighten all six screws using a 4-millimeter hex key wrench until each lockwasher is fully compressed and the radio is firm and flush in between the brackets.
3. Check the mounting area for proper clearance for cable service looping and for air circulation, plus an area to secure and rest the excess cable lengths.



NOTE

Proper mounting is one factor that ensures optimal radio performance. An improperly mounted radio may experience degradation in the quality of voice and data communications.

8.2 REMOTE-MOUNT RADIO'S DC POWER INSTALLATION

8.2.1 Overview of On/Off Power Wiring Configurations

Radio on/off power control is accomplished by the control head, except in the case of a data-only radio installation which has no control head. In a standard installation, when the control head is turned on, it “wakes-up” the radio via data activity on the CAN link. The following power wiring configurations are supported:

- **Radio turns on and off automatically with vehicle's ignition switch/key** — This configuration allows the on/off state of the vehicle's ignition switch/key to control the on/off power state of the radio. The white wire of the control head's DC Power Cable is connected to a fused switched power source, typically identified as vehicle “Accessory” power. This source must switch on (up to positive (+) battery voltage potential) when the vehicle's ignition switch/key turns on, and it must switch off (to near zero volts) when the ignition switch/key turns off. The required fuse rating is 3 amperes. When using this configuration, the CH-721 control head's on/off/volume control must be left in the on position for automatic power-up/down to function properly.



NOTE

In a remote-mount radio installation, to fuse the white wire of the control head's DC Power Cable, a waterproof (HFB type) fuse holder and a 3-amp AGC fuse are included with the cable.

- **Radio turns on and off with a manual switch** — This configuration is used when, for example, the radio must remain on even when the ignition key must be removed from the vehicle and a separate on/off switch is acceptable. The white wire of the control head's DC Power Cable is connected to one side of a manually-controlled switch, and the other side of this switch is connected to unswitched and fused vehicle power. The required fuse rating is 3 amperes. When using this configuration, the CH-721 control head's on/off/volume control must be left in the on position for automatic power-up/down to function properly.
- **Radio turns on with control head's on/off/volume control (“hot wired”)** — This configuration allows radio on/off power control only via the control head's on/off/volume control. It may be desired if, for example, the radio must remain on even when the ignition key must be removed from the vehicle and a separate on/off switch is not desired and/or not acceptable. The white wire of the

control head's DC Power Cable must be connected to unswitched and fused vehicle power. The required fuse rating is 3 amperes.

In all of the above cases, both the radio's main DC power input (red wire) and the control head's main DC power input (also a red wire) must each be connected through an in-line fuse to unswitched vehicle DC power. The red wire of the radio's DC Power Cable must be connected to raw battery power (positive battery terminal) via the supplied fuse. Likewise, the red wire of the control head's DC Power Cable must also be connected to unswitched vehicle DC power via another supplied fuse. The white ignition wire of the radio's DC Power Cable is only used for the data-only radio (i.e., no control head), and it is the only means for turning its power on in the data-only radio installation.

8.2.2 DC Power Cable and Main Fuse Holder Installation

The radio's DC Power Cable has a 3-pin connector, a 20-foot red wire (for the main power connection), a 20-foot white wire (only connected in a data-only radio installation), and a 4-foot black wire (for the ground connection). It is supplied with waterproof fuse holders, two AGC-type fuses, and non-insulated ring terminals. The following installation procedures are recommended:

8.2.2.1 **Black Wire Connection (Ground Wire)**

1. Connect the radio's DC Power Cable to the radio by mating its 3-pin connector to the radio's 3-pin power cable connector as follows: Visually align the key and firmly push and turn the outer locking ring clockwise until it stops. A click will be sensed to confirm proper mating.



Do not confuse the radio's DC Power Cable which has a 10-AWG red wire with the control head's DC Power Cable which has a 12-AWG red wire. The radio requires much more DC operating current than the control head. Therefore, it requires the larger wire size of 10-AWG. **The part number of the radio's DC Power Cable is CA-012365-001.**

2. Prepare to connect the cable's black wire to vehicle ground by locating an area of vehicle metal within approximately two (2) feet of the radio. This surface **must** have a solid and stable connection to vehicle ground. If not, add grounding strap(s) as necessary.
3. Strip the area of any paint or dirt to expose a bare metal surface, approximately $\frac{3}{4}$ -inch square.
4. Drill a hole in the approximate center of the bare metal surface, and deburr it. A $\frac{3}{8}$ -inch non-insulated ring terminal is supplied with the cable to make this ground connection. Therefore, hole diameter should be appropriate for the utilized grounding screw/bolt size and type used to connect the ring terminal to the bare metal surface. This hardware is not supplied.
5. Cut the black wire to the required length plus some additional length for a service loop, then strip insulation back approximately $\frac{1}{4}$ -inch.
6. Crimp a $\frac{3}{8}$ -inch non-insulated ring terminal (supplied with the cable) to the end of the black wire.
7. Attach the ring terminal and black wire to the bare metal surface using stainless-steel self-locking hardware (i.e., machine screws with washers and locking nuts) or other appropriate hardware to ensure a reliable terminal-to-metal contact. Tighten securely.
8. Apply an approved paint or rust-inhibitor over the remaining exposed bare metal surface and around the ring terminal.

8.2.2.2 Red Wire and Main Fuse Holder Connection (Radio's Main Power Wire)

1. Continue installation of the radio's DC Power Cable by routing its 20-foot 10-AWG red wire to the location of the vehicle's battery (or its main DC bus bar or stud). Remove interior panels, door kick panels, etc., and route the wire through existing channels in the vehicle body as necessary. Protect the wire from possible chafing where necessary. Tie and stow the wire as necessary.



Plan the routing of the 10-AWG red wire carefully, using an existing access hole in the vehicle's firewall if possible. Alternately, drill a new hole approximately 3/8-inch in diameter and install a small rubber grommet to protect the wire from chafing on the hole's sharp metal edge. **To prevent fumes from entering the passenger compartment, this hole/grommet/wire combination must also be sealed with a silicon-based sealer before completing the installation.**



Do **not** install any wiring or fuse holder over or in the near vicinity of the vehicle's engine. Excessive engine heat can cause permanent damage to these components and can lead to intermittent electrical connection to the battery.



Before making connections to the battery's positive post, carefully disconnect the battery's negative (ground) cable(s). This will prevent tools or other metallic objects which come in contact with the battery's positive terminal from shorting to vehicle ground, causing sparks or even a fire or an explosion! When disconnecting the negative cable(s), cover/insulate the positive post(s) if it is not already so a tool cannot short between the posts. Some vehicles, such as those with diesel engines have more than one battery; in this case, disconnect the negative cables at all batteries.

Radio and control head fuses should not be installed until all wiring is complete. This will prevent the radio from powering up prematurely and/or causing an in-rush of current that could lead to shorting of the battery, sparks, or even fire.

2. Obtain one of the waterproof (HFB type) fuse holders included with the DC Power Cable.
3. **Observe and follow the previously presented WARNING!**
4. Cut the red wire to the required length for connection to the battery's positive (+) battery terminal (or the main DC bus bar or stud).
5. Prepare to splice the waterproof fuse holder into the red wire by cutting it again, at approximately three (3) to six (6) inches from the end.
6. Strip all three (3) wire ends back approximately 3/8-inch, place a fuse holder shell on each wire, and securely crimp a fuse holder terminal to each wire end. Before crimping, verify fuse holder shells are oriented in the correct directions (i.e., with each large end towards the wire end).
7. Label this fuse holder and red wire appropriately (e.g., "M7300 Main Power: 15-AMP FUSE").
8. **Do NOT install a fuse into the fuse holder at this time.**
9. Crimp an appropriate electrical terminal to the short red wire. A corrosion-resistant 3/8-inch ring terminal is included with the cable for this purpose, but another size corrosion-resistant terminal type (not supplied) may be used if required.

10. Connect the ring terminal directly to the battery's positive post (or if present, to a stud on the battery's main/non-switched power distribution terminal block).



NOTE

Most M7300 radio installations have one or more control heads connected to the radio. In an installation of this type, the white wire of the radio's DC Power Cable requires no electrical connection. Rather than be cut from the cable, it is recommended that it be routed up to the vehicle's fuse box, coiled, labeled, and stowed for possible future use. The white wire of the control head's DC Power Cable is the radio installation's ignition sense input for on/off power control of both the control head and radio. Radio on/off power control is accomplished by the control head. The control head "wakes-up" the radio via data activity on the CAN link.

8.2.2.3 White Wire Connection (for Data-Only Radio Installations)

In the case of a data-only radio installation (i.e., no control head connected to the radio), the white wire of the radio's DC Power Cable is used as the radio installation's ignition sense input. Therefore, it requires electrical connection to a fused switched power source. The following procedure is recommended:

1. Route the 20-foot white wire of the radio's DC Power Cable to the location of the vehicle's switched power source connection point, typically identified as "Accessory" power. Remove interior panels, door kick panels, etc., and route the wire through existing channels in the vehicle body as necessary. Protect the wire from possible chafing where necessary. Tie and stow the wire as necessary.
2. Connect this white wire through a fuse to the switched power source in accordance with the instructions presented within the respective subsection of Section 8.3.4.2 (page 50) for the control head's white wire. Follow the procedure in Section 8.3.4.2.1 (page 50) if the vehicle's ignition switch/key must control the data-only radio's on/off power. Follow the procedure in Section 8.3.4.2.2 (page 51) if a manually-controlled switch must control the data-only radio's on/off power.



NOTE

The "hot wired" wiring configuration (as depicted in Section 8.3.4.2.3) cannot be utilized for the data-only radio, since this configuration does not employ the DC Power Cable's white wire.



CAUTION

When servicing the radio and/or control head, always manually power-down the radio equipment via the control head's on/off/volume control knob, and then remove the main power fuse near the battery.

8.3 CONTROL HEAD INSTALLATION

8.3.1 General Information

The remote-mount M7300 mobile radio must be connected to a control head to provide the operator-to-radio interface. Two different control heads are available — the CH-721 Scan model and the CH-721 System model. See Figure 8-4 and Figure 8-5 respectively. The CH-721 Scan model control head features three (3) large menu selection buttons. The System model control head has a 12-button keypad to allow advanced operations without the need of a DTMF-capable microphone.

Figure 8-6 on page 45 illustrates the rear panel of the two control head models. Both models have identical rear panels and rear panel connectors.

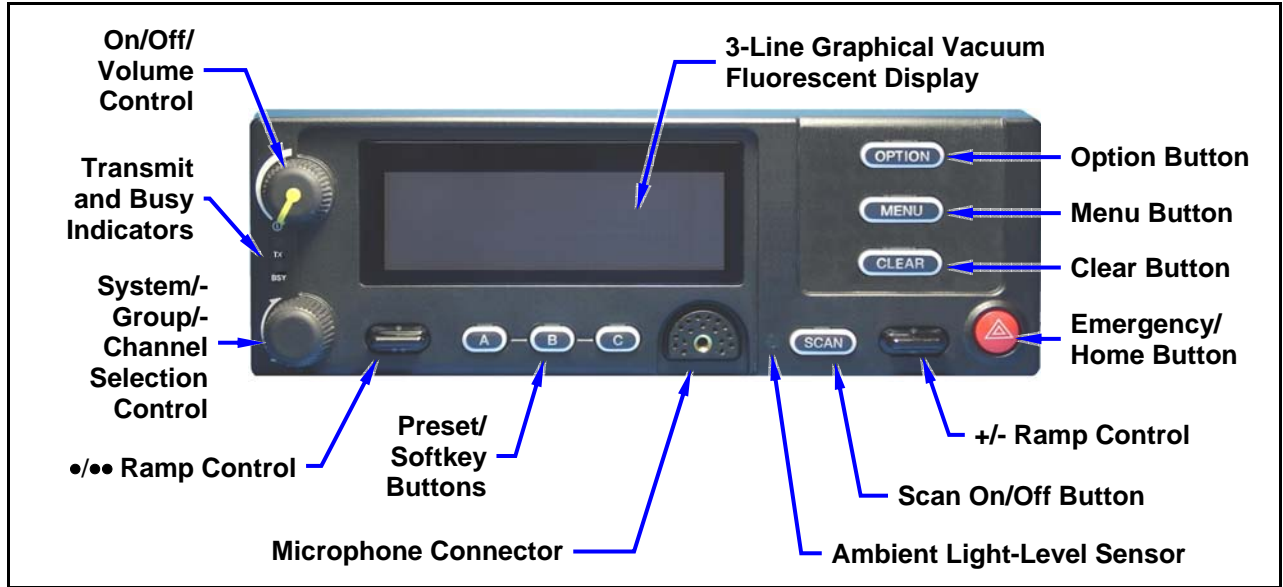


Figure 8-4: CH-721 Scan Model Control Head Front Panel

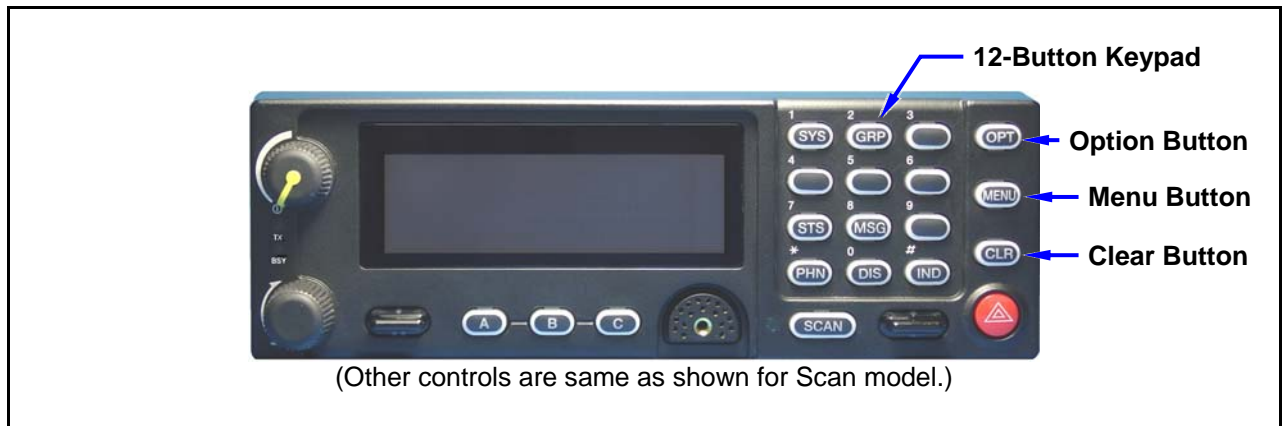


Figure 8-5: CH-721 System Model Control Head Front Panel

The CH-721 control heads feature a large easy-to-read 3-line graphical vacuum fluorescent display, an on/off/volume control knob, menu controls and buttons, trunking mode buttons, an emergency/home button, a scan on/off/volume control, and three (3) preset buttons. Other front panel components include a microphone connector and LED-type indicators. One LED indicator is the busy indicator that lights when the radio is receiving a call and one is the transmitter-enabled indicator that lights when the radio is transmitting. The front panel also has an ambient light sensor for automatic display dimming.

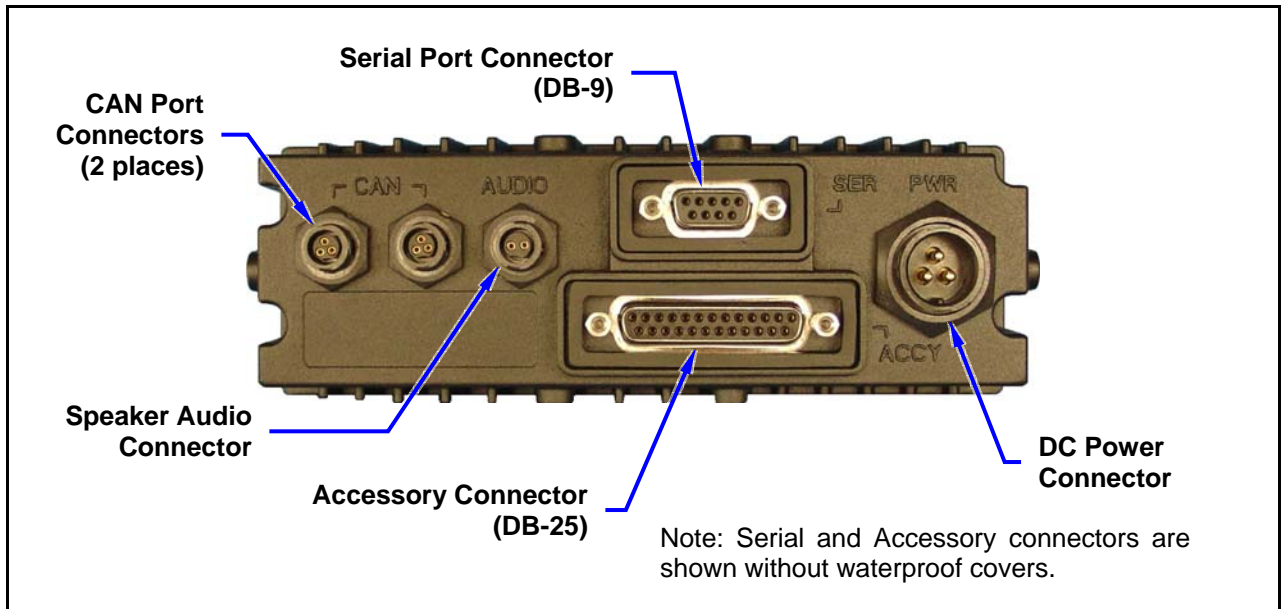


Figure 8-6: CH-721 Rear Panel (both control head models)



Prior to installing the control head, verify it has the proper software version installed and verify it has been properly configured for customer use.



Because Installation Kit MAMW-NZN7R contains the most complete set of materials for installing the radio and control head, the following instructions make repeated reference to items within this kit. Item numbers given in parenthesis refer to items in the kit as listed in Table 4-2 on page 18.

In a mobile installation, more than one control head can be connected to one mobile radio for multi-head installations. A multi-head installation may be required in a vehicle such as a fire truck or any large vehicle where more than one operator may require use of the radio. Multi-head installations also provide other benefits such as intercom functionality between different operator positions.

8.3.2 Control Head Mechanical Installation

8.3.2.1 Selecting the Mounting Location

When selecting a location for the CH-721 control head, first observe the safety and operator-convenience related information presented in Section 5.1 on page 21. Always consider and include clearance for the microphone's connector that must mate to the mic connector on the front panel of the head, and clearance for the connectors/cables that must mate to the connectors on the rear panel of the head. The CH-721 control head can be mounted under or on top of a mounting surface (typically the vehicle's dash) as space permits using either the standard U-shaped mounting bracket or the optional mounting pedestal.

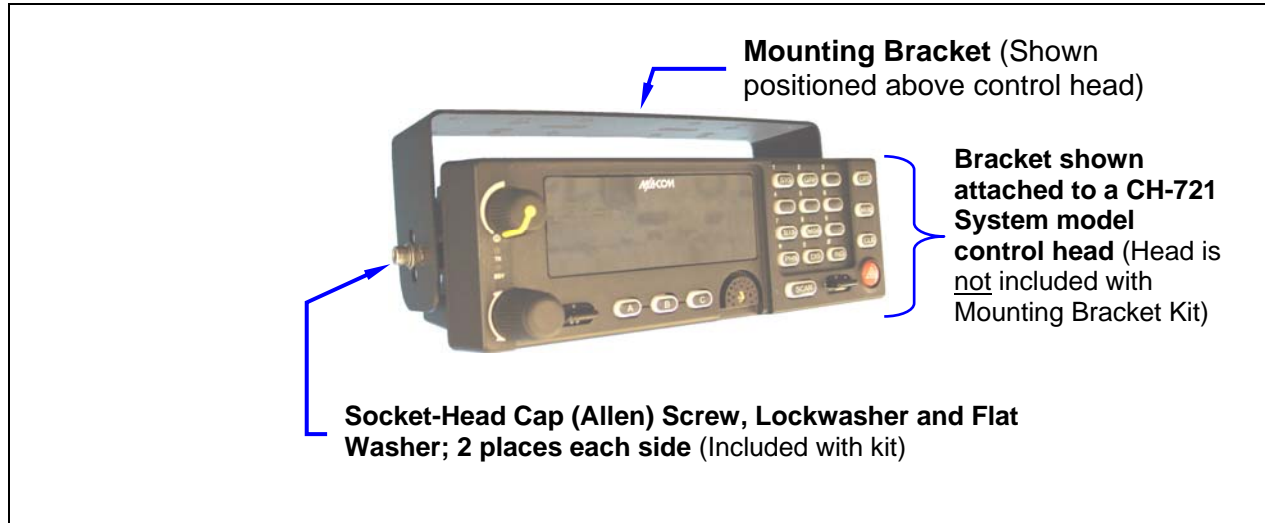


Figure 8-7: Standard U-Shaped Control Head Mounting Bracket (Kit Part Number KT-008608)

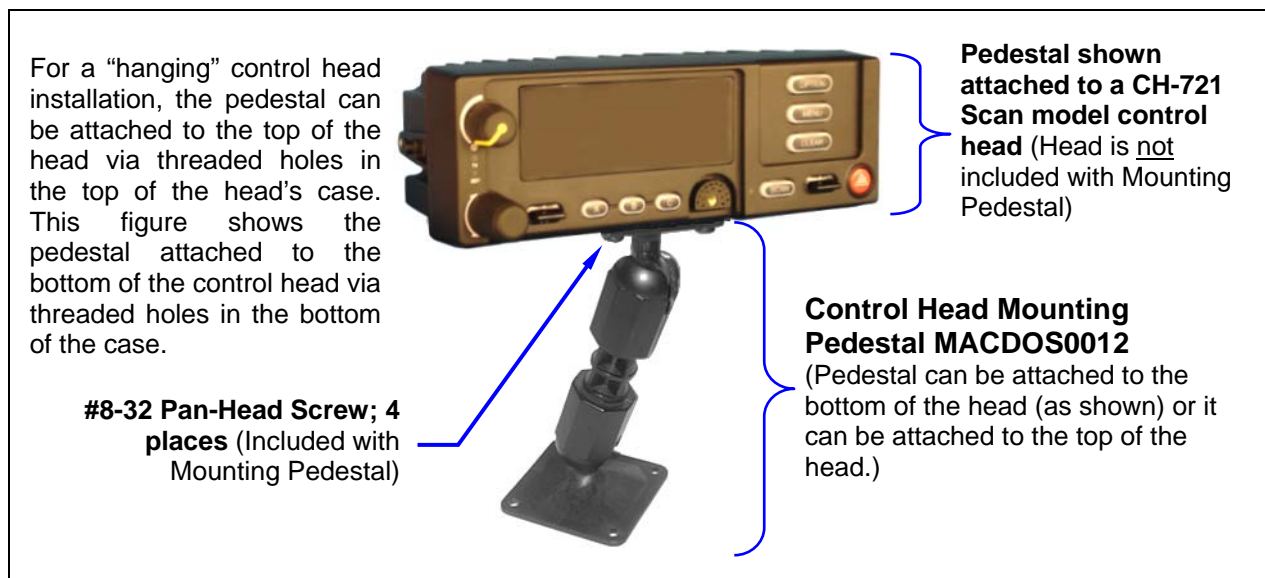


Figure 8-8: Optional Control Head Mounting Pedestal (Part Number MACDOS0012)

8.3.2.2 Using the Standard U-Shaped Mounting Bracket

If the standard U-shaped mounting bracket will be used to mount the control head, the following mounting procedure is recommended. As listed in Table 4-2 on page 18, this bracket is item 2 in the Installation Kit.

1. Using the mounting bracket as a template, mark and drill mounting holes into the mounting surface as required. The round and elliptical holes in the bracket's vehicle mounting surface are symmetrical, so forwards/backwards positioning is not important during this step. However, positioning is important in the next step.



Before drilling holes and/or installing mounting screws, verify these operations will not damage or interfere with any existing vehicle component (the fuel tank, a fuel line, the transmission housing, existing vehicle wiring, etc.). Always check to see how far the mounting screws will extend below the mounting surface prior to installation. Always deburr drilled holes before installing screws.

2. Position the bracket at the mounting surface so the two round holes in its two side "ears" are nearest to the normal location of the operator (typically towards the rear of the vehicle) and the two slotted holes are furthest from the normal location of the operator (typically towards the front of the vehicle).
3. Install and tighten the mounting screws. Screws for mounting the bracket to the mounting vehicle's surface are not included, as all installations differ. Self-threading screws are recommended. Use of self-drilling screws may cause damage to some mounting surfaces, such as a plastic dash panel.
4. Verify the bracket is held firmly to the mounting surface. Firm mounting prevents unreasonable vibration, which could damage the control head and/or cause its cable connections to loosen.
5. Slide the control head into the bracket, placing the two pegs protruding from its left and right sides into the respective round holes in the bracket's two side "ears."
6. In each side "ear" of the mounting bracket, start a #8-32 hex-socket-head cap (Allen) head screw with a lockwasher and a flat washer by inserting the screw through the slotted hole in the bracket and then into the threaded hole in the side of the control head. This hardware is included with Mounting Bracket Kit. The lockwasher should be adjacent to the screw head and the flat washer should be adjacent to the bracket. Turn each screw clockwise as observed from the head of the screw.
7. The control head can be positioned at various angles for best display viewing at the normal position of the operator. As necessary, turn it on the pegs to a good position and tighten both screws using an 1/8-inch hex key (Allen) wrench until the control head is held firmly in place. Do not over-tighten.

8.3.2.3 Using the Mounting Pedestal (Optional)

An optional Mounting Pedestal, part number MACDOS0012, may be purchased separately to replace the standard U-shaped mounting bracket. This pedestal can be attached to the bottom of the control head as shown in Figure 8-8, and then mounted to a mounting surface below the two. It can also be attached to the top of the head and then mounted to a mounting surface above the two.

8.3.3 Control Head-to-Radio CAN Cable Connections

8.3.3.1 General Information

A remote-mount radio installation requires a CAN cable between every two "CAN devices" and CAN terminators on each end of the CAN link. The M7300 mobile radio is considered a CAN device, and each CH-721 control head in the installation is also considered a CAN device. Figure 8-9 illustrates CAN cable

and CAN terminator connections for a single control head installation. Figure 8-10 illustrates this for a multi-head control head installation where, for example, one control head is located at the main operator location and another is located near the rear of the vehicle. Because CAN devices do not have internal terminators, the CAN link must be terminated at both ends via external CAN terminators, as depicted in the following figures.

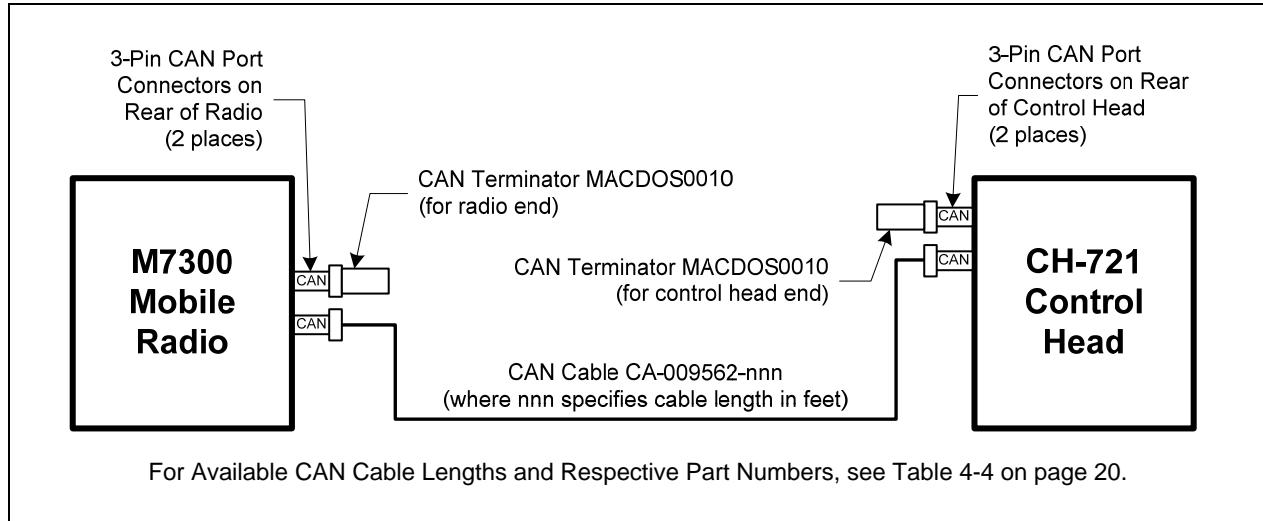


Figure 8-9: CAN Link Connections for a Single Control Head Installation

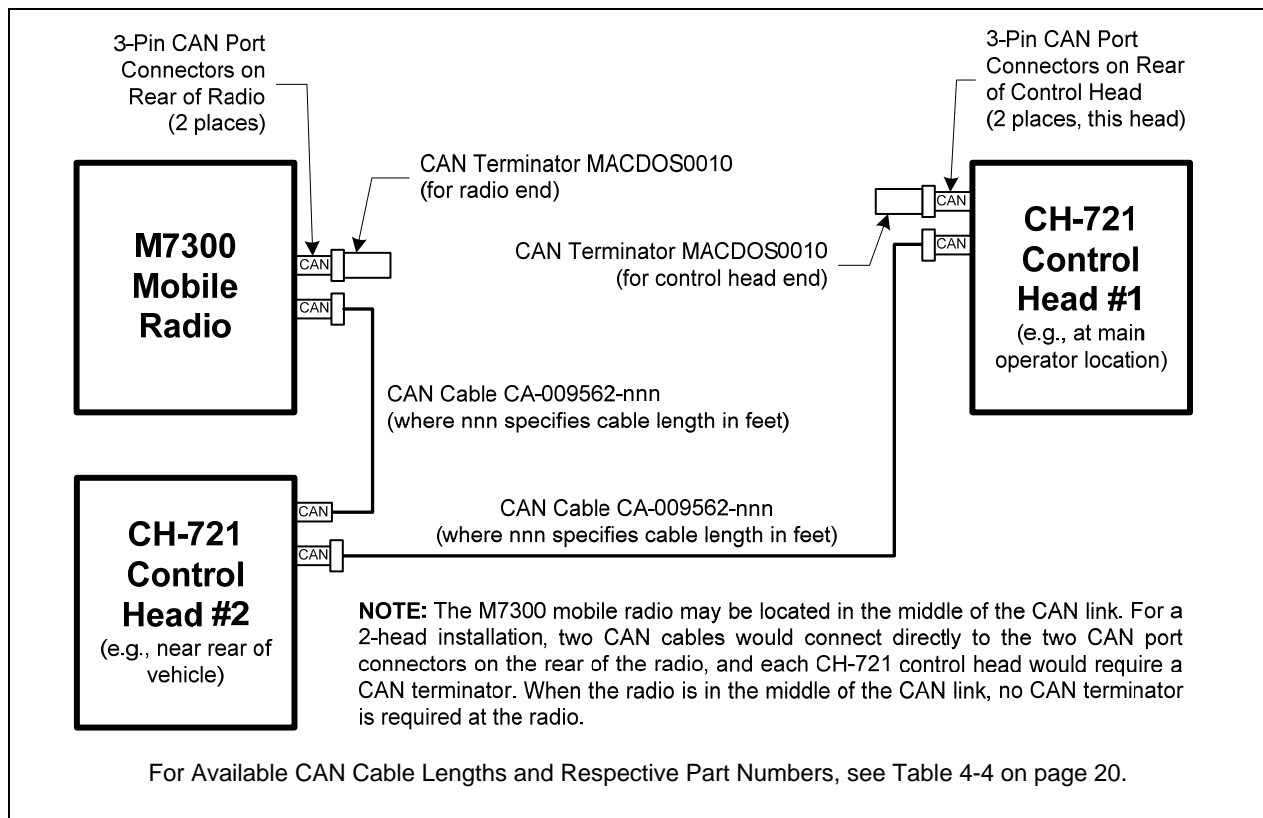


Figure 8-10: Typical CAN Link Connections for a Multi-Control Head Installation

Both the radio and the control head have two CAN ports to support “daisy-chaining” of multiple control heads or other CAN devices. Figure 5-3 on page 23 shows the radio’s two CAN port connectors, which

are located near the center of the radio's rear panel. Figure 8-6 on page 45 shows the two CAN port connectors on the control head's rear panel.

8.3.3.2 Make CAN Link Terminations and Cable Connection

Follow this procedure for an installation which has only one control head. For a multi-control head installation, refer to Figure 8-10 as necessary.

1. Mate a CAN Terminator (item 5 in Table 4-2 on page 18) onto either one of the two smaller 3-pin CAN port connectors on the rear panel of the CH-721. This action makes the CAN termination at the control head end of the CAN link.



NOTE

When mating any CAN connection (terminators and cables) to a rear panel connector, visually align the $\frac{3}{4}$ -moon-shaped keys of the connectors, and then gently push and turn the outer locking ring of the plug (male) connector clockwise until it stops. A mild click will be sensed to confirm proper mating. Without visual alignment as a guide, it is possible with excessive force to mate the CAN connectors improperly. Damage to the connector(s) may result. Therefore, visual alignment is recommended when mating CAN connectors.

2. Obtain a CAN Cable and mate it to the other CAN port connector on the rear panel of the CH-721. Typically, item 6 in Table 4-2 is utilized, a 30-foot CAN cable.
3. Route the cable through the vehicle's interior wire/cable channeling to the radio. Remove interior panels, door kick panels, etc., as necessary. Protect the cable from possible chafing as necessary.
4. Mate this other end of the cable to one of the two CAN port connectors on the rear panel of the radio.
5. Mate another CAN Terminator to the other CAN port connector on the rear panel of the radio. This action makes the CAN termination at the radio-end of the CAN link.
6. Loop, tie and stow the excess cable as necessary, leaving a service loop at the back of the radio and at the back of the control head.

8.3.4 Control Head Power Cable Installation

Plan the route of the control head's DC Power Cable carefully. Do not route the cable where it will be damaged by heat sources or by casual contact, and protect it from wire chafe per standard installation methods. The following procedures are recommended:

8.3.4.1 Install DC Power Cable and Make Power and Ground Connections

1. Connect the control head's DC Power Cable (item 4 in Table 4-2 on page 18) to the large 3-pin connector at the rear of the head. Visually align the key and gently push and turn the outer locking ring clockwise until it stops. A click will be sensed to confirm proper mating.
2. At the back of the control head, locate a nearby section of vehicle chassis ground and strip this area of any paint or dirt to expose a bare metal surface.
3. Cut the black wire of the control head's DC Power Cable to the required length, plus a service loop of at least six (6) inches, then strip it and crimp a $\frac{3}{8}$ -inch ring terminal to it. Two ring terminals of this type are included with the cable.
4. Drill a hole as necessary and attach this ring terminal to chassis ground. Use stainless-steel self-locking hardware (i.e., machine screws with washers and locking nuts) or other appropriate hardware to ensure a reliable terminal-to-metal contact. Tighten securely.

5. At the back of the control head, tie and stow the cable as necessary.
6. For the positive 12-volt DC main power source connection, route the cable's red wire to the location of an **unswitched** 12-volt DC power source, typically near the vehicle's battery. Remove interior panels, door kick panels, etc. Protect the wire from possible chafing as necessary. This is the control head's main DC power source.
7. Obtain one of the waterproof (HFB-type) fuse holders included with the control head's DC Power Cable.
8. Cut excess length from the red wire and splice the fuse holder into it, near the location of the unswitched 12-volt DC power source connection point.
9. Using an appropriate electrical terminal, connect the red wire to the unswitched DC power source. A 3/8-inch ring terminal is included with the cable for this purpose, but another terminal type (not supplied) may be used if required.
10. Obtain the 5-amp AGC-type fuse included with the cable, and install it into the fuse holder.



NOTE

Do not share the control head's fuse with any other device. Doing so can cause excess current to flow through the fuse, causing it to blow unnecessarily.



CAUTION

The fuse for the control head's red wire is rated at 5 amperes. The 3-amp fuse included with the cable must **not** be used for fusing the control head's main DC power. It fuses the head's white wire.

8.3.4.2 Connect DC Power Cable's White Wire

A review of the information presented in Section 8.2.1 (page 40) may be beneficial at this time. As required per the chosen power-up configuration, connect the white wire by following one of the three procedures presented in the respective sub-section that follows.

8.3.4.2.1 Control Head and Radio Turn on with Vehicle's Ignition Switch/Key

With this wiring configuration, the control head and radio automatically turn on and off with the vehicle's ignition switch/key. The white wire of the control head's DC Power Cable is sometimes referred to as the "white ignition switch wire" or the "ignition sense input wire." In this configuration, the white wire connects to a switched power source, typically identified as "Accessory" power, that switches on and off with the vehicle's ignition switch/key. When using this configuration, the CH-721 control head's on/off/volume control must be left in the **on** position for automatic power-up/down to function properly.



NOTE

The white ignition sense wire must be connected to a fused power source that switches from approximately zero volts to approximately +13.6 volts when the vehicle's ignition switch/key is turned from the OFF position to the ACCESSORY and RUN positions. Use of a switched power source that is subject to voltage changes as a result of other actions, such as opening a vehicle door, may result in undesirable radio operation and/or a degradation of radio performance.

1. Locate the vehicle's switched ignition or "Accessory" power connection point that will be used for the switched ignition 12-volt DC power source. This point is typically located at or near the vehicle's fuse panel. It may be necessary to consult the vehicle manufacturer's wiring diagram.

2. Route the white wire of the control head's DC Power Cable from the back of the head to the area near this connection point. Protect the wire from possible chafing as necessary.
3. Obtain one of the waterproof (HFB-type) fuse holders included with the control head's DC Power Cable.
4. Cut excess length from the white wire and splice the fuse holder into it, near the location of the connection point.
5. Using an appropriate electrical terminal, connect the white wire to the switched power connection point. An open-barrel spade terminal is included with the cable for this purpose, but another type of terminal (not supplied) may be used as required.
6. Obtain the 3-amp AGC-type fuse included with the cable, and install it into the fuse holder.
7. Tie and stow all wiring as necessary so it remains out of the way of casual contact and wire chafe is avoided.

8.3.4.2.2 Control Head and Radio Turn On with a Manual Switch

With this wiring configuration, the control head and radio are manually turned on and off via an on/off switch mounted separately from the control head and radio, not through the vehicle's ignition switch/key. This configuration is used when, for example, the radio must remain on even when the ignition key must be removed from the vehicle and a separate on/off switch is acceptable and/or required. In this configuration, the white wire connects to a fused switched power source such as that provided by a toggle switch mounted on the vehicle's dash panel. When using this configuration, the CH-721 control head's on/off/volume control must be left in the **on** position for automatic power-up/down to function properly.

1. Route the white wire of the control head's DC Power Cable from the back of the head to an area near the location of the panel-mounted on/off switch. Protect the wire from possible chafing as necessary.
2. Cut a short section (6 to 8 inches) off the end of the white wire and strip the ends.
3. Obtain one of the waterproof (HFB-type) fuse holders included with the control head's DC Power Cable, and crimp one half of it to one end of the short section of wire.
4. Using an appropriate electrical terminal, connect this short white wire to unswitched 12-volt DC power source at or near the vehicle's fuse box.
5. Cut another section of white wire from the cable. This wire must be long enough to reach from this fuse holder to the location of the panel-mounted on/off switch.
6. Strip one end of this wire and crimp the other half of the waterproof fuse holder to this wire end.
7. Strip the other end of this wire and, using an appropriate electrical terminal, connect it to the common terminal of the switch.
8. Connect the white wire of the power cable to the load (switched) side of the switch.
9. If not already, mount the switch to the vehicle's dash panel, or other customer-selected location.
10. Obtain the 3-amp AGC-type fuse included with the cable, and install it into the fuse holder.
11. Tie and stow these wires as necessary so they remain out of the way of casual contact and wire chafe is avoided.
12. Label this power switch accordingly. For example: "**RADIO ON/OFF.**"

8.3.4.2.3 Control Head and Radio Are “Hot Wired”

In the “hot-wired” configuration, the control head and radio are turned on and off only by the control head’s on/off/volume control located on the front panel of the control head. In this configuration, the control head’s white wire must be connected to **unswitched and fused 12-volt** vehicle power. Follow the procedure presented in Section 8.3.4.2.1, except connect the white wire to **unswitched** battery power instead of switched (“Accessory”) power.

9 SPEAKER INSTALLATION

9.1 FRONT-MOUNT RADIO INSTALLATION

In a front-mount radio installation, total speaker cable length (of both cables) is approximately 10 feet (308 centimeters). Therefore, to include service loops in these cables, the speaker must be mounted within approximately 9.5 feet (290 centimeters) of the M7300 mobile radio.

1. Select a location for the speaker that will allow for proper listening range with a moderate volume setting.
2. Install the speaker using the hardware and mounting bracket supplied with it. For the speaker's part number, see Table 4-1 (page 17).
3. Route the speaker cable to the rear of the M7300 mobile radio.
4. Connect the M5300/M7300 Option Cable CA-012349-001 (item 5 in Table 4-1) to the DB-44 connector on the rear of the radio. Tighten the cable's two (2) jackscrews securely. See Section 11.1 for additional information on this cable.
5. Mate the Option Cable's 2-pin connector (identified P2) to the 2-pin connector on the end of the speaker cable. A mild click will be sensed to confirm proper mating.
6. Route the cables out of the way of casual contact. Tie and stow as necessary.

9.2 REMOTE-MOUNT RADIO INSTALLATION

In a remote-mount radio installation, total speaker cable length (of both cables) is approximately five (5) feet. Therefore, to include service loops in these cables, the speaker must be mounted within approximately 4.5 feet of the installation's CH-721 control head.

1. Select a location for the speaker that will allow for proper listening range with a moderate volume setting.
2. Install the speaker using the hardware and mounting bracket supplied with it. For the speaker's part number, see Table 4-2 (page 18).
3. Route the speaker cable to the rear of the CH-721 control head.
4. Mate the 6-inch speaker cable (item 8 in Table 4-2) to the 2-pin connector at the rear of the control head by visually aligning the $\frac{3}{4}$ -moon-shaped keys of the connectors, and then pushing and turning the outer locking ring of the cable connector clockwise until it stops. A mild click will be sensed to confirm proper mating.
5. Connect the speaker cable's 2-pin plastic connector to the respective mating connector on the 6-inch speaker cable.
6. Route the cables out of the way of casual contact. Tie and stow as necessary.

10 MICROPHONE ATTACHMENT

There are several versions of microphones available for use with the radio. Each has a 17-pin flush-mount type connector that mates with the mic connector on the front panel of the control head. The mic's connector includes a captive thumbscrew that secures it to the mic connector on the front panel of the control head. A microphone clip is included with each microphone. The radio can be configured to provide a monitor function when the microphone is cradled in the clip. Connect the mic to the control head and install the clip as follows:

1. As illustrated in Figure 10-1, grasp the mic's connector with a thumb and index finger on the sides of the connector just adjacent to the thumbscrew.
2. Position the connector in front of the control head's mic connector so the mic cable's strain relief is hanging down and out at an approximate 45 degree angle.
3. Mate the two connectors by pressing them fully together. Do not apply any force to the thumbscrew when mating the connectors.
4. Tighten the thumbscrew finger-tight. Do not use a screwdriver to tighten it.
5. Using the microphone clip as a template, drill mounting holes in the surface of the selected location.
6. Select a mounting surface location that has clearance for the mic when it is clipped to the clip, and then attach the microphone clip to the surface. Use self-locking hardware (i.e., machine screws with washers and locking nuts), self-drilling screws, or other appropriate hardware as necessary. Tighten securely.
7. The microphone clip must be grounded to the vehicle's chassis. If not mounted to a grounded metal surface, complete this requirement by adding a jumper wire attached from chassis ground to the clip.
8. Clip the microphone to the clip.

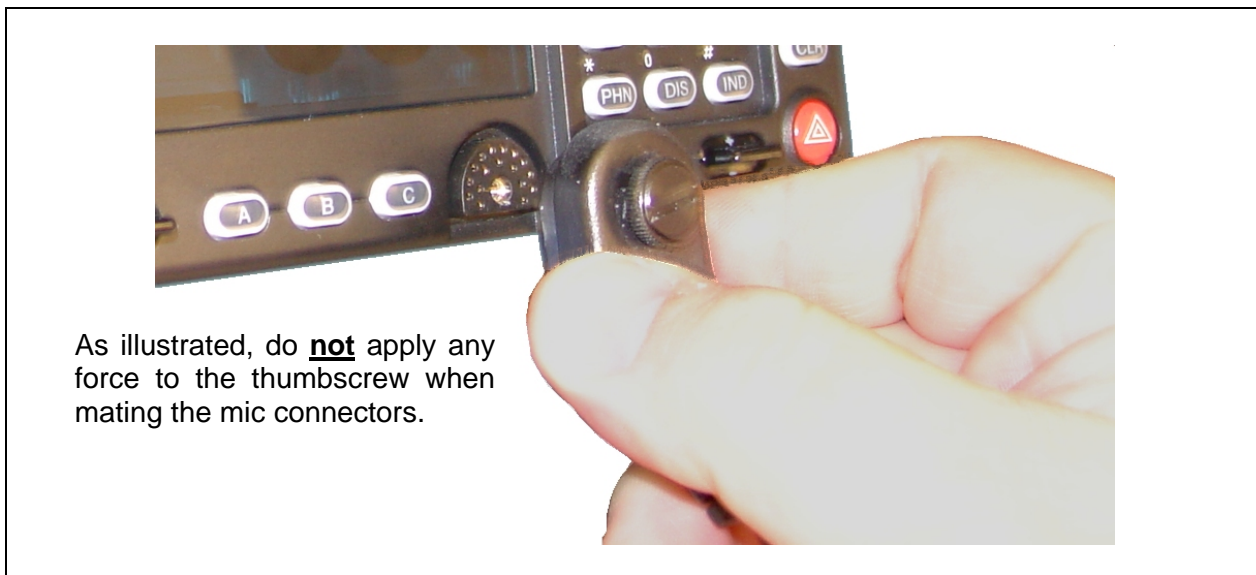


Figure 10-1: Attaching the Microphone to the CH-721 Control Head

11 OPTIONAL CABLES

11.1 M5300/M7300 OPTION CABLE CA-012349-001

M5300/M7300 Option Cable CA-012349-001 connects to the 44-pin I/O cable connector on the rear of the radio. It breaks out into several smaller standardized connectors, allowing straightforward access to external I/O interfaces provided by the radio. The cable also shortens radio removal and re-installation time when required. The cable is shown in Figure 11-1 below. The cable's 44-pin D-subminiature connector that mates with the connector on the rear of the radio is identified P1.

P2, the cable's 2-pin connector, provides connections for an external speaker in a front-mount M7300 mobile radio installation. See Section 9.1 (page 53) for connection instructions. P2 is not used in a remote-mount radio installation. In a remote-mount radio installation, the audio amplifier in the CH-721 control head drives the external speaker. In this case, the speaker connection is made at the rear of the control head.

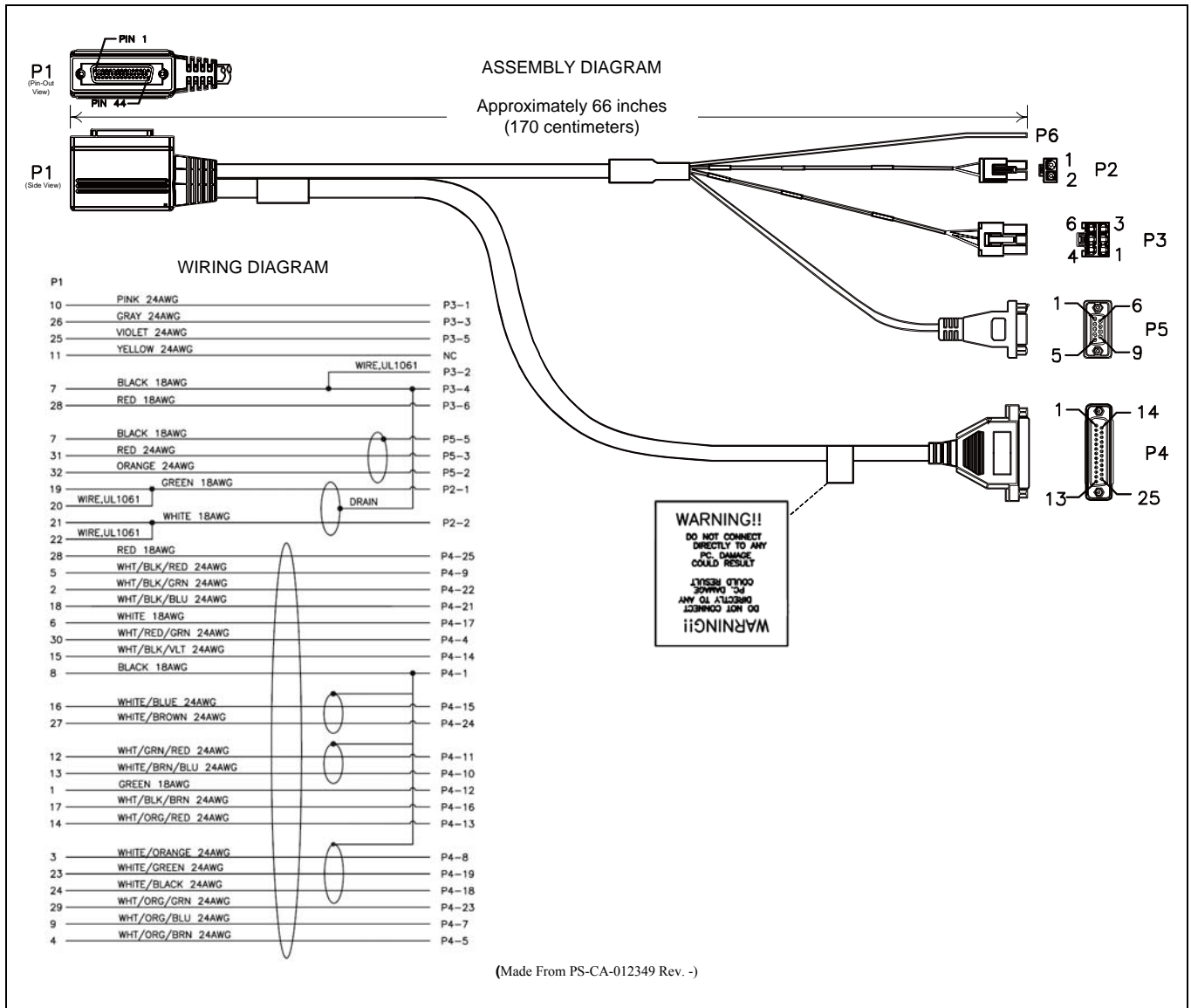


Figure 11-1: M5300/M7300 Option Cable CA-012349-001

P3, the cable’s 6-pin connector, is a connector for basics accessories (e.g., hookswitch, etc.).

P4, the cable’s D-subminiature 25-pin connector, provides audio and data connections for connections to optional equipment such as an external siren and light system (e.g., Federal Signal SS2000 SmartSiren®).

P5, the cable’s D-subminiature 9-pin connector, provides NMEA-formatted GPS serial data connections for the external computer processing the NMEA-formatted GPS data received by the radio’s internal GPS receiver. See Section 12 on page 61 for additional information.

Table 11-1: M5300/M7300 Option Cable CA-012349-001 Interconnections

44-PIN I/O CABLE CONNECTOR P1 PIN	SIGNAL NAME	TO/FROM	DESCRIPTION
19	SPKR1	P2 pin 1	Speaker Audio Output 1 (Not used in a remote-mount radio installation)
20	SPKR1		
21	SPKR2	P2 pin 2	Speaker Audio Output 2 (Not used in a remote-mount radio installation)
22	SPKR2		
10	OUT2	P3 pin 1	Digital Output 2 (open-collector)
7	GND	P3 pins 2 & 4	Chassis Ground (fused on radio’s PK Board at 3.15 amps)
26	HKSW	P3 pin 3	Hookswitch Digital Input. Active = Ground. Inactive = Open
25	INP2	P3 pin 5	Digital Input 2
28	SWA+	P3 pin 6	Switched A+ (DC Power) Output
8	GND	P4 pin 1	Chassis ground (fused on PK Board at 3-amps)
30	DGPS_DATA	P4 pin 4	GPS Serial Data
4	EXTRX	P4 pin 5	External Rx Audio Output (for non-CAN based radio)
9	EXTMOD	P4 pin 7	External Tx Audio Input (for non-CAN based radio)
3	SDATA	P4 pin 8	In a front-mount M5300/M7300 radio installation, this pin for the siren/PA interface is the siren serial data output (open-collector/open-drain) from the radio’s mounted (local) CH-721. It serially transfers siren and light control data from the head/radio to a connected third-party siren and light system (e.g., Federal Signal SS2000 SmartSiren®). Data rate = 1200 bps. For a remote-mount radio installation, see footnote ² .
5	FDISC	P4 pin 9	Buffered Discriminator Audio
13	ALO	P4 pin 10	Audio Ground/Reference (fused on radio’s PK Board at 3.15 amps)
12	MICHI	P4 pin 11	In a front-mount M5300/M7300 radio installation, these two pins provide the public address (PA) mic audio from

² In a remote-mount M5300/M7300 mobile radio installation, this pin on the radio’s DB-44 connector should not be used. It is not functional. Instead, the respective pin on the CH-721 Option Cable’s female DB-25 pin connector. See Section 11.3 for additional information.

Table 11-1: M5300/M7300 Option Cable CA-012349-001 Interconnections

44-PIN I/O CABLE CONNECTOR P1 PIN	SIGNAL NAME	TO/FROM	DESCRIPTION
1	EXTALO	P4 pin 12	the mounted (local) CH-721 to the siren and light system (e.g., Federal Signal SS2000 SmartSiren®). For a remote-mount radio installation, see footnote ² .
14	VOLHI	P4 pin 13	Volume High
15	CTLON	P4 pin 14	Control On Digital Output (for non-CAN based radio)
16	XTONEENC	P4 pin 15	External Tone Encode Audio (for non-CAN based radio)
17	XTONEDEC	P4 pin 16	External Tone Decode Audio (for non-CAN based radio)
6	EXTALO	P4 pin 17	External Audio Output (Balanced, Low; for non-CAN based radio)
24	HORNRING	P4 pin 18	In a front-mount M5300/M7300 radio installation, this pin for the siren/PA interface is the horn/ring logic input to the radio's mounted (local) CH-721. When a connected third-party siren and light system (e.g., Federal Signal SmartSiren® SS2000) has its horn/ring function active, this input is used to signal the head/radio as such. For a remote-mount radio installation, see footnote ² .
23	SONOFF	P4 pin 19	In a front-mount M5300/M7300 radio installation, this pin for the siren/PA interface is the siren on/off logic output (open-collector) from the radio's mounted (local) CH-721. It is the signal that powers the connected third-party siren and light system (e.g., Federal Signal SmartSiren® SS2000) on and off. For a remote-mount radio installation, see footnote ² .
18	INP1	P4 pin 21	Digital Input 1 (for non-CAN based radio)
2	OUT1	P4 pin 22	Digital Output 1 (open-collector; for non-CAN based radio)
29	TXENB+	P4 pin 23	Transmit Enable B+ (for non-CAN based radio)
27	EXTMIC	P4 pin 24	External Mic Audio Input
28	SWA+	P4 pin 25	Switched A+ DC Power Output (for non-CAN based radio)
32	GPS_NMEA_RX	P5 pin 2	Serial Rx Input for GPS NMEA-Formatted Serial Data
31	GPS_NMEA_TX	P5 pin 3	Serial Tx Output for GPS NMEA-Formatted Serial Data
7	GND	P5 pin 5	Ground for GPS Serial Data Signals (fused on radio's PK Board at 3.15 amps)
11	IGNITION	(no connection)	Unused/Spare ignition sense input.
33 through 44	—	(no connections)	These pins of P1 are not used/not connected.

11.2 SERIAL PROGRAMMING CABLE CA-013671

Serial Programming Cable CA-013671-010 (10 feet long) and CA-013671-020 (20 feet long) can be used to program and configure the M7300 mobile radio via a Personal Computer. This cable has a female DB-9 connector on one end for connection to the PC's serial port and a male DB-9 connector on the other end for connection to the serial port on the rear of the radio. The cable's assembly and wiring diagrams are shown in Figure 11-2 below.

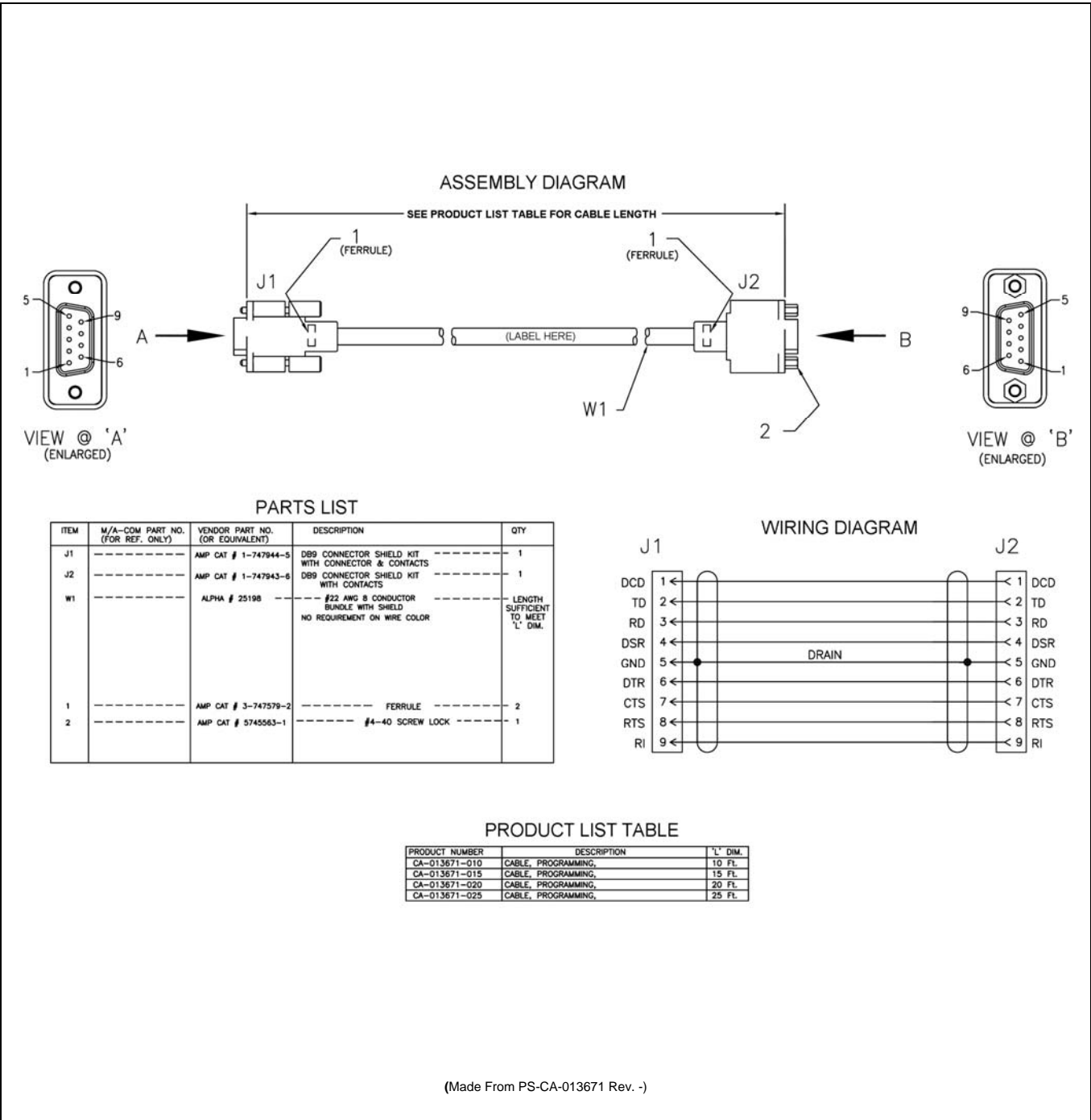
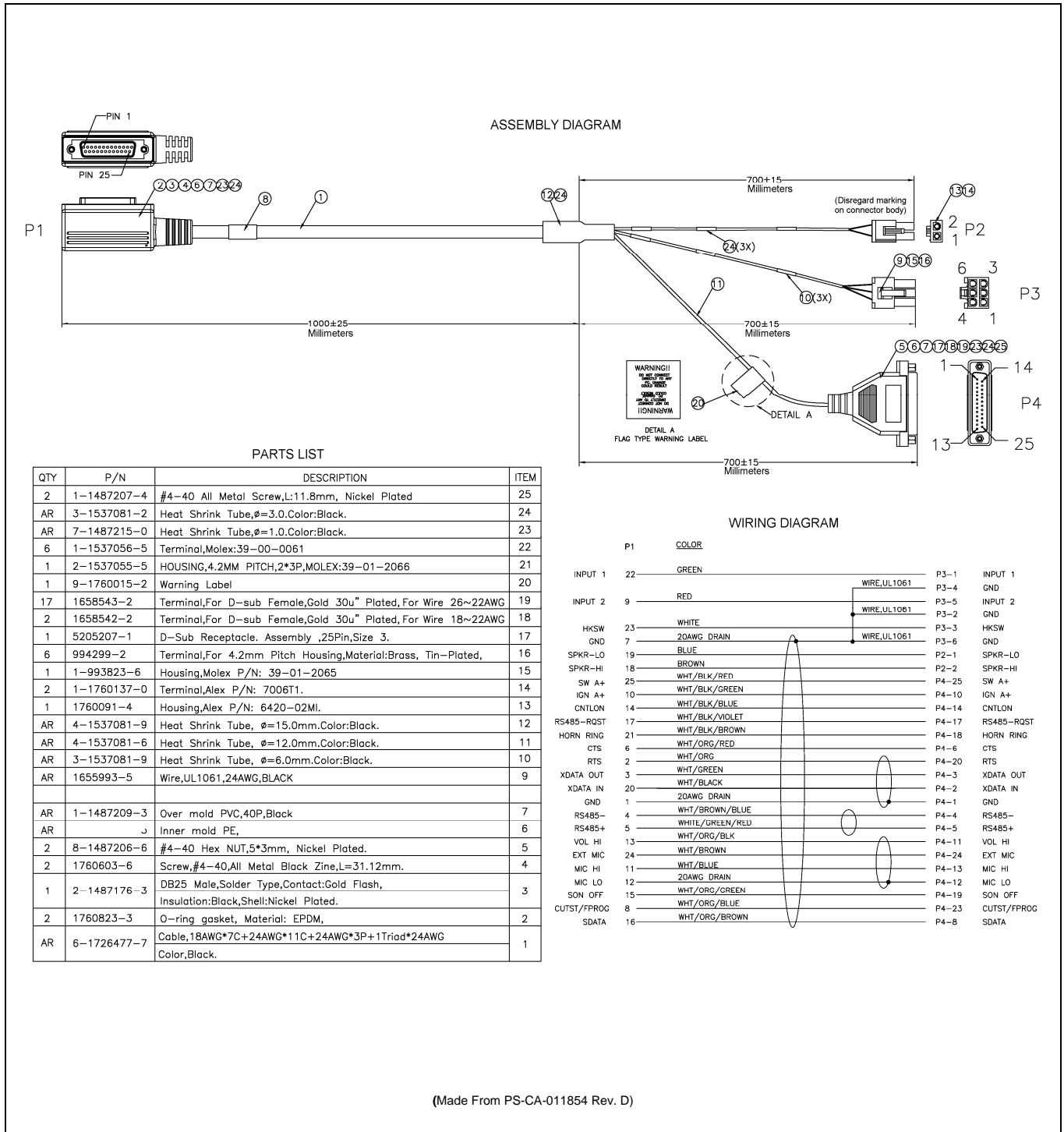


Figure 11-2: Programming Cables CA-013671-010 and -020

11.3 CH-721 OPTION CABLE CA-011854-001

CH-721 Option Cable CA-011854-001 can be used to connect optional equipment to the 25-pin D-subminiature (DB-25) connector on the rear of the CH721. This cable expands the connections available at the 25-pin connector to three (3) separate connectors. The cable's assembly and wiring diagrams are shown in Figure 11-3 below.



(Made From PS-CA-011854 Rev. D)

Figure 11-3: CH-721 Option Cable CA-011854-001

11.4 CH-721 SERIAL PROGRAMMING CABLE CA-104861

Serial Programming Cable CA-104861 (5 feet) can be used to program and configure the CH-721 control head via a Personal Computer. This cable has a female DB-9 connector on one end for connection to the PC's serial port and a male DB-9 connector on the other end for connection to the serial port on the rear of the head. The cable's assembly and wiring diagrams are shown in Figure 11-4 below.

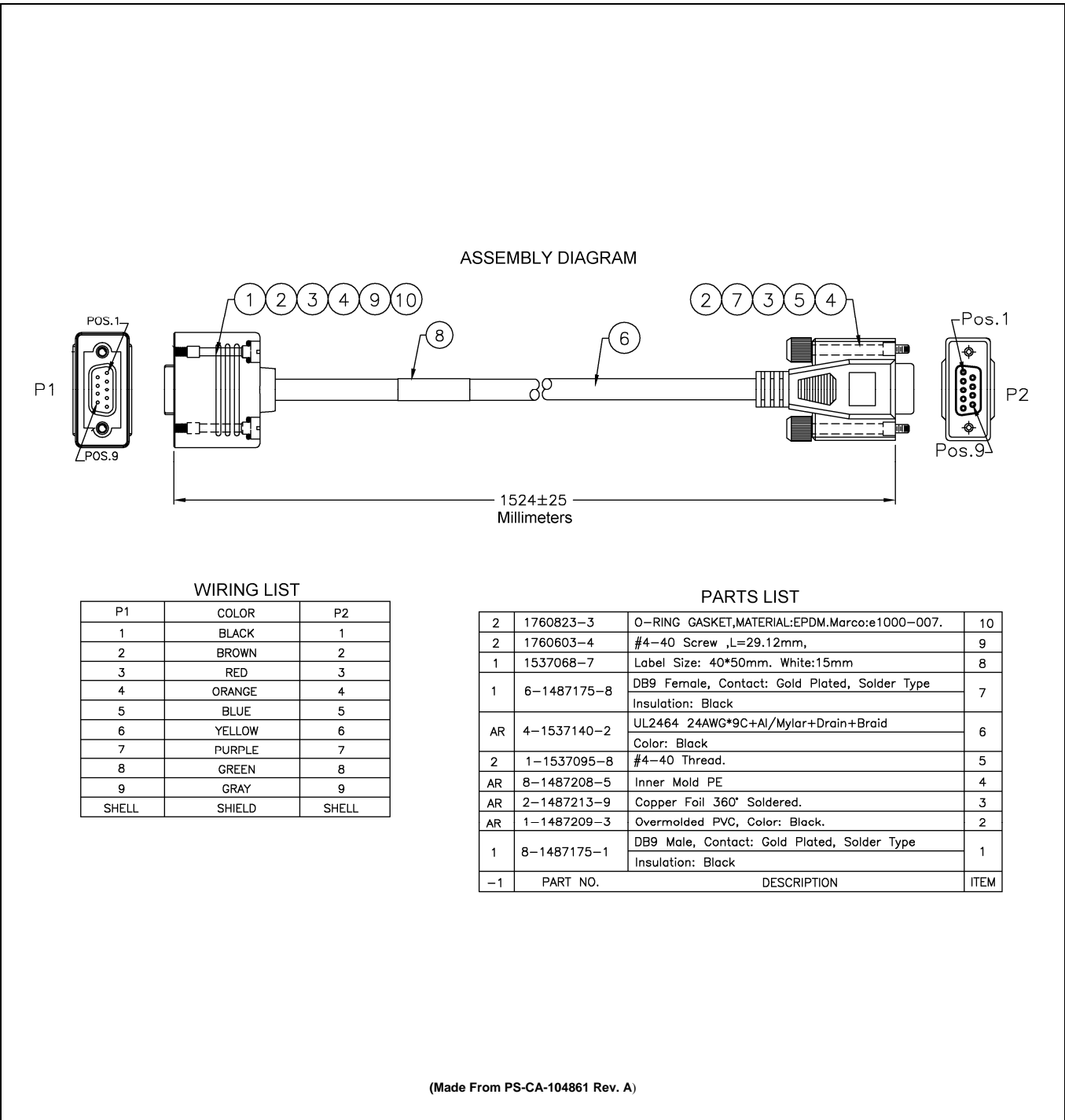


Figure 11-4: Programming Cable CA-104861

12 GPS NMEA-FORMATTED SERIAL DATA CONNECTION

To obtain GPS NMEA-formatted serial data from the radio, use of the M5300/M7300 Option Cable CA-012349-001 is required. Follow this procedure to complete the GPS NMEA-formatted serial data connections:

1. Obtain M5300/M7300 Option Cable CA-012349-001. Each “leg” of this cable is approximately 65 inches long (166 centimeters).
2. Connect the cable’s 44-pin D-subminiature (DB-44) male connector to the DB-44 female connector on the rear panel of the radio. Tighten the two jackscrews with a small flathead screwdriver. Do not over-tighten.
3. Connect the cable’s DB-9 female connector to the computer’s serial port DB-9 male connector — either directly or with an optional MAMROS0055 serial cable — and tighten the screws until firm. Route the cabling as required.
4. Follow the manufacturer’s instructions on processing the NMEA-formatted GPS data from the radio.



NOTE

If the M5300/M7300 Option Cable is not available, a 3-wire serial cable can be field-fabricated. On the radio end, this cable must interface to the three GPS-related signals of the radio’s 44-pin I/O Cable connector (pins 7, 31 and 32). See Table 11-1 for additional information.



NOTE

Industry software to process GPS information through this interface is not supported by M/A-COM.

13 INITIAL POWER-UP TEST

1. At the radio's main waterproof (HFB-type) fuse holder installed near the vehicle battery, insert the 15-amp AGC-type fuse that was included with the radio's DC Power Cable.
2. Tie and stow all fuse holders at this location to prevent excess vibration/movement.
3. Carefully reconnect the vehicle's battery ground cable.
4. If not already, temporarily connect the mobile antenna cable from the vehicle-mounted 900 MHz antenna to the female TNC RF connector on the rear panel of the radio. This is a temporary connection until test procedures in Section 14 are complete.
5. If the radio is equipped with the GPS receiver option, permanently connect the antenna cable from the GPS antenna (or mobile/GPS combo antenna) to the female SMA connector on the rear panel of the radio. The male SMA connector on most GPS antenna cables has a 5/16-inch hex collar, so the use of a wrench of this same size is normally required for tightening. However, some may have collars with only knurled surfaces, so a standard wrench or torque wrench cannot be used. In either case, do not over tighten the connector and do not twist the cable when tightening.
6. If the installation is wired so the vehicle's ignition key/switch turns the radio on and off, turn the switch to the Accessory or Run position.
7. If the control head is not already powered up, do so by rotating its on/off/volume control clockwise out of the detent position.
8. Verify the control head has powered-up by observing its display. If the display is not lit, refer to Section 8.2.1 as necessary.



Unlike many mobile radio products, the radio powers-up to the **state of last control**.

As long as the software configuration parameters have been loaded, successful installation is almost immediately realized:

- After a short boot-up sequence, the control head displays login information and/or a talk group.
- If no errors are displayed, the installation is most-likely properly wired.
- If an error is displayed, recheck all cable connections, verify all fuses are properly installed, and verify battery power on the load side of the fuses, etc. If problems persist, contact M/A-COM's Technical Assistance Center (see page 16).
- Consult the Operator's Manual for operational information.

Refer to the following section for performance test information.

14 PERFORMANCE TESTS

This section includes procedures to verify the performance of the installation's mobile antenna system. There are three (3) procedures in this section:

- Changing Operating Mode for Tests
- Testing by Transmitting into a Dummy Load (a 50-Ohm RF Terminator)
- Testing by Transmitting into the Mobile Antenna



CAUTION

The accuracy of test results depends upon a DC power source in the range of 13.8 to 16 volts DC, with a current capacity of greater than 8 amps. Make sure the vehicle's battery is fully charged by running the engine for a few minutes before the test, and keep the engine running during the test procedures. **Abide by the following WARNING!**



WARNING

If the vehicle's engine must remain running, the vehicle location should be well ventilated so exhaust fumes from the engine do not cause harm!



CAUTION

If a vehicle equipped with this radio requires jump-starting, the radio installation's main AGC fuse (15-amp) should be removed from the holder prior to jump-starting. Doing so will prevent damage to the radio system.



NOTE

Prior to installation, the radio's power level should be configured appropriately. The wide range of power levels indicated in the following procedures takes into account such things as: customer's requirements; measurement errors, especially to include uncalibrated equipment; cabling losses; and voltage and temperature variations. By no means should the result from Performance Testing in this section be construed as the exact value of power level output from the radio, as the value is set and more accurately measured in the factory. The values obtained in these test procedures determine a successful installation only.

14.1 CHANGING OPERATING MODE FOR TESTS

To complete tests in this section, placing the radio in a conventional mode and using an average-responding wattmeter to measure RF transmit power is recommended. However, if the radio is not programmed for conventional mode operations (i.e., OTP mode is available but ECP mode is not), tests will require a peak-reading RF wattmeter to measure RF transmit power. To select either conventional or OpenSky mode, use one of the following procedures:

14.1.1 Changing from OpenSky to Conventional

1. If necessary, apply power to the radio and turn it on.
2. Use the control head's **•/•• Ramp Control** to scroll through the menu until **Mode Menu** appears in the middle line of the display. This control is shown in Figure 8-4 and in Figure 8-5 on page 44.
3. Use the **+/- Ramp Control** to select an available conventional channel/system.

4. Confirm the selection by pressing the **MENU** button, then toggling the **Ramp Control** once (to select **Y** for Yes), followed by pressing the **MENU** button again. The radio will enter the selected mode as indicated by the display.
5. Select a conventional channel for test transmissions using either the **•/• Ramp Control** or the **System/Group/Channel Selection Control** (required control per programming).

14.1.2 Changing from Conventional to OpenSky

1. If necessary, apply power to the radio and turn it on.
2. Use the control head's **•/• Ramp Control** to scroll through the menu until an OpenSky system's name is displayed.
3. After a few seconds, the radio will automatically transition to OTP mode for operations on the selected OpenSky system.
4. If the radio is not programmed for auto-login, login to the OpenSky system. For login instructions, refer to the Operator's Manual (publication MM-014716-001) or the respective Quick-Guide (publication MM-014368-001) as necessary. The Quick-Guide is included with the radio when it shipped from the factory.
5. Select a talk group for test transmissions using either the **•/• Ramp Control** or the **System-/Group/Channel Selection Control** (required control per programming).

14.2 REQUIRED TEST EQUIPMENT

Table 14-1: Required Test Equipment

TEST EQUIPMENT	MODEL / PART NUMBER & DESCRIPTION
Average-Responding Wattmeter (for conv. measurements)	Bird Electronic Corp. Model 43 (or equivalent) with Type N female connectors at input and output ports.
or	
Peak-Reading Wattmeter (for OpenSky measurements)	Bird Electronic Corp. Model 4314B (or equivalent) with Type N female connectors at input and output ports.
Wattmeter Slug	Bird Electronic Corp. Element 25E, 25 watts, 400 - 1000 MHz (or equivalent).
RF Coaxial Jumper Cable	Pasternack Enterprises PE3661-36 (or equivalent) 50-Ohm Coaxial Cable with TNC male connector and Type N male connector, approximately three (3) feet in length. The utilized cable must have VSWR below 1.5:1 within the RF passband.
N-to-TNC RF Adapter	Pasternack Enterprises PE9090 (or equivalent) Type N male to TNC female adapter. Required to connect the cable of the vehicle-mounted 700/800 MHz antenna to the wattmeter.
50-Ohm RF Terminator ("Dummy Load")	Pasternack Enterprises PE6106 (or equivalent) 50-ohm RF terminator rated at greater than 50 watts power, with Type N male connector.
Vehicle-Mounted Antenna	Tests are performed with the vehicle-mounted 700/800 MHz antenna per the installation described in Section 6 of this manual.

14.3 TRANSMITTING INTO A DUMMY LOAD

1. Using the Type N male to TNC male RF coaxial jumper cable, connect the radio's antenna connector to the wattmeter's input connector. Refer to Figure 14-1 as necessary.
2. Connect the 50-ohm dummy load to the wattmeter's output connector, in place of the antenna cable from the vehicle-mounted 700/800 MHz antenna.



NOTE

As previously stated, if conventional mode is not available per radio programming (i.e., OTP mode is available but ECP mode is not), a peak-reading RF wattmeter is required to measure RF transmit power. Otherwise, the use of an average-responding wattmeter is recommended. Recommended wattmeter types are listed in Table 14-1.

3. If not already, turn the radio on and set it to the required operating mode (based upon available radio programming and test equipment). Refer to Section 14.1 as necessary.
4. Set the radio to a test talk group or conventional channel, if available.



NOTE

It is recommended that a test talk group/channel be allocated for this testing. This same group should be used during the antenna test procedure which is presented in the subsequent section.

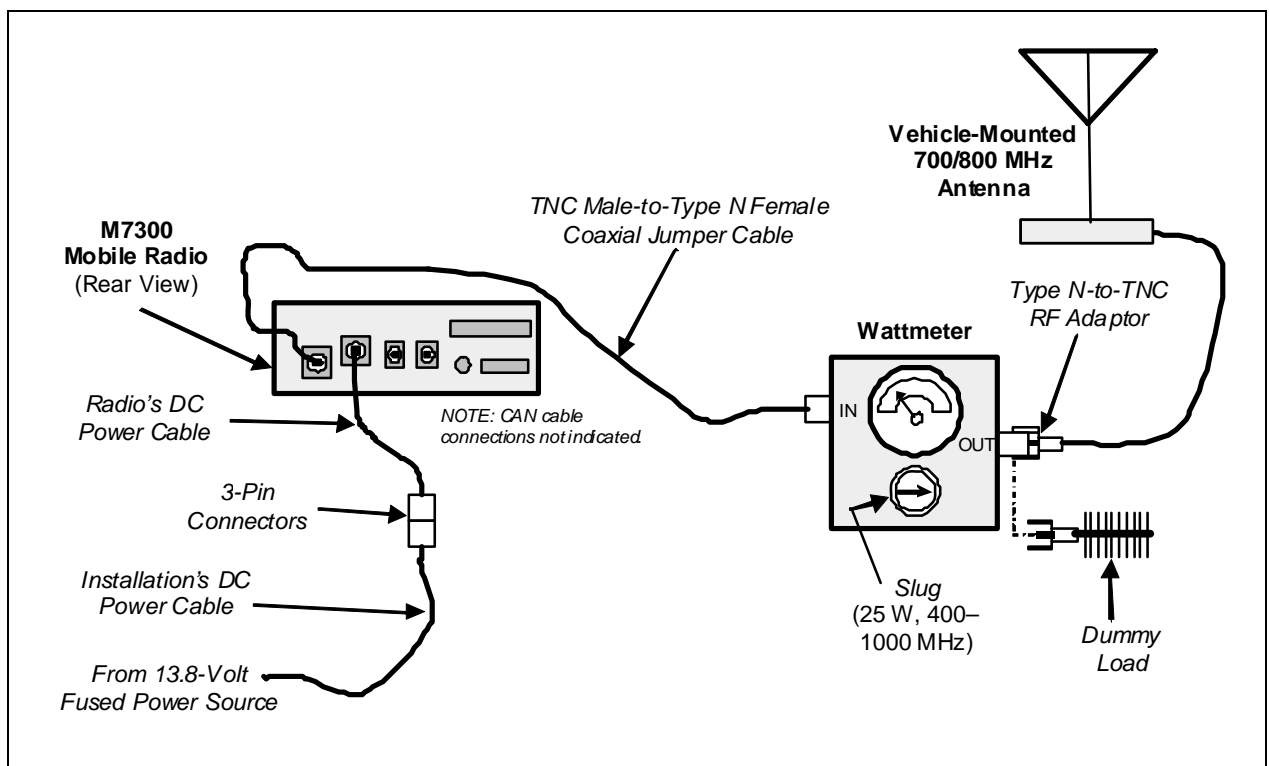


Figure 14-1: Wattmeter Connections for Antenna System Tests

5. Position the wattmeter's slug to measure forward RF output power. Rotate it if necessary. The arrow on the face of the slug must point away from the radio and towards the dummy load for forward power measurements.

6. **For conventional mode transmissions**, set the wattmeter to measure average RF power.
For OpenSky mode transmissions, set the wattmeter to measure peak RF power.
7. Key the radio's transmitter via the microphone's PTT button.
8. For an OpenSky mode transmission, compare the wattmeter's reading with the target RF output power range of between **11.8 and 18.9 watts** (15 watts \pm 1 dB). This transmit output power range assumes the radio is currently configured for high-power transmit.

For a conventional mode transmission, compare the wattmeter's read with the target RF output power range of between **27.7 and 44.2 watts** (35 watts \pm 1 dB). This transmit output power range assumes the radio is currently configured for the high-power transmit.



NOTE

Transmit only for as long as needed to take the measurement, then immediately disable the transmission.

9. **If the wattmeter reading is within the range**, record the measured value in the appropriate space on the data collection form near the end of this manual.

If the wattmeter reading is outside the range, verify the radio's power supply voltage (i.e., battery voltage) is within the specified range, recheck all connections and measure the RF output power again. If this fails to produce a reading within the range, replace it and repeat this procedure. If problems persist, contact M/A-COM's Technical Assistance Center (see page 16).

14.4 TRANSMITTING INTO THE MOBILE ANTENNA

1. Connect the antenna cable from the vehicle-mounted 700/800 MHz antenna to the wattmeter as shown in Figure 14-1.
2. If not already, turn the radio on and set it to the required operating mode (based upon available radio programming and test equipment). Refer to Section 14.1 as necessary.
3. Set the radio to a test talk group or conventional channel, if available.



NOTE

It is recommended that a test talk group/channel be allocated for this testing. Otherwise, interference with other radio users in the system may occur. **Also, during transmissions, always observe the RF exposure-related safety information presented in Section 1.2 (begins on page 6).**

4. Position the wattmeter's slug to measure forward RF output power. Rotate it if necessary. The arrow on the face of the slug must point away from the radio and towards the antenna for forward power measurements.
5. **For conventional mode transmissions**, set the wattmeter to measure average RF power.
For OpenSky mode transmissions, set the wattmeter to measure peak RF power.
6. Key the radio's transmitter via the microphone's PTT button.
7. For an OpenSky mode transmission, compare the wattmeter's reading with the target RF output power range of between **11.8 and 18.9 watts** (15 watts \pm 1 dB). This transmit output power range assumes the radio is currently configured for high-power transmit.

For a conventional mode transmission, compare the wattmeter's read with the target RF output power range of between **27.7 and 44.2 watts** (35 watts \pm 1 dB). This transmit output power range assumes the radio is currently configured for the high-power transmit.



NOTE

Transmit only for as long as needed to take the measurement, then immediately disable the transmission.

8. **If the wattmeter reading is within the range**, record the value in the appropriate space on the data collection form near the end of this manual.

If the wattmeter reading is outside the range, verify the radio's power supply voltage (i.e., battery voltage) is within the specified range, recheck all connections, and measure the forward power again. If these checks/corrections fail to produce a reading within the range, check all cabling and connections and repeat the testing procedure to this point. In the event the wattmeter reading still falls outside the range, replace the antenna, make sure all connections are seated firmly, and repeat the testing procedure. If problems persist, contact M/A-COM's Technical Assistance Center (see page 16).

9. Position the wattmeter's slug to measure reverse (reflected) RF power from the antenna. The arrow on the face of the slug must point away from the antenna and to the radio to measure reverse power.
10. Key the radio's transmitter via the microphone's PTT button.
11. Compare the wattmeter reading with the RF power output range of **2 watts or less**.



NOTE

Transmit only for as long as needed to take the measurement, then immediately disable the transmission.

12. **If the wattmeter reading is within the range**, record the value in the appropriate space on the data collection form near the end of this manual.

If the wattmeter reading is outside the range, make sure the antenna is consistent with the specified frequency range of the radio. Recheck all antenna connections, and measure the reverse power again. If the installation employs a 1/4-wave unity-gain antenna, observe the **NOTE** that follows step 8. If these checks/corrections fail to produce a reading within the range, replace the antenna and repeat the entire antenna test procedure. Any value exceeding the maximum allowable reflected power value will result in a diminished RF output signal. If problems persist, contact M/A-COM's Technical Assistance Center (see page 16).

13. Disconnect the coaxial cable jumper and wattmeter.
14. Permanently connect the cable from the vehicle-mounted 700/800 MHz antenna to the radio's antenna cable by mating the two TNC connectors together. Use two pairs of soft-jaw pliers to gently tighten this connection. Do not over tighten and do not twist either cable.
15. Make several test calls on the radio system to verify operation of the mobile radio. Before making the calls, select other talk groups or conventional channels, as required to verify operation.



NOTE

To prevent RF leakage and ensure peak performance, make sure the RF connectors are tight, but do not over-tighten so connector damage will not occur.



WARNING

Improper installation of the RF cables may lead not only to poor radio performance but also to harmful exposure to RF electromagnetic energy.

Testing is complete. The radio is now ready for normal communications.

14.5 TEST PERFORMANCE DATA FORM

Clip  Here

Enter the information requested on this data collection form. Clip this form and file it as a permanent record of the tested performance of the M7300 mobile radio installation.

Mobile Radio Serial Number

Antenna Make and Model Numbers

Date of Test
(mm/dd/yyyy)

Company Performing Installation

Technician Performing Test



Watts
Power into a Dummy Load

Watts
Forward Power with Antenna

Watts
Reflected Power with Antenna

15 COMPLETE THE INSTALLATION

Double-check the following items before considering the installation completed:

- Verify all newly installed mechanical hardware is mounted securely and all respective mounting hardware is tight.
- Verify all electrical interconnections are connected properly and the associated connector attachment hardware is tight. Pay special attention to all RF antenna cables!
- Verify all related fuses are correctly installed and properly rated.
- Verify all electrical cables and wiring are tied, stowed, and protected so they are out of the way of casual contact, away from sources of extreme heat, and wire chafing cannot occur. Pay special attention to all RF antenna cables!
- To prevent fumes from entering the vehicle's passenger compartment, seal the hole/grommet/wire combination at the firewall with a silicon-based sealer.
- Verify all vehicle components are properly reinstalled such as kick panels, headliners, and seats.
- If the installation includes a separately-mounted on/off power switch for manually turning the radio (and possibly others systems) on and off, verify it is labelled accordingly. For example: “**Radio ON/OFF.**”
- Remove all tools and unused hardware from the vehicle.
- Verify the test performance data has been recorded on the data collection form shown in this manual.

16 WARRANTY

- A. M/A-COM, Inc. (hereinafter "Seller") warrants to the original purchaser for use (hereinafter "Buyer") that Equipment manufactured by or for the Seller shall be free from defects in material and workmanship, and shall conform to its published specifications. With respect to all non-M/A-COM Equipment, Seller gives no warranty, and only the warranty, if any, given by the manufacturer shall apply. Rechargeable batteries are excluded from this warranty but are warranted under a separate Rechargeable Battery Warranty (ECR-7048).
- B. Seller's obligations set forth in Paragraph C below shall apply only to failures to meet the above warranties occurring within the following periods of time from date of sale to the Buyer and are conditioned on Buyer's giving written notice to Seller within thirty (30) days of such occurrence:
1. for fuses and non-rechargeable batteries, operable on arrival only.
 2. for parts and accessories (except as noted in B.1) sold by Seller's Service Parts Operation, ninety (90) days.
 3. for P7200, P7100^{IP}, P5400, P5300, P5200, P5100, P3300, PANTHER™ 405P and 605P, M7300, M7200 (including V-TAC), M7100^{IP}, M7300 and M3300 radios, two (2) years, effective 10/01/2007.
 4. for all other equipment of Seller's manufacture, one (1) year.
- C. If any Equipment fails to meet the foregoing warranties, Seller shall correct the failure at its option (i) by repairing any defective or damaged part or parts thereof, (ii) by making available at Seller's factory any necessary repaired or replacement parts, or (iii) by replacing the failed Equipment with equivalent new or refurbished Equipment. Any repaired or replacement part furnished hereunder shall be warranted for the remainder of the warranty period of the Equipment in which it is installed. Where such failure cannot be corrected by Seller's reasonable efforts, the parties will negotiate an equitable adjustment in price. Labor to perform warranty service will be provided at no charge during the warranty period only for the Equipment covered under Paragraph B.3 and B.4. To be eligible for no-charge labor, service must be performed at a M/A-COM factory, by an Authorized Service Center (ASC) or other Servicer approved for these purposes either at its place of business during normal business hours, for mobile or personal equipment, or at the Buyer's location, for fixed location equipment. Service on fixed location equipment more than thirty (30) miles from the Service Center or other approved Servicer's place of business will include a charge for transportation.
- D. Seller's obligations under Paragraph C shall not apply to any Equipment, or part thereof, which (i) has been modified or otherwise altered other than pursuant to Seller's written instructions or written approval or, (ii) is normally consumed in operation or, (iii) has a normal life inherently shorter than the warranty periods specified in Paragraph B, or (iv) is not properly stored, installed, used, maintained or repaired, or, (v) has been subjected to any other kind of misuse or detrimental exposure, or has been involved in an accident.
- E. The preceding paragraphs set forth the exclusive remedies for claims based upon defects in or nonconformity of the Equipment, whether the claim is in contract, warranty, tort (including negligence), strict liability or otherwise, and however instituted. Upon the expiration of the warranty period, all such liability shall terminate. The foregoing warranties are exclusive and in lieu of all other warranties, whether oral, written, expressed, implied or statutory. **NO IMPLIED OR STATUTORY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE SHALL APPLY. IN NO EVENT SHALL THE SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL, INDIRECT OR EXEMPLARY DAMAGES.**

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